THE

COMPLETE GRAZIER

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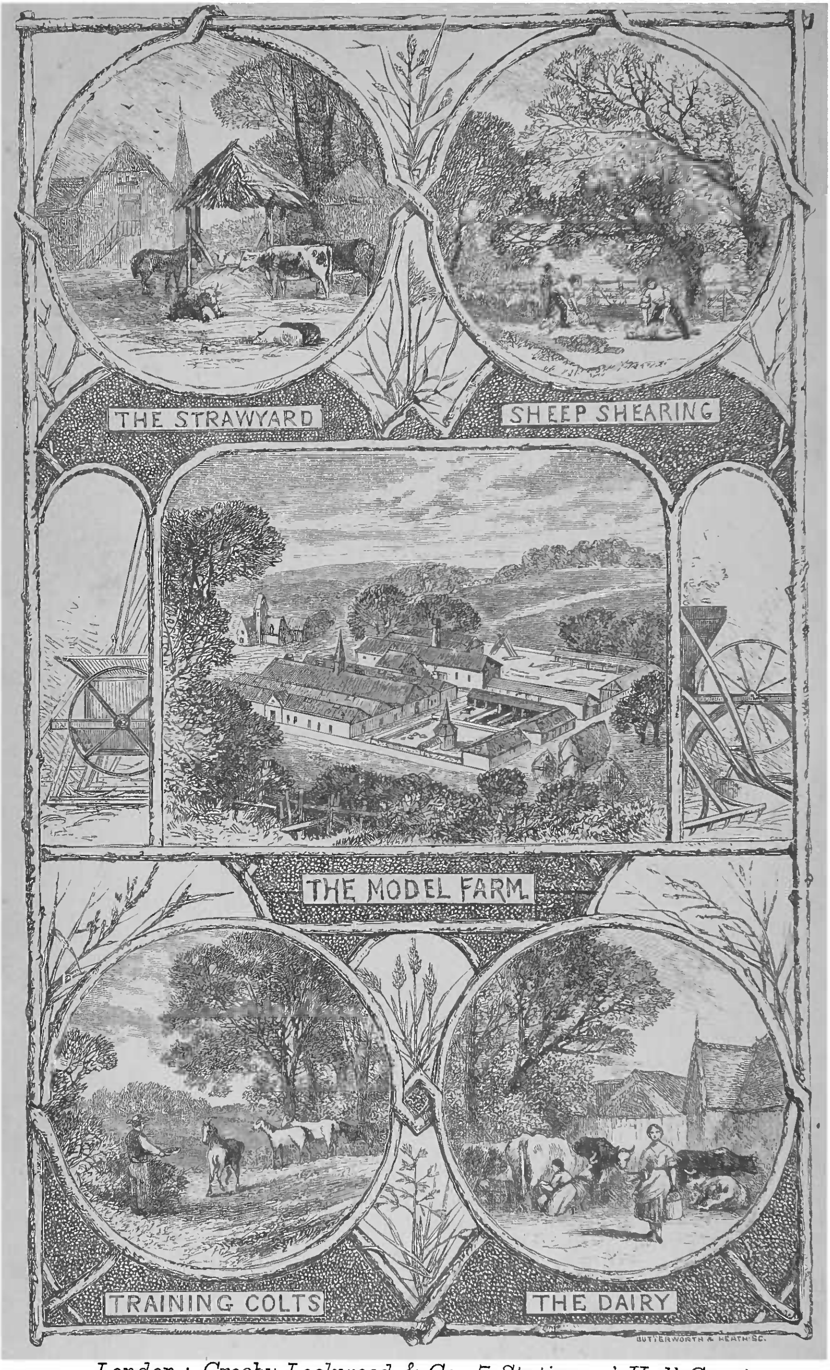


London: Crosby Lockwood & Co., 7 Stationers'-Hall Court.

TO

THE NOBLEMEN, GENTLEMEN, AND FARMERS

COMPOSING THE

SMITHFIELD CATTLE-CLUB,

TO WHOSE EXERTIONS

THE PUBLIC IS SO MANIFESTLY INDEBTED FOR

MANY VALUABLE

IMPROVEMENTS IN THE LIVE STOCK OF THE COUNTRY,

This Work

IS RESPECTFULLY DEDICATED

BY THEIR MOST OBEDIENT SERVANT,

THE EDITOR.

July 1877.

THE

COMPLETE GRAZIER

AND

FARMER'S AND CATTLE-BREEDER'S ASSISTANT

A COMPENDIUM OF HUSBANDRY

INCLUDING THE BREEDING, REARING, FEEDING AND GENERAL MANAGEMENT OF STOCK, THE MANAGEMENT OF THE DAIRY, THE TREATMENT, TRANSPORT AND PRESERVATION OF DAIRY PRODUCE, ETC.

DIRECTIONS FOR THE

CULTURE AND MANAGEMENT OF GRASS LAND, OF GRAIN AND ROOT CROPS,

THE ARRANGEMENT OF FARM OFFICES, THE USE OF IMPLEMENTS AND MACHINES, AND ON

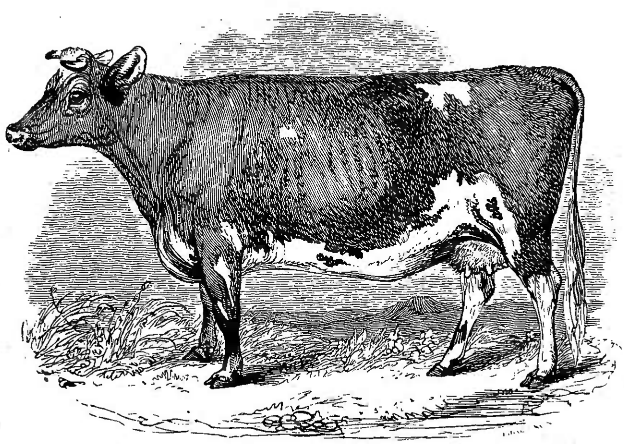
DRAINING, IRRIGATION, WARPING, ETC.

AND THE APPLICATION AND RELATIVE VALUE OF MANURES

BY WILLIAM YOUATT, ESQ., V.S.

Member of the Royal Agricultural Society of England; Author of 'The Horse,' 'Cattle,' etc.

COPIOUSLY ILLUSTRATED WITH WOOD ENGRAVINGS



TWELFTH EDITION, VERY CONSIDERABLY ENLARGED, AND BROUGHT UP TO THE PRESENT REQUIREMENTS OF AGRICULTURAL PRACTICE

BY ROBERT SCOTT BURN

One of the Authors of 'The Book of Farm Implements and Machines' and 'The Book of Farm Buildings.'
Author of 'The Lessons of My Farm,' 'Outlines of Landed Estates Management,' etc.

LONDON

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PREFACE

TO

THE TWELFTH EDITION.

IN preparing a new edition of this work, the estimation of which by the agricultural public is sufficiently attested by the fact that it is the *twelfth*, the Publishers and Editor have aimed at rendering it as complete a compendium as has been possible, within its limits, of the important branches of Husbandry of which it more especially treats.

While it has been deemed advisable to retain that original scope and arrangement of the work, which may be said to be stamped with the approval of numerous readers, all the matter has been carefully revised, and large additions have been made, so as to bring the whole up to the present requirements of agricultural practice.

Amongst the chapters which have been so altered that they may almost be said to be re-written, may be named those on the Breeding and Feeding of Cattle and on the Preparation of their Food; the Soiling of Cattle; the Arrangement of Farm Buildings and Cottages; the Varieties and Uses of Implements and Machines; on Draining, Irrigation, Liquid Manure and Sewage Treatment and Utilisation, &c.

Special attention has been devoted to Dairying, in all its departments; including the recent discoveries and methods of practice in connection with Milk and the preparation of its various products; the Factory System of working, as distinguished from that of isolated Farms; the improvements in the Transport and Preservation of Milk and of Dairy Produce generally.

An altogether new feature has been introduced, consisting of a series of chapters embracing the work of the Farm to be done throughout the year. For the convenience of ready reference these have been arranged under special heads as 'Calendars' for Cattle, Dairy Cows, Sheep and Lambs, Horses, Pigs, and Poultry.

A large number of new illustrations have been added wherever they have been considered likely to elucidate points under discussion.

To aid him in a duty which, although somewhat arduous, has been withal pleasant, the Editor has not failed to consult a wide range of the best authorities on agricultural science and practice; he has also availed himself of those special opportunities which are at his disposal of gathering from the experience of others information of a high practical value. He ventures therefore, reasonably, to hope that this new edition will maintain the hitherto high reputation of an esteemed work.

In conclusion, the Editor has to acknowledge his obligations to the following Firms who have assisted him with illustrations and descriptions of the various Machines and Implements of the Farm which enrich its pages:—Messrs. Ransomes, Sims and Head; Messrs. J. and F. Howard; Messrs. John Fowler and Co.; Messrs. Barnard, Bishop, and Barnards; Messrs. Samuelson and Co.; Messrs. Clayton and Shuttleworth; Messrs. Fisken and Co.; Messrs. Richmond and Chandler; Mr. Clay; Messrs. Musgrave and Co.; Mr. Walter A. Wood; The Beverley Iron and Waggon Company; Messrs. Williamson Brothers; Messrs. Cambridge, Parham and Webb; Messrs. Garrett; Messrs. Turner; Messrs. Shanks; Mr. Nicholson; Mr. Bentall; Mr. Boby, &c. &c.

He is also indebted to the leading agricultural periodicals, as 'The Mark Lane Express,' 'The Agricultural Gazette,' 'The North British Agriculturist,' 'The Farmer,' 'The Irish Farmers' Gazette,' the Journals and Transactions of the leading Agricultural Societies and Farmers' Clubs, and to a large number of foreign and colonial books and journals; from the pages of all of which many valuable facts and suggestions have been obtained.

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THE

COMPLETE GRAZIER.

BOOK THE FIRST.

ON THE VARIETIES, BREEDING, REARING, FATTENING, AND GENERAL MANAGEMENT OF CATTLE.

CHAPTER I.

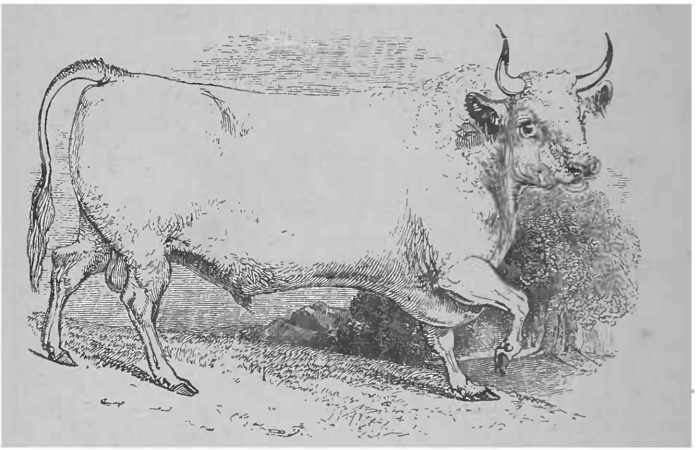
INTRODUCTORY VIEW OF THE DIFFERENT BREEDS OF CATTLE IN GREAT BRITAIN AND IN SOME FOREIGN DISTRICTS.

OF all the various sources from which the wealth of nations is derived, few have a superior claim to attention than the branch of rural economy which is the subject of the following pages. In fact, when it is considered that not only the servants of a farmer, but his cattle also, are productive labourers—when we recollect the stimulus to industry, as well as the rapid circulation of capital which the farmer occasions by furnishing constant employment to the numerous artificers who are occupied in manufacturing the implements that are indispensably necessary to him—when we call to mind the immense mass of materials which his *productive* labour supplies for the purposes of commercial intercourse, and especially the influence produced by that labour on the comfort and appearance of towns, whose inhabitants might otherwise be destitute of the necessaries of life—when all these diversified circumstances are taken into consideration, every reflecting enquirer must acknowledge, that of all the methods in which capital can be employed, this is by far the most advantageous to society.

Justly, therefore, has it been remarked, 'that the capital employed in agriculture not only puts into motion a greater quantity of productive labour than any equal capital employed in manufactures, but also, in proportion to the quantity of productive labour which it employs, it adds a much greater value to the annual produce of the land and labour of the country, while it increases the real wealth and revenue of its inhabitants.'[1]

Many circumstances have long conspired to render live stock an object of the utmost importance to the farmer; and notwithstanding the great advances made in other branches of husbandry, nothing has undergone a greater change of system, and few things have received more manifest improvement, than the breeding, rearing, and management of cattle. It will therefore be advantageous to commence with an outline of the principal breeds of cattle found in the United Kingdom.

FIG. 1.



THE WILD OR SUPPOSED ABORIGINAL CATTLE OF GREAT BRITAIN.

WILD CATTLE—of a bull of which fig. 1 is a portrait—are still found in Chillingham Park, in Northumberland; at Wollaton, Nottinghamshire; and at Ribbesdale, Yorkshire. They are the remains of the native Caledonian cattle which once roamed over the northern provinces of England and the southern parts of Scotland, and some of which had found their way to the mountains of Wales.

The following account of them is given by the Earl of Tankerville, and the late Mr. Bailey of Chillingham.[2]

Their colour is white, except that some of the bulls appear of

[1] 'Smith's Wealth of Nations,' 4th edit. vol. ii. p. 53.
[2] 'Agricultural Survey of Northumberland,' 3d edition, p. 141, and 'Proceedings of the British Association at Newcastle upon-Tyne in 1838.'

a cream colour; the muzzle is black or brown; the whole of the inside of the ear, and about one third of the outside, from the tip downwards, is red or brown, and the horns white with black tips, very fine, and bent upwards.[1] They have no manes, but some of the bulls have a little coarse hair on the neck, about an inch and a half or two inches in length. The weight of the oxen is from thirty-eight to forty-two stones of fourteen pounds; and that of the cows, from twenty-five to thirty-five stones the four quarters. The beef is finely marbled, and of excellent flavour.

From the nature of their pasture, and the frequent agitation into which they are thrown by the curiosity of strangers, it cannot be expected that they should accumulate much fat; yet the six-years' old oxen generally become exceedingly good beef. One of them was caught, and became as tame as the domestic ox, and throve as well as any short-horned steer could do. It weighed about sixty-five stones.

At the first appearance of any person they set off at a trot, and gradually increasing their speed, gallop to a considerable distance; they then wheel round, and come boldly up again, tossing their heads in a menacing way. On a sudden they make a full stop, at the distance of forty or fifty yards, looking shyly at the object of their fear; but on the least motion being made, they again turn round, and set off with still greater speed. Forming, however, a shorter circle, and returning with a bolder and more threatening aspect, they approach considerably nearer. This they practise several times, shortening their distance, and advancing still nearer until they come within a few yards, when most people think it prudent to leave them. They feed mostly in the night, basking or sleeping during the day. In summer several successive weeks will pass with scarcely a possibility of seeing them, for at the appearance of anyone, even at the greatest distance, they retire into the wood, or behind some rising ground, and so screen themselves from view. On the other hand, when in winter coming down for food into the inner parts, they suffer almost anyone to come among them.

The mode of destroying them is, perhaps, the only modern remains of the grandeur of ancient hunting. On notice being given that a wild bull will be killed on a certain day, the inhabitants of the neighbourhood come in great numbers, both horse and foot. The horsemen drive the bull from the rest of the herd until he stands at bay, when a marksman dismounts and shoots him. At some of these huntings twenty or thirty shots have been fired before he was subdued. On such occasions the bleeding victim

[1] There is, however a breed of the same cattle in Yorkshire, which is said to be hornless. See the introduction to the work entitled 'British Husbandry,' in the Farmer's Series of the Library of Useful Knowledge.

grew desperately furious from the smarting of his wounds and the shouts of savage joy that were echoing on every side. From the number of accidents that have occasionally happened, this dangerous hunt has been seldom practised of late years—the park-keeper generally going alone and shooting one of them with a rifle.

When the cows calve they hide their young ones for a week or ten days in some sequestered situation, suckling them two or three times a day. If any person comes near the calves, they press their heads close to the ground, and lie like a hare in its form, in order to conceal themselves. This is a proof of their native wildness, and is corroborated by the following circumstance, which happened to the writer of this narrative. He found a hidden calf, two days old, very lean and very weak. On his stroking its head it got up, pawed two or three times like an old bull, bellowed loudly, retired a few steps, and then bolted at his legs with all its force. Once more it pawed, bellowed, stepped back, and bolted as before; but the intruder knowing its intention, and stepping aside, it missed him, and fell, and was unable to rise again, although it made several efforts. It had, however, done enough; for the whole herd was alarmed, and coming to its rescue, obliged him to retire. The dams will allow no person to touch their calves without attacking him with impetuous ferocity.

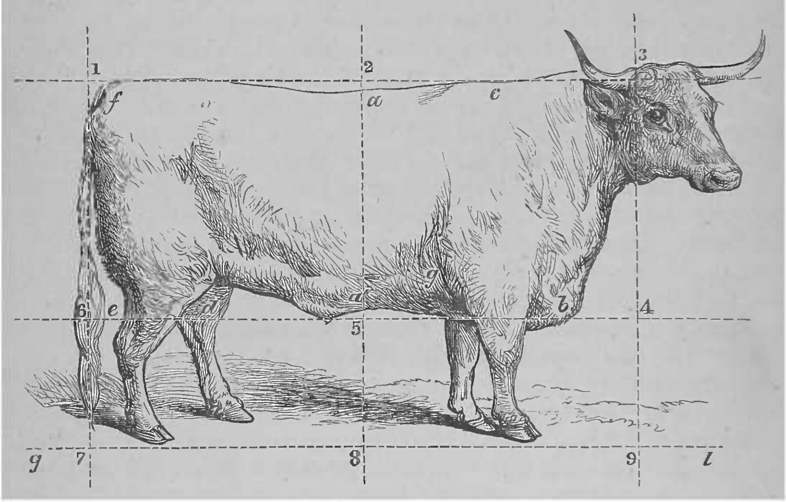
When any one of the herd happens to be wounded, or grown weak or feeble through age or sickness, the rest set upon it, and gore or trample it to death. There is rarely, however, any sickness among them, and they are seldom suffered to become more than eight or nine years old.

The question has been raised, and pretty fully discussed, as to whether the wild cattle now described have been the progenitors of the various breeds of this country which will presently come under our notice. The whole subject is, however, so beclouded with mystery, and the evidence required to enable us to come to a decision on the point goes so far back into the history of our own country, that records are not to be met with, or, if met with, cannot be trusted as authentic. Nothing is left us, therefore, but conjecture, and that of a vague and unsatisfactory kind. There is, however, nothing to militate against the notion that all the breeds, with their distinctive and sometimes apparently most opposite characteristics of form and habits, which minister to the convenience of the population and add to the wealth of the country, have been descended from the wild cattle of Chillingham Park. Nor is it difficult to believe this, when we consider that circumstances of climate and locality— which very much influence the peculiarities and habits of plants—may also, and in point of fact, do influence those of animals. As has been well remarked by an able writer on the subject:—'Circumstances alone will have a great tendency to change the conformation and characteristics of a species. Thus, in cold countries, the whiteness prevails as a colour, and fur or wool as a coat. In warmer climates, the brown prevails as a colour, and the hair as a covering; while in those absolutely hot, the dun seems to obtain as a colour, and the down as a clothing. So easy is the adaptation of organised beings to the state in which they are placed, and so vast is the expansibility of nature, that she can extend or shorten, or increase or diminish conformation, so as to render it suitable to the wants, the happiness, and the existence of the animal. . . . And it is possible that the influence of a pasture may lengthen or shorten the horns—that by breeding from long or short-horned, or from hornless animals, the variety may be perpetuated till they lose in the course of ages many of their original characteristics. It is impossible, for instance, in Essex, to grow the ox to the same size, other things being equal, as in the county of Durham; nor on the Ayrshire hills can he be produced in the same form or stature as in the Devonshire valleys. The Highland Scot is suited to the cold climate of the exposed and stormy North, and the Short-horn to the sunny Lowland pastures; and who shall say that the God of Nature has not impressed on those created beings the capability of adapting themselves to His plastic handiwork of developing their tendency to follow the peculiarities of the situation in which they are placed? An elephant can never degenerate into a mouse, a cat never improve into a tiger; but a wild dun cow of Warwick may be the progenitor alike of the thin, spare, feeble-looking Alderney and the flesh-mountain ox of Durham.' And this forcible writer concludes by quoting Dr. Pritchard, who says:—'In all our stock of domesticated animals we see profuse and infinite variety, and in the races of wild animals from which they originally descended we find a uniform colour and figure for the most part to prevail. Domestication is to animals what cultivation is to vegetables, and the former probably differs from the natural state of the one class of beings in the same circumstances which distinguish the latter from the natural condition of the other class. The most apparent of these is the abundant supply of the peculiar stimuli of each kind. Animals in a wild state procure a simple and unvaried food in precarious and deficient quantities, and are exposed to the inclemencies of the seasons. Their young are produced in similar circumstances to the state of seedlings which spring uncultivated in a poor soil; but in the improved state, all the stimuli of various food, of warmth, &c. are afforded in abundance, and the consequence is a luxuriant growth, and *evolution of varieties*, and the exhibition of all the perfections of which each species is capable.'

Since the last edition of this work was issued, another and a warm discussion has been raised on the subject of the Wild Cattle.

In the controversy which arose, several writers, some of them eminent as breeders of farm stock, took part. The question discussed, or the point mooted, was not so much what has been already hinted at, 'Have all our breeds sprung from this breed, or are the Chillingham Park or White Cattle the progenitors of all the varieties met with in another practice of cattle-breeding?' but a much more incisive question, namely: 'Was there ever such a thing as an aboriginal breed of cattle in this country, and did they ever exist?' And springing from this question arose another: 'And if there was a breed from which all other breeds have descended, was this represented by the White Cattle, and were those known to exist at Chillingham Park the descendants of these?' The discussion was, as we have said, a warm one, but it ended very much where it began, leaving the whole question or questions surrounded with the doubt and uncertainty which will for ever now, we fear, enshroud them. It may be stated, however, that those who maintained that the Chillingham Park cattle were the true descendants of the original breed had much the best of the argument.

FIG. 2.



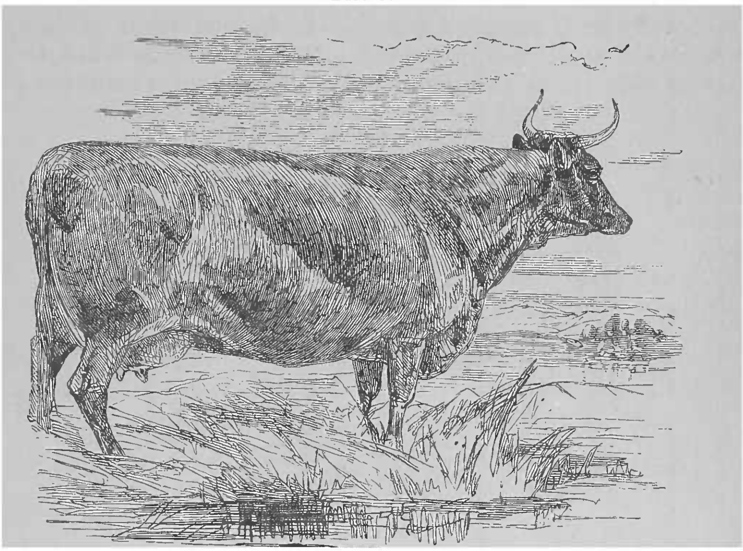
DEVON OX.

THE MODERN OR PRESENT BREEDS OF BRITISH CATTLE.—In giving a general description of the breeds of cattle which are met with in various districts, and take part in the farming of Great Britain, we shall begin with the DEVON BREED. Of this we give, in fig. 2, an illustration of an ox, in fig. 3 of a cow, and in fig. 4 of a bull. The breed is found in its purest and best form in North

Devon; in the agricultural report of which district its peculiar qualities are thus described by the late Mr. Vancouver:—

'Its head is small, clean, and free from flesh about the jaws; deer-like, light and airy in its countenance; neck long and thin; throat free from jowl or dewlap; nose and round its eyes of a dark orange colour; ears thin and pointed, tinged on their inside with the same colour that is always found to encircle its eyes; horns thin, and fine to their roots, of a cream colour, tipped with black,[1] growing with a regular curve upwards, and rather springing from each other; light in the withers, resting on a shoulder a little retiring and spreading, and so rounded below as to sink all appearance of its pinion in the body of the animal; open bosom, with a

FIG. 3.



DEVON COW.

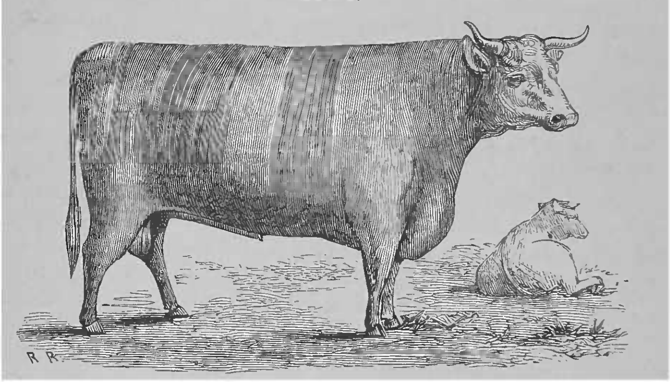
deep chest or keel; small and tapering below the knee, fine at and above the joint, and where the arm begins to increase it becomes suddenly lost in the shoulder; line of the back straight from the withers to the rump, lying completely on a level with the pin, or huckles, which lie wide and open; the hind quarters seated high with flesh, leaving a fine hair-ham tapering from the hock to the

[1] The late Arthur Young, formerly secretary to the Board of Agriculture, describes the thorough-bred Devons as of a bright red, neck and head small, eye prominent, and round it a ring of bright yellow; the nose round, the nostril having the same colour; the horn clear and transparent, upright, tapering, and gently curved, but *not* tipped with black.

fetlock; long from rump to huckle, and from the pinion of the shoulder to the end of the nose; thin loose skin, covered with hair of a soft and furry nature, inclined to curl whenever the animal is in good condition and in full coat, when it also becomes mottled with darker shades of its permanent colour, which is that of a bright blood red, without white or other spots, particularly on the male; a white udder is sometimes passed over, but seldom without objection.

'This description may be considered as a summary of the perfections as to the exterior appearance of the animal: what, under the same head, may be regarded as defects, appear first in the sudden retiring of the vamp from behind the huckle to a narrow point backwards; the great space between the huckle and first rib; the smallness of the angle inwards at which the ribs appear to be projected from the spine or back-bone, often giving the appearance of a flat-sided animal, and in its being so much tucked up in the girth as to show an awkward cavity between the keel

FIG. 4.



DEVON BULL.

and navel, the line of which, it is presumed, should always be found to hold a position as nearly as possible parallel with that of the back from the withers to the loin. The animal is, however, generally well grown, and filled up behind the shoulder.'

The North Devon cattle are highly esteemed, both for feeding and draught, but are not so much valued for the dairy; yet their milk, although deficient in quantity, is of such excellent quality that as much butter can be made from that yielded by a North Devon cow as from that yielded by the breeds which are esteemed better milkers. For all the purposes of labour, whether activity, docility, or strength and hardiness, this breed cannot be excelled. It is said that, on fallow land, it is no uncommon day's work for four steers to plough two acres with a double-furrow plough. The employment of oxen for draught purposes is, however, fast dying out. As the improved practice of agriculture is extended, it brings with it the necessity for the employment of a higher class of animal, as well as of human labour. The labour of oxen having been found deficient in those qualities required in improved practice, is therefore, as said above, being less and less used. Although they do not attain the height of several other breeds, they fatten early and rapidly, and their flesh is of excellent quality. Many will, with proper care, weigh from forty-five to fifty stones when about two and a half or three years old; and the quality of the meat is unrivalled by that of any other breed.

In South Devon there is a mixture of the pure North Devon stock with a larger breed, of the same kind, called the *Old Marlborough Red*; which is said to have descended from the South Molten stock, although at present they differ materially from them in size, and in having a dingy brown or blackish colour at the ears, nose, and round the eyes, or wherever the orange tint is observable in the genuine race. A cross with this species is found to fatten more readily than the pure South Devon, and is therefore generally preferred.

The Devon, according to Mr. Smith, is eminently fitted for every hardship, the frame being compact, and the offal light; they have power and great endurance; being 'cast in a peculiar mould' they have a degree of elegance in their movement which is not to be excelled. As animal food producers they are unsurpassed, and in consequence they receive the first attention of the London West-end butchers. A first-rate Devon has a prominent eye, with a placid face, small nose, and elegantly turned horns which have an upward tendency (and curl outwards at the end), as if to put the last finish upon his symmetrical form and carriage. These animals are beautifully covered with silky coats of a medium red colour. The shoulder-points, sides, and fore-flanks are well covered with rich meat, which when blended with their peculiar property of producing meat of first-rate quality along their tops, makes them what they are—'models of perfection.' . . . Some object to the North Devon, and class him as a small animal, with the remark, 'he is too small for the grazier.' In saying this it should ever be remembered that the Devon has his peculiar mission to perform—viz. that of converting the produce of cold and hilly pastures into meat, which could not be done to advantage by large-framed animals, however good their parentage. The Devon may thus be designated the 'pony of the ox tribe.'

The pedigree of the various animals constituting the 'pure-bred Devons' will be found in the 'Devon Herd Book.' From this will be traced the fact 'that nine-tenths of the present herds of these truly beautiful animals are directly descended (especially in their early parentage) from the old Quartly stock'—Mr. Francis, of Quartly, having the honour of being looked upon as the introducer of the new breed.

The Devon is a first-class grazier and butchers' beast. Although showing their highest condition, and seen in their greatest perfection in their own habitat, they do well in the more sheltered situations and amongst the richer pastures of more highly cultivated lands. As has been truly remarked of them by the editor of the 'Devon Herd Book' in the pages of *The Field*, they bear the 'change of soil and climate well, thrive where many breeds would starve, and rapidly outstrip others when they have plenty of good pasture.' We have said above that they are good butcher's beasts. On this point the same eminent authority remarks:—'As converters of vegetable and animal food, breed against breed, they return as much per acre, or for weight of food consumed, as any. . . . Their beef is of fine quality, and brings a high price in the market. They withstand extremes of temperature. On a poor pasture, from their peculiar build, they are enabled to travel rapidly over the ground without fatigue, and get sufficient nourishment, where a heavy short-horn or Hereford would starve. The very best of this beast are the best in the world. . . . The cry has been for the animal that will be the first ready for the butcher, and the Devon has answered it.'

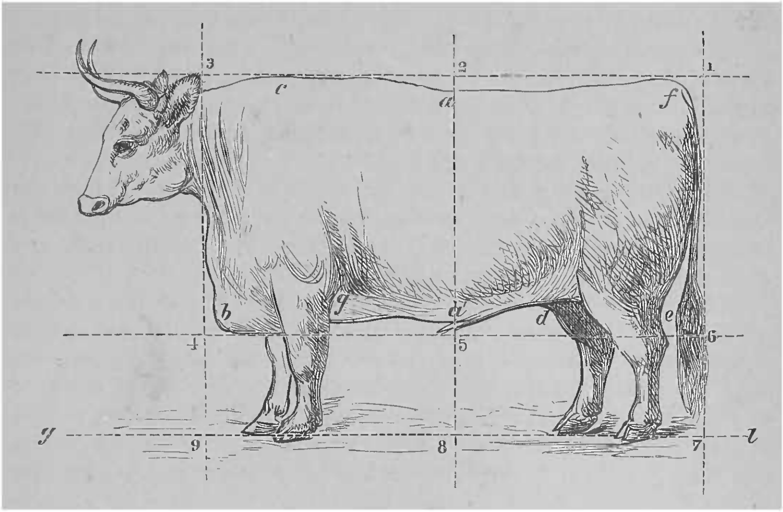
The Sussex Breed (fig. 5 is an illustration of an ox of this breed, fig. 6 that of a cow) differs from the Devonshire by being larger and coarser. When pure bred, the cattle are invariably of a dark red colour; and those which are marked with a mixture of either white or black are usually crossed with foreign blood. In other respects they are thus described by an eminent breeder,[1] the accuracy of whose judgment has been confirmed by many intelligent graziers:—

'A thin head, and clean jaw; the horns pointing forward a little, and then turning upward, thin, tapering, and long; the eye large and full; the throat clean, and no dewlap; long and thin in the neck; wide and deep in the shoulders; no projection in the point of the shoulder, when looked at from behind; the fore legs wide; round and straight in the barrel, and free from a rising back-bone; no hanging heaviness in the belly; wide across the loin; the space between the hip-bone and the first rib very small; the hip-bone not rising high, but being large and wide; the loin, and space between the hips, to be flat and wide, but the fore part of the carcass round; long and straight in the rump, and wide in

[1] Mr. Ellman, of Glynde. See 'Agricultural Survey of Sussex,' p. 231.

the tip; the tail to lay low for the flesh to swell above it; the legs not too long; neither thick nor thin on the thigh; the leg

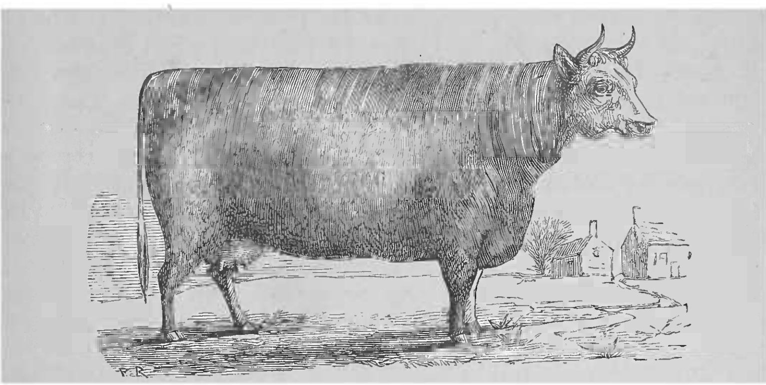
FIG. 5.



SUSSEX OX.

thin; shut well in the twist; no fulness on the outside of the thigh, but all of it within; the squareness behind, common in all

FIG. 6.



SUSSEX COW.

long-horned beasts, greatly objected to; the finer and thinner in the tail the better.

'Of these points the Sussex beasts are apt to be more deficient in the shoulder than in any other part. A well-made ox stands straight, and nearly perpendicularly, on small clean legs; a large bony leg is a very bad point, but the legs moving freely, rather under the body than as if attached to the sides; the horns pushing a little forward, spreading moderately, and turn up once. The horn of the Devonshire, which very much resembles the Sussex, but small and lighter, is longer, and rises generally higher. The straightness of the back line is sometimes broken, in very fine beasts, by a lump between the hips.'

The true Sussex cattle are large hardy animals. They are chiefly found in their own county, where they are prized for their labouring powers more than anything else. Few of the cows are good milkers, nor do the oxen fatten at an early age.

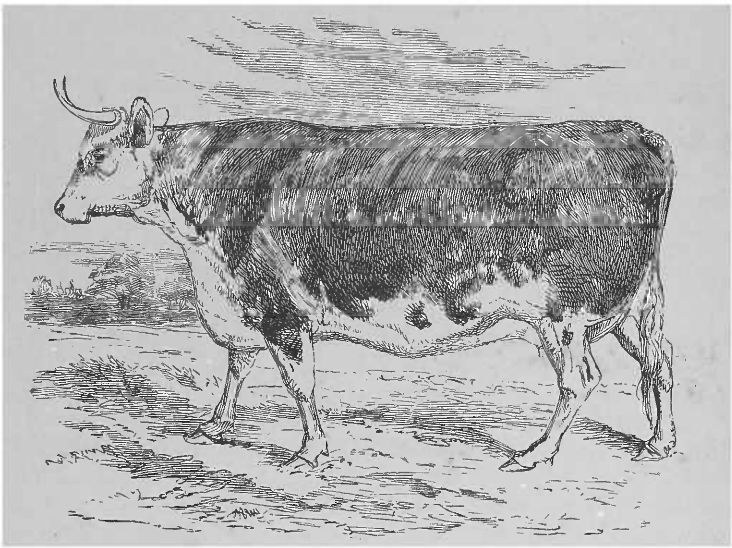
The finest herd of Sussex cattle was at Beckley, on the borders of Sussex; they were formerly the property of Mr. Selmes, of Knell Farm, who some years since challenged Lord Althorpe to show a certain number of short-horns against an equal number of Sussex cattle. This herd passed into the hands of Mr. Smith of the same place, who worked them from four to six years, and then put them up to fatten, when they attained an immense size.

But the breed is by no means likely to die out; on the contrary, it is securing increased and increasing attention. Amongst the best known breeders are Mr. T. Smith, of Beckley, the old seat of the best breeder of former times above alluded to, in last paragraph; the Rev. T. Gould, of Burwash; Mr. Ed. Cave, of Berwick's Court, this gentleman being the first to introduce the breed to the notice of the committee of the Smithfield Club; Mr. T. Child, of Plinbold; Mr. R. Hawes, of Westham; Mr. Marshal, of Bolney; Mr. Agate, of Horsham; Mr. Heasman, of Angmering, and many others, might be named did our space permit. The last-named breeder, in a paper on the breed published in *The Field*, says that the breed is a great favourite with the butchers; that 'they are second to none as regards early maturity and weight for age. At three years old well-fed steers will weigh from twelve to fourteen score pounds per quarter.' The favourite colour now is 'cherry,' an intermediate tinge between the light and dark red of former times, the dark red being so very dense in some instances as to approach almost to a black, for which, indeed, at a short distance, it was to be taken.

The Hereford Breed (see figs. 7, 8, and 9) is a variety of the Devon and Sussex, but is larger and weightier than either, being generally wider and fuller over the shoulders or chine, or breast, or brisket, as well as the after part of the rump. The prevailing colour is a reddish brown, and the face is white or mottled; the hair fine and inclined to curl, and the skin thin and elastic.

In the true-bred Hereford cattle there is no projecting bone in the point of the shoulder, but it regularly tapers off. They have considerable breadth before, and are equally weighty in their hind-quarters. There is a great distance from the point of the rump to the hip-bone; the twist is full, broad, and soft; the arm, so far as the pastern joint, tapering and full, but thin and tapering below the joint. The animal handles remarkably well, and is especially mellow on the rump, ribs, and hip. The quality of the meat is not hard, but fine as well as fat. There is little coarse flesh about them, the offal and bone being small in proportion to their weight, while their disposition to fatten is equal, if not superior, to that of any other breed in the island; they are not, however,

FIG. 7.



HEREFORD COW.

calculated for the dairy. The Hereford cattle arrive early at maturity, and are excellent at the plough or the team, though seldom worked in their native districts; but it is as fattening stock that they excel. There is a more extraordinary disproportion between the weight of the Herefordshire cows, and that of the oxen bred from them, than is to be found in any other breed. They are comparatively small, extremely delicate, and light fleshed; and not unfrequently the mothers of oxen nearly three times their own weight.[1]

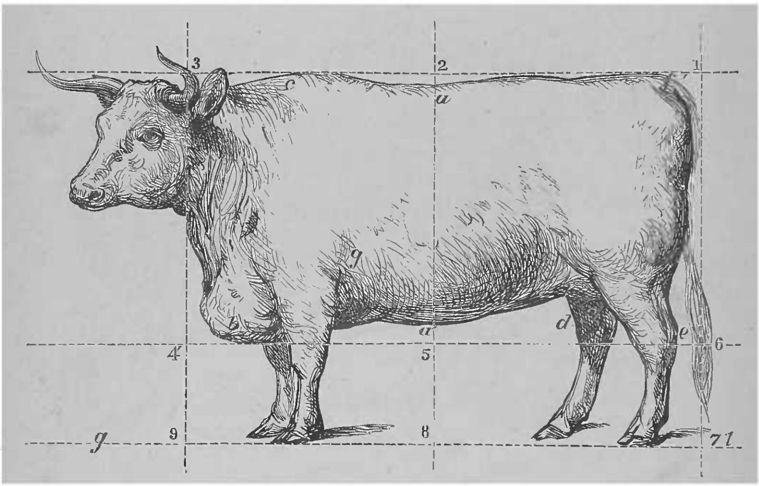
[1] See the 'Agricultural Survey of Herefordshire,' p. 118, and a Paper by T. A. Knight, Esq., in 'Communications to the Board of Agriculture,' vol. ii.

On comparison with the Devon and Sussex, the Hereford breed will not be found equally active and hardy in the yoke; but for grazing purposes it is generally considered to be unrivalled.

Some breeders prefer the Hereford to the Short-horn; there is no doubt of its value as a rapid fattener, and a producer of excellent beef, and when selected carefully they possess good dairy qualities.

The *Hereford* breed was formerly in high repute for the draught purposes of the farm. This purpose being, however, nearly set aside, the breed is more prized for his 'beef-producing propensities, for which his scale of form, early maturity, and aptitude to fatten, render him highly distinguished.' The fol-

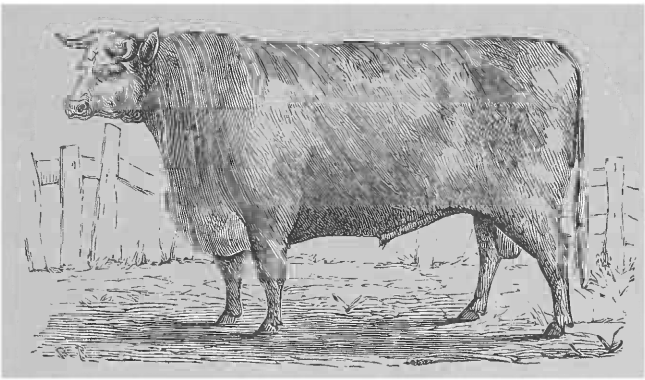
FIG. 8.



HEREFORD HEIFER.

lowing, according to Mr. Smith, from whom we have already quoted, are the characteristics of the breed:—'The face, mane, throat, the under portion of the body, the inside and lower portion of the legs, and the tip of the tail, are beautifully white; the other parts of the body a rich red, usually darker in the male than the female; the horn is white or light yellow, of a waxy appearance, sometimes tipped with black. The forehead is broad, with spreading horns; those of the bull straight and level with the poll, and of the ox and cow slightly curved, with an upward tendency. The eye is full, yet of a massive expression, denoting the quietness of disposition and temper characteristic of the Hereford, and which is of paramount importance to insure the profitable feeding of all ruminating animals. The cheek is fine, the head small in proportion to the carcase, which is long, level, and cylindrical. The hide is thick yet mellow, and well covered with moderately long soft hair, having a tendency to curl. The brisket is prominent, the chest well expanded, and the breed is eminently distinguished for neatness of shoulder, the bone being thin and flat, the kernel full up, the outside shoulder well covered with mellow flesh, the chine good, the loin broad, the hips wide and level, the whole back displaying a straight line, well covered with flesh from the neck to the tail. The twist flank and fore flank are good; the outside thigh is perhaps the most defective part. The whole body is well covered with rich mellow flesh, yielding with pleasant elasticity to the touch. The legs are short,

FIG. 9.



HEREFORD BULL.

and the bone small, and the whole contour displays great constitution, and exhibits, perhaps, a larger proportion of flesh in proportion to bone, than any other breed.'

Mr. E. F. Wells, an authority on points connected with the Hereford breed, has the following observations on the colour and form of Hereford cattle :—

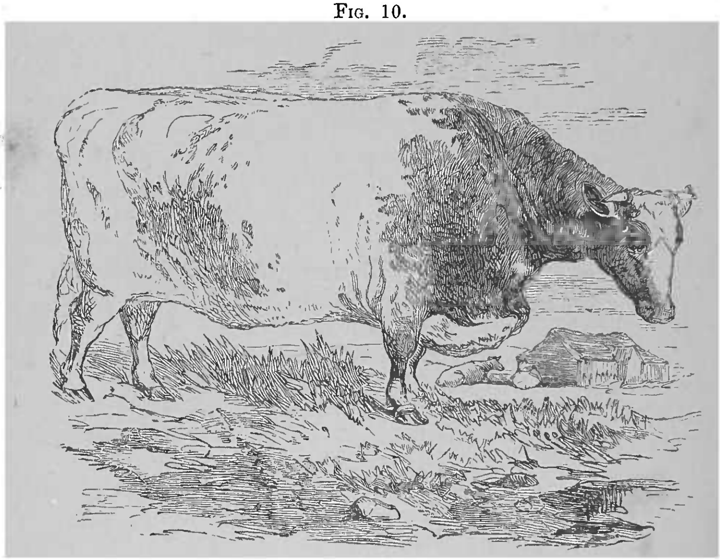
'Both light and dark colours have been at different periods in general estimation, as the caprice of fashion has ruled, for there is not in reality any sound reason for the rejection or adoption of either exclusively. Mr. Andrew Knight was favourable to light colours—grey or yellowish red—and as he may not be supposed to have given a preference to them on purely fanciful grounds, he is known to have entertained the opinion that they are the quickest feeders. The darker colours were at one period much approved, and by eminent breeders; among them may be mentioned Mr. B. Tomkins. Mr. Edward Jeffries had also many very dark in his herd, and a bull of his, nearly black, was exhibited many years ago at Hereford. I believe there is no rule to be considered of at all general application as to one colour being more hardy than another in the breed of Herefords. One reason why light reds or yellows are often less in esteem, may arise from the fact that cattle, when in a state of disease, become lighter in colour. Many persons also entertain an opinion that grey or roan is a colour indicative of delicacy. But, I will ask, is it so considered among the Short-horns? There is at the present time, perhaps, more prejudice about colour than at any former period. On what reasonable grounds is it that the white-faced is preferred to the mottled? This point may be conceded to the former, that a herd of them exhibit a more desirable uniformity; but a similarity in size and form would be a higher aim, and a more important acquisition; and in the advocacy and adoption of either colour to the exclusion of the other, the faults prevailing in each are often disregarded, and opportunities of reciprocal improvement lost sight of.[1] Mr. Andrew Knight has stated, in one of his publications, that it is probable that the first specimens of the white-faced were imported from the Continent, some cows of that colour having been introduced into the county by a Lord Scudamore, and the supposition seems to be somewhat strengthened by the variety having only become numerous in the last century. Those who are so strongly their advocates should be prepared with some better cause for their preferences than their becoming fashionable. It would also be desirable we should know what is the cause that of late the buyers of this breed for the purposes of stock are grown so fastidious as not to allow a tinge of black about the head, neck, and legs, when it can be well ascertained that some of the best and finest specimens of the old Hereford breed have been so marked, accompanied, too, with black noses, against which there is also much prejudice existing among many. I never heard that the eminent breeder Mr. Benjamin Tomkins was in the habit of rejecting a good animal on account of its colour; and, perhaps, there have been none of equal eminence whose attention was less directed to that point. But if he had a preference it was, perhaps, to the grey, a colour he began with and esteemed to the last. If Mr. Tomkins was a disregarder of colour, so also was Mr. John Price. He selected of Mr. Tomkins all the three varieties of colour in Herefords; not that he might possess specimens of each, but finding animals of each variety possessing the form and qualities he was seeking. From this

[1] As an additional support to this opinion. I repeat a statement I made in a former letter, from a conversation I once had with Mr. Tulley, of Cliro. that he was told by his mother, who had attained a great age, that she remembered the first introduction of the white-faced breed.

inattention to colour on the part of Mr. Tomkins and Mr. Price, there have gone about many erroneous notions that their breeds were not pure Herefords. Is it likely, I would ask, that either the one or the other, equally tenacious about the pure descent of their herds, and knowing so well the time and difficulty of wiping out a bad stain, would so far commit themselves as to cross too with an alien stock? I consider the idea to have originated entirely from the fact I have adverted to—their indifference about colour.

'There is, unfortunately for the improvement of Hereford cattle, too little attention paid to the true principles of form—an object which the late Mr. Price long and unceasingly pursued—and it must be regretted that it is more appreciated in the native county of the breed; the breeders generally contenting themselves with the possession of a few points, which they consider all important, and which give the animal a striking appearance to common observers, without, however, that proportion of parts which it is so desirable to attain. But to go more into detail—I think the formation of the fore-quarter is receiving less attention than it ought, the capacity of the chest in particular, and the ribs which enclose it. The posterior ribs attaching to the loin, the hips, and the rump, seem to occupy the exclusive attention of too many. This also, it is commonly thought, must be accompanied by a very soft touch, in preference to one moderately firm and elastic; it is also considered an advantage if the animal is large—a term often erroneously given to one standing on high legs, without corresponding width and depth of frame. Neither is the malposition of the fore-legs considered of much detriment to the animal; so little attention having been given to the fore-quarter, the advantages or disadvantages of fore-legs crooked or straight have not been properly estimated. There has been, too, an anxious desire to increase the width of the hips, often to the sacrifice of other parts—the middle of the loin and the thigh. An attempt also to get the rumps too long, leads to a deficiency in the twist, a fault which I fear is rather on the increase with Herefords in general. No animal of the cow kind can be called complete in form, in which the under points are not as well furnished as the upper; and yet how often do we see a striking disproportion. The shoulders in Hereford cattle are liable to but little objection, being for the most part free from bareness along the front of the shoulder-blade, and from any unnecessary projection of bone at that part commonly termed the shoulder-point. The position of the blade will, of course, vary in obliquity; when that is sufficient, the upper part of the blade will be better united with the chine, and the kernel before the shoulder larger and more developed. The circularity of the pectoral ribs is also greater with such position of the shoulder-blade, and the fore-flank more prominent. Many give a preference to a moderate shortness of the rib. It may often accompany an increased extension of what is (I think erroneously) termed the first rib; but as it represents small intestines, it cannot be supposed to be characteristic of strong constitution; besides, it prevents the flank being placed low enough, which a horizontal line drawn from the elbow will show. The head and neck may be made the subject of a few remarks. In many specimens of good Herefords the neck is placed low in reference to the shoulder, and the head is carried downward in consequence. In cattle, as well as sheep, this form is often accompanied by a fatness of the chine, but it is disadvantageous to an animal when in a pen with others

FIG. 10.

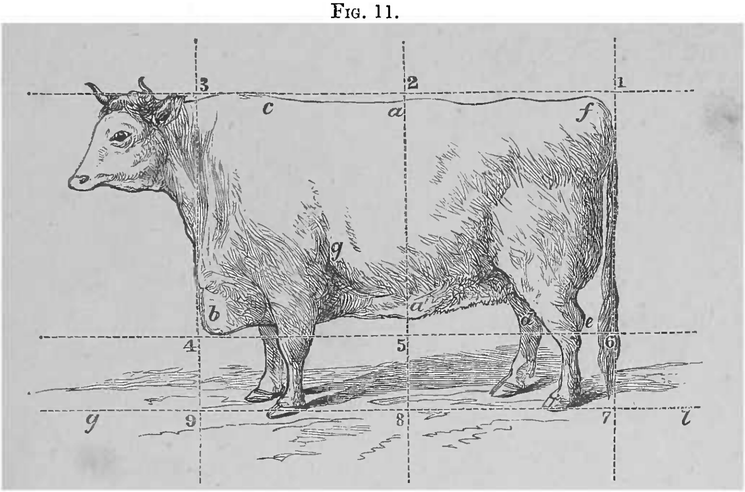


SHORT-HORN HEIFER.

that carry their heads higher. Many of Mr. B. Tomkins's and Mr. Price's had this growth, and I never heard it objected to on any other grounds. There may occasionally be seen some good Herefords, too, with their heads set on abruptly to the neck, rendering the junction of those parts thin and narrow, which is, I think, an indication of too great delicacy, and consequently to be avoided.'

The SHORT-HORNED CATTLE.—In fig. 10 we give a pictorial illustration of a Short-horn Heifer; in fig. 11, an illustration in outline showing the square form (see remarks on 'form' and 'points' in cattle); and in fig. 12 a portrait of a Short-horn crossed with a Gloucester. Under the denomination of Short-horns are included the *Holderness* and *Teeswater breeds*, which have been supposed to derive their origin from a cross with some large bulls that were imported by Sir William St. Quentin, nearly a century ago, from Holland into Yorkshire, and in the east and north ridings of which county the two latter breeds have been long established and deservedly esteemed. It has, however, been doubted whether any advantage was derived from this intermixture; for the increase thus obtained in size was thought to have been counterbalanced by a more than proportionate increase of offal. But, fortunately, the error was not universal; for some intelligent breeders, aware, even at that day, of the superiority of symmetry to bulk, preserved the breed, of which they were already in possession, in its native purity; and it is from some of that stock, so maintained, that the

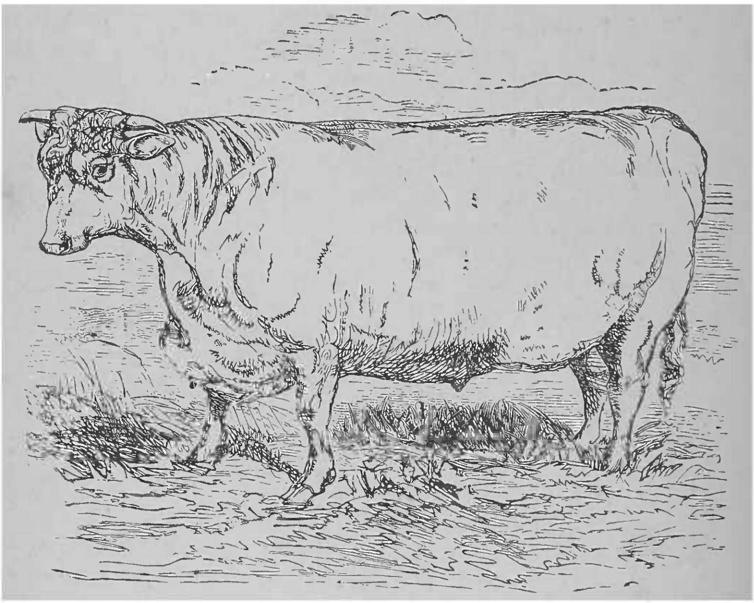
Fig. 11.



SHORT-HORN OX.

present *improved Short-horned* cattle, sometimes known also as the *Durham breed*, is supposed by some to be descended. Considerable doubt has, however, been thrown on this account of the origin of the Short-horn, from the circumstance that importation of cattle from the Continent was most stringently prohibited during the whole of the eighteenth century. It is useless to speculate upon this subject, for speculation is vain, no authentic records being now available to enable us to describe what is, after all, no very important matter; enough for us to know, that the improved Short-horn, now the crack breed of Great Britain, owes its introduction to the skill of Mr. Charles Colling, of Ketton, in the county of Durham, and to that of his brother Robert. It was to the skill of Charles Colling that the main credit of introducing an improved breed is due. Of this breed Mr. Charles Colling sold a bull in 1810 by public auction, for the enormous sum of 1,000 guineas; Messrs. Wetherell, Trotter, Wright, and Change being the purchasers. This large sum has, however, been excelled in a more recent time, by the sale of Colonel Townley's famous bull 'Master Butterfly,' to an Australian gentleman, for 1,260 guineas. Mr. Bolden sold, in 1856, to Mr. Thorne of New York, the 'Grand Duke,' and '2nd Grand Duke,' for 1,000 guineas each. Again, at the sale of Earl Ducie's Short-horn herd at Trotworth, in 1852,

Fig. 12.



SHORT-HORN GLOUCESTER.

'nine animals,' the *Agricultural Gazette* informs us, 'descended from Charles Colling's Young Duchess (three of them being calves), fetched the enormous sum of 4,160 guineas, averaging 462 guineas a-piece.' Such is the estimation in which the Short-horn is held by modern breeders. The history of the celebrated *Durham Ox*, the property also of Mr. Charles Colling, is too remarkable not to merit attention.

He was bred in the year 1796, and at five years old was not only covered thick with fat upon all the principal joints, but his whole carcass appeared to be loaded with it, and he was then thought so wonderful an animal, that he was purchased in February 1801, for 140*l.*, to be exhibited as a show; his live weight being then 226 stone of 14 pounds. In the following May he was again sold for 250*l.* to Mr. John Day, who, two months afterwards, refused for him 2,000 guineas. On May 14 Mr. Day could have sold him for 525*l.*, 1,000*l.* on June 13, and 2,000*l.* on July 18. He was exhibited in almost every part of the kingdom until February 19, 1807, when he fell and dislocated his hip-bone. Every remedy was attempted in vain, and on April 15 he was shot. Although he must have lost considerably in weight during his two months' illness, he weighed 187 stones 12 pounds;[1] and Mr. Day stated his live weight, at ten years old, to have been 278 stones.

Uncommon as was the weight of this animal, he was exceeded in size by a Yorkshire ox, bred by Mr. Dunhill, of Newtown, near Doncaster, whose weight was 264 stones 12 pounds. He was supposed to have lost nearly forty stones while being exhibited in London.

Still more recently, another beast of uncommon size, fed by Lord Yarborough, was exhibited under the title of 'the *Lincolnshire Ox*;' but, although bred in that county, from a favourite cow belonging to Mr. Goulton, he was got by a descendant of Comet out of Countess, also of the Durham breed. This extraordinary animal measured five feet six inches in height at the shoulders, eleven feet ten inches from the muzzle to the setting on of the tail, eleven feet one inch in girth, and three feet three inches across the hips, shoulders, and middle of the back. The lowest point of his brisket was only fourteen inches from the ground. There was a distance of one foot ten inches between the fore legs, and the girth of the fore leg was nine inches.

The following account of the Kirkleavington herd of Shorthorns, late the property of Thomas Bates, Esq., is not a little interesting:—'It may be asserted with confidence that at the time of its dispersion or sale on May 6, 1850, this herd was unequalled by any other in existence. Magnificent size, straight and broad back, arched and well-spread ribs, wide bosom, snug shoulder, clean neck, light feet, small head, prominent and bright, but placid eye, were the features of usefulness and beauty which distinguished it in the highest degree. The hide is sufficiently thick to indicate an excellent constitution; its extraordinary elasticity, together with the soft furry texture of the coat, evinced throughout the herd excellent quality of flesh and disposition to rapid taking on of fat. "Young Duchess," a two-year old heifer, got by

[1] Viz.

	st.	lbs.	
Four Quarters	165	12	See 'Agricultural Survey of Durham,' p. 233.
Tallow	11	12	
Hide	10	2	
	187	12	

Comet (the bull we have already spoken of), dam by Favourite, was the originator of that portion of this herd called the "Duchess family." One of her calves, "the Fourth Duke of York," now in the possession of the Earl of Ducie, is as fine a bull as England can produce. The only three calves yet got by him have realised the sum of 379*l.* 1*s.* The herd consisted of forty-eight cows, heifers, and heifer calves, and twenty bulls and bull calves, and realised a total amount of 4,558*l.* 1*s.*[1]'

'For some years past,' says a writer in the 'Irish Farmer's Gazette,' 'considerable rivalry has existed between the admirers of two different strains of short-horned blood—to wit, that derived from Mr. Bates's herd, already alluded to, and that which is possessed by the Messrs. Booth. The Booth family have been long celebrated as breeders of Short-horns, but of late years their herd has become especially famous, not only on account of the numerous honours obtained by it at the national shows, but also from the great improvement which the Booth blood makes in a herd. For this latter reason "Booth" bulls are always in great demand by breeders, who hire them for a season, and lately Mr. Richard Booth had twenty-six bulls out on hire, at prices varying from 100 guineas to 250 guineas for a year's service; 300 guineas having been offered unsuccessfully for the use of his Crown Prince. From the circumstance that Mr. Booth had not sold any of the females of his herd for many years, there are few breeders who possess an unalloyed strain of "Booth blood" on both sides; but this is found in the herd belonging to Mr. Barnes, Westland, co. Meath, who purchased a pair of heifers from the late Mr. Booth, of Killerby, and having since used only Booth bulls, that blood, as it exists in the "Mantalini" family, is to be met with in all its integrity at Westland. Other breeders have got a few females of this line from Mr. Barnes, amongst which we may mention his Victoria, sold in 1860, along with her very youthful calf, to Lady Pigot, for 500 guineas. Another of the same line, Miss Warlaby (bred by Mr. Barnes), eight years old, was sold at Mr. Chaloner's sale, at Kingsfort, co. Meath, on the 18th of July, 1860, for 372*l.* 15*s.*; whilst a yearling bull calf out of her, by Harbinger, fetched, after keen competition, 346*l.* 10*s.*, and her two months old heifer calf was bought for 210*l.*

'The far-famed Booth herd, according to the excellent account given by Mr. Dixon in his review of the "Herds of Great Britain," was commenced about 1790 by Mr. Thomas Booth with well selected cows of the then existing Short-horns, which he put to the best of Robert Colling's bulls, among which was Twin Brother to Ben (660).[2] After these he used Son of Twin Brother to Ben,

[1] 'Farmer's Magazine,' June 1850, p. 532.

[2] This number is that referred to in the 'Herd Book'—each animal has its distinctive number by which it is known.

Suwarrow, Easby, and the Lame Bull. We alluded to his purchase of Albion at the Ketton sale, and at Mr. Robert Colling's sale he purchased Pilot, of the Wellington tribe, dam by Favourite, the Pilot and Albion crosses being the making of the herd. "Henceforward he only used those bulls which were bred in the herd; and his sons, with the exception of a sparing use of Lord Stanley, Exquisite, Lord Zetland's Lord Lieutenant (sire of Leonard), have pursued the same plan" (Dixon). To these may be added Mussulman, the sire of the celebrated bull Buckingham (3239).

'To give even an abridged account of the many celebrated males and females which have sprung from the "Booth Herd" would require a volume of itself; and there is no one who has the slightest knowledge of modern Short-horns to whom the names of Hamlet, Buckingham, Leonard, Hopewell, Vanguard, Windsor, Crown Prince, Prince Arthur, British Prince, Prince of Warlaby, &c. among the bulls; and of Bracelet and her twin sister Necklace, Mantalini, Faith, Hope, Charity, Birthday, Bud, Hawthorn Blossom, Plum Blossom, Nectarine Blossom, Bridesmaid, Bianca, Queen of the May, Queen of the Isles, Queen Mab, Soldier's Bride, Bride Elect, &c., &c., among the females, are not quite familiar.

'Cattle of the pure "Booth blood" are distinguished by their mellowness, the depth and width of their fore-quarters, and consequent fulness of girth, the uncommon spread of their ribs, their good backs and loins; but they are sometimes deficient in style, and rather plain in the head, and coarse in the horn, which peculiarities were brought in by the Leonard cross, and came to him from Thorpe (2757), the sire of Leonard (Lord Lieutenant) having been got by Thorpe. The celebrated Favourite had something of the same defect, being rather coarse in his horn. The Duchess tribe, on the other hand, are characterized by a great deal of elegance in the head and neck, but this is accompanied with defects, such as barrenness in "the side of the chest," "shoulders rough and prominent in their points, and bare of flesh," as has been truly said by Mr. Carr. On the other hand, to use Mr. Carr's well chosen words, in a Booth animal, "the neck, fine at its junction with the head, increases rapidly, though not abruptly, in size until it melts insensibly into the shoulders and wide projecting brisket, which again blend imperceptibly with the crop, fore-flank, and ribs, without any depressions or protuberances. When the animal walks the elbow joint is scarcely, if at all, seen, and there is no hollow behind it. The motion of the shoulder-blades and shoulder-points is imperceptible, the former being laid snugly back into the crops, the latter hidden by the full neck vein, which blends with the muscles of the shoulder, neck, and brisket, forming gently tapering lines to the head and breast end." Now that the heat of rivalry has somewhat cooled down, and that the respective upholders of each of these famous strains of blood are prepared to acknowledge the merits of the other, it is considered that a judicious blending of the good qualities of each would be highly desirable; and such a union is, in fact, considered by several eminent breeders to be the very acme of Short-horn breeding.

'The colours which belong to the Short-horn are rich red, pure white, and a mixture of the two in great variety, the most fashionable being a roan, more or less deep. A yellowish red is also occasionally met with, but it is not so much liked, although it prevailed at one time in some of the best animals of the breed; Hubback, for instance, was "yellow, red, and white." We have no right to object, therefore, to animals of that colour, on the score of purity of blood, although we have heard it done. Many dislike a white, but this seems rather a prejudice than an objection which can be traced to good grounds. It has been justly remarked "that some of the very best of the improved Short-horns have been white ones."'

The following is a description of the Short-horn breed, from the pen of Mr. R. Smith, in the 'Journal of the Royal Agricultural Society:'—'He should have a symmetrical and compact form, of sufficient size, on shortish legs; the body should be covered evenly with flesh, of a mellow and elastic nature, yet firm enough and springy to the touch, following the fingers when the pressure is withdrawn; the forehead should be open, without a contracted air about it, and tapering gracefully to the muzzle; the eye prominent, yet placid; neck moderately long, nearly running into the shoulders, which should be well laid, gracefully fitting into the fore-quarters; the girth good over the heart; the fore-arm, where it joins the body, broad and tapering, with fine bone below the knee, and fitting level into the girth, and so maintaining a straight line along the whole animal to the extremity of the hip; the neck vein should be prominent and well filled up with flesh, running neatly into the shoulder-points, which should not be prominent, (i.e. rough), but well covered, and the muscle on the outside of the shoulder being well developed; the ribs should spring well and level from the backbone, increasingly so towards the back rib, which should be well home to the quarter—in fact, the space here (termed the false rib) should carry on in a straight line over the hip, gradually tapering on the side bones at the tail, but the quarter must be well packed, not "scooped out," so to speak; the hip-bones should be dovetailed into the quarter and false rib so completely that one ought to be at a loss where to find them—i.e. they should not be too recognisable; the flank will then, as I have already said, be deep and full, forming a parallel line with the animal's back from the bottom of the girth; the back, again, from behind the top of the shoulder all along the vertebræ, should be well covered;

the loins should be wide and thick; the edge-bone, or ridge, along the quarter should form a straight line in continuation with the back, and should also be well covered (which, in a great many animals, it very imperfectly is) to the same level; the twist should be straight down (square), moderately wide and deep, containing a great deal of heavy flesh, and the legs should be well under the animal; there should be a thick coat of mossy hair, not sharp, or what is termed wiry. Altogether, such an animal will have an ease and grace of motion as it walks which is only attained when the whole formation is in perfect harmony. There is, invariably, too, a style and grandeur of appearance unmistakeably stamping the "high caste" Short-horn. Many well-bred animals will not feed level, but get patchy, which is fatal to them as show animals, however stylish and fashionable in their outline. It is, therefore, indispensable that an animal should lay on flesh uniformly on every part, so as not to spoil the proportion of the several parts. Rough shoulders are always accompanied by heavy open shoulder-blades, and a slack bad girth, deficient through the heart as well as at the top of the plates immediately behind the shoulder. The animal is also sadly deficient in neck vein, being weak and ill-filled where it joins the shoulder-points. Again, however good an animal is in all other respects, it is imperative that the hind-quarter be well finished and neat; nothing proclaims a low-bred character so distinctly as an ill-turned quarter. If the tail is not neatly set on, failing to come well out to form the square at the twist, you may be sure something is wrong. While, however, the tail is well set on, and the side bones sufficiently high to carry the flesh fully up to the level of the quarter, there should not be any redundancy to mark and separate the rumps from the adjoining quarter. The hind legs must not be overlooked: if the hocks are too much bent, too long, or not well within the animal, it is a serious objection. The hind legs should be nearly straight, and well under the animal; this not only looks well, but is a mark of strength, as obviously as the reverse is one of weakness.'—*Journal of Royal Agricultural Society of England*, vol. xx. p. 330.

The following is a scale of points for *Short-horn Cows*, as given in the 'Transactions of the Board of Agriculture of Lower Canada,' which may be some guide to the reader in the choice of a cow:—

1. Purity of breed on male and female side; sire and dam reputed for docility and disposition, early maturity, and aptitude to fatten; sire a good stock-getter, dam a good breeder, giving a large quantity of milk, or such as is superior for making butter and cheese.

2. Head small and tapering, longer and narrower in proportion than that of the bull; horns fine and gradually diminishing to a

point, of a flat rather than a round shape at the base, short and inclined to turn up, those of a clear wavy colour to be preferred, but such as are of a transparent white, slightly tinged with yellow, admissible; ears small, thin, and well covered with soft hair, playing quick, and moving freely; forehead of good breadth between the eyes, and slightly dished; eyes bright, placid, and rather prominent than otherwise, with a yellow rim round them; the lower part of the face clean, and well developing the course of the veins; muzzle small; nose of a clear orange or light chocolate colour, the former much preferred; nostrils wide and well opened; lower jaw thin; teeth clean and sound.

3. Neck fine and thin, straight, and well set on the head and shoulders, harmoniously widening, deepening, and slightly rounding, in a delicate feminine manner, as it approaches the latter point; no dewlap.

4. Shoulders fine and well placed; fore-legs short, straight, and well spread apart; fore-arm wide, muscular, slightly swelling, and full above the knee; the bone fine and flat below; knees well knit and strong; foot flat, and in shape of an oblong semicircle; horn of hoof sound, and of a clear wavy colour.

5. Chest broad, deep, and projecting; the brisket in a lower line than the belly.

6. Barrel round, deep, and well ribbed to the hips.

7. Back short, strong, and straight from the withers to the setting of the tail; crop round and full; loin broad; huckle-bones on a level with the back; tail well set, on a level with the back, or very slightly below it, fine, and gradually diminishing to a point, and hanging without the brush an inch or so below the back, at right angles with the back.

8. Hind-quarters from the huckles to the point of the rump long and well filled up; twist well let down, and full; hind-legs short, straight, and well spread apart; gradually swelling and rounding above the hock; the bone fine and flat below; foot flat, and in shape of an oblong semicircle; horn of the hoof sound, and of a clear wavy colour; legs not to cross each other in walking, nor to straddle behind.

9. Udder broad and full, extending well forward along the belly, and well up behind; teats of a good size for the hand; squarely placed, with a slight oblique pointing out; wide apart; when pressed by the hand the milk flowing from them freely; extra teats, indicative of good milking qualities, but should never be milked, as they draw the bag out of shape. Milk veins large and swelling; milk excelling either in quantity or quality for making butter or cheese.

10. Skin of a medium thickness; movable and mellow; a white colour admissible, but a rich cream or orange much preferable.

(We speak of a bare skin beneath the hair.) It is believed, as a rule, that cows with a cream-coloured skin yield the richest milk. Hair well covering the hide, soft and fine, and if undercoated with soft thick fur in the winter, so much the better. Colour, pure white, red roan, bright red, red and white, spotted roan, or reddish yellow.

YORKSHIRE BREED.—This is a variety of the Short-horned bull, not of the improved Short-horn, but still possessing many of its qualities. It is held in high estimation by the London dairymen, from its yielding large quantities of milk, and at the same time keeping up a tolerably fat condition for the table. The following is a description of the Yorkshire cow by Mr. Haxton:—'*Head* long, and rather slender from eye to nose; *eyes* bright, yet mild; *chops* thin and clean; *horns* small and tapering to a point; *neck* thin behind the ear, but gradually swelling out towards the shoulder, and free from loose skin. The *chest* deep and prominent, and not too wide, the latter characteristic being peculiarly that of the improved pure short-horn cow, who is a manufacturer of flesh and not of milk; the *chine* fleshy and full, and the girth behind the shoulder more remarkable from being the result of depth of chest than breadth. The short *ribs* springing from the back bone in the form of an arch; *hind-quarters* broad between the haunch bones, and long from these to the point of the rump; *thighs* rather flat than thin, and *hind-legs* rather *dog-houghed* than straight. The skin of the Yorkshire cows is probably her worst feature, being rather too thin and devoid of hair to be compatible with hardiness and strength of constitution; notwithstanding these defects she is a valuable animal when well sheltered and well fed. The udder is in general extraordinarily large, thin skinned and flexible, and the abdominal or milk veins, as they are commonly but erroneously termed, large, swelling, and puffed out at the junction with the udder. The udder itself is well forward on the belly and back between the legs, so as to give the appearance of great length rather than breadth, when viewed from the side, but its vertical depth in good specimens of the Yorkshire cow is not great. The teats are sometimes rather long and thick at the neck, and when this is the case there is apt to be a difficulty in retaining the milk when the udder is full; but while this is so far a defect, it renders the process of milking much more easy and expeditious than when the teats are small, and of little compass at the junction with the udder. In those cases where the teats are apt to become gorged with milk, the udder should be emptied thrice a day instead of twice, which will relieve the teats from pressure.

The LONG-HORNED Leicestershire or Craven cattle are descended from a breed that has been established in the Craven district, in

Yorkshire, where they produced a stock that soon became remarkable for its beauty and propensity to fatten.

Of this *Canley stock*, Mr. Robert Bakewell, of Dishley in Leicestershire, procured some cows, which he crossed with a Northumberland bull, and thus reared that celebrated race, well known as the *Dishley breed.* They were long and fine in the horn, had small heads, clean throats, straight broad backs, wide quarters, and were peculiarly light in their belly and offal. Probably from the effect of domestication and gentle treatment, they were remarkably docile. They grew fat on a smaller proportion of food than the parent stock, but gave less milk than some other breeds. The chief improvement effected seemed to have been, their aptitude to fatten early on the most valuable points, and in the superior quality of the flesh.

Notwithstanding the deservedly high reputation, as a breeder, enjoyed by Mr. Bakewell during his life, and that still attaches to his name, the long-horns have ceased to be general favourites. They are, however, still to be met with, and chiefly in Warwickshire and Leicestershire, where they are valued as dairy cattle; more cheese than butter is usually made from their milk, and some cows will furnish from 400 to 500 cwt. of cheese each in a season. In the short space of thirty or forty years this stock has degenerated and dwindled away in a marvellous manner, considering its prevalence and value at the commencement of this century; this has been ascribed to the close *in and in* system of breeding which was pursued by most of the great breeders of long-horned stock; and many regret it exceedingly. The Durham variety of this breed is now held in the greatest estimation.

The modern improvements made in the long-horned cattle, since the first attempts of Bakewell, consist chiefly in the coarser parts having been reduced, and the more valuable ones enlarged. The present breed is finer boned, extending to the neck, throat, and breast; the back is straight, wide, and well covered with flesh; the rump is also broad, and particularly fleshy on the points, and about the root of the tail. Even when only in store order, the flank is thick and fleshy, and, in every part, the animal handles loose and mellow.

Such were the distinguishing points of these cattle; but they were formerly not thought perfectly attainable except the beasts were fed on the richest pasture. This has proved to be an error; for not only are the long-horns now found on land of no extraordinary quality, but they are admitted to be hardy, and capable of thriving on ordinary pastures, thus justifying the assertion of Bakewell, that this breed kept itself in good condition on less food than any other of equal weight—an opinion that seems to have been fully justified by the large prices that have been repeatedly given for the stock.

Although the breed has gone out of fashion, and is being rapidly supplanted by the Short-horn, which is *par excellence* the favourite breed, still, there are some fine herds of Long-horns here and there to be met with; such as that of the Duke of Buckingham, Stowe Park; of Sir T. Harpur Crewe, Bart., Calke Abbey, Derbyshire; Mr. Chapman, of Upton, Nuneaton, &c. And, in view of the undoubtedly excellent points which it possesses, and which fit it for a good grazier's beast, it need not be matter of surprise that, in the space of a few years from now, we may see the fashion for it revive. The cows are prolific, and they are good milkers; but as fattening stock, their weakness lies in this, that they do not fatten quickly, taking longer to come to the state known as 'ripeness' for the butcher than the short-horn—the quickest fattener of all the breeds—and other breeds. This weak point, however, being in former days much weaker than it now is, there is room for hope that further experience will bring improvement in years yet to come. Seeing the wide varieties we have, of soil, locality, and climate, it is a pity to allow any breed practically to die out; as it may be found to suit some locality or kind of climate not yet much noticed or worked upon. The importance of this is obvious, when we consider the enormously increasing demand there is for butcher's meat—a demand which at times seems scarcely able to be met by the greatest efforts and the most far-seeing provision of the grazier and butcher.

The next breed we have to notice is marked by a peculiarity we have not as yet come across in any of those noticed; this is the absence of horns. Cattle possessing this peculiarity are technically known as 'polled herds.' They are represented in England by the Suffolk and Norfolk, and in Scotland by the Galloway, the Angus, Morayshire, and Aberdeen breeds. In continuation of the English breeds which we have now under consideration, we take up first the Norfolk and Suffolk breeds.

The Norfolk Polled Breed, known as the 'Norfolk Red Polls,' is by some held to be the original breed of this county; by others to be the result of crossing with the polled Galloway cattle (see farther on for a description of this breed), large numbers of which, at a very early period in the history of the county, were imported into it. It would appear, however, from records recently disentombed from amidst the many connected with the county, that there was a true native breed or race of cattle having some of the peculiarities of the present breed. This original or county breed, if so it was, had, as the favourite colour, a deep blood-red, for the body, with a white or a mottled face. They, however, had horns, but these were small, or at least middle-sized, and clean cut. The body was small-boned, but with good round barrel, set on short legs 'well loined and thin thighed.' The head was fine.

This breed were good fatteners, taking on meat evenly, and finishing off at three years as freely as other breeds at four and five. They were hardy and were favourites with the grazier and butcher. The present breed possesses, no doubt, the peculiarities of the Galloway, with which at an early period it was crossed. It is held in high esteem, and there are, according to *The Field*, at least a hundred farms in the county in which fine herds of it are bred. The oldest herd is that established by Mr. George, of Eaton near Norwich, in or about the first decade of this century, and the most recent is that of Mr. T. Brown Markham. Between these are the herds of Sir Willoughby Jones, Bart.; of Messrs. Hudson, of Quarles Gamley and Blakeney; Mr. H. Birbeck, Stone, Holy Cross, &c.

The 'Suffolk Polled Cattle,' known frequently as the 'Suffolk Duns,' so far as their history can be traced, has been a polled breed from the earliest period in the history of the county. The colours usually met with are light dun (hence the above name), red and white, or yellow and white. The hair is fine and silky, the skin thin; the cows are excellent milkers, the head in some being very fine, and the general outline showing indications of thorough breeding. As milkers, indeed, it seems scarcely to admit of a doubt but that they are more valuable even than breeds such as the Ayrshires and Alderneys, which have, or are held to have, the highest reputation; and for this, if for no other reason, that they have not the tendency to 'go dry,' like the Ayrshires and Alderneys.

The steers have, on the whole, good form, the chines and back good; they are somewhat deficient in fulness in the front, this being narrow as compared with the hind quarters. The cattle sent out by the best breeders to the various shows are such as prove the value of the breed; few but what are fit, in the words of an eminent breeder from another county, to 'go to any show-yard.' One peculiarity makes them very valuable to the grazier—their hardness, which enables them to fit themselves for a wide range of districts, and to thrive in situations exposed to cold winds where other cattle would not do at all. This also helps them to improve even on such poor pasture lands as would be quite unfitted for the keep of cattle of other breeds.

The Welsh Breed is supposed to have been the same as the wild cattle already described, and is said to have been wild in the mountains so late as the reign of King John. From intermixture with the lowland cattle, and subsequent crosses, various breeds are now found throughout the Principality, materially differing from each other, and having lost almost every trace of their common origin.

The breed most generally known in North Wales is distinctively called the *Anglesea breed*, though by no means confined to that part of the country. They are chiefly black, slightly marked with white, and have thick horns, of a medium length, curving upwards. They are small and short in the leg, but well-proportioned and clean. They have deep barrels, high and wide hips and carcass, deep chest, large dewlap, and thin but commonly rough hides. They were favourites with Bakewell, who considered them as nearer to perfection, in some points, than any other, except his own improved breed; and many of our graziers inherit his predilection. When fat, the average weight of their quarters, at four years old, is from eight to eleven score pounds. They are very quick feeders, and thrive well when brought into rich pastures, make excellent beef, and the cows are generally tolerable milkers.

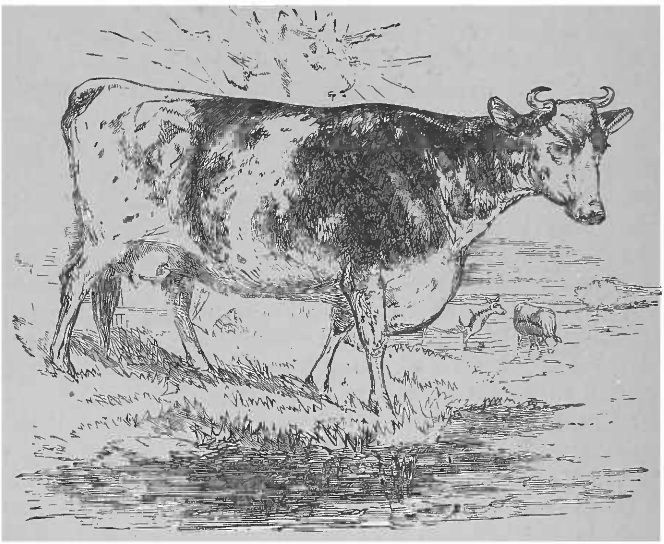
The Cardigan cattle are mingled with the Glamorgan, and are in considerable demand for stocking inferior pastures. The Carmarthen and the Cardigan are so much alike that they are occasionally confounded with each other. They are not quick feeders, nor do they carry much fat, but the little flesh they have upon them is good. Mr. Lloyd curiously states of the Cardigans :—'They are hardy, work and travel well, and take on fat kindly, but the best improvement that could be made in the management of them would be to give them better food in winter. The small and hardy species reared upon the mountains are commonly termed *Runts*; but they are far from being so despicable as might be supposed from the epithet which is applied to them, for they support themselves upon the hardest fare, thriving where others would starve, and unrivalled as the cottager's cow.'

The breeds most prevalent in South Wales are the Pembrokes and the Glamorgans. The Pembrokes are a very hardy useful breed of cattle, excellent workers, being docile and active. The cows, if pretty well kept, are good milkers; and the oxen, if fattened for the butcher, will, at four years old, weigh from fifty to sixty stones. Some crosses between this breed and the pure North Devons have been attended with success, and, from their intrinsic value, the Pembrokes are well worthy of a greater degree of attention being devoted to them than they have hitherto had.

Colonel Pennant is celebrated for his breed of large Welsh oxen, but it is said that the breed of Welsh cattle is rapidly deteriorating, and is likely soon to become extinct, from the practice of selling all the best heifers, to be fattened for the English market, leaving the worst only for breeding.

THE CHANNEL ISLAND BREED.—The 'Alderney' (see fig. 13 for illustration of a cow) is the name by which this breed is best known in this country, although we believe that the 'Jersey' is the proper name for the breed. They are valued chiefly for the richness rather than for the quantity of milk which they yield; and being graceful and deer-like in form, they are prized by gentlemen, and gentlemen farmers, to whose grounds they form a very beautiful ornament. The size of the Jersey or Alderney breed is small, the colours most esteemed are the light red with white, the brown, and the fawn; brindled colours very rarely met with. The horns are short, and generally curled, and the bones fine. The best milch cows are observed to have a yellowish circle round the eye, with the skin at the extremity of the tail of a deep yellow colour, approaching to orange. As fattening cattle, they have but few good points; being thin and hollow in the

Fig. 13.



ALDERNEY COW.

neck, hollow and narrow behind the shoulders, sharp and narrow on the hucks, light in the brisket, and lean on the chine, with short rumps and small thighs; but their flesh is fine grained, high coloured, and of excellent flavour. They are also very large in the belly; but this, as well as some of the points already mentioned, is rather an advantage to milch cows, to which purpose the stock is usually applied in this country; and their udder is well formed.

The Alderney cows are very rich milkers; and both on that account, and because of a certain neatness in their appearance, notwithstanding the defects in their shape, they command high prices. They are, therefore, mostly in the possession of gentlemen; who, rarely keeping a regular breeding stock, the cows are consequently crossed by any neighbouring bull, and thus the pure breed is preserved in the hands of but very few persons.

There is a very prevalent notion that they will thrive on any kind of land, and they are therefore not uncommonly kept on bare paddocks, with the assistance of hay in winter. Like all light cattle, they certainly do not require the same support as larger animals; but their native pasture in the islands is of the richest kind; and it is doubtless owing to the less nutritive herbage on which they are frequently fed in England that the quantity of their milk is not equal to its quality.

THE BREED OF IRISH CATTLE, of which many thousand carcasses are annually exported, is distinguished by little variety, excepting that which necessarily arises from the difference of situation. They consist of two aboriginal breeds; the one adapted to the rude and mountainous parts of the country, and the other, mixed with, and improved by, the Lancashire breed, and pasturing on the flatter and richer parts of the country. The counties of Meath, Roscommon, Clare, Limerick, Cork, and Tipperary are chiefly celebrated for the vast herds which are there annually bred and slaughtered for exportation; and many of the most public-spirited breeders have, of late years, incurred very considerable expense by purchasing prime stock from England for the purpose of improving their breeds; a measure that has already been attended with the most beneficial effects, and that will, doubtless, in the course of a few years, prove a source of considerable wealth to Ireland. It cannot, however, be denied that these exertions have not hitherto been sufficiently general to effect any very manifest improvement in the common stock of the country.

The diversity in appearance in the cattle of Ireland, which is so obvious to a close and experienced observer, 'has arisen,' says a recent writer in the 'Irish Farmer's Gazette,' 'in great measure, from the numerous breeds which have been introduced, especially bulls from time to time, and the careless and irregular manner in which these have been used by the common class of farmers. The imported bulls might be used for a season or two, and the produce would then be put, perhaps to a cross-bred bull, or a bull of no particular breed, simply because such a bull could be got for a shilling, or because the cross-bred bull was most convenient. From this cause, amongst others, there is in many parts of the country a race of mongrels, which it is impossible to assign to any particular breed, whilst in others we may readily detect traces of some distinct breed. . . . So that in some country fairs we have seen descendants of half-a-dozen different breeds, and not a pure-bred animal of any breed on the ground.' The *Kerry breed* of Irish cattle is the favourite, and is no less remarkable for its diminutive size than for the quantity of milk which it yields. There is little doubt but

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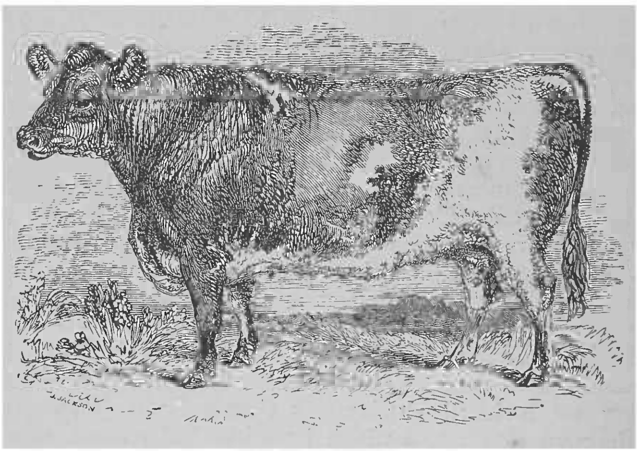
that the Kerry breed is closely allied to the Bretonne cow already described, as it closely resembles it in many points. The milk yielded by a pure-bred Kerry—a rather difficult thing to obtain now—is not only large in quantity, but very rich in quality. They fatten readily, and the meat is of good flavour and of fine grain. The colour varies; in some it is black, in others red and brindled, and in many mottled in these colours. The hair of the bull, when kept in their native mountains, is long and coarse, but when fed in the lowland districts, and on nutritious food, it becomes short and fine. The head 'is small and fine, with a clear bright eye, neck fine, horns short and turned upwards. Sometimes the horns are not "cocked" alike, there being a kind of twist in the "cock," and some look upon this as one sure mark of a true Kerry. In general they are light in the hind-quarters, but high boned, and wide over the hips.'

Fig. 14.



GALLOWAY HEIFER.

The Galloway Breed (see fig. 14), or, as it is often termed, the Polled Scots, derived its appellation from the county of the same name, in which these cattle are chiefly reared, and whence vast numbers are annually sent to Norfolk and other English counties, to be fattened for the markets. In general they are black, or dark brindled brown. They are without horns, except occasionally a small loose excrescence resembling a horn. They are smaller than the Devons, yet considerably larger than the North, or even the West Highlanders.

Mr. Mure, of Grange near Kirkcudbright, thus describes the Galloway cattle. We owe much to him:—'They are straight and broad in the back, and nearly level from the head to the rump.

They are round in the ribs, and also between the shoulders and the ribs, or the ribs and the loins. They are broad in the loins, without any large projecting hook-bones. In roundness of bone and fulness of ribs they will compare with any breed, and also in the proportion of the loins to the hook-bones, or protuberances of the ribs. They are long in the quarters and ribs, and deep in the chest, but not broad in the twist. The slightest inspection will show that there is less space between the hook and hip-bone and the ribs than in most other breeds—a consideration of much importance; for the advantage of length of carcass consists in the animal being well ribbed home or as little space as possible lost in the flank.

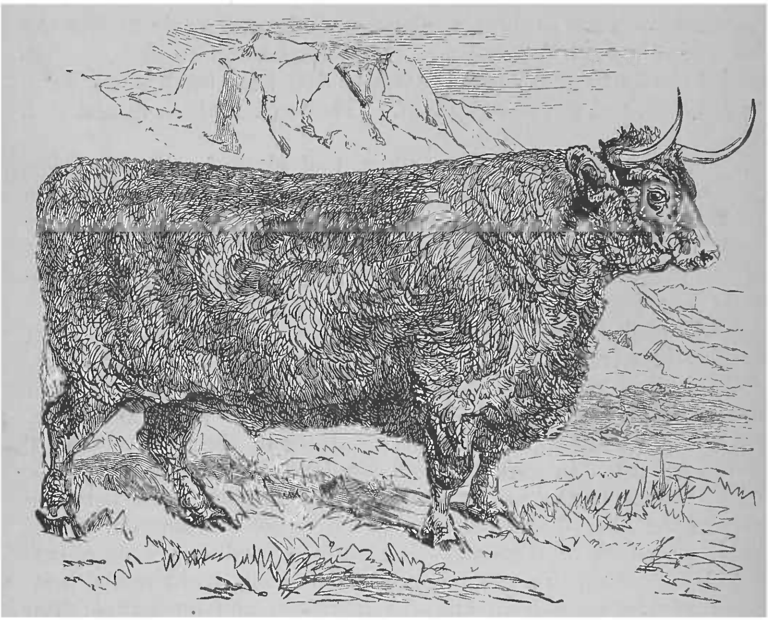
'The Galloway is short in the leg, and moderately fine in the shank-bones, with a hardiness, and disposition to fatten. No breed is so large and muscular above the knee, with room for a deep, broad, and capacious chest. The neck is thick almost to a fault.

'The skin is loose and mellow, and clothed with long soft silky hair, and handles soft and kindly; so much so that even on the moorland farms their hides little indicate the privations they undergo. The colour in the pure-bred animal is black.

'In roundness of barrel, and fulness of ribs, the Galloway cattle may perhaps vie with even the most improved breeds. It is, however, to be regretted that sufficient attention has not been paid to their improvement; and, in many parts of the Lowlands, they have been materially injured by an inconsiderate intermixture with Irish and Ayrshire cows, in consequence of a prevalent idea that the latter are superior milkers. Bulls of the most approved kinds have been introduced from England, but without any apparent benefit to the native stock; and although a cross between this and the short-horned breed—which is not uncommon in the border counties of England—is said "to produce an excellent animal, possessing in a great degree the feeding qualities and best points of the short-horn and the hardiness and docility of the Galloway cattle," it is yet added, "that although the first cross with the short-horn does produce a good beast, no good breeder would choose to continue his stock from these crosses." Some maintain that the surest method of improving the Galloways consists in adherence to the pure breed. They are a hardy race, subsisting on the coarsest pasture, and increasing rapidly when removed to more favourable situations. They fatten kindly; their flesh is of the finest quality, and the joints being of a moderate size, and more suitable for consumption in private families than those of the larger breeds, they, with the West Highlanders, usually command the highest prices at Islington or London market.'

The best **Highland Breed** (see figs. 15 and 16) of horned cattle is reared in the western part of Scotland. The horns are large, sharp-pointed, and upturned, and the colour generally black, though sometimes brindled or dun. The hides are thick, and covered with long soft hair of a close pile, which nature seems to have intended as a protection against the severity of the climate under which they are bred, for they lose much of this distinction when reared in a southern country. In other respects they are not unlike the Galloway breed, many of whose best qualities they possess, and particularly their hardiness of constitution, beautiful

Fig. 15.



WEST HIGHLAND OX.

symmetry, and finely-flavoured flesh. Their straight and level backs, their round and deep carcasses, and the quantity of good meat which they yield in proportion to their size, are most valuable points.

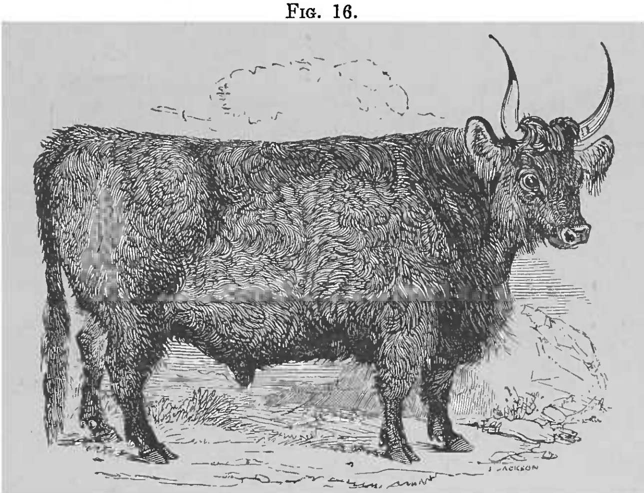
Of this breed there are several distinct varieties. The principal are the *Kyloes*—the aboriginal breed of Scotland, and existing in its greatest state of purity in the Isle of Skye. In Perth and Ross, and Argyle, the pastures will bear a larger breed, and it is in the latter county that the real *West Highlander* is to be seen in full perfection. The broad back, the short legs, the fine muzzle, and the black-tipped horn, the quality of the meat, and the quickness of fattening, will sufficiently distinguish him.

The *North Highlanders*, from the Orkneys, and Caithness and Sutherland, possess similar excellent points, but the exposed country and scanty pasturage which they inhabit materially lessen their size. Too many of them are comparatively neglected on account of their diminished bulk.

The AYRSHIRE BREED (see fig. 17) ranks deservedly high in the estimation of dairymen, and the most approved form of the best milkers is thus described by Mr. Aiton, to whom we are indebted for the annexed portrait:—

'Head small, but rather long and narrow at the muzzle; the eye small, but quick and lively; the horns small, clear, bended,

FIG. 16.



HIGHLAND OX.

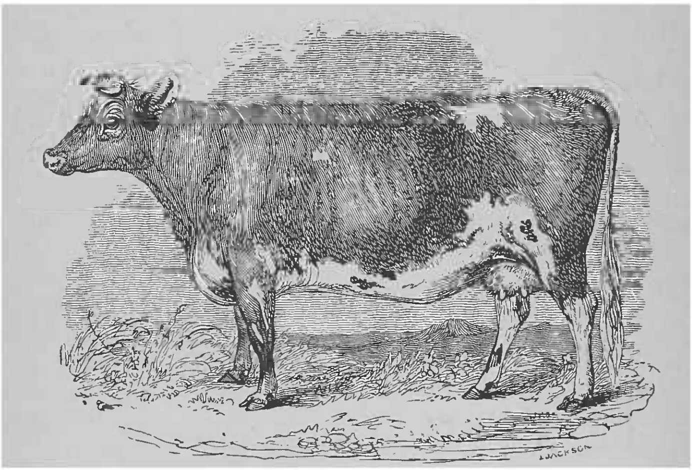
and the roots at a considerable distance from each other; neck long and slender, and tapering towards the head, with little loose skin hanging below; shoulders thin; fore quarters light and thin; hind quarters large and capacious; back straight, broad behind, and the joints and chine rather loose and open; carcass deep, and the pelvis capacious and wide over the hips, with fleshy buttocks; tail long and small; legs small and short, with firm joints; udder capacious, broad, and square, stretching forwards, and neither fleshy, low hung, nor loose, with the milk-veins large and prominent; teats short, pointing outward, and at a considerable distance from each other; the skin thin and loose; hair soft and woolly; the head, horns, and other parts of least value, small, and the general figure compact and well-proportioned. There is to the present day much dispute with regard to the origin of the Ayrshire cow.'

The following, from a report to the Ayrshire Agricultural Association, gives the 'points' which indicate superior quality in the Ayrshire dairy cows:—

'Head short, forehead wide, nose fine between the muzzle and eyes, muzzle moderately large, eyes full and lively, horns wide set on, inclining upwards, and curving slightly inwards.

'Neck long and straight from the head to the top of the shoulder; free from loose skin on the under side, fine at its junction with the head, and the muscles symmetrically enlarging towards the shoulders.

FIG. 17.



AYRSHIRE COW.

'Shoulders thin at the top, brisket light, the whole fore-quarters thin in front, and gradually increasing in depth and width backwards.

'Back short and straight, spine well defined, especially at the shoulder, the short ribs arched, the body deep at the flanks, and the milk-veins well developed.

'Pelvis long, broad, and straight, hook-bones (ilium) wide apart, and not much overlaid with fat, thighs deep and broad, tail long and slender, and set on level with the back.

'Milk-vessels capacious and extending well forward, hinder part broad and firmly attached to the body, the sole or under surface nearly level, the teats from two to two-and-a-half inches in length, equal in thickness, and hanging perpendicularly; their distance apart at the sides should be equal to about one-third of the length of the vessel, and across to about one-half of the breadth.

'Legs short, the bones fine and the joints firm.

'Skin soft and elastic, and covered with soft, close, woolly hair.

'The colours preferred are brown, or brown and white, the colours being distinctly defined.'

The *Dunlop* cattle are said to have been produced from a cross between a Highland bull and an Alderney cow, or, as some believe, an Alderney bull and an Ayrshire cow; but an experienced breeder, who has long been resident in the county, is of opinion that the improvement of the native stock is due to the introduction of some Dutch or Tees-water cows about the middle of the last century. Their colour varies from a dark brown, approaching that of a Devon, to the cream colour of the Alderney, and in both cases it is generally mixed with white. The head and horns and dewlap small; the neck thin; they are round and straight in the barrel; the loin and space between the hips are flat and wide; they are rather short in the leg than otherwise, and bear a general similarity to the breed from which they sprang. In some parts they are known under the name of *Cunningham cattle.* There is a district so named in Ayrshire. The Dunlop cheese, once so celebrated, was manufactured from the milk of the Ayrshire cow. The Ayrshire cows are excellent milkers in proportion to their size, and their milk is good in quality. They are also very hardy, and will thrive on very ordinary pastures.

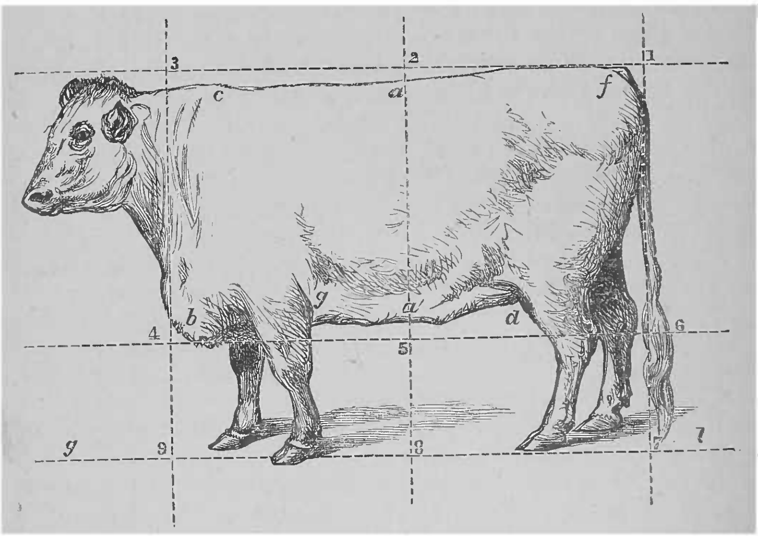
The *Polled Angus Breed* (see fig. 18 for illustration of ox of this breed). This is another of the Scottish polled or hornless breeds, of which the Galloway breed—already described—is another example. Indeed, some maintain that the Angus and Galloway are very nearly allied, the former being a mere offshoot of the latter. The great improver of the breed, or rather the introducer of the improved breed of polled Angus cattle, is Mr. Hugh Watson of Keillor, who has been termed the Calling of the Angus breed. The approved colour of the polled Angus is black, but some animals have white more or less marked. The head is fine, the carcass round and low, legs short and with full shoulder.

Polled Aberdeen Cattle. The polled Aberdeen attains to a large size, with heavy weight. The colour is usually black, and they are coarser in make than either the Angus or the Galloway breed. Crossed with a short-horn, the animals arrive sooner at maturity, and the beef is improved.

At the same time, it is to be noted that a cross with a short-horn is only likely to be beneficial where the breed is pure. A first cross will give good results, but every subsequent crossing lessens the chance of benefit being received. It should also be remembered that from the north of Scotland, where the black polled cattle are so valuable, short-horns are not always found to suit the climate.

Shetland Island Cattle. This race or breed, which is essentially distinct from other breeds, is met with in the exposed islands of the extreme north. Diminutive in size, yet of symmetrical form, with long and silky hair, fine and small bones; they are capable of living on the scantiest fare, yet produce beef of exceedingly fine quality, and rich milk. Crossed with the short-horn,

FIG. 18.



POLLED ANGUS OX.

the breed comes sooner to maturity, fatten better, and still yield beef of a fine and delicate quality.

We have thus given brief sketches of the principal breeds of cattle which are met with in the farms of the United Kingdom. There are, besides, many crosses and local breeds, distinguished by the name of some district, or of the breeder, the description of which would take up more space than their importance seems to us to demand. Many of these local breeds are, moreover, fast becoming extinct, through the gradual introduction of the more improved breeds of the present day.

Measurements, from the 'North British Agriculturist,' of the prize cattle exhibited at the Birmingham and London shows, will, in conjunction with the remarks already given, be useful to the reader :—

The following are the measurements of the prize cattle exhibited in Bingley Hall, Birmingham, and in the Agricultural Hall, London. We adopt the placing of the breeds as given in the catalogue of the Smithfield Club, which places the Devons first, while in the catalogue of the Birmingham Show the Herefords occupy the first place. Their classing of the animals according to age is also different—the youngest being placed first in the Smithfield Club catalogue, while the oldest are first in the Birmingham catalogue. The ages are also different—the Birmingham classes being for steers under three years and three months, and animals above three years and three months; while the Smithfield Club classes were for animals not exceeding three years and for those above three years. The animals obtaining the third prize at Birmingham were not generally measured.

DEVONS.

	Birmingham. ft.	in.	London. ft.	in.
Steers not exceeding 3 years—				
1. Girth	7	2	7	1
Length	4	5	4	8
2. Girth	7	4	7	2
Length	5	4	4	8
3. Girth	0	0	7	3
Length	0	0	4	10
Steers exceeding 3 yrs.—				
1. Girth	8	4	7	10
Length	5	2	4	10
2. Girth	8	2	8	3
Length	5	0	5	5
3. Girth	0	0	7	11
Length	0	0	5	2
Heifers not exceeding 3 years —				
1. Girth	7	3	7	7
Length	5	0	4	8
2. Girth	7	7	7	4
Length	5	0	4	11
3. Girth	0	0	7	6
Length	0	0	5	0
Cows—				
1. Girth	6	9	7	7
Length	5	0	4	9
2. Girth	0	0	7	2
Length	0	0	4	8
3. Girth	0	0	7	9
Length	0	0	5	0

HEREFORDS.

	Birmingham. ft.	in.	London. ft.	in.
Steers not exceeding 3 years—				
1. Girth	7	10	7	10
Length	5	0	5	0
2. Girth	7	11	7	8
Length	5	0	4	10
3. Girth	7	10	7	9
Length	5	0	5	1
Steers above 3 years—				
1. Girth	9	1	8	7
Length	5	8	5	3
2. Girth	8	7	8	7
Length	5	6	5	3
3. Girth	0	0	9	1
Length	0	0	5	6
Heifers—				
1. Girth	8	3	8	2
Length	0	0	5	3
2. Girth	7	9	8	3
Length	0	0	5	0
Cows—				
1. Girth	8	1	8	2
Length	5	0	5	0
2. Girth	8	5	8	3
Length	5	0	5	1

SHORT-HORNS.

	Birmingham. ft.	in.	London. ft.	in.
Steers not exceeding 2 yrs. and 3 months—				
1. Girth	8	2	8	3
Length	5	1	4	9
2. Girth	8	3	8	1
Length	5	0	5	2
3. Girth	0	0	7	6
Length	0	0	5	2
Steers above 3 years and 3 months—				
1. Girth	9	2	8	8
Length	5	6	5	4

SHORT-HORNS—*continued.*

	Birmingham. ft.	in.	London. ft.	in.
2. Girth	8	8	8	7
Length	5	4	5	0
3. Girth	0	0	8	10
Length	0	0	8	13
Heifers—				
1. Girth	8	9	8	8
Length	5	4	5	4
2. Girth	8	5	8	4
Length	5	2	5	2
3. Girth	0	0	8	3
Length	0	0	5	0
Cows—				
1. Girth	8	8	8	6
Length	5	2	5	2
2. Girth	8	3	8	3
Length	5	2	5	2

SUSSEX.

Steers of any age—				
1. Girth	0	0	8	3
Length	0	0	5	0
2. Girth	0	0	8	1
Length	0	0	5	6
3. Girth	0	0	7	8
Length	0	0	4	10
Heifers or Cows—				
1. Girth	0	0	8	0
Length	0	0	5	1
2. Girth	0	0	7	5
Length	0	0	4	9
3. Girth	0	0	7	9
Length	0	0	5	1

NORFOLK OR SUFFOLK POLLED.

Steers of any age—				
1. Girth	0	0	8	1
Length	0	0	5	2
2. Girth	0	0	8	2
Length	0	0	5	5

LONG-HORNS.

Steers of any age—				
1. Girth	8	4	8	0
Length	5	5	5	5
Heifers or Cows—				
1. Girth	7	10	7	10
Length	5	2	4	10

SCOTCH HORNED.

Steers of any age—				
1. Girth	0	0	7	11
Length	0	0	4	11
2. Girth	0	0	7	8
Length	0	0	4	10

SCOTCH POLLED.

	Birmingham. ft.	in.	London. ft.	in.
Steers of any age—				
1. Girth	9	3	9	2
Length	5	8	5	5
2. Girth	8	9	9	1
Length	5	8	5	8
Heifers—				
1. Girth	8	0	0	0
Length	5	2	0	0
2. Girth	8	0	0	0
Length	5	0	0	0
Cows				
1. Girth	8	1	8	3
Length	5	5	5	0
2. Girth	8	0	7	5
Length	5	2	4	10

IRISH.

Heifers or Cows—				
1. Girth	0	0	6	6
Length	0	0	4	4

WELSH.

Steers of any age—				
1. Girth	8	6	8	8
Length	5	1	5	10
2. Girth	0	0	8	4
Length	0	0	5	2
Heifers or Cows—				
1. Girth	0	0	6	10
Length	0	0	5	2

CROSS OR MIXED BREEDS.

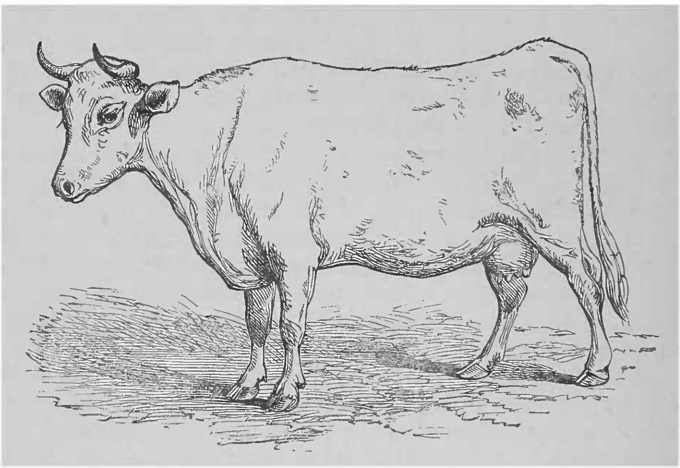
Steers not exceeding 3 years—				
1. Girth	0	0	8	0
Length	0	0	4	8
2. Girth	0	0	7	9
Length	0	0	4	11
3. Girth	0	0	7	10
Length	0	0	8	3
Steers above 3 years—				
1. Girth	9	9	8	9
Length	5	8	5	2
2. Girth	8	2	9	8
Length	5	0	5	7
3. Girth	0	0	8	4
Length	0	0	5	3
Heifers not exceeding 4 years—				
1. Girth	8	4	8	0
Length	5	0	5	3
2. Girth	8	0	8	4
Length	5	0	5	0

FOREIGN BREEDS.—In a work like the present it will be reasonably expected that a description, however brief, be given of the most important of the foreign or Continental breeds. The trade with some of the districts abroad in the importation of their cattle into this country is very great, and is rapidly increasing each year. Some of the breeds, moreover, are so good in several of their 'points,' some for fattening, others for dairy stock purposes, that it may yet be a question whether it would not be advisable to cross them with some of the best of our breeds. Be this as it may, a brief notice of a few of the leading breeds will not be out of place here, and may be interesting to our readers.

We have already described the Alderney breed, which with the Guernsey and Jersey, are generally claimed as the 'Channel Island breeds.' They are more celebrated and useful as milkers than as fattening stock. They may be said to be the amateurs or gentleman's stock, as from their comparatively small size, their graceful form and gentle habits, they are better fitted for the small lawn-like pastures of those classes than our larger and more ponderous breeds of native cattle. Considerable numbers are imported into this country for this purpose. But the amateurs' breed, *par excellence*, is the 'Brittany' or Morbihan breed. Some years ago there was quite a mania in this country for animals of this breed, and large numbers were brought over which fetched high prices. This has greatly, if not wholly died away, although numbers are still to be seen. The great charm which the animals of this breed possessed for amateurs, who had but very limited expanse of grass for feeding purposes, were their exceedingly small size, their gentle docile habits, and the small extent of pasture which sufficed for their feeding. Not only small in size, they are graceful in their movements, and thus add to, rather than detract from the attractions of lawns, for feeding on which they are well adapted. Another characteristic which renders this breed peculiarly attractive for gentlemen or amateur farmers is their undoubtedly high milking qualities. Some, indeed, yield extraordinarily large quantities, taking into consideration the small bulk of the animals, and the little food they consume. The milk is, moreover, not only supplied largely, but it is rich in quality, and yields a high proportion of butter. So that, taking all those points under review, it is not matter of surprise that the breed should be the favourite that it is. It is not now—as already hinted at—so 'fashionable' as it was some years ago, for after any undue excitement there is always a reaction; but the breed possesses beyond any doubt such qualities befitting it specially for the increased and increasing class who 'love to farm a bit,' that we shall not be surprised if a desire to introduce it for the benefit of this class should again revive. It would be worth while to try the effect of crossing it with some of our own small breeds, as the Kerry cow, notoriously a good milker; or with the Channel

Island breeds. The colour of the Brittany cow is generally black and white; its height only from thirty-two to forty-two inches high. The form is symmetrical, head fine, short, with well-defined outlines, small muzzle, ears small and well set on, with fine small horns, well set on the head, curving outwards and upwards, the points approaching each other. The neck is fine and slender, the brisket small and not generally prominent. As in all well-bred animals the back is level, but well set in; withers well formed, and loins broad and long. The fore-quarters are roomy, giving ample space for development of the lungs; the legs are short but muscular, and remarkably fine, giving a graceful look to the *tout ensemble.* The hide is fine, giving a good touch; the udder (in

Fig. 19.

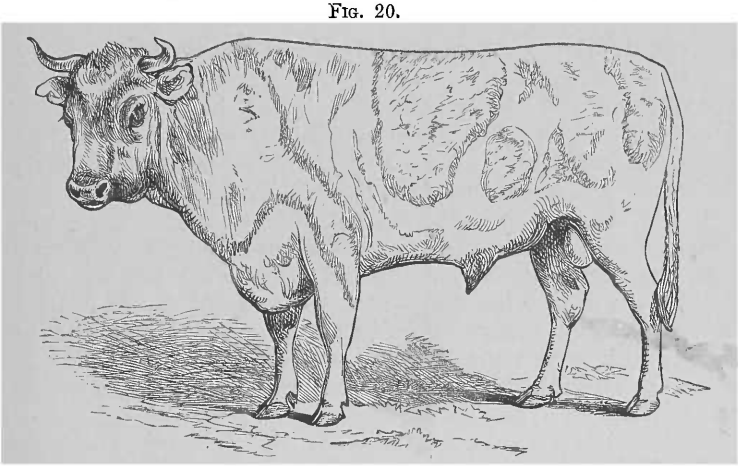


FURNES COW.

the cow) is large. One good point in the breed is their hardy constitution; they can bear exposure to extremes of temperature, and can feed and thrive well, and yield good supplies of milk, on scanty pastures on which others would do but very poorly, even allowing for the difference in size. Although we have given a generally favourable description of the Brittany cow, still it need scarcely be said that there are specimens which do not come up to the standard, while there are those who do not take the same view of the breed at all. Nevertheless, we believe it to be one well adapted for the amateur class of farmers, if farmers they can, or have any desire to, be called; and one or two may well be added to the small herds of such cows as the Channel Island breeds or the Kerry cow, which they may feel inclined to keep.

Large numbers of cattle are imported annually from Holland and from the rich pasture fields stretching along the sand-dune-protected margin of the North Sea, from that country almost up to Calais. The Dutch cows are celebrated for their milking capabilities; they are generally black and white in colour. They are closely allied to if not the same breed, known as the Normandy. While the cows yield large supplies of milk, the cattle fatten rapidly and attain a moderate weight. They are at maturity when about four years old. In fig. 19 we give an illustration of the breed known as that of Furnes, vast herds of which are fed on the polder and enclosed lands stretching from Ostend on the one side, up to and beyond that of Dunkirk on the other. They yield their fair quota to the large number which are brought over every year to this country.

FIG. 20.



'DER HADERSLEBNER STEER.'

Extending our observations so as to look in the regions further north, we come to that part of what is now Prussia, but which, formerly belonging to Denmark, was so well known as the Duchy of Schleswig-Holstein. Of this the low-lying but splendidly rich and fertile tracts of land which border the seas, the Baltic on the northern, the North Sea on the southern side, are, so to say crowded with vast herds of cattle of various breeds, some of which are distinct, others more or less allied to one another. Looking down from the elevated roads which run along the tops of the embankments which keep out the sea—in some districts the only point which rises above the universal level—it is difficult to conceive how the land can support such numbers. The secret of this is of course the amazing richness of the soil, which raises crops of the finest grass. The importation of cattle from these provinces is very large. Some idea may formed of it when we state that from the small harbour of the still smaller town of Tonning no fewer than 40,000 head of cattle are shipped for London annually. We have said that the breeds are various, and fig. 20 is an illustration of a bull of the best of the fattening breeds, known as the 'Haderslebner.' This is pastured on the rich marshy lands.

CHAPTER II.

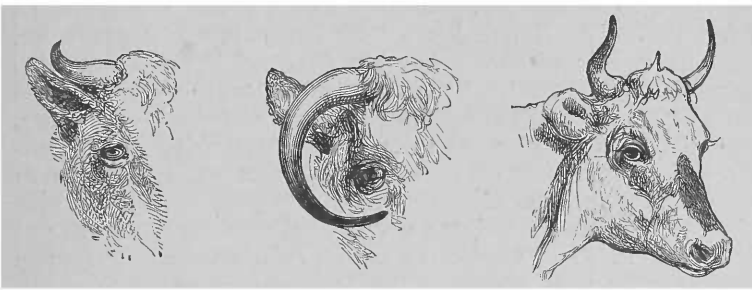
COMPARATIVE VIEW OF THE DIFFERENT BREEDS OF CATTLE.

FROM the previous introductory view of the various species of neat cattle, the reader will probably be enabled to form some estimate of the value of the respective breeds herein described. The three which are chiefly reared are the *short-horn*, the *long-horn*, and the *middle-horn* breeds, and concerning their merits and demerits there has always been a difference of opinion among the most experienced breeders. In fig. 21 we give part of a head showing the first of the above classes, the short-horned; in fig. 22 of the long-horned; and in fig. 23 of the middle-horned; this we give in full, as it represents the head of a cow of the breed of which fig. 20 is the bull. The Alderney is sometimes classed as a fourth breed, the 'crumpled horn.'

It has been observed by Mr. Culley, that 'the long-horns excel in the thickness and firm texture of the hides, in the length and closeness of the hair, in the beef being finer-grained and more mixed and marbled than that of the short-horns, in weighing more in proportion to their size, and in giving RICHER milk; but they are inferior to the short-horns, in giving A LESS QUANTITY OF MILK, in affording less tallow when killed, in being slower feeders, and of a coarser make, and more *leathery* or *bullish* in the under side of the neck. The long-horns excel in the hide, hair, and quality of the beef; the short-horns in the quantity of beef, tallow, and milk. Each breed has long had, and probably will have, its zealous advocates; and both kinds may have their particular advantages in different situations. Why may not the thick firm hides, and long close-set hair of the one kind, be a protection and security against those impetuous winds and heavy rains to which the western coast of this island is so subject, while the more regular seasons and mild climate upon the eastern coast are most suitable to the constitution of the short-horn?'[1]

It should, however, be understood, that the preference above given by Mr. C. to the long-horn species, on account of the superior quality of the beef, applies only to the variety of that breed which was selected, improved, and recommended by Mr. Bakewell, and which is described in the introductory account already referred to, under the name of the *Dishley breed*. In fact Mr. Culley is of opinion that 'a breed of short-horn cattle might be selected, *equal* if not *superior* to that very *kindly fleshed* sort of Mr. Bakewell, provided any able breeder, or body of breeders, would pay as much attention to these as Mr. Bakewell and his neighbours have done to the long-horns.'[2]

FIG. 21. FIG. 22. FIG. 23.



SHORT-HORN. LONG-HORN. MIDDLE-HORN.

This, as the opinion of an eminent breeder, was entitled to considerable attention; and was corroborated by a fact stated in the 'Agricultural Survey of Northumberland,' 'that the long-horns had been introduced into that county from the improved stocks of the midland counties, at different times and by different breeders, but had, in most instances, given way to the improved breed of short-horns, and, at the time the first report was published in 1804, had been abandoned by every breeder in the county, the improved breed of short-horns, from the stock of the Messrs. Colling, having proved themselves so much superior.'[3]

Since that period, continued exertion has been made for the improvement of the short-horn breed, and the great weight to which they arrive must always insure them a high rank in the estimation of those graziers who possess land of sufficient richness to forward heavy beasts. The popularity of the long-horns soon

[1] Culley on Live Stock, p. 80. [2] Ibid. p. 81.
[3] Page 140, 3rd edition, 1813; in which the assertion remains uncontradicted.

passed away. Their *maker*, if he may be so termed—the man who had brought them to the state of perfection which they attained—had scarcely departed ere the character of the breed began to change. 'It had acquired a delicacy of constitution,' says the author of the work on 'Cattle' in the 'Farmer's Series,' 'inconsistent with common management and keep, and it began slowly, but undeniably, to deteriorate. In addition to this, a rival, a more powerful rival, appeared in the field. The improved short-horns began to occupy the banks of the Tees. They presented equal aptitude to fatten, and greater bulk and earlier maturity.'

The contest among the larger breeds of cattle now lies between the *middle-horns* and the *short-horns*, and particularly between the Herefords belonging to the first division, and the *improved* short-horns or Durham cattle, belonging to the second. For aptitude to fatten they are nearly on a level, but the short-horn may have some advantage in *early* maturity, and will grow to a larger size. The Hereford is not far beaten in either particular, while its flesh is of finer grain and flavour. For the dairy, the short-horn has no rival. The relative situation, the nature of the soil, and the fancy of the individual, must decide between the two, when the principal objects of the farmer are grazing and fattening. For abundance of milk, the decision must be given in favour of the short-horn.

One other difference there may be between the Herefords and the Durhams. The former are most profitable for grazing, and the latter for stall feeding. The Durhams, when in the stall, increase most rapidly in weight, and present at last a fair and even carcass. Some of the latter are apt to be patchy, and, generally speaking, there is not the difference in the gross price between the Hereford and Durham, which the difference in weight would lead us to expect.

For the northern districts of the kingdom, the black polled breed of cattle is particularly valuable (see p. 40.) Indeed, if the same care had been taken with the improvement of this breed which has been taken with that of others, as the short-horns or the Herefords, there is every reason to believe that the results would have been as satisfactory, and probably as remarkable. For their tendency to come early to maturity, to fatten quickly, and above all to produce a quality of meat second to none, the black-polled cattle are remarkable. We have only to note what such breeders as Mr. Hugh Watson of Keillor and Mr. McCombie of Tillyfour, Aberdeenshire, have done, to be convinced of the value of this breed. Attempts have been made to improve the breed, by a cross with short-horns, but they have not always proved successful. For a note on this subject, see under the head of Polled Aberdeen Cattle. It should never, we may here further remark, be forgotten that climate has a very marked influence on stock, just as it has on crops. The short-horn is the animal *par excellence* for mild, the black polled for more northerly and ruder climates. It is worthy of note that while many instances are met with of West Highland cattle being spoiled in the breed by crosses with short-horns, the improvement has uniformly been manifest where they have been crossed with black polled cattle.

In instituting comparisons between various breeds of cattle, it should, however, not be overlooked that circumstances of climate, locality, and soil exercise an influence more or less marked upon their peculiarities, and aptitude for fattening and yielding milk or the reverse. The influence of the parents is also to be taken into account, and the way in which these have been reared and fed, and the age at which they are used, and the state or condition of their health. The breeder, if he is to be successful must indeed be perpetually on the look-out for circumstances—and these operating in a variety of ways, form a number, so to say, of directions—which are at all likely to exercise an influence, good or bad, as the case may be, on the qualities and peculiarities of his stock. Take, for example, dairy cows. The same breeders set up one class of animal as the best, to the exclusion of all others, without taking at all into consideration circumstances which naturally affect their milk-producing powers, just as if breed was everything, and food or housing were of no account. The two should, if possible, be made to work together. Breed is good, if it enables the dairyman to get meat out of his food; but it should be remembered, that both the quality and the quantity of the milk, and consequently to a large extent, of the butter and the cheese made from it, depends more—at least largely, as will be generally admitted—upon the food than the breed. It is a fact well-known to dairymen that some cows having not the slightest pretension to breed—so thoroughly mongrel are they—are those which give the largest yield of milk, and that of the best quality, when once they are put under proper feeding and management. As regards different breeds for the dairy, Dr. Voelcker has some remarks which are likely to be useful in choosing the herd. Breeds which have small cows—as, for example, the Kerry or the Brittany, or small animals coming from larger breeds—are, as a rule, those which give the richest milk for the same kind and quantity of food. The Alderney gives the richest milk of any of the breeds. The Ayrshire breed is celebrated for the excellence of its milk. The short-horn is usually looked upon more as a fattening breed than as one yielding a good dairy cow; but certain 'families' of the breed give dairy cows which cannot be surpassed as milkers, and yet are almost equally famous for their aptitude to lay in fat and improve in condition. The Yorkshire cow is a favourite in many districts, and it is the cow *par excellence* of the London dairies; and it is closely allied to, indeed is 'eventually a short-horn.' It is more useful, however, for the quantity than for the quality of the milk which it yields, quantity with a population like London obviously being the more valuable peculiarity. And of this breed, it is curious to note—for no reason can be given for the prejudice—a red cow is the peculiar aversion of the London dairyman, a dappled animal being the favourite. As we have already said, one prefers one breed, another another; one dairyman says that he finds the Hereford breed gives him the finest cows—a breed almost universally thought of only as a fattening breed; another prefers the Devon, while a third deems a cross between them the best. With opinion so diverse, and predisposing circumstances to all kinds of changes and peculiarities, the tyro who is beginning the practice of grazing will own that he has much to do in the exercise of a careful observation, a wise prudence in selection, and a sound and thorough method of treatment and management, before he can lay claim to being considered a 'complete grazier.'

CHAPTER III.

GENERAL OBSERVATIONS ON BUYING AND STOCKING A FARM WITH CATTLE.

THE profit to be derived from the occupation of land depends so much on the command of the requisite capital, that the most important consideration for a young beginner is to be well advised on this essential point, and to be assured that he possesses sufficient means to turn every acre to the best account: always bearing in mind that a comparatively small farm, with sufficient capital, will be more beneficial than another of larger extent without the power of employing it to advantage. Assuming it therefore as certain, that the young grazier is provided with this indispensable requisite, we shall proceed to give a few general hints on the buying and stocking his farm; and introduce, under the respective accounts of rearing and breeding the different species, such remarks on their various merits and faults as will materially assist him in the course of his labours.

The first object of attention is to consider the proportion between his stock and the quantity of food that will be necessary to support it. The nature, situation, and fertility of the soils that compose his farm, are equally worthy of notice, as well as the purpose for which he designs more particularly to rear or feed his cattle; and chiefly, whether for the dairy, or with the view of supplying the markets. It will be expedient to observe the greatest exactness in these proportions, because, in case he should overstock his land, he will be compelled to re-sell before the cattle are in a fit state for the market, and consequently, at certain loss; while, on the other hand, he will incur a diminution in his profit if he should not stock his land with as many cattle as it will bear.

He should next endeavour to procure thoroughly good male animals; an extra 10*l.* or 20*l.* is always well bestowed thus; and he should decide on the breed or breeds he intends to keep, for by purchasing and breeding from various different breeds indiscriminately, he will never have a good animal, and eventually his herd will be mongrels. Neither must he pursue the *in and in* system to any extent, or he will find his stock deteriorate rapidly.

Among the various professional breeders of modern times, few have attained greater celebrity than the late Mr. Bakewell, of Dishley, to whom we are indebted for many new and important improvements in the science of rearing cattle. It is difficult to say what were the precise principles that guided him in the selection of his stock, but they were comprised in the four following particulars: beauty of form, or a pleasing proportion between the various parts of the animal; utility of form, or a disposition to accumulate flesh and fat on the best and most useful parts; a fine quality of the flesh; and a propensity to fatten at an early age and in a short space of time. He paid much attention to what is generally termed the *kindliness* of the skin, or a mellowness and softness, and yet firmness, equally distinct from the hard dry integument peculiar to some cattle, and the loose and flabby feeling of others.

The practice of judging of the animal by the eye only was abandoned, and the sense of touch brought to the aid of that of sight; and, by repeated practice, the art of judging of the kindliness to fatten arrived at such perfection, that any well-informed breeder, with tolerable personal experience, could, on examining a lean beast, tell, almost instantaneously, in what points or parts he would or would not fatten.

Sir John Sinclair has given an excellent account of this handling of both fat and lean beasts. 'When the hide or skin feels soft and silky, it strongly indicates a tendency in the animal to take on meat; and it is evident that a fine and soft skin must be more elastic, and more easily stretched out to receive any extraordinary quantity of flesh, than a thick or tough one. At the same time, thick hides are of great importance in various manufactures. Indeed, they are necessary in cold countries, where cattle are much exposed to the inclemency of the seasons; and, in the best breeds of Highland cattle, the skin is thick in proportion to their size, without being so tough as to be prejudicial to their capacity of fattening.'[1]

These supposed principles of Bakewell deserve very attentive consideration.

I. *Beauty or symmetry of shape*—in which the form is so compact, that every part of the animal bears a pleasing proportion to the rest. This, however, is so intimately connected with the second principle, that we comprise them both in the same description.

II. *Utility of form.*—Both beauty and utility demand that the head of the cow and the ox should be fine and small, gradually tapering towards the muzzle. This is a great point of beauty, and it is also essentially connected with utility, for there are few good milkers, or good feeders, who have not this fineness of muzzle. A thick clumsy head would materially add to the proportion of that which is useless and unprofitable. The neck, towards the setting on of the head, should be finely shaped, although it may be allowed somewhat rapidly to thicken towards the shoulder and breast. The chest is the all-important part. It should be deep and broad, and carried to the fullest extent. The back should be broad as well as level, and the animal ribbed almost home. There should not only be room for the heart and lungs before, but for the capacious paunch behind. The loins should be wide at the hips, but not too prominent, for there is the most valuable meat. The thighs should be full and long and near together, and the legs short almost to a blemish. The bones of the legs should be small, but not disproportionately so, and the hide mellow, but not loose—everywhere covered with hair, soft and fine, but not effeminately so. Such is the animal in whom are blended the qualities of beauty and utility.

III. The *flesh*, or texture of the muscular parts, is a quality that necessarily varies according to the age and size of cattle, yet it may be greatly regulated by attention to the food employed for fattening them. It consists in the flesh being marbled, or having the fat and lean finely veined or intermixed, when the animals are killed; and, while alive, a firm and mellow feeling.

IV. In *rearing live stock* of any description, it should be an invariable rule to breed from small-boned, straight-backed, healthy, clean, kindly-skinned, and barrel-shaped animals, having clean necks and throats, and little or no dewlap; carefully rejecting all those who have heavy legs and roach backs, or with much appearance of offal. As some breeds have a tendency to generate great quantities of fat on certain parts of the frame, while in others it

[1] Hints regarding Cattle, p. 157, &c.

is more mixed with the flesh of every portion of the animal, this circumstance will claim the attention of the breeder as he advances in the knowledge of his business.

v. In the *purchasing of cattle*, whether in a lean or fat state, the farmer should on no account procure them out of richer or better grounds than those into which he intends to turn them. He should select them either from stock feeding in the neighbourhood, or from such breeds as are best adapted to the nature and situation of the soil.

vi. *Docility of disposition* is an object of great moment; for, independently of the damage committed by cattle of wild tempers on fences, fields, &c., it is an indisputable fact that *tame beasts require less food to rear, support, and fatten them.* Every attention should therefore be early paid to accustom them to be docile and familiar; and gentle, kindly, equable treatment will most effectually conduce to this end.

vii. *Hardiness of constitution*, particularly in bleak and exposed districts, is a most important requisite. It usually depends on *form*; all animals with fine arched ribs and wide chests and backs, are more likely to prove hardy than those having their fore quarters narrow.

There is a rather prevalent opinion that white is a mark of degeneracy; but the wild cattle of Chillingham are invariably of that colour, and the highest-bred Herefords are distinguished by white faces.

viii. Connected with hardiness of constitution is *early maturity*, which, however, can only be attained by feeding cattle in such a manner as to keep them constantly in a growing state. Beasts and sheep with this propensity, and thus managed, thrive more in three years than they would do in five if they had not sufficient food during the winter.

ix. There is in some animals a *kindly disposition* to acquire fat on the most valuable parts of the carcass at an early age and with little food, compared with the quality and quantity consumed by others. On this account smaller cattle have been recommended as generally having a stronger disposition to fatten, and as requiring, proportionably to the larger animal, less food to make them fat; consequently, a greater quantity of meat can be produced per acre. 'In stall feeding,'—the nature, method, and advantages of which will be stated in a subsequent chapter,—it has been remarked, that, 'whatever may be the food, the smaller animal pays most for that food. In dry lands, the smaller animal is always sufficiently heavy for treading, in wet lands he is less injurious.'[1] This opinion, however, is combated by some very able

[1] Papers of the Bath and West of England Society, vol. x. p. 262.

judges, who still contend that the largest animals are the most profitable. They doubtless may be so on good keep; but the smaller animals will thrive on soils where heavy beasts would decline.

x. Besides the rules thus stated, there are some particulars with regard to the *age* of neat or black cattle and sheep, which merit the farmer's consideration.

'Neat cattle cast no teeth until turned two years old, when they get two new teeth. At three they get two more; and, in every succeeding year, two, until five years old, when they are called *full-mouthed*; although they are not properly full-mouthed until six years old, because the two corner teeth, which are last in renewal, are not perfectly up until they are six.'[1]

The horns of neat cattle also supply another criterion by which the judgment may be assisted, after the signs afforded by the teeth become uncertain. When two years old their horns are without wrinkle at the base, but at three years old a circle or wrinkle appears, to which another is added at every year, so that by adding two to the number of these circles or rings, the age of an animal may be ascertained with tolerable precision, unless these rings are defaced or artificially removed, by scraping or filing—a fraudulent practice too frequently adopted in order to deceive the ignorant or inexperienced purchaser. These circles, however, must not be confounded with other ringlets that are sometimes found at the root of the horn, and which are a tolerably sure indication that the animal has been ill fed during its growth; another frequent consequence of which is that the horns are crooked and unsightly. There is also a tip at the extremity of the horn, which falls off about the third year.

The bull is termed a *bull calf* until he is one year old, and then a *yearling bull*, and afterwards a two, three, four, and five years old bull, until six, when he is *aged*. When castrated, he is called a *steer calf*, then a *yearling steer*, then a two or three years old steer, and so on until after four, when he becomes an *ox* or *bullock*.

The cow does not assume that name until four years old, previous to which she is called, first a *heifer-calf*, and then a *yearling heifer*, and a two or three years old *heifer*.

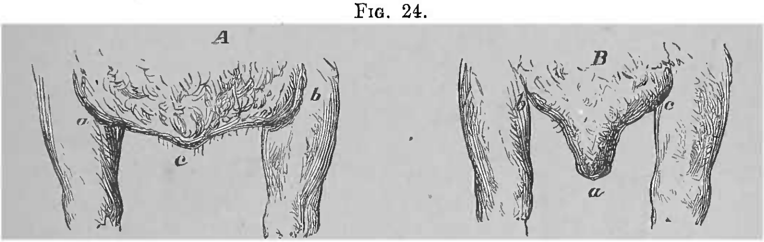
xi. As supplementary to the points already discussed in this chapter, bearing on the characteristics in 'points' which distinguish good stock, and as taking up also one or two subjects which should be considered by the grazier in stocking his farm, we give the following paragraphs.

In a small but valuable work or pamphlet, by Mr. E. F. Wilkes,

[1] Culley on Live Stock, pp. 208, 209.

there are some excellent and practical remarks and illustrations, forming 'a guide to form in cattle.' This is published at Hereford by Mr. Head, High Town, and is well worth purchasing and studying by the reader. The hints given are so good, that it is to be regretted that there are not more of them. We do the reader a service by drawing attention to one or two of the leading points to be observed in form in cattle, illustrating those by sketches adopted from the drawings given by Mr. Wilkes. 'Form,' or the external outline of what may be called the framework of the animal is, Mr. Wilkes remarks, of the utmost importance; for however much an animal may be covered with fat, unless the form indulging this be good in its points, the animal is defective, and that in proportion to the defects in the form. Mere size or bulk does not constitute perfection in cattle, although this is a point of great importance, and upon it will be found a few remarks in this chapter at another place. But size, combined with good points of

FIG. 24.

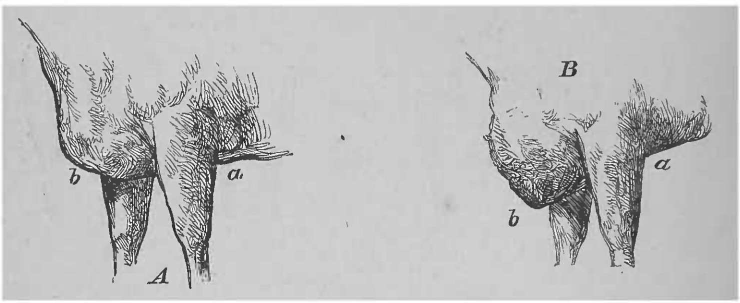


GOOD (A) AND BAD (B) FORMS OF BOSOMS.

form, go far to make good cattle, to which, if there be added a ready tendency to take on fat and flesh evenly, and a fecundity which ensures the animals breeding freely; then, what may be called the 'standard of perfection' may fairly be looked upon as being reached.

Breeders know well the value of ample width giving space in the fore-quarters of the animal for the important organs of respiration. The form of the bosom and shape of brisket is one indication of good form at this point, and it influences also the tendency to lay on fat evenly. In fig. 24, the diagram at top marked A shows a good form; in this the bosom in front view is rather level from a to b, the centre c being kept up, not pendent or projecting; while, at the sides joining the arms inside, the spaces are well filled up with muscles. The opposite of this—which, however, is sometimes much admired—is roughly indicated, in a purposely exaggerated form, in the diagram B in same fig. 24. The centre a of the bosom is deep and pendent, and the outsides of the arm at b and c are not well filled in with muscles. Of the two forms here sketched, Mr. Wilkes states that that in *a*, fig. 24, 'affords in reality more width in the carcase generally, and is adapted in well-bred animals to carry the most meat in a given compass. While on this important part of the frame or form of cattle designed for meat-producing purposes, it will be useful to indicate two forms of the bosom or brisket, as in fig. 25. In one diagram, marked *A*, the best form is shown; this gives a 'full round bosom,' carrying its width through the lower part of the chest, with sufficient circularity in the lower part of pectoral ribs. The diagram marked *B* shows a bosom terminating deeply and abruptly behind the fore legs as at *a*; in place of being kept almost level on as in corresponding point in diagram marked *A* in same figure. Viewed in profile, the form of brisket or lower part of the bosom is very different in the two; in diagram *A* the shape is full, well rounded, with an easy curve; in diagram *B* it is pointed, and has a sharp curve going up

Fig. 25.

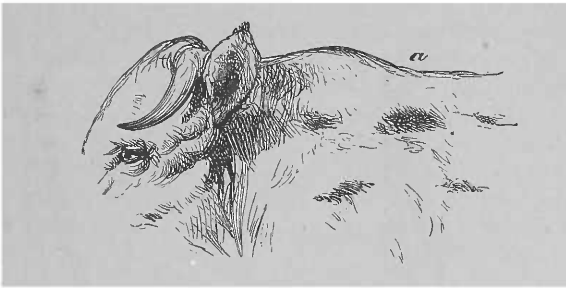


GOOD (*A*) AND BAD (*B*) FORMS OF BRISKETS.

to point behind the legs. Other delineations of 'briskets' are shown at *b* in figs. 2, 5, 8, 11, and 18.

Although it is a 'point' not much thought of by some breeders, or, if so, not deemed to be of great importance as influencing the qualities of the animal, still the way in which the shoulder-blade is 'set on' does influence the pectoral region, which we have shown to be of high importance. Thus the falling down behind the shoulder-blade, as in fig. 26 at *a*, is a defect 'which is commonly accompanied with a want of sufficient capacity in the chest.' But, in the illustration in fig. 27, this part, as at *a*, is well filled up, giving, as Mr. Wilkes remarks, a good chine. This form, he says, is a most difficult thing to acquire in an animal, so as at the same time to get length and depth of frame. The best form of chine is one which is rather thick and round, than one elevated much above the shoulder-blade. The position of the shoulder itself should not be overlooked. When well placed it should fall somewhat back in an easy gentle curve; not stand almost vertically up, or give what is called an upright shoulder,' which is generally accompanied with coarseness of bone. See also figs. 5, 8, 11, and 18, at *c*. The

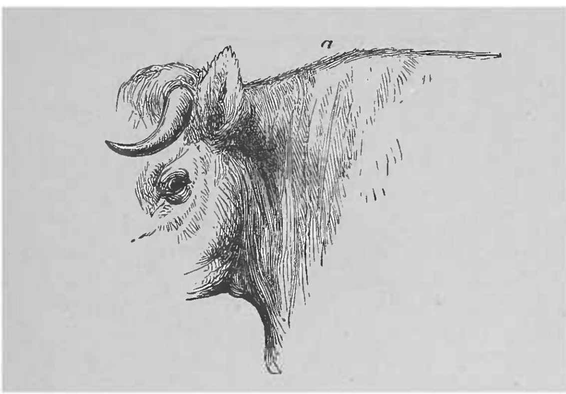
Fig. 26.



DROOPING SHOULDER-BLADE.

'setting on' of the tail is another 'point' which should not be, overlooked; at fig. 28 diagram *a* shows a tail 'set on' too high, high, giving a falling in behind and on to the rump; in diagram *b* the tail is 'set on' too low, giving an ugly rise in the rump, with

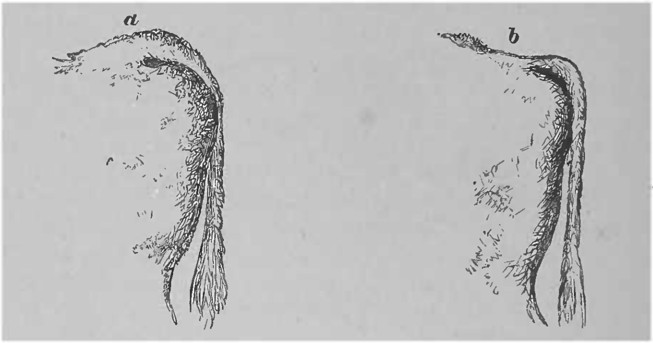
Fig. 27.



FULL SHOULDER-BLADE, GIVING GOOD CHINE.

depression behind towards the tail. Fig. 29 shows a tail well 'set on,' nearly on a level with the general line of back, and giving a well-shaped rump at *a*. This last figure (29) also illustrates an important point to aim at—namely, full thigh and a low and deep flank. A thin thigh and high flank should be avoided. The high flank shortens the ribs, which some breeders do not like, as it gives too deep a belly; but by care this may be avoided, and a fair length of rib obtained, so as to give the desirable depth of flank

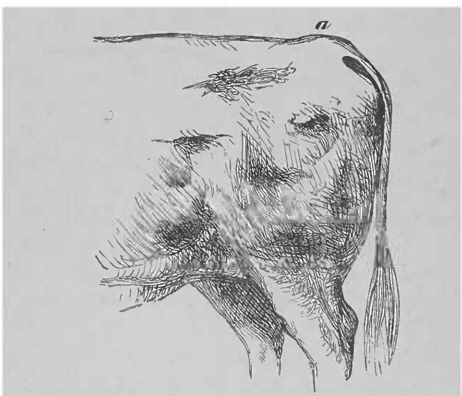
Fig. 28.



(*a*) TAIL 'SET ON' TOO HIGH. (*b*) TAIL 'SET ON' TOO LOW.

and roundness and thickness of thigh. A well rounded ear, standing clear out from the head, is a better indication of a tendency to take on fat quickly than a drooping, slouching, and narrow ear.

Fig. 29.



WELL 'SET ON' TAIL.

While on the subject of form or contour we do the reader an important service by drawing his attention to one or two remarks, the brief digest of a larger paper of extremely practical and suggestive interest, read before a conference of short-horn breeders in

America, by Dr. Sprague, of Iowa, who has given in its matter evidence that he is thoroughly acquainted with his subject. Our author dwells upon the importance of attending to the conformation and consequent contour of that part of the frame of the animal which contains or covers the vital organs—the heart, the lungs, and the liver. As closely connected with this part, our author says that two of the worst defects in the contour of a short-horn, and as a consequence of all other stock, are the following:—First that form in which the ribs start from the spine, go downward in such a direction that they give a wedge-like shape to the upper third part of the chest; the second is the long rib, which, deficient at its lower end, causes an upward curve to be formed in the lower line, at a point immediately behind the fore-legs. These defects are so bad that he doubts if there are any others which are so difficult to 'breed out.' A rump, he says, which droops, or a forward carriage which is low, may be made to disappear in the course of two or three 'crosses,' and so that they may not reappear in future progeny; but the two defects above-named, depending upon deficient vital organs within, are not so easily dealt with and got rid of. It may take many crosses of the most judicious kind to plant large vital organs in the offspring where those have been deficient, even although they have been so in the case of one parent only.

Although the statement is somewhat paradoxical, it is nevertheless true that the short ribs should be long; and in place of bending sharply down, as they do in badly-formed beasts, they should stand out from the spine horizontally, so as to form a level place in front of the hips. This is a good 'point,' and should be carried out by the breeder, as it generally accompanies, and thus perhaps influences, the round deep chest which is of such importance, as we have shown already. Every inch of additional width obtained by this point in the 'rear third' of a fattening ox, gives a 'cut' one inch in thickness, and in surface extending from top to bottom something worth trying to get for the butcher and the cook.

When a hind-quarter 'holds its width well back' in the beast, it carries a larger weight of meat than the hind-quarter which 'narrows in quickly' back from the hip. In conclusion, let the breeder bear in mind that a perfect contour in a fattening beast gives such an evenness to the flesh in all parts of the body, so well distributed, to use another phrase, that it is difficult to tell where one 'point' ends and the next begins.

Although not connected with contour, it is so closely connected with the subject of good flesh, which it is the object of contour to lay evenly on to the frame of the fattening beast, that we should say a word or two on 'texture' of this flesh, the importance of which it is impossible to over-estimate, and yet it is a thing generally overlooked by breeders and often by butchers. The feel or touch is supposed popularly to indicate the texture of the meat, but Dr. Sprague very properly points out that it is not a correct, often indeed a very misleading guide. Texture can only be judged correctly by the eye; and, as said above, it is not all breeders, even good ones, who can tell what it is. Good meat should not have its fibres so distinctly visible that they may be seen like layers of veneer or thick cardboard laid side by side; but they should so run into and blend with one another that it is not easy to say where one ends and the other begins. Colour, too, we may also here remark, is a good test of meat. Blue-toned and dull-looking meat is not good, neither is dark sombre-tinted. It should be clear, ruddy, and fresh-looking.

As regards general contour of cattle, an animal is supposed to be well fattened and filled up—to have, in fact, good form—if, when looked at sideways, it has a rectangular shape. This is popularly called square, but of course cannot be so. The dotted lines, for example, in figs. 2, 5, 8, 11, and 18, indicate what is meant; the rectangle in these being made up of two rectangles of equal length, although the depth varies from the top and bottom lines being taken along the back and belly lines of the animal, and in a direction parallel to the ground line, *g l*, in all the above-named diagrams.

The setting out of the diagrams showing the outlines of certain breeds, as in figs. 2, 5, 8, 11, and 18, not only illustrates our remarks as to 'points,' &c., but enables comparative observations to be made of different animals, showing how the position, form, &c. of the points vary in different animals. And although portraits or even bold outlines such as we have given in some of the figures, are in some respects better than highly shaded drawings—as the outline or form of the animal is more clearly shown—still in a very short time, comparatively, the young grazier will be able to 'draw in his mind's eye,' if the phrase be allowable, outlines which he can in imagination thus make use of much in the same way as in figs. 2, 5, 8, 11, and 18. Thus the points, 1, 2, 3, 4, 5, 6 and 7 of the rectangle give distance-points from which the position of the various points and their forms may be ascertained. Thus the point 4 (see figs. 2, 5, 8, 11 and 18) gives the distance-point for measuring the position of 'brisket' *b*. (See fig. 30 for positions and designations of 'points' of cattle.) The point in figure 2, the means of measuring or noting the fall or depression of the back *a*, and the distance *a a′* and the depth of 'barrel;' the figure 5 the rise from 5 to *d* of the 'plates;' the figure 6 the distance of the thigh or hough *e*; the figure 1 of the position of 'pin bone' or 'tail-head,' and so on; the points in all the diagrams, figs. 2, 5, 8, 11, and 18 being the same. The height of legs from ground line, $g\ l$, or line 7, 8, 9, can be measured or estimated by distance from the line 4, 5, 6. In all the figures above

FIG. 30.

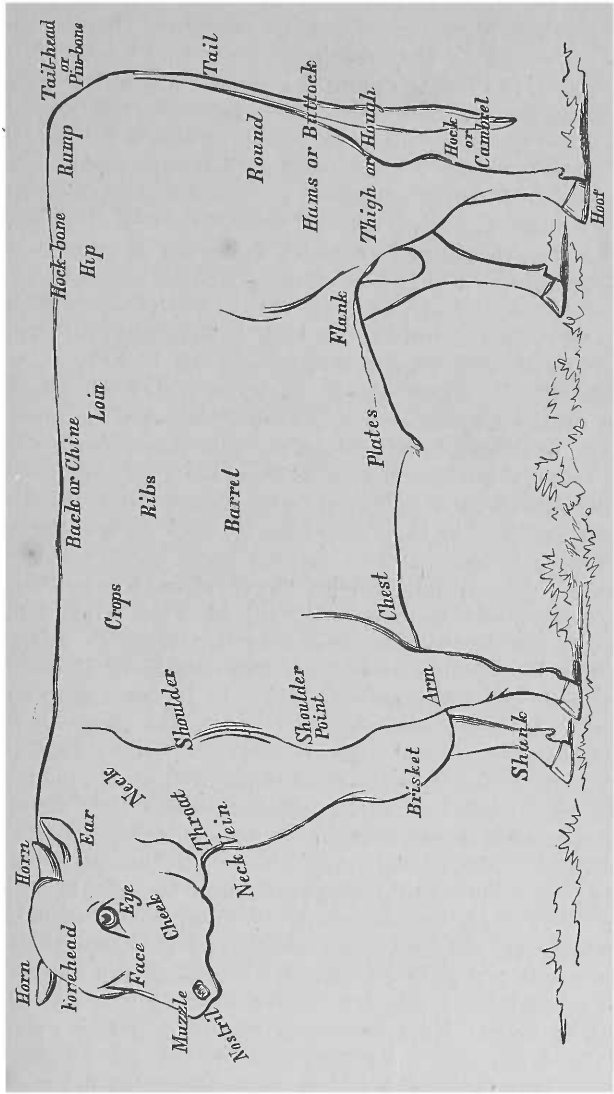


DIAGRAM ILLUSTRATING POSITIONS AND NAMES OF 'POINTS' IN CATTLE.

named, d indicates the 'flank,' c the rise of shoulder as explained in connection with figs. 26 and 27.

XII. *On the Judging of the Value of Stock by the System of*

Points.—At one, and that no very distant, period in the history of agriculture, it was held by many of its most advanced practitioners that it was a disgrace that no standard or standards could be set up, by which to estimate and value the various breeds of cattle and their several examples or specimens; that all was left to chance, or rather to the experience gained by long and intimate dealings with the animals; and that nothing was left but this by which to determine their worth. At length the system of 'points' was advocated, and by many practised, although no official recognition of it was made for some time. We have given a *vidimius* of the principal points which are generally understood to be indications of the value of cattle; but there are obviously other 'points,' if so they may be termed, which are of great importance in estimating the value of an animal, but which cannot be marked or 'ticketed,' so to say, as to be visible to the eye and reckoned up like the items of an account, such as the quality of the animal, its vigour as a breeder, &c., &c. Even the 'touch,' to which so much is attached and which in some scales of points has a certain value set against it, is one which, being a variable quality, will have, as in practice it has, a variable value. On these and other points—we do not use this word of course in the technical sense—each individual who is examining an animal has his own opinion, so that as a fact it remains true in practice, that these opinions—if they be made and given under the auspices of an agricultural society, 'awards' as they are then technically termed—are not generally received as being true expressions of the value of the animal or animals under inspection or 'judging'; but being looked upon more as that of individual opinion, are valued and set down accordingly. It is not therefore to be wondered at, that these opinions or 'awards' give rise to much discussion and dissatisfaction. Hence it is that of late attempts have been made to institute some other method of arriving at an opinion on the value of cattle, especially where they are exhibited at shows, and are therefore as a consequence looked up to, or likely to be looked up to, as what might be called 'models;' and therefore a desire produced to obtain breeds from them for their perpetuation; or for the improvement of other and less valuable breeds.

That the subject is of great practical importance there can be no doubt, nor any as to its being so discussed and decided that a system which can be relied upon for accuracy may be eliminated and relied upon. This discussion has to a certain extent been given; and, amongst the papers which it has called forth, perhaps the most valuable, as certainly it is the most exhaustive and logical, is one published by Mr. Alexander Bruce, Chief Inspector of Live Stock for New South Wales, and which first appeared, we believe, in this country in the pages of 'The Farmer.' Mr.

Bruce, in introducing the system which he advocates, and which we shall presently allude to, draws pointed attention to the defects of the present one so much used. We have already adverted to the fact that animals—which may be easily conceived—vary in the points of excellencies or defects which they possess. Thus, as Mr. Bruce remarks, one animal may be valuable or high in 'quality,' but it may be defective in 'form,' or while good in some points of form which indicate value, it may be as eminent for having other points of form which indicate the reverse; or it may be good both in form and in quality, and yet defective in vigour and size. Now judges 'being,' as was once facetiously remarked by one, 'but men,' like other men have their prejudices, fancies, or predilections, one going in for one point, another for another; so that in judging where the animals are numerous more especially, the practice virtually is a species of summing up, or counterbalancing of the one point of an animal against another, in order to arrive at a conclusion, which, being a species of 'average decision,' will be as fair as he possibly can make it to the exhibitor of the animal in question. If one judge alone was employed at shows, even this system would be bad enough; but where there are, as is usual, three, it is very much worse; for then comes the 'tug of war,' when each brings forward his decision to be best. The result therefore often is that the best talker gains the day, or the most determined in standing out, or lots must be cast as to which of the three decisions is the one to be made public. Another defect of the present system is the hurry of the examination. On this point we have only to ask anyone to compare the difference between the style of a man who is examining an animal in order to purchase it for himself with that gone through at a show, to convince him that where so little time is given to a work which all admit to be one requiring great deliberation and care, that that work cannot be done well. We have alluded to the prejudices of judges—indeed, of all who are concerned with stock—as to certain 'points' as placed against other points in an animal; but there is one prejudice notoriously well known to exist amongst three judges, and that is in favour of a certain class or 'breed' of animal. With some, if the animal is not of *his* breed, no matter how good it is, it stands a poor chance of gaining a favourable decision. All who know anything of stock, know what is meant by a 'Booth man,' a 'Bates man,' and of the strength of the prejudices which these terms convey.

But we come to a far more important defect of the present system, as pointed out by Mr. Bruce; important, inasmuch as it affects the whole question of the improvement of the breeds of cattle throughout the country. The difficulties attendant upon the gaining of a knowledge of a stock are well known, but not so well known, perhaps, as they should be; as few would but think it strange to hear one of the most eminent, if not the most eminent breeder of the country, state that every day he is learning something respecting cattle, seeing a point to-day that he did not know of yesterday. Such being the case, then, it would be satisfactory to know the opinions of the judges, in which was authoritatively stated the points in which the animals excelled which took the prizes: the 'reasons why,' in short, the awards were made as they were. By this means an 'authoritative record of those points would be created;' and, further, breeders would be directed, 'who are looking for stock to improve their herds in particular points, where animals high in those points are to be found,' and the 'questions as to what breed of stock is the most profitable for the breeder and the farmer would be in a fair way of being settled.' Mr. Bruce advocates a very complete register of points being kept by the judges, and these being published would in fact make each exhibition or show 'thoroughly educational,' afford the largest amount of practical information with 'respect to stock, and their excellencies and defects, thereby teaching the uninitiated and educating the rising race of breeders.

We confess to having a difficulty in seeing why the same thing should not be done in the way of the stock department by the leading shows which is done, for example, by the Royal Agricultural Society of England in the department of steam engines, in which a vast amount of detailed information is given on all the 'points' or 'marks' of all those tried—not merely the prize engines—of a highly practical character. If this were done as regards stock, breeders would be as well informed in their department as machinists are in theirs. And yet there must be some difficulty in the way, for it is not done; but what it is we know not, and fail to see why there should be. Some, however, think there is; and as on almost every other subject, so on this, 'many men have many minds,' for we find a 'breeder' in a leading journal almost scorning the idea of having any 'system of points' to indicate the value of cattle, and who maintains that while fancy animals, pigeons, terriers, &c., may be judged by 'points,' it is wholly out of place in 'adjudicating on the merits of Short-horns, Herefords, or Devons, whose beauty, utility, and fashion are so intimately blended.' In animals of the higher class, he says, 'we have a combination of the useful and the ideal which can only be properly recognised by a critical taste as well as judgment, not in its ultimate analysis above law, but certainly not subservient to figures.' But surely, if the system of points be not subservient to figures—which, by the way, are but the conventional organs used by way of giving in the briefest fashion the relative values of certain points—the judges can still be able to publish the reasons for their awards. These reasons *they must have had, or ought to have had,* before these awards were given; the one being the foundation or basis of the other, without which it could not exist. And if a knowledge of animals is the result of critical taste as well as judgment, the facts upon which these operated can be stated. And if this, and this only, were done, one of the advantages we have already pointed out by another system of judging than that now in use, would be gained by the public. There are certain indications of value in a breed; this cannot be disputed; and if a conventional system can be agreed upon by which these points can be valued, or made clear to the public, we see no reason why it should not be adopted.

In deciding upon a system of 'points' generally applicable, it would be necessary at least, and greatly to the convenience of discussing and deciding upon these, if there was a general system of technical names of the parts of the animals decided upon; that is, if there was a universal nomenclature. For one on hearing the breeders or sellers of different districts talk about the peculiar merits of their animals, or a student in agriculture in reading what may be written thereon by different authorities, would be quite at a loss to know, in several instances, what were the parts meant. The technical names used in the North of England and in Scotland are different in some instances from those used in the South, although the parts are the same in both. In one sense this is of no great importance, as 'dealers' will soon find out, and do soon find out, those differences. But its importance, and, in fact, its necessity, becomes evident as soon as the subject of a universal code of 'points' is broached, and that be deemed of practical value to have for reference to be made to it. For it is at once obvious, even to the least practised mind, that the reference cannot be made universally unless the corresponding points have corresponding names which are to be universally recognised. In the judging of cattle or deciding their value it is surprising what a diversity of opinion exists, even amongst those who are considered first-rate practical men, as to the method which should be adopted. Some decide on the value of a fat beast entirely by the eye, that taking in the various parts as they are indicated; others, again, almost wholly set aside the system of points, and trust to their handling—or 'touch,' as it is called by some—of the various parts; while others combine the two, looking at the points and also handling the beast. But little as some regard the value of the 'touch' or the handling, there is little doubt but that it is of great importance in helping one to decide as to the value of a fat beast. A soft, movable, or what might be called almost a species of floating feel of the skin at certain parts, as at the ribs (see fig. 30) is a good sign of the quality of the meat. But this—and here the value of the system of judging by combining points and touch is shown—should be in conjunction with the ribs, well rounded, for flat ribs will generally give a hard unkindly touch. With ribs well rounded, and the skin of the soft movable kind above noticed, the hair or 'coat,' as in some districts it is generally termed, is thickly laid on, and in place of being hard, short, and wiry, is soft, and feels something like the nap of fine silk velvet. All these taken together are indications of a good fattening beast, which is likely to prove, as the saying is, one which will 'put its meat into a good skin'—a saying, by the way, which, old as it is, shows that from early times the skin was looked to as a point in a good beast. They also show that it is not easy to judge a beast by one method alone. It may be so in the case of fattening beasts, but certainly the touch or handling cannot be dispensed with in the case of dairy cows. In the chapter treating of these we have alluded to the 'milk veins;' now, although those can be seen and their value so far decided on, they must be handled and felt before this can be fully so. Even in a fattening beast the touch of the 'neck vein' is of importance, for by it one can tell the condition of the fat at once about the shoulder point. Generally the touch or handling, as in the cases cited, is done with the finger-points; but a good judge, by passing the hand flat over certain parts, as along the back, can tell at once the parts which are in good flesh and fat condition, and those which are not so.

We have said that, as regards form, a rectangular outline, well filled up, viewed sideways, is a good indication of a well-conditioned beast, as in fig. 11; the same standard is also valuable when applied to the back as looked down upon, or what an architect would call a 'ground plan,' the side frame corresponding to a 'side elevation.' The back broad and level of a well-formed good-conditioned animal, will fill up this frame, as in fig. 11 (see fig. 16 at *a*), the hinder quarter, from the hock bones to the rump or pinhead or tail-bone, forming a species of rounded triangle, the front quarter a species of square rounded off at the shoulder points. What might be called a 'back elevation' would show a *square* frame equally well filled in from the hock bones to the thighs, both of those parts being rounded off to meet the back at the rump and the thighs at the lower part. The 'front elevation,' so to say—keeping up the similitude borrowed from architectural planning—would also show a 'square frame,' the shoulder-points at the front showing a breadth nearly the same as that of the hock bones at the hind-quarters. Such, then, may be taken as some of the leading features of the methods in use of judging of the value of fattening beasts; but from what we have said it will have been, we trust, perceived by the tyro in the art of grazing, that to make a good judge he must take every opportunity of examining and handling the animals themselves; attend sales and shows, visit 'crack farms,' and educate himself by all the means at his command; use his ears in listening to what known judges, experienced feeders and breeders, and successful dealers say of certain animals, his memory in remembering all that is said, his eye in noticing the difference between good and bad form, and his delicacy of touch in handling the beasts under his notice. It takes the exercise, indeed, of no small skill in observing, noting all, remembering all the points to be considered in cattle-judging, and the tyro may conceive that he has no mean task before him when he bears in mind the saying of one of the most successful—if not the most successful breeder of the century—that not a day passed over his head when amongst stock but what he saw something he had never seen before in them, and learned some new point of knowledge of which before he had been ignorant.

XIII. *On the Selection and Management of Store Cattle in Stocking the Farm.*—There is no class of farm stock in the department of cattle which in their selection requires the exercise of so much skill and judgment, and in their management so much care, as that of store cattle. Many think that any sort of beast will do to lay in, feed up, and sell off with a profit, and that with just the ordinary style of doing things. But a little consideration will show that the position we have assumed above is the correct one; for, if nothing else, this one consideration would show its importance: they are the source, so to say, from which are drawn the supplies of those animals which are sent into the market to keep up the food required by our increased and ever-increasing population. And how to send them in to market in the best condition, with the least expenditure of food and labour, is the problem which the store cattle-keeper has to solve. One of our most eminent feeders states that it is one of the most difficult things in stock-keeping to know how to decide upon the value and the qualities of store cattle. We have, he says, many judges of fat cattle among farmers and butchers, a few good judges of breeding stock, but 'our really good judges of store cattle are exceedingly few.' The further remarks of this eminent authority on this important department are so practically valuable that we cannot do better than give here a brief *resumé* of them.

That good judges of store cattle are so few, as above stated, may well be understood when we consider what this authority states they ought to be able to do. At a glance, they ought to be able to tell how much the animal will improve, how much additional value can be put upon him on good, bad, and indifferent land, and on turnips in three, six, or twelve months. The difficulty of the problem here to be solved is seen at once, nor is it lessened by the fact that there are no rules by which this difficulty can be lessened; for a store grazier's knowledge is to be picked up by long observation and experience; and, what is still more puzzling, by the aid of a 'natural gift.' Still, there are some rules with which a store cattle-keeper should be acquainted. Thus, for example, it is essential that he should know how the animals he purchases have been kept, and upon what system they have been fed during the previous six months. Without this knowledge he will be working completely in the dark. This comes back to the badness of the system we have elsewhere alluded to—of buying in open market beasts of which nothing is known. Our authority states there is another important rule or principle guiding his practice—that he will buy no cattle for store beasts unless they have been kept in open straw-yards and fed exclusively on turnips and straw. And of the two—yellow turnips and swedes—he decidedly prefers the yellow. On no account should the store cattle-feeder have anything to do with beasts which have been fed through the winter previous upon cake, corn, brewer's grains, wash or potatoes, and kept up in close hot byres or houses, or in close straw-yards. This mode of feeding for store cattle he calls unnatural. Before they begin to improve three months will have passed away, and then come on the cold bitter east winds of April and May, to which they will be exposed when put on grass, and which will soon bring them down in condition and at a rate, as he observes, 'which will astonish you some morning.' While by no means going the length of saying that a little cake or corn will ruin beasts for grazing, he says that the less artificial food they get during winter the better. Classifying the winter foods on which store cattle are sometimes kept, as above stated, cake is stated to be the best substitute for corn and turnips; potatoes, brewer's grains, and brewer's wash or dreg the worst. Of potatoes, indeed, the authority says that he would rather throw them on a dung-heap than give them to a store bullock. His store cattle never see cake, corn, or potatoes; they are kept in open court-yards, well bedded with as dry straw as can be had, and receive as many turnips as they can eat. For protection in bad weather a sufficient covering is provided. It is scarcely necessary to say that careful superintendence of the animals is requisite in order to keep them up to the mark.

Such is the winter treatment of store cattle. As soon as they can be got out to grass in spring the better; and if attention has been paid to the pastures so that there is an early bite of fine, sweet rich grass, it is surprising how rapidly the animals improve. If kept during the winter as above described, and put out to grass as now stated, they will add as much as one-third, at least fourth, to their live weight during the first four or five weeks of early and good grass feed. Of course much will depend, as already stated, not only on the grass but on the weather. And, as regards the grass, it is, as we have elsewhere pointed out, an important matter to keep changing the pastures. This plan, if judiciously conducted, on a farm on which there is a wide range of different fields, alone will greatly increase the pasturing value of the fields. The changes should be made about every fortnight or every ten days, according to circumstances. Much greater attention is required to be given to pasture fields than is generally given. If the weather be continuously wet, or much rain falls during a given time, so as to render the surface 'trashy,' it is quite a mistake to put cattle out in this, however fine the grass may be, and therefore tempting to the grazier for his winter-fed 'stores.' They will not only be themselves injured by exposure to the wet, at this early season too generally accompanied by cold winds; but they will, being in a restless uncomfortable state, keep wandering up and down till the field is 'poached' and tracked up; which will thus be spoiled, not merely for the season, but very likely will be several seasons before it gets back to its originally good state. In this department, therefore, as indeed in all others connected with stock, the master's eye has constantly to be on the look-out to observe what has to be done, what ought to be avoided. In pasturing grazing cattle much depends also upon the kind of pastures fed off. There is a vast difference between the systems of pasture fields of new and of old grass. In new grass land, for example, there is a certain period in early summer when the grass takes a sudden spring in advance forward; and if not eaten down at the proper time it will soon become coarse and rank, and in the course of a little longer time be little better than dry half-withered 'fog' with little or no nutritive properties. Hence the field will be but a dead loss to the grazier. Close attention should therefore be paid to this condition of the grass, so that it be eaten off when at its best; then the cattle should be taken off and the land allowed to rest, when the cattle may be put on again, by which time the grass will be as sweet and good as ever. It is by attention never flagging, never wearying, to such points as these that causes the difference between the grazing of cattle which pay and that which does not. And unless the grazier is determined to give this close attention, he had far better not begin to follow the calling. Losses in grazing are often attributed to bad cattle, bad land, bad seasons, anything and everything bad, in fact, but the bad management, which alone is really the cause of the losses which are so bitterly deplored and of which we hear so much.

We now come to the wintering of the 'Store Cattle,' after the pastures have passed their best, and the beasts have to be put upon turnips. Our authority states that the sooner the cattle are put up the better. He sows every year from twelve to sixteen acres of tares, and about the beginning of July sets aside a portion of the new grass full of red clover, and from the 1st to the 17th of August the tares and the clover are fit for the cattle. We have said that the sooner they are up the better; a week's housing in August, September, and October 'is as good as three weeks in the dead of winter.' The cattle are begun to be put into the yards about the first of August, drafting off those required for the Christmas markets, thus giving relief to the pastures and yet leaving enough of cattle in them. Through the months of August, September, and October, the cattle do best in the yards, but when the weather becomes cold stall-feeding is the best. The cattle should not have unripe tares given to them; they should be three parts ripe at least; and, when mixed with the red clover, a capital feeding mixture is produced. To succeed the tares, yellow turnips should be ready. About ten days after the first lot has been taken up from grass, a second lot is then taken up, thus further relieving the pastures and allowing the cattle left in to thrive all the better. The whole of the cattle are thus gradually drafted from the fields to the fold, regularly in succession till the end of September, at which time all ought to be under cover which are intended to be fattened during the winter; care being taken, as above noted, to draft off the strongest and best first—those meant for the Christmas sales—till the worst are left, which are brought into the fold.

As to the breeds best adapted for store cattle under this system, being that adopted for the northern counties, the following is the conclusion come to by our authority—namely, that the best beasts are the Aberdeen and Angus Polled Breeds, and the crosses with the Aberdeen and North Country. The age of the store cattle is a point which should be considered. It is stated that, although no doubt a two year-old will put on more meat than a three-year old, and for a 'long keep will pay as well,' yet he prefers aged cattle, as they 'get sooner fat, are deep on the fore-rib, and take less cake to finish them off.'

The management of store cattle, like that of other departments of stock, varies, as we have already remarked, with climate, locality, and soil, and the grazier must keep those points always before him if he wants to be successful. For the more southern parts of the kingdom there is a wide choice amongst the breeds of the Short-horns, Herefords, Devons, and the Norfolk and Suffolk Polled, with crosses of the same. Other remarks on this point will be found in the early portion of this chapter. For remarks on the 'Principles and Practice of Breeding' the reader is referred to the chapter on horses.

CHAPTER IV.

OF THE BULL.

THE bull generally attains the age of puberty as early as twelve or fourteen months, and may be used moderately at this age without injury. Young bulls which have been suckled on the cow in a pasture will generally serve cows more readily at an early age than those reared in the house. It is not advisable to put old or heavy bulls on young heifers. Neither is it well to allow the bull to run in the pastures with cows, and especially is this practice injurious to young bulls, often spoiling their tempers, besides doing them other harm; wherever the situation can by any means be made to admit of its being avoided, this should never be permitted. As it is desirable at times for the bull to have exercise, he should be allowed a loose box when young, and should be regularly rubbed down every day, as that conduces to health, and as he gets older be led out occasionally. The temper of the animal much depends upon the treatment he receives, nevertheless some bulls are naturally far more vicious than others.

As much, if not more, attention should be paid to the size and qualities of the family of the male as is given to his own. Many a small bull, if well descended, will produce finer stock than a heavier animal whose pedigree is not so good. Nor should a male be hastily rejected; some graziers fatten and slaughter a bull after he is two and a half or three years old before his capabilities as a stock-getter can possibly have been sufficiently tested. Others, on the contrary, going to the opposite extreme, will rear and breed from bulls got by inferior parents, and which are themselves very mediocre animals.

All the breeders of Durham cattle make it a *sine quâ non* that none but bulls of undoubted descent shall be used.

Professor Tanner gives the following as *points indicating a well-developed bull.*

'The *head* should be rather small in proportion to the animal, and well set on the neck, with a fine tapering muzzle, a broad forehead, bright, full, yet placid eyes, furnished with a graceful horn of fine quality, and ears small and fine.

'The *neck* should be thick, but not too short, but having a graceful appearance by tapering steadily towards the head, and yet not getting thin behind the ears.

'The *shoulder* should be snugly in the carcase; it should be covered with a well-developed muscle down to the knee, below which it should possess a fine and flat bony structure.

'The *chest* should be bold and prominent, wide and deep, furnished with a deep but not a coarse dewlap.

'The *carcase* should be barrel-shaped, having a top level and broad, especially across the hips; the ribs should be well rounded; the space between the last rib and the pin should not be too short, yet at the same time we must guard against too much length; there will, however, be little cause for objection, if the rib is well rounded, and the bone flat, for it will add weight to the animal in a good part. The flank should be full and pendent.

'The *hind legs* should be full and fleshy down to the hock, with a well-developed buttock, showing great substance, but below the hock we require a fine and cleanly formed bone.

'The *tail* should be finely formed without much hair.

'The *hide* mellow to the touch, covered with a fine yet plentiful coat of hair.'

The following remarks by Mr. Bowly, the well-known short-horn breeder, will be of value in connection with the subject of the bull:—

'In the selection of a bull, so much depends on the character of the female he is required for that it is almost impossible to lay down a rule on paper. To secure, however, a decidedly masculine character, it is better he should be too coarse than too fine. The man who at present possesses an ordinary herd of cows has a very simple course to pursue: if he will procure a well-descended bull from any improved breed, he will make great advance; even if the bull is not a first-rate animal himself, the offspring will partake most of the character of the purest and oldest blood, on whichever side it may be. The produce of a pure bull and an ordinary cow will often surpass in many points the high-bred sire; but it would be wrong to use a cross-bred bull, even if he were very good; for his stock would almost invariably be inferior to himself.

'In proof of the general result of using a pure-bred sire, I knew a man who began breeding with a very inferior herd of cattle, the greater portion being the black Welsh, and by using pure short-horn bulls for three or four generations he produced from them a very respectable herd of short-horns, and entirely lost the black colour; yet I have no doubt that, if he had ventured to use one of the bulls bred by himself, the black colour of his Welsh ancestors would have appeared again.'

A very important, if not indeed the most important, point connected with the life of the bull, is the age at which he should commence to propagate his kind. This is alluded to at the commencement of this chapter, and the age named—a year old

—at which he may be used moderately for this purpose. That he may be so used of course there is no doubt of, but the real question to be asked by the intelligent breeder of cattle is *should* he? This question cannot be answered off-hand, or by any number of references to any established practice, however extensive. For the truth is, that all such questions have, unfortunately for the true advance of the science of agriculture, been answered far too frequently in the 'off-hand' style; and as for reference to practice, that too often is that which should be avoided rather than followed. The only answer worth having to a question with such important bearings is that furnished by science. What, then, has it to say on this point?

It is purely a physiological one. But even from what is called ordinary experience, something like a common-sense answer to the question named above may be had. The propagation of a species demands, on the part of both parents, that they shall have attained that age at which all their physical powers shall be fully and healthfully developed. But if it be true, or, as perhaps we should rather say, if the view be correct that the sire or father exercises the principal influence upon the progeny, it would follow that the greatest care should be given to the male, to see that it has reached the period when all its physical powers are fully and healthily developed. Now, if in cattle feeding or fattening it be an established maxim or axiom—a point which cannot be disputed—that a fattening beast is at its best or ripest for the butcher at or about four years old—that is, that the animals are then fully matured, although the best authorities consider about five years old as nearer the mark, certainly not *less* than four years—it is difficult to see how a bull is supposed to have his physical powers fully developed, so as to act as a sire, when his age is only one year. This may be taken as what we have named above as the 'common sense' answer to the question we have asked. But it is right that we should have the more precise physiological or scientific answer to it. This we find ready to our hand in a paper contributed to an American journal, which treats of the subject in a way much more exhaustive and satisfactory than that we have elsewhere met with. We shall endeavour in a few words here to give the essence, so to say, of the much longer original paper.

The growth of a young animal depends upon the secretion or formation of the blood, and that again owes its existence to the food which it consumes. The propagating substance formed by the blood, when taken from the animal, extracts from its body a corresponding proportion of the blood which, if left in the system, would otherwise go to nourish it and complete its growth, which completion is, as we have seen, between its fourth and fifth, certainly not below its fourth year of existence. To form the requisite amount of propagating substance required in the exercise of the paternal function, it has been estimated that forty ounces of blood are required. Consuming of food three per cent. in proportion to his weight, and passing of this no fewer than seven-eighth parts of it away in the form of excretions and dejecta it is but reasonable to suppose that what remains of the blood-producing powers of the food is but just sufficient to maintain the gradual increase or growth of the animals. But even granting a more liberal proportion, it may fairly be answered that one half of the food, or its equivalent, which is supplied at the time to the animal to maintain and increase his growth, is taken away from him each time he 'serves.' Up to the period when he attains his full growth, there is a daily increase of his size, which requires evidently a daily, or at least a gradual increase in his food, the one being proportionate to the other; for the greater his bulk the greater the quantity of food it demands. Now, when during the period of his growing, the young bull is called upon to 'serve,' the power to digest the food, and thus to form blood, is reduced. The growth or onward progress of the animal is retarded, inasmuch as all the blood formed by the food consumed is fully required to maintain the growth. Propagation is therefore equivalent to a suspension of growth. But the evil does not stop here. We have shown elsewhere that if all animals of the farm be once let down they will never be brought up to the same point of condition; and if it was merely a suspension of the growth for the time being that was the result of the process above-named, growth would be resumed on the normal circumstances of the animal being resumed also. But, as above stated, it is not so, for deterioration to a certain extent is permanent. Hence the twofold evil of using young bulls before their full growth is attained. When, however, this full growth is reached, the animal requires less food, for it has only now to maintain or keep up its condition, nothing being required to increase its bulk. But if the same amount of food be given the animal, as its digestive powers still remain as good as before, and as these go to form blood, a reserve power or force is stored up, so to say, within the animal, and this can be drawn upon without injuring him, if that reserve power be used in the form of the propagatory substance. It is thus that a full-grown animal, fed properly in proportion to his bulk, is capable of begetting his like without injuring himself, if that power be not used to excess. And the converse of this holds good, namely, that if an animal has not attained his full growth, each time he exercises the paternal function he will draw from his system that which is necessary to increase his growth. The mistake in using too young animals is a grave one, for it affects them through the whole after life of the animal. It is a mistake which arises often from the fact that the animal, even when very young, can exercise the paternal function. But the capability to do so does not prove that its exercise is not prejudicial. This function can only be exercised properly when the animal has reached maturity, and not till then. And the losing sight of this fact has been, and still is, the cause of so many poor animals being met with for sale.

CHAPTER V.

OF THE COW.

COWS are either purchased with a view of being fattened for sale, or for breeding, or the purposes of the dairy. In the first case it will be advisable to attend to the kindliness of their skins, and the disposition to fatten. With those that are intended for breeding, care should be taken to select the best of the particular stock that is to be raised; and, for the dairy, those that yield the most and the richest milk. The desirable qualities of a dairy cow are, that she should give an abundant supply of milk, fatten readily, and turn to good account in the shambles. As the dairy constitutes, in many parts of the kingdom, an object of great importance, it is worth much consideration whether a particular breed should be kept for that purpose, or whether it is preferable to have the stock arranged partly for the butcher and partly for the dairy. 'It is probable,' observes Sir John Sinclair, 'that, by great attention, a breed may be reared, the males of which might be well calculated for the shambles, and the females, when young, might produce abundant quantities of good milk; and when they reached eight or nine years of age, be easily fattened. This,' he justly remarks, 'would be the most valuable breed that could be propagated in any country; and, indeed, some of the best English and Scottish breeds have almost reached that point of perfection.' Such an object would be readily attained if it were more the practice to use bulls from the best fattening stock with the best milch cows.

The following are given by Professor Tanner as the *points indicating a good milking character in milk cows.* 'The most prominent of these are the vessels which co-operate in the production of milk. These consist of the vessels which bring the blood, the glands which separate the milk, and the veins which carry away the blood when thus acted on. Of the former I may name those veins which show themselves between the bearing (vulva) and the udder. These are often buried, so that they cannot be seen, and although on pressure immediately above the udder they frequently appear, yet we must not immediately condemn the animal as a bad milker when they cannot be observed. Generally if the skin is mellow, and not much fat present, these veins show themselves readily. Their presence is very desirable, and combined with a full development upon the surface of the udder, they indicate a free supply of blood to the milk glands. It is also considered a good point where these veins present a knotty appearance.

'The milk glands are situated in the upper portion of the udder, and are generally four in number, each gland being in connection with its own quarter of the udder. The udder should be capacious, extending well behind the legs, and also forward under the belly; the coat should be thin, with a soft skin, and show considerable decrease in size after the cow is milked.

'The teats, which are the channels from the four reservoirs in the udder, should be placed well apart from each other, and not cramped together, for this generally indicates a want of sympathy in the udder. The udder may appear large, and yet be found fleshy rather than capacious. After the blood has been acted on by the glands, it is conveyed away by the veins, but none of these can be seen externally. The milk vein, which runs along the side of the belly, has been thus called from its supposed connection with the udder, but such is not the case. Especial attention is desirable to the mellowness of the skin, and more particulary if the animal is poor. This vein is a sure indication of the quality of the blood supplied, and for all practical purposes may be taken as a guide.'

Some attention also has been given within a few years to a discovery made by Mons. Guenon respecting the '*escutcheon*,' as it is termed. . . . It can scarcely have escaped the reader's notice that the hair on the buttocks of cattle grows in two different directions, one portion pointing up, and another part downwards, and thus producing a sort of fringe at the point of juncture. This hair which has an upward tendency has been termed the 'escutcheon.' A very extended observation has proved that, '*other conditions being equal*, the modification of form presented by the escutcheon will lead to an estimation not only of the *quantity* of milk which the animal will produce, but also of *the time* during which the cow will *keep up the supply* of milk. Without going much into detail on this point, I may briefly state that the larger the extent of the escutcheon the greater is the promise of milk, and also of the continuance, even after the cow is again in calf. A cow may have a small escutcheon, and yet be a good milker;

but observation leads to the conclusion that if she possessed a more fully developed escutcheon she would have been a better milker. It may be considered a point of merit not as *deciding* whether or not the cow is a good milker, but rather as an additional indication, which may be taken into consideration, in conjunction with other characteristic points. It is also desirable, in estimating the extent of escutcheon, to make full allowance for the folds in the skin; otherwise a large escutcheon may be taken for a small one. Besides the escutcheon, there are tufts of hair (*épis*) which have a certain degree of value when seen upon the udder of a cow.' [1]

It will be interesting and useful to explain the signs of a good milking cow, according to M. Guenon's system, which is exceedingly well described in the celebrated Continental treatise undernoted. [2] M. Magne, in giving the summary of the signs of good milkers, divides the cows, according to the quantity of milk which they give, into four classes. (1) First-rate cows (*les très bonnes*); (2) Good cows (*les bonnes*); (3) Middling cows (*les médiocres*); and (4) Bad cows (*les mauvaises*). He, however, before proceeding to describe and illustrate the signs of these four classes, warns his readers that this classification is used only to give a summary of the marks he has been discussing. For there is no mark which can serve for methodically classifying cows as milkers; if the *escutcheon* had any determinate or exact value (*une valeur certaine*), it would still be necessary to take into account the extent of the surface, or the form which the basis forming the escutcheon cover will assume. This cannot be done easily, nor would it be valuable if done unless the shape and weight of the cow were also taken into account. The forms or shapes of the escutcheon also are so various, that the classification of cows according to the quantity of milk which they give is adopted by M. Magne.

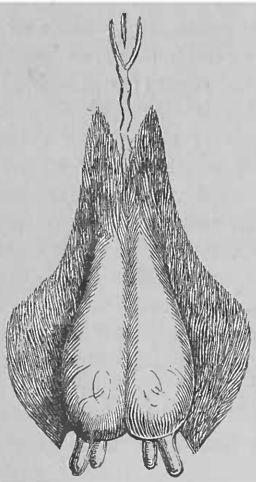
First Class. First-rate Cows. In this class are placed cows in which both divisions of escutcheon (*l'écusson d'inférieur*), the mammary and the perinæum are large, continuous, and uniform, and cover at least a large portion of the perinæum, the inside of the thighs and the udder, extend moreover, with little or no break, more or less over the limbs; elliptical in shape and situated in the posterior face of the udder: fig. 31 illustrates this. The escutcheon marks just described, although observed in very good cows, are not always indicative of them, for they are also found in middling or mediocre animals. But the cows may be considered first-rate as milkers, if, in the absence of a well-de-

[1] On Breeding and Rearing Cattle, by Professor Tanner, in Transactions of Highland Society.

[2] Choix de Vaches Laitières, par J. H. Magne, Bruxelles.

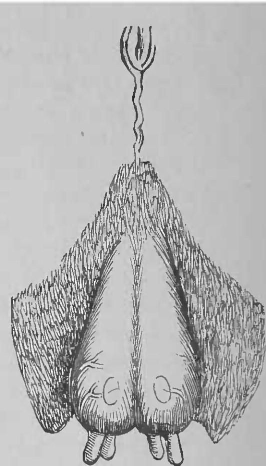
veloped escutcheon, they possess the following marks. Veins of the perinæum, varicose and visible externally, or at least easily made so by compression at the base of the perinæum; veins of the udder large and knotty; milk veins frequently double, and equal on both sides of the animal, and forming zig-zag or wavy lines within the belly. In addition to the marks shown by the veins and by the escutcheon, the udder should be large and yielding, of homogeneous texture, having a thin skin covered with fine hair, and yielding or shrinking much under the process of milking. The chest should be ample, and a good constitution displayed by regular appetite and a disposition to drink much; the skin soft and supple (fine tough), hair short and soft, head small, horns fine and

Fig. 31.



ESCUTCHEON OF FIRST-RATE COW.

Fig. 32.



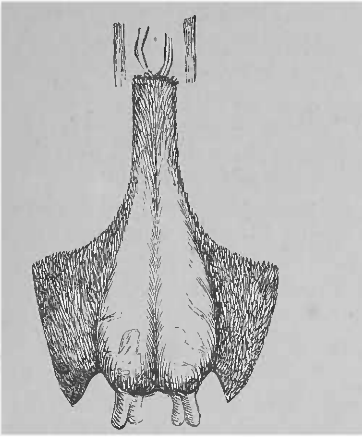
ESCUTCHEON OF SECOND-RATE COW.

smooth, eye quick but gentle, fine neck, and feminine air (*air féminine*).

Second Class. Good Cows. They present the mammary portion of the escutcheon well developed; but the perinæum portion is either wanting or but partially developed, as in fig. 32. The form with the upper escutcheon, as in fig. 33, marks a cow which will give milk for a shorter time when she is again in calf. In other cases, both portions of the escutcheon are only moderately developed, or but slightly indented, as in fig. 34. The milking qualities of cows should be doubted where large veins do not accompany the escutcheon. This remark is applicable in special degree to those cows which had many calves, and are in full milk;

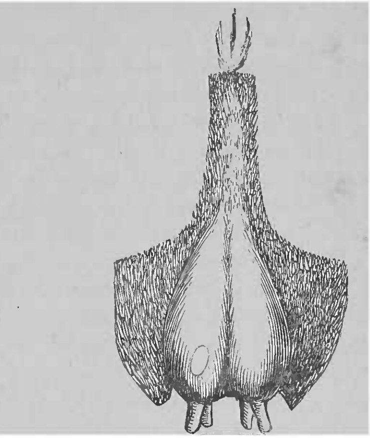
for be the escutcheon ever so well developed, the cows are middling or bad, but do not belong to either the first or second class

FIG. 33.



ESCUTCHEON OF SHORT MILKING COW.

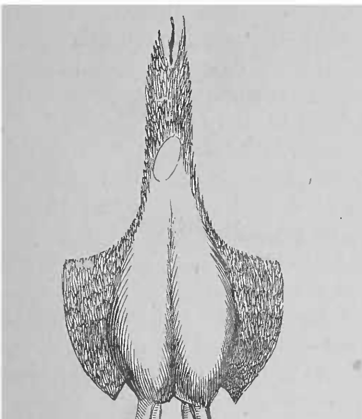
FIG. 34.



ESCUTCHEON OF MODERATELY GOOD COW.

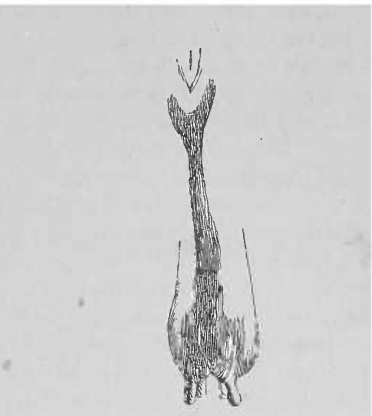
if the veins of the udder are not in considerable numbers, and the milk veins under the belly are not large. The general cha-

FIG. 35.



MEDIOCRE ESCUTCHEON.

FIG. 36.



BAD ESCUTCHEON.

racteristics, as noted in the first class, are of course not to be neglected.

Third Class. Mediocre Cows. Possess the lower tuft of the escutcheon of the mammary part little developed or indented, and the perinæum portion irregular, narrow, and contracted, as in fig. 35. The udder in cows of this class is small, skin hard, will shrink little on being milked. The perinæum veins are not visible, and the veins of the belly are small and straight. The head is large, skin stiff and thick (bad touch), and the animal is often peevish and restless.

Fourth Class. Bad Cows. Possess escutcheons of very small extent, as shown in fig. 36, no veins are visible in the udder or the perinæum, and the milk veins are feebly developed. The cows of this class are generally in good condition, and showy, taking animals. The thighs are fleshy, the skin hard and thick, neck thick, head and horns large, and the latter of large diameter at the base. While attention, however, is paid to the points of the cow, those of the bull should not be overlooked, for he has assuredly a strong influence in the milking capabilities of his produce. This is obvious when we consider that a bull descended from a good milker would likely favour the milking capabilities in his descendant, but much more so if he were put to another good milker. Of course the converse of this is equally true.

While considering the points by which good dairy cows may be ascertained, we should be doing our readers an injustice did we fail to draw their attention to a very remarkable and suggestive paper very recently published in the Proceedings of the Board of Agriculture of Ohio, in the United States, and proceeding from the pen of, as its facts and suggestions are based upon elaborate investigations made by, Dr. Sturtevent. The theory upon which this author bases his practice in deciding the value of dairy cows, and ranges the various established breeds under various 'types,' is quite novel, and has not even, we think, been hinted at before now.

The theory upon which the system is based is a very simple one in its statement, namely that the type of the breed of a cow has a certain determinate relation to the quality of the milk which the cow yields. Naturally the milk produced by a cow is just that which is required to rear or suckle her calf, and all which they yield in addition to this owes its existence to art; in other words, to the peculiarities or habits induced by the way in which they are domesticated and made subservient to the necessities of man; and it is remarkable how the animals change, not only their external form, but their internal functions, to meet those requirements, when put under certain modifying influences. Thus the Ayrshire which Dr. Sturtevent calls the 'symbolization of the dairy type' has been altered in its development, and can be again altered by certain styles of breeding. But the true typical Ayrshire dairy cow has its teats set wide apart in the udder, and the teats are small and short and cylindrical in form, the udder being flattened and held close and firmly to the belly by a fibrous tissue, partly elastic. In the Holstein breed and Dutch, a black and white cow has a long-shaped udder. In the Jersey or Channel Island cow the glands of the udder are pointed, the teats cone-shaped, and are set closely together in the udder. These three breeds Dr. Sturtevent takes as the types of dairy cows, and he finds, on examining the milk of animals of those breeds, that the butter or fat globules vary in each, both in their size and number. The result of a number of experiments is thus summarized:—

(*a*) The milk globule of the Jersey breed is larger than the corresponding globule of the other breeds mentioned, and there are fewer globules under 1-27,000 of an inch, for convenience called granules.

(*b*) The milk globule of the Ayrshire is smaller than that of the Jersey, and intermediate in size between those of the Jersey and Holstein; and the milk from individual cows of the Ayrshire breed can be grouped into two classes or grades, according to the size and distribution of the globules. This milk abounds in granules.

(*c*) The milk globule of the Holstein is the smallest of the three. The globules are more uniform in their size than in the Ayrshire milk, and there are fewer granules.

From these Dr. Sturtevent deduces in like manner the following propositions:—

1. The butter globules show a certain and definite relation between the quality of the milk and the breed.

2. The breed determines to a large extent the composition of the butter.

3. The breed determines to a large extent the most economical and advantageous manufacture of cheese.

As there is a 'breed' difference in the product from the udder, Dr. Sturtevent points out the importance in the breeding of dairy cows to keep to the proper type of udder. Thus he remarks that if in breeding Ayrshire cows the breeder seeks to place on the udder the large cone-shaped teats set widely apart, in place of the short cylindrical small diametered and widely-set teats of the true type, he will be departing from that type, and will therefore not obtain the same results in the dairy produce. Again, if in breeding from Jersey cows, he seeks to have the teat of the form, set, and size of the Ayrshire, he is departing from the true type of this breed. The following give the final results of the investigation, showing the milk requirements as supplied by the different breeds, and the relative value of these breeds for different practical purposes.

For Butter. That the globule should be of good size, of uniform size, and should be in abundance; or, expressed otherwise, a large percentage of cream. Requirement best fulfilled by the Jersey, Ayrshire (butter family).

For Cheese. That the globule should be so small as to remain mixed with the milk under all circumstances; *i.e.*, a white and not a blue skim-milk. Requirement fulfilled by the Ayrshire. That the globule should be easily mixed with the milk again after rising. Requirement best fulfilled by the Dutch and the Ayrshire.

For the Milk Retailer. That the globule should remain for a sufficient time mixed with the milk, so that an evenness of quality may occur during delivery to customers. Requirement best fulfilled by the Ayrshire and Dutch.

Farmers' Requirement. An abundance of yield under given circumstances. Requirement fulfilled in the order, Ayrshire, Dutch, Jersey.

Breed Adaptations. We have in this essay indicated the following results for breeds:—

The Ayrshire cow is superior in those shapes which indicate milk productions to the Dutch or Jersey cow.

The Ayrshire cow (butter family) is especially fitter for the dairy-farmer who packs his butter and sells at the market quotations.

The Ayrshire cow (cheese family) is especially fitted for the cheese manufacturer, as she possesses his requirements in such excess that reasonable skimming of the vats may be practised without injury to the saleability of the product.

The Ayrshire cow, without regard to the branch to which she belongs, will average well for butter or cheese, or both, without possessing either quality in such excess as do the cows of that family of the breed which have been solely bred for either purpose.

The Jersey cow is superior to the other two breeds in those qualities of milk which indicate quick churning and (in those markets which have been educated to the orange-yellow colour and waxiness) a large price.

The Jersey cow is fitted, by the quality of her milk, for the village resident, the suburban locality which has special facilities for the disposal of butter, and for the amateur farmer.

The Dutch cow possesses a milk neither pre-eminent for butter or cheese, yet possessing qualities which will allow of the manufacture of either, but not to the best advantage. The products of this cow require further study, as the keeping quality of the butter in my own experiment was so remarkable as to indicate strongly the direction of her usefulness.

Locality Adaptations. Jersey breed—local and suburban;

Ayrshire breed—cosmopolitan and universal; Dutch breed—preference limited by locality.

The breeding of cows for dairy purposes requires to be carried out with the greatest care, all the more where high bred or pure pedigree cows are used; for it seems to be admitted by many that high breeding in cows is inimical to their ready breeding and milking qualities. Not that there is anything to prevent the combination of good fattening, breeding, and milking qualities in one cow; but in highly-bred animals the milk glands are comparatively torpid and weak, so that much of the food material which would go to the formation of milk is devoted to that of fat. On this point the following, from a leading article in the 'Mark Lane Express,' will be useful and suggestive. The article, we may here state, was one reviewing Professor Voëlcker's 'Lecture on Milk.' 'Terribly high-bred cattle,' says the writer, 'for instance, are not thought to be anything like average milkers; and after "the Nursery" and the "jolly" heifers "as leads," people begin more and more to suspect them. Even, in fact, during this last year's lecture on cheese, we find among our own rough notes of what the Professor did say, this somewhat damaging admission: '*At Cirencester our stock are too well bred to give much milk:* the mongrels are the best for that." Still he has been induced to institute a trial between the two, the nature and results of which were listened to, as they will be read of, with "bated breath" by many a breeder of prize beasts. Let us premise that "the common dairy cows" were of the old Gloucester breed, a very useful animal now often with a taste of the Durham in her, and then at once follow out the comparison: "In the month of September, in 1860, I selected three cows from the common dairy stock and three pedigree short-horns. They were kept in the neighbourhood of Bristol, on what is at present Mr. Stratton's farm, which was then in the occupation of Mr. Proctor, being fed upon good pasture land. I carefully ascertained the quantity of milk, and also the quality. After they had been kept for some time on pasture, the milk was collected. Each cow then received 1 lb. of excellent linseed-cake, and in a week's time the quantity was increased to 2 lbs. per cow. I carefully analyzed the milk of the common and of the pedigree cows; and on looking over the results, I find no perceptible difference between the quality of the milk of the common stock and that of the thoroughbred short-horns. Thus the common cows yielded milk which gave nearly four per cent. of butter, and the thoroughbred short-horns gave a milk of the same quality within one-fifth per cent. The total amount of solid matter in both cases was the same. When 1 lb. of linseed-cake was given, the quality of the milk was not materially bettered; in both cases milk of the same quality was produced; and the same general remark may be made with respect to the 2 lbs. of linseed-cake which was given to each cow. In all these cases the quality of the milk was not improved, whether it were the common cows or the pedigree cow. The quantity of milk produced by the three pedigree cows, kept on grass alone, amounted to 28 pints in the morning and 21 in the evening, making together 49 pints. The common dairy stock produced rather more than 31 pints in the morning and 21 in the evening, making together 52 pints. When they received 1 lb. of cake per cow, the three pedigree cows gave in the morning 26½ pints, and in the evening 22, making together 48½ pints, which was very nearly the same quantity as that produced before. The three common dairy cows produced in the morning 28½ pints, and in the evening 18, making together 46½ pints. When 2 lbs. of cake were given to each cow, the three pedigree cows produced 26½ pints in the morning and 21 in the evening, making together 47½ pints; whereas the three common dairy cows, with the same quantity of cake, produced 30 pints in the morning and 19 in the evening, making together 49 pints. It follows from this, that whilst the quality of the milk was not materially bettered, the quantity became slightly less, especially in the case of the three ordinary cows. From the three pedigree cows we had 49 pints of milk per day with grass alone, with 1lb. of cake per cow the quantity was 48½ pints, and with 2 lbs. of cake it was reduced to 47½; from three common dairy cows, fed on grass alone, we had in the first instance 52 pints per day, with 1 lb. of cake the quantity was reduced to 46½, and with 2 lbs. of cake it was 49 pints; it would appear from this that the additional food evidently had a tendency to go into meat or to produce fat."

'Perhaps the most curious fact in this otherwise gratifying statement is the first we come to. Mr. Voëlcker made his selection and experiment in the autumn of 1860, and yet in the spring of 1861 he speaks of "our stock as being too *well bred.*" There are two important queries arising here: were the College stock better bred than Mr. Proctor's? And, as we presume, were Mr. Proctor's better milkers than the College cows? Taking this performance, however, of the pedigree cows, not merely with those they were pitted against, but by any general comparison with other sorts, it will be seen that the improved short-horn stands very well as a dairy cow.

'We have dwelt the more especially on this part of Professor Voëlcker's lecture, as pedigree animals are just now getting into bad odour. There is a growing opinion that they will neither breed nor milk; and, as will be found from a paragraph in another place, the first, second, and third prize short-horn cows at Leeds have all come to grief! But this startling fact may be due far more to the absurd manner in which these animals have been treated, than to any innate defects of their own. As the Professor shows, if we feed for beef we shall get beef; and if we wish for milk, his experiment declares as plainly that we may have it. It is the suicidal forcing system, which we have so long protested against, that is destroying the fair fame of the short-horns. The real value of a brood mare or a brood cow centres in her ability to breed, and the Royal Agricultural Society will yet have to face this abuse with more determination. The pedigree tribes have gained more credit for themselves in competition at Cirencester than they have for a long time at the great national shows. No one now can venture with safety to buy a prize cow, and if he buys a calf he had better send her to be educated at Cirencester College. Under such judicious guardianship she may eventually *matriculate.*'

In concluding the subject of the breed of dairy cows, it should be remembered that the breed of any locality may be improved by selecting the heifers of the best milkers, and breeding with these by bulls also obtained from the best milkers. And to enable the 'best milkers' of a herd to be known, we would strongly recommend a systematic dairy account to be kept, in which the name, age, and all peculiarities of each cow are put down in a book, with a series of columns given to this cow's register, in which the results of the mornings' and evenings' milkings are carefully entered. Another advantage flowing from this plan would be that the effect of any system of special feeding could be at once noted.

Although the cow may be supposed to arrive at puberty at the end of eighteen months or even earlier, it is not generally advisable to put her to the bull before the age of twenty-two months or two years. Much, however, depends upon the breed, the treatment, and constitution of the heifer. It is said by some breeders in the northern part of the island, that young cows may be sent to the bull as early as even *one year* old; but there would then be much danger in calving; and, although the practice might certainly be an essential improvement where the dairy constitutes a primary object, provided their growth did not become stinted, it is generally and properly considered injudicious. Either the mother or the offspring, or both, must materially suffer. It likewise often happens that when such young heifers fall in calf they miss calving in the following year, and thus nothing is gained in stock, while the animal itself is evidently injured. It is therefore advisable not to permit cows to take the bull earlier than two years, and cautious breeders defer it another year, or even longer. In conformity with these latter opinions, Mr. Bakewell would not send his cows to bull until they were three years old, and even at that protracted period they often missed calf.

A notion formerly prevailed, and is not even yet entirely exploded, that the best mode of improving stock, of every description, was to choose males of the largest size. The result, however, is generally a great increase of bone without any corresponding improvement in other qualities, and such an incongruity of shape as evidently denotes a mongrel breed. The most judicious method is, to employ males of superior shape, but yet of a suitable size, and to couple them with females nearly as large, if not larger. The nearer the other qualities of both approach to perfection, the better will it be for their progeny; but it is material that, even in their best points, there should not be too great a disparity. Gradual improvements will always be followed by certain ultimate success, while violent attempts to effect a sudden change will invariably disappoint expectation.

The most advantageous time, generally speaking, for a cow to *take the bull* is, from the commencement of May until the middle or close of July, so that she may calve in January, or not later than March or April; and as it is in most places a matter of considerable importance to have a uniform supply of milk throughout the year, it would prove a source of profit, to a farmer possessing a considerable number of cows, so to arrange the circumstance of breeding as to have three or more cows dry at all times.

But cows may and do calve at all seasons of the year. Hereford breeders generally contrive that their cows shall calve about Christmas or a little before. The West Highland breeds are arranged so as to calve about April, or early in May. Heifers should calve about this time, as the spring grass is very beneficial to their milk; older cows may calve early in the autumn. In short, it is a matter for the consideration and convenience of the grazier, and not one on which special rules can be laid down.

The period of time during which cows are allowed to *run dry* previously to calving is by no means settled. By some graziers they are recommended to be laid dry when they are about five or six months gone with calf; but repeated and successful experiments prove, that six weeks or two months are sufficient for this purpose; indeed, cows kept in good condition are sometimes milked until within a fortnight of calving. This, however, is a practice not to be recommended; for if the cow *springs* before she is dry, serious injury may ensue.

The usual symptoms of the approach of parturition are *springing—increased size of the udder*; also enlargement of the bearing, and a glairy discharge from it; a sinking or leanness between the udder and the bearing, a decided depression on each side of the rump-bone, with evident uneasiness, and sometimes decided moaning. Waxy matter on the teats is also a sign of approaching labour. The cow becomes more and more restless—lying down and rising again, often looking towards her hind parts, and frequently lowing at intervals. She must then be supplied with plenty of litter, to protect the calf from injury. To a certain extent, also, she must be watched; in other respects, everything is left to nature—some cows bring forth standing, and others lying down.

In general the cow *conceives* after once taking the bull; but if she should chance to fail, she should be sent to him again in the course of a fortnight or three weeks afterwards. To prevent, however, this accident, it will be advisable, on her return home, to keep her that night separate from the other cows.

The desire of having a full supply of calves has induced many to have recourse to *artificial means*, in order to make cows to take the bull—a measure which cannot be too much deprecated, for the most efficacious mode of obtaining this object undoubtedly consists in keeping them in good heart. The time when a *cow is in season*, is known by her restlessness or riding other cattle; and an inflamed appearance of the external parts, accompanied by a discharge from the vagina. These symptoms, generally, do not continue more than three or four days, and sometimes not so long, and do not return during a fortnight or three weeks. When conception has taken place they disappear.

The *period of gestation*, or the time during which the cow goes with calf, varies much. A bull calf usually goes about forty-one weeks, with a difference of a few days either way; a cow calf coming in the least time. From 282 to 285 days may, therefore, be assigned as the average period of gestation. At the close of this period she usually produces one calf; though instances sometimes occur when two, or even three, are brought forth. It may not, however, be useless to remark, that some cows are naturally *barren*, which is said to be the case when a male and female calf are produced at the same time. The male animal is perfect in all respects; but the female, which is denominated a *free marten*, is, generally speaking, incapable of propagating her species. There are, however, a few instances on record of her breeding. She does not differ very materially, in point of form or size, from other cattle, though the flesh is erroneously supposed to be greatly superior in flavour and fineness of the grain.

The late Earl Spencer has left us data as to the period of gestation in the cow, founded on observations on no less than 764 of these animals.[1] He says:—

'The shortest period of gestation when a live calf was produced was 220 days. Any calf produced at an earlier period than 260 days must be considered as premature, and any period of gestation exceeding 300 days must also be considered as irregular.'

[1] Journal Royal Agricultural Society, vol. i. p. 165.

He states that out of the 764 cows he observed 314 calved before the 284th day and 310 after the 285th day, thus showing that the average period of gestation is about 285 days, as above stated on the authority of Mr. Torr, the eminent breeder of short-horns in Lincolnshire. It is a generally-received opinion that when the period of gestation exceeds forty-one weeks a bull calf may be expected, and observation and experience have demonstrated that there is some foundation for this opinion.

As cows are very subject to *abortion* when improperly treated during gestation, they ought to be watched with more than ordinary care through the whole of that period, and particularly the latter portion of it. The principal causes of abortion are violence or accidents, too good or too poor condition, hereditary predisposition, some epidemic or atmospheric influence; and last, and not least, contagion, or a tendency to *slip the calf*, being propagated from one cow to another, from the irritable imagination of the beast. It is therefore a matter of prudence, or almost of necessity, to separate the cow that has slipped her calf from the rest of the herd; and it should not be forgotten that cows that have once slipped their calves are more liable than others to a recurrence of miscarriage. For about a month or six weeks before the time of calving it will be advisable to turn the cow to grass, if in the spring; but if it happens to be winter, she should be fed with the best hay, and some turnips, potatoes, carrots, or other winter fodder, or a mixture of bran and oats or bean-meal, to which grains may be sometimes added. Should these not be at hand, the mere boiling of a portion of her hay, and giving it with the water, when cool, will be found to keep the body in a healthy state for calving, and also improve her milk. It is not desirable that she should be fattened, because the fatter the cow is, the less milk she gives, and yet, if she is too poor, there is danger lest she should drop in calving. The middle course between these two extremes is the best, enough to keep them in good condition, but no more.

The following note from the pages of the 'Scottish Farmer,' in connection with the point now under discussion, will be worthy of attention here:—

'The cow cannot, on the whole, be regarded as a troublesome animal to manage, but not unfrequently there are morbid states which have puzzled farmer and veterinarian not a little. Thus, abortions are common, and under other circumstances we find young animals manifesting parturient pains before their full time, which causes no little anxiety to the stock-owner. Solitary instances of such premature efforts are apt to be mistaken, and if the mouth of the womb is explored it is found closed and firm.

We have often observed violent straining under the circumstances, and the fœtus pushed up above the neck of the womb. Not unfrequently such cases are improperly taken for abnormal indications of the mouth of the uterus, and this is forcibly opened or cut, parturition is brought on, and the cow not unfrequently dies. Early interference in all such cases is very injudicious, and if travelling or other cause of excitement has disturbed the cow, it may be advisable to give a purge or feed lightly, and to wait. In the large majority of instances, two or three days pass over, when proper efforts come on, the parts become dilated, and a fine healthy calf is born. It is very rare to have much disease about the mouth of the womb, which would interfere with a birth; whereas the false labour pains are very common. It is a rule in all obstetric operations that it is best to interfere little; and in many instances in which a cow has not been delivered at her time, a calf has been found piecemeal in a state of putrefaction, or has remained in the womb to dry and mummify, without producing any general disturbance.'

When the term of gestation is nearly complete, the animal should be kept near the homestead, in a quiet close, apart from other cattle, in order that she may be under constant observation, and that assistance may be ready in case of a difficult birth. As the final period approaches, attention should be paid to avoid constipation by means of laxative drinks. Bean-mashes are the best, the fodder being diminished in quantity. Oil-cake for two weeks before calving, say 2 lbs. per day, will also be beneficial. If the cow should be so much exhausted in calving that the throes are not sufficient to produce the birth, she should have a drink composed of gruel, treacle, and salts, 1 lb. of each, and $\frac{1}{4}$ oz. of ginger may be added with advantage. Should not this be readily effectual, the ergot of rye—the *spurred* rye—may be given in doses of a drachm every hour, infused in boiling water: it will often have great power in exciting or recalling the pains, and may be continued, if necessary, during seven or eight hours. Cows sometimes calve in a recumbent posture, and care must then be taken that the place at which they lie down is not on a steep descent, for in such case the calf is apt to be brought prematurely forward, and, by the straining and irritation which this produces, a tedious and sometimes dangerous calving is occasioned. When, however, the act of calving has actually commenced, the operation will be aided by the animal being placed on a gentle descent. The celebrated Thaer states that calving is sometimes attended with difficulties arising from the bad position of the calf in its mother's womb. This evil may be greatly diminished by skilful and judicious aid.

The first thing to be done, in such a case, is to obtain an exact idea of the position in which the calf should be placed, and its actual deviation from that position. By gently thrusting the hand into the womb, this deviation may not only be ascertained, but in most cases corrected by turning the calf. The usual cause of resistance is a false position of one of the fore legs, or of the whole body, in consequence of which the forehead shows itself instead of the muzzle. Force must no more be applied in this case than it would be to make anything pass into the gullet. Any violent traction may be fatal, where nature will assist if we will only give her time. All assistance given must be guided by discretion. Misdirected aid may do an infinite amount of mischief, and is too often fatal; this I know from experience. As, however, this is not the place for teaching the obstetric art, I pass it over, strongly recommending all farmers who pay any attention to their cattle to avail themselves of every opportunity of acquiring information on this matter, since in the country it is not always possible to obtain the assistance of skilful veterinary surgeons. In other respects, however, it is best to leave all to nature and chance; for without proper knowledge we shall be more likely to kill the cow and her calf than to save her.

About half, or at most three quarters of an hour, is the ordinary time occupied by actual labour in the cow.

After a cow has calved she should be left quietly with her little one: it is cruel and dangerous to separate them. A warm mash should be given, and her water slightly warmed. In fine and dry weather she should be watched attentively, in case she should require aid, but no artificial means used, unless she evidently needs assistance. On the following day she may be turned out about noon, and regularly taken in during the night, and this for three or four successive days.

The above hints are given on the supposition that the cow is well, and that no difficulty has happened during the time of calving; and particularly that she has not *slipped* or *cast her calf* before its full time. It should be observed that the proper position of a calf while in the uterus is with its head foremost, its back being towards the cow's back, and its two fore feet lying parallel to the sides of its head. When the fœtus appears in any other manner, it is termed an *unnatural position*; and the extraction of the calf under these circumstances may require some skill and dexterity: but as no instructions can be adequate to every possible case, it will always be necessary, when this event takes place, immediately to apply to a veterinary surgeon, lest the death of a valuable animal should be the consequence of injudicious treatment.

After the calf is produced, it will sometimes be necessary to assist the natural functions of the animal in removing the *secundines*,[1] provided in the uterus for nourishing the fœtus, and which, continuing there after the birth, would become putrescent, and produce irritation in the womb, and probably considerable fever. There is no danger, however, that this will immediately take place, and a few days will pass before any material inconvenience will ensue. No attempt should be made hastily to remove it, without there is evident inconvenience or danger from its retention. An aperient drink, composed of a pound of epsom salts and a quarter of an ounce of ginger, will always be useful after calving.

It may be necessary to milk the cows three or four times a day for two or three days, especially if they are full of flesh and the udder hard. The calf should be suffered to suck frequently, if in the house; or, if in the field, to run with the mother, and suck at pleasure: it being carefully ascertained that she does not prevent it from sucking, for, if the udder or teats are sore, she will probably drive it away, and danger of losing both animals will be incurred. Should the udder or the teats become hard, or knotty, or tender, the most easy and effectual remedy will be to let the calf derive all its nourishment by sucking. In a great majority of cases the indurations will gradually disperse. Should, however, ulceration of the udder, or general fever, ensue, the cow must be treated as described under 'the Diseases of Cattle.'

The falling down of the calf-bed is a serious accident, which sometimes occurs after a laborious birth, when the cow is more than usually fatigued; some beasts, however, are naturally disposed to this weakness. The placenta, or cleansing, should be first removed, after which the operator may replace the calf-bed as gently and as quickly as possible, and secure it in its situation by the application of *proper bandages*. This likewise demands, in a majority of cases, the assistance of a well educated and skilful practitioner. The animal should afterwards be kept as quiet as possible. Opium, or febrifuge medicines, as nitre and fox-glove, with gruel and mashes, may be administered; but the stimulating drinks too often given in these cases must be avoided, as pregnant with the greatest danger.

When the calf-bed comes down, and no immediate aid can be procured, it should be deposited on and covered with a clean linen sheet; the irritation thereby produced being considerably

[1] Or afterbirth, sometimes termed the *cleansing*. Cows will often eat this excrement with avidity, and to prevent that it is generally removed; but this practice is of doubtful utility, for nature seems to have provided this substance as a kind of medicine for the animal, which may be requisite at the time, and its being eaten is never known to be prejudicial to the health of the cow.

less than that of the air, litter, &c. Before it is replaced, the parts that have been so exposed should be well cleaned with warm water, to which, if there is much bleeding, or any appearance of mortification, a little spirit may be added.

After calving, the cow should not be permitted to take the bull until four or five weeks have elapsed, although she may exhibit symptoms of bulling sooner. The womb is, during that time, in so relaxed a state as seldom to admit of conception.[1]

In high-class dairying the object, so far as the cows are concerned, is two-fold: first, to obtain the largest field with the finest quality of milk; second, to keep the cow in such a way that while this the first object is gained, she will be maintained in good condition, so as either when 'dried off' or set aside from dairy purposes she will be ready for the butcher, or can be quickly made so.

These two objects were for long, and indeed are now by many, deemed incompatible; so that all that was aimed at was to get as much milk as possible out of the cow in a given time, and thus send her off to the butcher 'for what she would bring.' Under the improved and modern system of dairying, it is found that the two objects are quite compatible, and that they can be secured.

To succeed in this considerable knowledge and skill are required, and no small amount of patient painstaking care. In the first place the animals selected should be first-rate milkers, this being the primary point; but as they have to be sold to the butcher in good condition, some of the points of fattening beasts must be found in them. But while the latter features must not be neglected, the first object, as said above, is to get milkers of the first class. In this chapter the indications of a good milk cow have been stated and illustrated; as regards contour or form the following will be of service to the practical reader. The authority we have already named while on this subject points out that with the cow the bony frame is of secondary importance, and that what is required to be looked after with vigilance is the vital organisms, as the heart, lungs, and liver. If those be large and capable of vigorous action, and if accompanied by a liberal distribution of cellular tissue, a rapid conversion of food into nutritive constituents will be ensured, and the deposition of these in the cellular tissues. A large stomach is of the utmost importance, inasmuch as it gives a large surface, from which the gastric juice issues.

It is right, however, to state that there are those, and eminently good dairymen too, who hold that dairying, for the double purpose of getting the maximum of milk both as regards quantity and quality, with beef-procuring qualities, cannot

[1] See Skellett on the Parturition of the Cow, which contains much valuable information on the subject of difficult births.

be carried on at a profit. That just as you secure the one, so in like, or perhaps even in greater proportion, you lose the other. They therefore answer in the negative, Can we get a breed which will yield at once milk and beef in the highest degree? In truth this question is surrounded with difficulties; but, as we have but just now said, improved practice has shown that they can be obtained in the same animal. We confess to seeing no physiological difficulty in the way to prevent this.

CHAPTER VI.

ON THE TREATMENT AND REARING OF CALVES.

THE importance of bringing calves to an early maturity, with the fullest development of their best qualities, has naturally excited the attention, and employed the ingenuity, of the most expert breeders. The best general plan is to adhere as closely as possible to nature; but as various modes of treatment have been adopted, we will endeavour to bring into one view the most useful facts connected with this subject.

After the calf is produced, the cow almost uniformly shows an inclination to cleanse it by diligently licking off the slimy matter adhering to the young animal; and this she should be allowed to do without the slightest hindrance. It is a very bad practice to give gruel to the calf soon after birth; the *beistings*, or first milk drawn from the cow, will be the best thing that can be administered. It is seemingly provided by nature as the first aliment of the newly-born animal; and is not only intended for the purpose of early invigoration, but, by its mild aperient quality, it carries off the fæces that had been accumulating in the intestines of the fœtus during the last months of pregnancy.

There are two modes of feeding calves:—one is, to permit them to run about with the parent cow during the first year; the other is, to wean them when about a fortnight old, and bring them up by hand.

The former expedient eventually produces the best cattle, and is adopted in those districts where fodder is abundant and cheap.

Whether calves are designed to be raised for breeding, labour, or fattening, care should be taken that they have a sufficient supply of good food; for if the supply of it is scanty at first, the animal will rarely, if ever, attain a considerable growth. The best time for weaning them is about that period of the year when the young grass acquires succulence enough to entice the appetite, and to afford complete nourishment without the aid of the teat. Calves that are dropped in October or November will thrive rapidly by the nourishing pastures into which they may be turned in the ensuing spring, if they have been allowed to suck and been properly sheltered throughout the winter; but the milk is often too scarce at that season to be usually bestowed upon them; and *winter-wearied* calves seldom arrive at much perfection. Calves will do better to be in the house, and the cows brought up twice or thrice a day to suckle them, as by this system a greater number of calves may be reared from the same number of cows.

Various plans have been suggested and tried with considerable success, for rearing calves without any, or at least with a small quantity of milk. The time of weaning them varies, from a fortnight until they are seven weeks old; but the latter period is preferable, on account of the weak and tender state of the calves, if separated from the dam at an earlier age.

In several counties of England calves are left with the cow for about ten days or a fortnight, and, being taken from her, are taught to drink first new milk for a week or two, then new and skimmed milk mixed; and if after a month or so the calf seems thriving, skimmed milk only is given, with oat or barley-meal, or crushed linseed, at first in small quantities, and gradually increased in proportion to his age and growth. Of the patience and attention requisite in teaching calves to drink, a very inadequate idea only can be formed by those who have never witnessed this tedious process. When the animal has fasted two or three hours, the first and second fingers of the right hand, being previously well cleaned, are presented to its mouth. It readily takes hold of them, and sucks eagerly. In the mean time, a vessel of lukewarm milk is placed, and supported by the left hand, under the calf's mouth; and, while the young one is sucking, the right hand is gradually sunk a little way into the milk, so that it may lap a sufficient quantity without its nostrils being stopped. If, either from accident or from too sudden precipitation of the hand into the milk, the calf should let go its hold, the attempt must be repeatedly renewed until it is crowned with success.

Small wisps of fine hay are then placed within their reach, which they begin by sucking, and gradually become induced to eat. Turnips chopped small, or carrots, and good sweet hay, may then be given them; and when they eat well, linseed-cake and oat-cake may be added. They should be liberally kept for the first six or eight months, well housed, and kept warm and clean.

In the county of Suffolk calves are usually weaned soon after Christmas, when they are fed with lukewarm skimmed milk and water, having bran or oatmeal in it, and some very sweet hay until the grass is ready. If the farmer has any carrots, they form an excellent article of food.

About three quarts of new milk daily are sufficient for the support of a calf. It should be given regularly at stated hours, and he should be kept as quiet as possible, for rest will be found materially to promote his growth.

In Ayrshire calves intended to be reared for dairy cows are fed on milk for the first four, five, or six weeks, and allowed four or five quarts of new milk at each meal. Some farmers never give them any other food than milk while they are young, and lessen the quantity when they begin to eat grass or other food, which they generally do when about five weeks old, if grass can then be had. The milk is wholly withdrawn about the seventh or eighth week. If they are reared in winter, or before the grass rises in spring, they must be longer supplied with milk, as a calf will not so soon learn to eat hay or straw, or thrive so well on them alone as on grass. Others feed partly with meal after the third or fourth week; or gradually introduce some new whey along with the meal, and afterwards withdraw the milk altogether. Hay-tea, linseed-jelly, oat and wheat-meal porridge, treacle, &c., are sometimes used with advantage; but milk, when it can be spared, is by far the best as well as the most natural food.[1]

Where the supply of milk is small, the following plan is recommended by a writer in the 'Irish Farmer's Gazette.'

'Rearing calves without some portion of milk should not be attempted; but with some milk good calves can be reared as follows:—On three qrs. linseed-meal and four qrs. bean or pea-meal pour 30 quarts boiling water, cover up well for 24 hours, then pour it into a boiler holding about 30 quarts more of boiling water; give it half an hour's boiling, stirring it well all the time; then put by for use, giving it to the calves milk-warm, mixed with milk. The calf should get its dam's milk for the first week, when the mucilage may be mixed with it, at the rate of one-third mucilage to two-thirds milk, gradually increasing the mucilage and decreasing the milk till the seventh or eighth week, when the milk may be entirely withdrawn. For the first week the calf will require between four and five quarts a-day of milk; the second week, six quarts mixed milk and mucilage; third week, seven quarts; fourth, eight quarts; fifth, nine quarts; sixth, ten quarts; seventh, eleven quarts; and so on, increasing one quart a-day per week till it is between three and four months old, when it may be weaned. Hay-tea, made by pouring boiling water on sweet, nutritious hay, is an excellent addition. If you have no milk to *begin* with, it would be better to leave calf-rearing alone.'

[1] Aiton's Dairy Husbandry, chap. i. sect. 4.

Another mode of rearing calves was suggested by his Grace the late Duke of Northumberland, the design of which was to render the use of new milk unnecessary, while the expense was reduced to a very considerable extent. It is effected in the following manner: 'Let half an ounce of common treacle be well mixed with a pint of skimmed milk; then gradually add one ounce of finely-powdered linseed oil-cake, stirring it until the mixture is properly incorporated, after which it is to be added to the remainder of a gallon of milk. The whole, being made nearly of the temperature of new milk, may then be given to the animal. After a short time the quantity of pulverised oil-cake may be increased. This method is said to have been advantageously adopted. Lord Egremont used linseed-jelly in the proportion of one pint to a gallon of skimmed milk, without treacle, but it did not answer.'

Mr. Beamish has adopted the following plan as a substitute for milk in the rearing of calves:—

Thirty quarts of boiling water are poured on three quarts of linseed-meal and four quarts of bean-meal, all then close covered up; and at the end of 24 hours, added to 31 other quarts of boiling water then on the fire, being poured in slowly to prevent lumps, and being well stirred with a small, flat, shovel-shaped board, perforated with holes, to produce thorough incorporation. After 30 minutes' boiling and stirring, the mucilage is put by for use, to be given blood-warm to the calves as soon as they are three days old; first in equal portions with new milk, increasing gradually to two-thirds, as the calf gets older, substituting skim-milk after a month, and feeding on mucilage alone after six weeks. This mode of feeding will be as follows, viz:—

Weeks	New milk Quarts	Skim-milk Quarts	Mucilage Quarts	Total per Week Quarts
1st	22	...	10	32
2nd	21	...	21	42
3rd	20	...	29	49
4th	20	...	36	56
5th	...	20	43	63
6th	...	20	50	70
7th to 15th	...	...	756	756
	83	40	945	1068

The following is from the 'Farmer's Magazine,' the writer stating that he has reared successfully, for many years, calves on this system:—

'Two gallons of water are made to boil, and then a pint of fine flour is mixed with cold water, sufficient to make it into the consistency of thick cream. This is thoroughly mixed, and put into a bowl capable of holding half a gallon; a small quantity of hot water introduced into the mixture, and stirred, so as gradually to decrease the temperature of the flour and water in the bowl, will prevent it running into lumps. This is plunged again into boiling water, and stirred until the whole again cools. This coagulates the mass, and forms a thick, nutritious porridge. It is a great advantage if one-sixth part of cold skimmed milk is then plunged into the mixture, which not only gets scalded itself, but very materially improves it. Two gallons of the mixture per day will be found generally sufficient.'

An infusion of hay, or sometimes of pea-haulm, called hay-tea or hay-water, has also been applied for the purpose of rearing calves with the smallest quantity of milk; but it is not generally efficacious. In order to make this infusion, such a portion of fine, sweet hay, cut once or twice, is put into a small earthen vessel as will fill it on being lightly settled with the hand. The vessel is then filled with boiling water, and carefully closed. At the end of two hours a brown, rich, and sweet infusion will be produced, in appearance not unlike alewort, or strong tea, and which will remain good for two days, even during summer. It is to be used in the following manner:—

'At the end of three or four days after a calf has been dropped and the first passages have been cleansed, as already recommended, let the quantity usually allotted for a meal be mixed, consisting, for a few days, of three parts of milk and one part of the hay-tea: afterwards the proportions of each may be equal; then composed of two-thirds of hay-tea and one of milk; and, at length one-fourth part of milk will be sufficient. This preparation (the inventor of which was, many years since, honoured with a gold medal by the Dublin Society of Arts) is usually given to the calf in a lukewarm state every morning and evening; each meal consisting of about three quarts at first, but gradually increasing to four quarts by the end of the month. During the second month, besides the usual quantity given at each meal (composed of three parts of the infusion and one part of milk), a small wisp or bundle of hay is to be laid before the calf, who will gradually come to eat it; but if the weather is favourable, as in the month of May, the beast may be turned out to graze, in a fine sweet pasture, well sheltered from the wind and sun. This diet may be continued until towards the latter end of the third month, when, if the calf grazes heartily, each meal may be reduced to less than a quart of milk with hay-water; or skimmed milk, or fresh butter-milk, may be substituted for new milk. At the expiration of the third month the animal will scarcely require to be fed by hand, though, if this should still be necessary, one quart of the infusion given daily, and which during the summer need not be warmed, will be sufficient.'

The economical mode above detailed has been adopted in some counties of England, with the addition of linseed-cake finely pulverised and boiled in the hay-tea to the consistence of a jelly, without employing any milk in the mixture;[1] and, as so many excellent artificial grasses are now cultivated for the feeding and fattening of cattle, we conceive that an infusion of any one of them would be found more nutritious than if it were prepared from the promiscuous mixtures of grass usually occurring in common hay.

In Devonshire the method commonly followed in rearing calves is very similar. The greatest number are usually dropped between Candlemas and May, and some much later; but the most experienced breeders prefer the early ones. They are permitted to suck as much as they like three times a day during the first week or ten days, after which they are suckled by hand, and fed with warm new milk during three weeks longer. They are then fed, during the two following months, twice a day, with as much warm skim-milk as they can drink—in which some feeders mix a small portion of finely-powdered linseed-cake or meal. After this the meals of milk are gradually abated, and, at the end of four months, the calves are wholly weaned from milk, and fed on hay, chopped roots, oat-meal and other artificial food, until they go to pasture.

In the northern counties of England it is a common practice to give the calves equal parts of milk and sweet whey, made lukewarm; but, as this mode often produces scouring, or looseness, we think the following method, which was a few years since communicated to the public by a spirited and experienced breeder, is greatly preferable. For the first four or five weeks he fed them regularly, but oftener than is usually done, with new and skimmed milk. At the end of this time his calves were gradually taught to drink strong water-gruel, consisting of equal parts of bean or oat-meal, mixed with one half of butter-milk, which was carefully stirred with the gruel, after the latter was removed from the fire. This method of treatment he is stated to have pursued with great success for many years. His calves were uniformly strong and healthy, while everything that could tend to retard their growth was effectually prevented.

In the county of Norfolk, calves are fed with skimmed milk, in

[1] In the Letters and Papers of the Bath and West of England Society, vol. v., we have a singular instance of success in this mode of rearing, by Mr. Cook. In 1787 he bought three sacks of linseed, value 2*l.* 5*s.*, which lasted him three years. One quart of seed was boiled in six quarts of water, for ten minutes, when a jelly was formed, which was given to the calves three times in the course of the day, mixed with a little hay-tea. Thus he was enabled to rear, in 1787, seventeen calves; in 1788, twenty-three; and in 1789, fifteen, without any milk at all. He states that his calves throve much better than those belonging to his neighbours, that were reared with milk. Pot-liquor has also been found an excellent substitute for milk; and it is well known that the great ox bred by Mr. Dunhill (already mentioned in the Introductory View) was chiefly reared on it.

which is mixed a little wheaten flour. They have also chopped turnips in a trough, and some hay in a low rack. As soon as they begin to eat turnips freely, they are no longer supplied with milk; these roots, with the addition of a little hay, furnishing them both with food and drink. The period of raising calves in the above-mentioned county is from Michaelmas to Candlemas; but the time of feeding them wholly with turnips varies according to circumstances or accident.

Towards the month of March, those which are first reared are turned out among the fattening bullocks during the day, and sheltered at night, although, if the weather proves favourable, they are in a few days turned out altogether. In the succeeding summer they are kept on clover, or other luxuriant grasses; and, in the following autumn, are sufficiently strong to live in the straw or fold-yard. This circumstance is considered as a great advantage to be derived from rearing calves early in the season, as those that are raised during the spring require two years' nursing.

The following method of raising calves by Mr. William Budd, of Boston, in America, and which obtained the prize from the Agricultural Society of Massachusetts, we give in his own language, extracted from his communication to that Society.

'Take the calves, when three days old, from the cows, and put them into a stable by themselves; feed them with gruel, composed of one-third barley, two-thirds oats, ground together very fine, sifting the mixture. Each calf is to receive a quart of gruel morning and evening, which is to be made in the following manner:—to one quart of the flour add twelve of water, boil the mixture half an hour, let it stand until milk-warm. In ten days, tie up a bundle of soft hay in the middle of the stable, which they will eat by degrees. A little of the flour put into a small trough, for them occasionally to lick, is of service. Feed them thus till they are two months old, increasing the quantity. Three bushels of the above mixture will raise six calves.'

Mr. Clift, of the New York Agricultural Society, takes the calf from the cow at two or three days old: he then milks her, and, while the milk is warm, teaches the animal to drink by holding its head into the pail. If the calf will not drink, he puts his hand into the milk, and a finger into the mouth, until the young one learns to drink without the finger. After he has been fed with new milk for a fortnight, the cream is taken from the milk, and with the latter an equal or larger portion of thin flax-seed jelly is mixed and the whole given milk-warm. Thus, as the spring is the most advantageous season for making butter, he is enabled, during the six or seven weeks that the animals are kept previous to weaning, to make as much butter as they are worth; a practice that merits the attention of our English farmers, to whom it would afford a very essential saving, particularly in those counties where butter forms the chief article of manufacture.

With regard to the use of these artificial foods for calves, it may be accepted as a safe rule that, if their use can be dispensed with and the milk given, it will be the most economical plan, and in every way the most satisfactory. Milk is the natural food of the calf. The 'beisting,' or the milk first drawn from the cow, contains an unusually large quantity of cheesy matter, and its use by the calf prevents costiveness, and aids its delicate digestion. 'Milk again,' says Johnson, 'is a perfect food for a growing animal, containing the curd which is to form the muscles, the butter which is to supply the fat, the phosphates which are to build up the bones, and the sugar which is to feed the respiration. Nothing is wanting in it.' The 'internal organism of the calf points to the use of milk *alone* for the early period of its life, and a careful observation of the most successful practice tends to confirm this opinion. For the same reason, we may also learn another lesson from the natural habits of the animal—that the supplies of food should rather be moderate and frequent than larger in quantity after long intervals. . . We find that calves which run with the cow thrive better than others, because they can draw their supplies of milk frequently, and in small quantities—in fact, at such times as they feel the want. . . . No doubt it may be questioned whether this is an economical method, and one desirable for general adoption; but there are cases which render such a course absolutely essential to success; and, I believe, in many other cases the question of economy is too often viewed under the contracted aspect of present cost rather than future return.'

'In rearing a calf,' says Professor Tanner, from whose paper on Rearing and Breeding Cattle, in 'The Journal of the Highland Society,' the above is taken, 'there is one object to be kept steadily in view, and that is to promote the development of the body as much as possible. In the calf which is to be fattened and killed no one will dispute it, and I believe it will be equally important in the case of those which are to be reared for beef, but it is still more important in rearing breeding stock. From the period of birth this development should be progressive, not interrupted by checks from poor and insufficient food, to be followed by better allowance for a time, and thus only alternating its progress and relapse. When high-bred stock are to be reared, a very different system from this is adopted. In fact, if it were not so, they would rapidly degenerate. In rearing these calves, they follow the natural course of allowing the calf to run with its dam, or else let it have frequent access to her, while at the same time she is fed with oil-cake to give richness to the milk. This is the system which is most calculated to produce the best results. The use of artificial food for the calf is carefully avoided in its early stage; but when it is desirable to force the young animal into a more rapid growth, the supplies of artificial food may be given through the medium of the cow. In this manner similar benefits will result, without any prejudicial influence upon the stomach of the calf.' As to the economy of this practice, 'my own impression,' says the Professor, 'is, that a liberal system of feeding is always desirable, and that it is not as extravagant a plan as it is frequently thought to be.'

The calves should, if possible, be ready to wean in the month of May. Before putting them out to grass, the calves should be accustomed to the use of green meat; some early vetches, rye, clover, &c., will prepare the stomach for the succulent food of the pastures. The weather being mild and the herbage in good condition, the calves should be put out, and on young pastures or recently laid down grasses rather than old pastures. As cold is prejudicial, it will be advisable to shelter the calves at night. A good supply of water and a change of pasture are desirable for the first summer. The calves should be put into the pastures first, the older cattle following and finishing up. The supply of oil-cake should be kept up, to prevent those checks in the growth to which allusion has already been made. In some cases the calves are not turned out, but are reared in well-littered yards and sheds, green food and oil-cake been given to them.

An absurd and thoroughly cruel notion too prevalent is, that calves are the better for being 'roughed,' that is, exposed to the severest weather in winter and supplied with scanty food. Mr. Bowly, the eminent breeder, exposes the fallacy of this in the following:—

'I have no faith in the idea which I have sometimes heard expressed, that "roughing" calves (which means exposing them to cold and hunger) makes them hardy. On the contrary, it has the effect of weakening their constitutions; and this system pursued towards the young stock for two or three generations will ruin the best breed of cattle in the country; the offspring after this time will have lost all the quality, early maturity, and propensity to fatten shown by their ancestors, and it will require years of the greatest care to recover what is thus lost.' He, however, is careful to notice that it is on the other hand 'very injurious to force young animals, although it *may* be necessary in those individuals which are intended to compete for prizes. The tendency of such a system is to curtail their usefulness as breeding animals; for, though most of them so forced will breed, there is, of course, more risk in calving them, their milking properties are greatly lessened, from those vessels intended by nature for the supply of milk being coated with fat, and they decay prematurely, and have all the marks of age upon them at seven or eight, whereas I have bred from cows not so forced up to twenty-two years of age. The happy medium is the best, where they are kept in thoroughly good condition.'

The successful rearing of calves very much depends on the regularity and frequency of feeding them. The common practice is, to supply them with food twice in the day, viz. in the morning and at evening, when they generally receive as large a quantity as will satisfy their craving appetite. Hence the digestive organs are necessarily impaired, and too many animals either become tainted with disease, or perish from the inattention of their keepers; whereas, by feeding them thrice, or even four times, in the day, at equidistant intervals, and allowing them sufficient space for exercise, they will not only be preserved in health, but will greatly improve in condition.

Whatever food is allowed to young calves, care should be taken not to change it too suddenly. A calf should have attained a certain degree of strength before it can dispense with the food most natural to its age, or thrive without the aid of milk: this fluid should therefore be allowed as long as possible. Even when that has been withdrawn, and the animal has begun to eat grass, hay, or artificial food, the milk or the substitutes that had been employed in lieu of it should be partly continued until he begins to prefer the pasture. It is a common notion that, provided young stock acquire size, their condition is immaterial; and, after the first winter, they are often turned into the roughest pasture, and kept during the following winter on chopped straw, with, perhaps, a little indifferent hay. This, when they are intended to be sold to the fattening grazier, may be the most profitable mode, and, in some situations, it may be the only one that can be adopted; but, when they are to be reared for the breed, it is absolutely requisite, as the only means of bringing them to perfect maturity, and improving every good quality, that they should be kept on good pasture during the summer, and allowed roots with some sound hay in the winter, and green food in the spring. A contrary mode, however apparently economical, is decidedly disadvantageous; for the worst breed will ultimately be improved by good feeding, while the best will degenerate under a system of starvation.

The best time for castrating male, or spaying female calves, is about the expiration of the first month, as at that period there is least danger, provided they are in good health. This operation is, in some places, deferred until the animals are two or even three years old, but to the certain injury of their form, their size, the quality of the meat, and their docility at labour. Formerly castration was effected by tying a strong cord round the bag above the testicles. The nutriment of these parts being thus cut off, they were either suffered to remain until they dropped spontaneously, or were cut away, and the animal was perfectly castrated. Modern ingenuity, however, has devised a better means of removing the testicles, viz. by excision; but, as this cannot be effected without resorting to an experienced practitioner, we decline to give any directions respecting an operation which, if unskilfully performed, must prove greatly injurious to the animal. Let it, therefore, suffice to state, that after the calves are castrated, or spayed, as the difference of sex may require, the animals should be kept quiet, and tolerably warm for the first two or three days, and not be too highly fed.

CHAPTER VII.

ON THE FEEDING OF CALVES, FOR VEAL.

VEAL being a favourite article of diet, the fattening of calves is an object of no small importance, particularly in the vicinity of the metropolis. Hence various kinds of food and modes of treatment have been recommended; but the best way is to keep them in somewhat dark places, in pens, lest they should fatigue themselves by sporting too much in the light, and to feed them on milk, with the addition of bean, pea, or barley meal, during the last few weeks. It is a common, although an injudicious practice, to give them about a wine-glassful of gin or rum, mixed up in as much flour as it will moisten, between the regular hours for suckling. This is made into balls, and forced down the throat. The calves usually become sufficiently fat in ten or twelve weeks; and it is not desirable to keep them beyond the time when they are fit for the butcher, as small veal, if equally fat, is preferred to that which is large. Cleanliness, as an indispensable object in fattening cattle, should be particularly attended to here. For this purpose, the pens should be elevated to such a height from the ground that the urine may pass freely, and litter should be supplied every day, in order that the animals may lie dry and clean. A large chalk-stone should also be suspended over the pen, so that the calves may readily lick it.[1] It is also a common

[1] Chalk is commonly supposed to assist in whitening the flesh. This idea is probably erroneous; but it has a salutary effect in correcting that acidity of the stomach to which calves are very liable and thus preventing the consequent scouring.

practice to bleed them when they are four or five weeks old, and again a little time before they are killed, by which means the whiteness of their flesh is supposed to be considerably increased. The quantity of blood subtracted is about two quarts, or more, according to the age and strength of the calf. This operation of bleeding is therefore frequently repeated by some persons, but the most experienced breeders are of opinion that it is sufficient to bleed them twice, only abstracting from them such a quantity at each time as their age and size will allow without hazard of destroying or weakening them. Other persons deem this altogether superfluous; and so it is as far as the breeder is concerned. The butcher may give the meat a whiter hue by the repeated bleedings that he practises on the poor brute; but it is done at the expense of humanity, and should be reprobated by every feeling mind.

The following mode of rearing these animals still prevails in the vicinity of Abbey-Holme, in the county of Cumberland, where the calves are remarkable for their size, fatness, and pleasing white colour. During the first two or three weeks the young calves are fed in the common way; and, at the end of that time, are conducted to what are termed feeding-sheds. Two small stakes are driven into the ground for every calf, at the distance of ten inches or a foot from each other. The head of the animal is then put through the intermediate space, a strap or cord being passed round its head, on either side of which there is a ring that surrounds the stake. By means of this contrivance the calf is prevented from licking itself, which habit, it is supposed, would materially affect its health and growth, while it is not so confined as to be hindered from lying down or rising at pleasure. When the calf is somewhat reconciled to its new habitation, the Abbey-Holme farmers supply it with better food than it has been accustomed to receive. Rightly judging that the latter part of a cow's milk is more nourishing and of a richer quality than that which is first drawn, they divide the milk according to the respective ages of the animals, invariably giving the better part to the oldest calves.

Another circumstance peculiar to that district is the regulation of the temperature of the feeding-sheds according to the alteration of the different seasons, so as to keep them, as nearly as possible, at the same degree of heat. This practice cannot be too strongly recommended. Warmth is, indeed, well known to be essential to the health, and particularly to the improvement in flesh, of all animals; but sufficient attention is not generally paid to the maintenance of an equal temperature, although, next to a proper shelter, it is the point of greatest importance.

Cleanliness is also an object of rigorous attention, the place being kept constantly dry, and supplied with a proper quantity of good litter. As soon as any of the animals refuse regularly to take their food they are consigned to the butcher, and their place is occupied by the next in age.

In some districts the only plan pursued is simply feeding the calves on milk alone, without the addition of any extraneous food, or nostrums for promoting condition, and without having recourse to bleeding. The calves are not allowed to suck the dam, but are brought up by hand, both because the quantity of milk given to the calf can be thus better ascertained and more regularly distributed, and the sucking by the teat is considered disadvantageous to the cow. The reason assigned for this disadvantage is that when the entire milk is not given to the calf, the cow retains a portion of the remainder, and the calf does not drain off the milk as he should. It is also well known that the milky seerskin is diminished whenever the udder is not completely emptied.

Some of the Strathaven feeders give the milk at first sparingly, from an idea that it sharpens the appetite of the calves; but others, more naturally, and with as good effect, allow a full supply from first to last. During a week or two after they are calved they are not found to consume more than about half of a good cow's milk, but the quantity is gradually increased to as much as they will drink. A well-grown calf, at four weeks old, will consume the entire milk of one cow. If in good health it will, in two or three additional weeks, take the greatest part of the milk of two cows; and, in order to bring them to the greatest degree of fatness, it is common to give those that are furthest advanced the last drawn or richest part of the milk of three cows, after they are nearly or quite two months old. This last practice, however, is rarely necessary; for it will generally be found that the animals will be fit for the butcher in about six or seven weeks, without any other attention than giving them their share of genuine milk, keeping plenty of clean litter under them in a place that is well aired and of moderate warmth, and excluding the light. Some have given eggs, and others have put meal into the milk; but the best feeders do not approve of such admixtures, which, they say, darken the flesh of the animal.[1]

The very intelligent writer from whom we have extracted this account does not state the average quantity of milk consumed by the calves during the process of fattening; but he says that the Strathaven farmers calculate on realising ten shillings per week from each calf, valuing the milk at from $1\frac{3}{4}d.$ to $2d.$ per quart; and many have used their milk in feeding veal when they could have sold it at these prices. If this is the case, it is clear that either the system or the stock must be superior to anything of the

[1] Aiton's Dairy Husbandry, chap. iii. sect. i. p. 60.

kind in England; for the calculation of the profit of sucking in Essex, where it is usually practised for the London market, is only four shillings and sixpence per week. Although that may be under the mark, yet ten shillings would probably be as much above it.

We are informed that the calves in Holland are reared in long and narrow, but tolerably lofty, suckling-houses. The pen in which the calf is kept is so narrow that it cannot turn round, but only go backward to the end of the pen, which is very short, or forward to the door. The house is kept in total darkness, and the pen is perfectly clean and sweet. When the suckler comes to feed the animal, a small hole is opened in the doorway sufficiently large to admit the head of the calf to be dismissed. As soon as the animal perceives the light it advances towards it, and thrusts out its head, which the suckler puts into the pail. Being taught thus to drink the milk, it very soon gets fat, and much more quickly than by either of our modes, in which the calf is usually tied up, or is permitted to run about in an open place. The Dutch farmers hang up a piece of chalk near the door for the animal to lick; and the pen is so contrived as to height that, when the calf is about to be removed, and the door of the suckling-house is open, it falls down on the tail of the cart, and the animal walks in and is secured. The floor of the Dutch calf-pens is a lattice-work, so that it always lies dry.[1] The practice is admirably adapted for fattening calves for the butcher, and for which quietude is absolutely requisite; but where the object in rearing them is to keep them as stock, it probably will be found more conducive to their health to turn them into a sheltered paddock or yard, only housing them at night.

CHAPTER VIII.

OF STEERS AND DRAUGHT OXEN.

THE use of oxen for the purpose of draught is now nearly in this country given up; it might therefore have been advisable to have left out in the present edition the following remarks; but as the work circulates largely amongst colonists, with whom the labour of oxen is almost a matter of necessity, it has been deemed advisable to retain them.

A good ox for the plough should be neither too fat nor too lean, for in the former case he will be lazy, and in the latter he will

[1] Malcolm's Compendium of Modern Husbandry, vol. i. p. 354.

be weak and unfit for labour. His body should be well developed, joints short, legs strong, eyes full, coat smooth and fine, and every part of it well put together, so that his strength may easily be ascertained.

Another requisite is that he answers to the goad, and is obedient to the voice. To this he can only be brought by gradual habit and gentle treatment. The calves that are designed for the yoke should not be broken in earlier than at two and a half or three years, lest they should be overstrained;[1] nor should this be deferred longer, because they may afterwards become stubborn and ferocious. Their work should be so proportioned as not to affect their growth, which continues until about their seventh year. Where this is not attended to, their value will be lessened in a greater degree than will be compensated by their labour.

The strength of this animal, when properly trained and managed, is very great, and he has patience to endure fatigue; but, being naturally slow, he must not be hurried beyond his usual pace. The only method by which success can be attained is patience, mildness, and even caresses: compulsion and ill-treatment will irritate and disgust him. Hence great assistance will be derived from gently stroking the animal along the back and patting him, and encouraging him with the voice, and occasionally feeding him with such aliments as are most grateful to his palate. When he is thus become familiar, his horns should be frequently tied, and, after a few days, a yoke put upon his neck. After this he should be fastened to a plough with an old tame ox, of equal size, and employed in some light work, which he may be suffered to perform easily and slowly. The young steer will thus be gradually inured to labour. After working in this manner for a certain period, the steer should be yoked with an ox of greater spirit and agility, in order that he may learn to quicken his pace; and, by thus frequently changing his companions, as occasion may allow, he will, in the course of a month or six weeks, be capable of drawing with the best of the stock.

After the steers are thus properly trained, it will be advisable to match such as are intended to draw in the same team or yoke, attention being paid to their size, strength, spirit, and temper; otherwise, by being unequally matched, they will not only spoil their work, and be greatly disqualified for draught, but the slower or weaker animal of the two, being urged beyond its natural powers, will inevitably receive material injury.

Another circumstance of essential importance in breaking-in young oxen is, that, when first put to work, whether at the plough

[1] In Devonshire, however, they are frequently put to gentle work at two years of age.

or in teams for draught, they should not be fatigued or overheated. Until they are thoroughly trained, therefore, it will be advisable to employ them in labour only at short intervals, to indulge them with rest during the noon-day heats of summer, and to feed them with good hay, which, in the present case, will be preferable to grass. It fact, while oxen are worked, they must be kept in good condition and spirit.

On their return from labour it will greatly contribute to preserve their health if their feet are well washed previously to leading them into their stalls, otherwise diseases may be generated by the filth adhering to them, while their hoofs, becoming soft and tender, will necessarily disable them from working on a hard or stony soil. The extremes of heat and cold ought also to be carefully guarded against, as disorders not unfrequently arise from excess of either temperature, and they are peculiarly exposed to fevers and to the flux, if chased, or hurried, especially in hot weather.

The following mode of training and working oxen, which has been successfully adopted in North Britain, we give in the words of the farmer by whom it is practised:

'Out of my stock of cattle,' says he, 'I select, when two years old (that is, after harvest, when they are rising three), four of my stoutest, best-shaped *stots* from the field. These, to accustom with harness, I bind up in my oxen byre every night for a week or two; and they are then taken out in pairs, and put into the plough with a pair of older-trained oxen yoked before them. This keeps them steady, and prevents their running off. After being yoked in this manner two or three times, I turn them again amongst the cattle in the straw-yard, where they remain until spring. They are then three years old. I yoke them all four, after training them as above stated, in a plough by themselves, which requires a little boy to drive; and in that way they are used until four years old, when they are worked in pairs as horses, by one man only, and do the same work at ploughing; for at carting, &c., I never use them, having as many horses as do that part of my work. When used in pairs, one man works two yokings, and the cattle only one each. If, however, I had occasion for two cattle ploughs, each pair might work well two yokings, the same as horses.'

The same intelligent correspondent also remarks, in addition to the above: 'If, when three years old, eight *stots* were worked four and four *alternately*, it would be a great relief; and I have uniformly found that cattle *moderately worked* thrive better than those that are idle or unemployed.' [1]

[1] Farmer's Magazine, vol. iii. p. 450.

The following system of a succession of breeding and working cattle has been recommended by that eminent agriculturist Mr. Ellman, of Glynde, in Sussex—the numbers depending on the means or inclination of the breeder:—

> 14 calves; of which nine were males: eight were kept for oxen, and one allowed for accident, or not taking to work.
>
> 14 two-year olds; of which eight are worked a little at two years and a-half.
>
> 14 three-year olds; part of which taken for cows, and others, if not good, fattened.
>
> 14 four-year olds; eight worked.
>
> 14 five-year olds; do.
>
> 14 six-year olds; fattened.

Thus twenty-four oxen are worked—eight at three, eight at four, and eight at five years old; and a reserve is kept for breeding cows, and accidents.[1]

The details of the Earl of Egremont's system, as followed to a great extent at Petworth, were as follows:

The calves are dropped from December to the end of February. They are weaned immediately, never permitting them to suck, but the milk being given for a few days, as it comes from the cow. When weaning on skim-milk, they should fall in December, or a month before or after, and should then be kept warm by housing; thus they will be equally forward with calves dropped late in the spring, and that ran with the cow. With the skim-milk some oatmeal is given, but not until the animal is two months old, and then only because the number of calves is too great for the quantity of milk. Water and oatmeal are then mixed with it, to make it go farther. To this heifers with their first calves are exceptions, for they do not become good milkers if their calves are not allowed to suck for the whole season. With the second calf they are treated like the rest. In May, the calves are turned to grass. During the first winter, from the beginning of November, they are fed upon *rowen*, or, as it is in some places called, *aftermath*. In the following summer they are at grass; and in the second winter on straw, with a turn on short rough grass. They have been tried on hay alone, but straw and grass do better. During the following and every other summer they are on grass, and are broken-in at Christmas, being then three years old, but are only lightly worked until the spring, when their real labour begins. From this time their winter food is straw, with clover hay from the beginning of January. They

[1] See Agricultural Survey of Sussex, p. 261.

are previously kept on straw alone, yet are worked three days in each week.

The best working breeds are the Hereford, Sussex, Devon, and a mixed breed between Hereford and Sussex. Some give the palm to Sussex cattle for working powers, but this is chiefly in their own county; beyond that they are little used.

Mr. Hall Keary states that Devon cattle are extensively used for the plough in Norfolk, and that for working purposes they are unrivalled. 'There is almost as much difference,' he says, 'between a Devon ox and other breeds, as between a light, cleanly, active cart-horse, and a heavy, hairy-legged, sluggish dray-horse.'[1]

The general character of the ox is patience and tractability. If young steers sometimes prove refractory and vicious, it is in most instances the result of defective management, or of bad treatment when first broken for the yoke. When an ox is unruly or stubborn, it will be advisable to keep him until he is hungry; and, when he has fasted long enough, he should be made to feed out of the hand. On his returning to labour he should be tied with a rope. If he at any time becomes refractory, gentle measures should always be attempted in order to bring him to work readily and quietly.

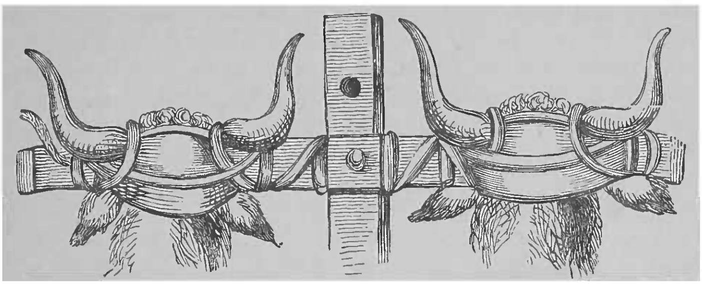
In *working oxen* to advantage, much depends on the mode of harnessing them, and the question, 'whether it is most advantageous to yoke oxen by the head or the collar?' has occasioned much discussion, and is even yet undetermined. The opinion throughout Great Britain is, almost universally, in favour of the collar; but throughout Spain and Portugal, where oxen are the only animals employed in agricultural labour, whether of road or field, they are invariably yoked by the head. The strength of the animal lies in his neck, of the power of which the head-yoke affords him all the advantage, while the collar deprives him of it, as he does not draw by the shoulders. The greater cost and trouble of harness, of yokes and bows, are also considerations of importance. In summer, harness has been found an incumbrance, the ox requiring all the relief and liberty that can be given in hot weather.

In Portugal these animals are harnessed in the following manner. A long leather strap is wrapped round the yoke, whence it passes to the lower part of the horns, and is again fastened to the yoke. By this contrivance, the heads of the oxen become more steady while performing their work, and these useful animals are rendered more tractable. In France and in the Peninsula, oxen are yoked in a manner better expressed by the aid of figures than

[1] Journal of the Royal Agricultural Society, vol. ix. p. 436.

by description. Figure 37 represents a view of the hinder part of the head and neck of these animals in the yoke, as they appear to a spectator. Figure 38 exhibits a front view of the upper part of their heads, in order to convey a more accurate idea of the mode in which the French oxen are fastened to the bow. We understand that the Earl of Shannon introduced this method of yoking oxen into Ireland, and that two oxen thus harnessed were enabled with great ease to draw the enormous weight of three tons.

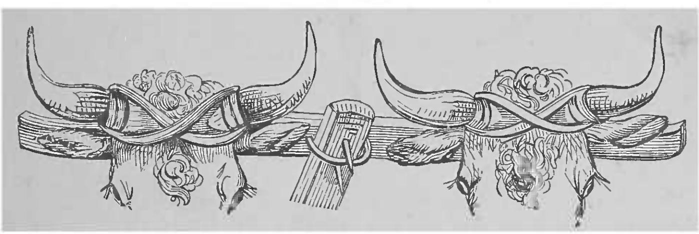
FIG. 37.



YOKE FOR DRAUGHT OXEN USED ABROAD.

The advocates for the collar insist upon the advantages of single-ox carts; and of ploughing with the team at length, by which, as they walk in the furrow, the land is not so much poached as when they are yoked abreast. They affirm, also, that the pace

FIG. 38.



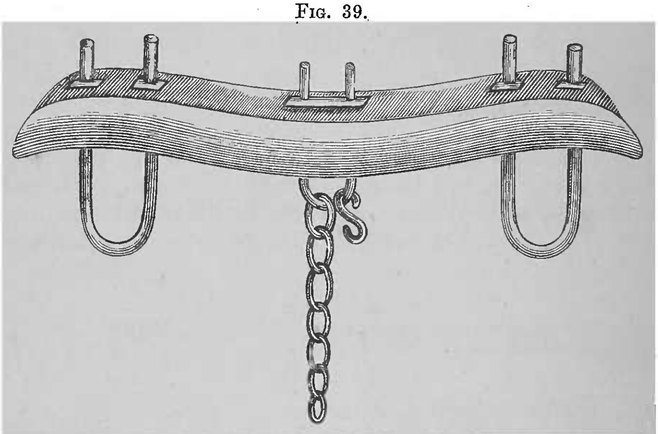
IMPROVED YOKE.

is quicker in harness, and that the animal works with greater ease. But their opponents allege that oxen are more advantageously worked in couples than singly, inasmuch as, being nearer to the draught, they possess greater power over it than when drawing at length. They also consider the additional expense occasioned by a double number of one-ox carts and drivers more than counterbalances the advantage of their use even if anywhere admitted, and they deny that the animal works either quicker or with greater ease.

It would be endless to detail the various comparative trials that have been published on this long-contested subject; and it may be deemed sufficient to state the result of two, made some years ago in Sussex, where, from oxen being extensively used, the dispute had excited more than common interest.

In order to decide the respective merits of the two methods, it was agreed that an acre of land should be ploughed by two teams, the one of six oxen in double yokes, the other of four oxen in collars; and then, again, with four oxen in single yokes, against four in collars. In the first trial, the six in yoke beat the four in collar easily; and in the second, there were only three minutes difference. The work was equally well performed; but the ploughing must have been very light, as the last match was completed in four hours and ten minutes.[1]

Fig. 39.



SUSSEX YOKE FOR DRAUGHT OXEN.

So far as this experiment may be considered decisive, it re-established the equality of the teams; but had it been tried with more severe labour, or on hilly ground, it might have proved different; and in steep ascents, more particularly, the yoke would probably have been found best adapted to the animal. It is a prevalent idea in England, that oxen are unfit for draught in hilly countries; a large portion of the Peninsula, however, is mountainous, and there they draw heavy weights in carts of a very rude construction. Being worked in yokes, they possess the power of preserving the line of draught, by lowering the head according to

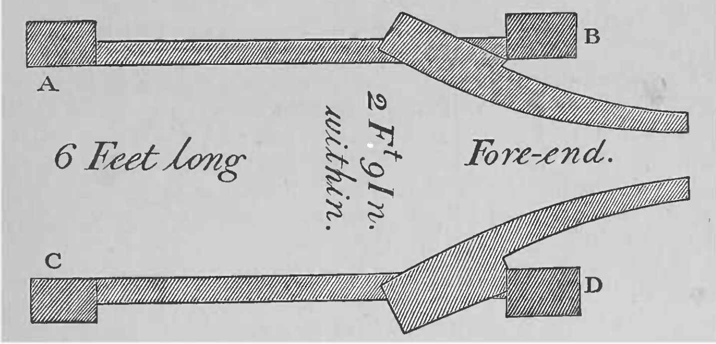
[1] See Agricultural Survey of Sussex, p. 261.

the inclination of the ground, an advantage which is lost in the application of the collar; and their chief strength is, also, supposed to depend on the joint power of the neck and the base of the horn.

The Earl of Egremont, also, put his cattle to the test at Petworth, in both road and field-labour, and his experience confirmed the opinion in favour of the old Sussex yoke, of which the opposite is a figure.

Connected with the subject of draught is another, which has only received of late years the attention that it deserves—viz. the *shoeing of oxen*; a necessary operation that, when carefully executed, will not only conduce to the animal's comfort and health, but also to the farmer's profit; for he will be enabled to draw both with greater speed and superior effect. According to the old practice, the animal was first *cast*, or thrown, and his legs bound together in the usual manner; he was then forced nearly upon his back, and his feet hoisted up to a convenient height by means of a forked pole,

FIG. 40.



BAKEWELL'S SHOEING SHED FOR OXEN.

the forked end taking the bandage that bound the feet, while the opposite end was firmly fixed in the sward upon which they were thrown. The farrier then proceeded to affix the shoes in a manner similar to that practised on horses. By this contrivance, the shoes were easily and firmly applied, but it was attended with the disadvantage that accidents sometimes occurred in the operation of casting; the other oxen were also apt to become unruly on seeing their companions roughly treated, and many valuable cattle were rendered completely useless. To obviate such accidents, an ingenious appliance, of great simplicity, was adopted at the late Mr. Bakewell's farm at Dishley (as shown above). It merely consisted of four posts, A, B, C, D, fig. 40, fixed firmly in the ground with strong side-rails.

The animal being led in, is confined by four straps going over the back and under the belly. The two projecting branches are hollowed on the top, for laying on the fore legs one at a time; the hind legs are severally held out, when wanted, by a long wooden lever, and thus the shoes are applied without any possibility of injuring the beast. It has, indeed, been suggested, and we think the plan might be easily carried into effect, that if calves intended to be reared for work were accustomed, while young, to have their feet taken up, and their hoofs beaten with a hammer, and this practice repeated during the winter while the steers are in the yards, they might afterwards be shod in the same manner and with equal facility as horses.[1] It is well stated that little skill is required in the smith in order to adapt the shoe to the foot of the ox. There is no weakness of particular parts, no corn, no tenderness of frog, no disposition to contraction to be studied. The simple principle is to cover the sole effectually. Around the outer rim the shoe should follow the line of the foot; it should somewhat project inwardly towards the toe, and be rounded towards the heel with the projection likewise inward. It should be fastened by three nails on the outer edge, the posterior nail being about the middle of that edge. The nails should be thin and flat-headed, so that when driven close they may occupy a considerable portion of the ground-surface of the fore part of the shoe. Both the ground and foot-surfaces should be flat, and the shoes made of good iron, but thin and light. The only difference between the fore and the hind shoe is, that the hinder shoe is thinner and lighter, not quite so broad or so much curved, and particularly more pointed and turned up at the toe.

Shoes.—Some farmers shoe the fore feet only, others take in the two outside claws of the hind feet. A little additional trouble or expense being taken, they would be safer.

The principal objection to shoeing the ox arises from the difficulty of putting the shoes on. The beast will seldom submit quietly, and recourse must be had to the *trevis* or to casting him. The latter is dangerous, and frequently accompanied by accident, either to the ox or the smith. Much of the unruliness of the beast, however, might be overcome by kind treatment, and by often handling the steer, and lifting up his feet, and striking them gently with a hammer. Finding that no harm is done to him, he will permit this without fear. It is fear, and not natural indocility, that causes the resistance of the beast.

[1] On the Working and Shoeing of Cattle, see chap. viii. No. 5, on British Husbandry, in the Farmer's Series of the Library of Useful Knowledge.

CHAPTER IX.

OF GRAZING CATTLE.

THE feeding and fattening of cattle, whether for labour or for sale, is the most important object in the whole economy of the grass farm: hence the farmer should previously consider the *nature* and *fertility* of his *pastures*, and the extent and quality of his other resources: and according to these he should regulate his system of *grazing*, *soiling*, or *stall-feeding*. He should then select those animals only which evince the most *evident disposition to fatten with the least consumption of food*, and depasture them upon such lands as are best calculated for the respective breeds, especially taking care not to bring cattle from rich to inferior soils, but, wherever it is practicable, to choose them from lands of nearly the same quality as those destined for their reception.

The introductory view of the different breeds of cattle prefixed to this work will probably supply some hints for enabling the farmer to decide what kind of stock is calculated for peculiar situations. In addition to this we would observe as a rule, very simple, but of great practical importance, that the larger beasts are preferable for the more luxuriant pastures, while in such as are less rich small stock answer best. Thus, a grazier who has fertile meadow or deep marsh land may select his beasts as large as he can find them; but he who has only indifferent grass should take care to proportion the *size* of his beasts to the *quality* of their pasture, for it is better to have cattle rather too small than too large for the quality of the land.

Hence we find, that in the rich grazing counties of Durham and Lincoln large breeds are chosen, while in Norfolk and Suffolk the Kyloes, Galloways, and Scotch cattle are fattened in preference to other breeds, not only on account of their value and the excellence of their flesh, but from the stock being better suited to the lightness of the soil.

The Herefords, the Devons, and the Short-horns are breeds now much approved for grazing and fattening purposes; and after them come the Glamorgans, the Pembrokes, and the Norfolk and Suffolk polled breeds of cattle, all of which are eminently profitable in particular situations. In order to carry on the grazing of cattle with effect, it is necessary that the farmer lay down a definite plan or system, and proceed regularly therein, deviating from it in those instances only which obviously tend to improve his cattle, and thus ultimately to increase his profits.

With regard to the species of cattle best calculated for grazing, spayed heifers and oxen are certainly superior to any other stock. The former are of less frequent occurrence, but they fatten with more expedition. Many graziers consider heifers more kindly in their disposition to feed than steers, particularly when they have already had a calf; and Mr. Honeybourne, the successor of Bakewell, at Dishley, was of opinion that they are superior to oxen for fattening at any age, and will uniformly produce a greater weight of beef per acre.[1] Cows are, however, liable to diseases of the udder on some land. Wintering heifers in calf, in some grazing districts termed *in-calvers*, may also be advantageously fattened if attention is paid to selection, and the beasts are well fed during the winter on rich succulent crops. They are occasionally sold for small sums at the autumnal or Michaelmas fairs, and may be disposed of in the succeeding spring, at considerable profit, with their calves running by their side.

Free Martens, or barren cows, have been tried for the purpose of fattening, but they rarely succeed. The same may be observed with regard to old cows, and such as are become dry. In some few instances they may prove a source of profit, but the speculation is a hazardous one, and at best they are much inferior to young or middle-aged stock in point of *kindliness to fatten*. Such cows have been found to fatten more readily after they have taken the bull than when barren.

In stocking lands, as the proportion of beasts must depend upon the fertility of the soil, it will generally be found that local custom will afford the surest guide. In the counties of Somerset and Devon one acre or one acre and a half of the better kind of land is allotted to one ox, to which a sheep is sometimes added. The best grazing land in Lincolnshire, we are told, will, under favourable circumstances, support one ox and a sheep on one acre during the whole summer; and the former will gain 20 stones, or 280 lbs., and the latter 10 lbs. a quarter, or 40 lbs.

In order to graze cattle to advantage, it will be profitable to change them from one pasture to another, beginning with the inferior ones and gradually removing into the best. By this expedient, as cattle delight in variety, they will cull the uppermost or choicest part of the grass; and by filling themselves quickly, as well as by lying down frequently, will rapidly advance towards a proper state of fatness, while the grass that is left may be fed off with labouring cattle, and lastly, with sheep. Hence it will be advisable to have several inclosures, well fenced and sheltered, and abundantly supplied with wholesome water. Respecting the best size for such inclosures, there is a difference of opinion. From ten

[1] See the Agricultural Survey of Leicester, p. 232.

to fifteen or twenty acres may be considered the most appropriate quantity; although, if any are of a greater extent, they can be divided by a strong but temporary fence for the purpose. Their size, however, should be various. Small ones are preferable in winter, and larger ones during the summer. Thus the greater and stronger cattle will be separated from the weaker ones; for, if cattle of various sizes are indiscriminately mingled together, the more powerful ones will master the others, driving them from place to place, and trampling upon or wasting more food than they can eat.

To prevent these inconveniences, and also to stock the land to the greatest advantage, some intelligent graziers recommend the following method of feeding and fattening cattle. Suppose that there are four inclosures; one should be kept perfectly free from stock until the grass is in its full growth, when the prime or fattening cattle should be put into it, in order to get the best food: the second best should then follow, and the young stock after all, arranging the whole of the feeding over the four inclosures in the following succession:—

First inclosure. Free from stock, until ready for the best cattle.

Second inclosure. For the reception of the best cattle, until sent to No. 1.

Third inclosure. For the second-best cattle, until sent to No. 2.

Fourth inclosure. For the young cattle, until sent to No. 3.

Thus the fourth inclosure is kept free from stock until the grass is got up, and ready for the prime cattle; to which we may add, that the inclosures should be finally gone over by store sheep. They will thus be eaten down to a close and even sward, to the great benefit of the after-growth.

Before we proceed to discuss the other circumstances connected with the grazing of cattle, it will not be altogether irrelevant to state a few particulars concerning the peculiar practice or management of some of the most eminent graziers.

Some farmers purchase *heifers* and other lean stock from the month of March or April to that of May, and turn them upon the meadows and pastures as early as possible. Then the beasts become completely fat on the *grass-feed* towards the close of October or the commencement of November, or later in the year, according to their kindliness in taking on fat. In the county of Middlesex this method is adopted with great success on the hay farms. The graziers there purchase small cattle, that are in tolerably good condition, as early in the autumnal quarter as the *rowen*, *latter-math*, or after-grass, is ready: into this the cattle are turned, and are sold to considerable advantage about the end of October or the beginning of November.

There is another mode practised in some grazing districts, where the lean stock are purchased at various periods and of different sizes, so that, some becoming fat sooner than others, they may be sent to market in succession. According to the management of these people the cattle are sometimes kept throughout *two* winters, during the first of which they are not at *full keep*, but in the following summer they are turned into good grass, and fattened off in the second winter with the best and most forcing food that the farmer possesses. The most common system, however, consists in buying small cattle as early in the spring as the grass affords a good bite, when they are allowed one summer's grass, and are stall-fattened in the ensuing winter.

With regard to the management of pasture-grounds, it may be observed, that those which are *laid*, or allowed to *rest*, at Candlemas, may be grazed in the following May; such as are laid in May, may be grazed at Midsummer; those to which rest is given at that season may be grazed at Lammas; while those that are laid at Lammas may be grazed in October, and, generally, throughout the succeeding winter.

A variety of circumstances will claim the farmer's attention in the grazing of his cattle, in order to conduct his business with regularity, or with profit. He should take especial care not to turn his stock into the pastures in the spring, before there is a *full bite*, or the grass has obtained a sufficient degree of length and maturity; for cattle whose tongues chiefly enable them to collect the food, neither can nor will bite near the ground, unless they are compelled by extreme hunger. In this case, it is obvious that they cannot enjoy their feed, and consequently cannot thrive.

Where beasts are turned into fields consisting either of clover entirely, or a mixture of natural and artificial grasses, much circumspection is required, in order that they do not devour so eagerly, or to such excess, as to become *blown* or *hoven*—an affection to which cows are more peculiarly liable than the other neat cattle. That disorder, however, may be prevented either by feeding the animals so as to gratify the cravings of appetite before they are turned into the pasture, or by constantly moving them about the field for a few hours after they have been turned in, in order that the first portion, at least, may be partially digested before the next is deposited. Should they, notwithstanding this, be attacked by that dangerous disease, they may be relieved by adopting the remedies pointed out in a future chapter.

Although the various grasses of which a pasture is composed ripen at different periods, yet the sward usually attains its greatest luxuriance about Midsummer; and from that time to Lammas it possesses a peculiar sweetness, so that during the intervening period stock may be allowed to bite somewhat nearer to the ground. It will, however, be necessary to remove fattening cattle, from time to time, into fresh grounds; so that by taking the uppermost and choicest part of the grass, they may feed both expeditiously and profitably, and no loss is thus incurred, for, as before stated, the grass left behind them may be fed off, first with labouring cattle, and afterwards with sheep. This point cannot be too carefully regarded, for if cattle are in want of sufficient food, they will lose more flesh in one day than they can possibly recover in three.

The pastures that are in fenny situations, or retain moisture for a considerable time, should be fed off as early as possible, lest sudden or long-continued rains should fall, which will not only render the juices of the grass thin and watery, and ultimately putrescent, but will also materially affect the health and constitution of the animal. In order to prevent the losses consequent on such accidents, it will be indispensably necessary daily and attentively to inspect the grazing stock, and if any beasts appear to be affected by eating wet grass, they should be immediately withdrawn to a dry shelter, and fed with hay or straw; or, if they cannot be conveniently removed, they must be driven to the driest spot, and there supplied with *sweet* cut grass and *dry* fodder.

The *hard* or *light stocking of pasture ground* is a point on which many graziers are by no means agreed. By some it is contended that the pastures should be stocked very lightly. They allege that although much of the produce is thus allowed to run to seed which the cattle will not eat, and which is consequently trodden under foot, where it rots and is wasted, yet experience evinces that a greater profit will, on the whole, be thence derived than by any other practice.

By others, on the contrary, it is maintained that the practice of light stocking is highly to be condemned; because it not only tends gradually to diminish the produce, but also to encourage the growth of coarse and unprofitable grasses, which materially deteriorate the pastures, and that the *hard stocking* of grass lands, particularly those of a rich quality, is an indispensable requisite of good management. It must be confessed that the superior fertility of the hard-stocked Lincolnshire pastures tends greatly to corroborate these views, which also receive further support from the practice of the most experienced graziers in Romney Marsh. It is recommended by a third party (whose opinion, perhaps, approximates more nearly to the truth), that *mixed stock* should be always kept on the same field; for the foul grass, produced by the dung of some animals, will be consumed by others; and as it is well known that different species of cattle prefer different kinds of grass, there is an evident advantage in this practice.

In every field numerous plants spontaneously spring up, some of which are disliked by one class of animals, while they are eaten by others; and not a few plants, although eaten with avidity at a particular period of their growth, are entirely rejected by the same beasts at another time. Hence it becomes necessary, not only to have a considerable variety of cattle in the same pasture, but also particular attention is required to augment or diminish the proportions of some of these classes of animals at certain periods of the year, otherwise a part of the produce will run to waste.

On this it is, however, to be observed, that where a great variety of animals are allowed to go at large in the same pasture, they rarely feed with that quietness that is necessary to ensure their thriving. One class, or description of beasts, is inclined to feed or to play, while others are mostly at rest; thus they mutually tease and disturb each other, and this inconvenience is materially augmented, if any kind of *penning*, or confinement, is attempted. Hence, also, it is obvious that the practice of intermixing various kinds of live stock is productive of evils that are, in many instances, greater than those resulting from the waste of food intended to be prevented. There is, indeed, no doubt that by *hard stocking* the grass will be kept short, and will consequently be more palatable to the animals that feed on it than if it were allowed to grow to a considerable length; but as animals that are to be fattened must not only have *sweet* food, but also an abundant quantity, it seems scarcely possible to unite both these advantages with an indiscriminate mixture of stock; it may, therefore, be generally prudent to confine the practice to neat cattle and sheep.

The following remarks by a 'Practical Farmer,' in the pages of the 'Mark Lane Express,' will be useful:—

'There is no department of a farmer's business that requires so much of his attention and matured judgment as the management of his stock. The anxieties of the winter are now over, and the adaptation of his stock to their pastures now claims his chief care. This is a question of no ordinary course. The state and condition of his stock, and the nature, fertility, and fruitfulness of his pastures, are alike equally requiring his notice. These must be in a state to suit each other. The condition of the stock to be depastured upon them must be in accordance with the "strength" and richness of the pasture. To "lay on" stock in poor or weak condition upon a rich pasture, or on strong land pasture, is certainly a very dangerous course, if not a destructive one. Good land must be stocked with good animals, or at least animals in a safe and healthy state. Poor or lean stock may possibly thrive on poor land, but seldom will they thrive on rich soils, or fast growing fruitful pasturage, even should a favourable season produce such on a poor soil.

'The art or science of grazing is no mean one, let the querulous and the despiser say what they may. The politician has the cares of government upon him; the banker, his issues, his notes, and his drafts; the merchant, his goods, his trade, and his credit; the manufacturer, his material, his orders, his patterns, his fabrics, and his workmen; the trader, his stock, his customers, and his bills. These and others, many and many, have their own peculiar cares and perplexities; but none are exceeded in number or in proportionate importance than those cares, anxieties, and perplexities daily experienced by farmers and stock-owners. Every animal is an object of individual and of especial daily care, every crop and every kind of crop is an especial object of intense interest, as upon the success attending the one or the other the farmer lives or droops.

'The profitable grazing of his stock, then, is to him a matter of paramount importance, and great are his perplexities and doubts as to the best mode of carrying this department of his business out. Much will depend upon the character of the soil and pasturage with which he has to do. The occupiers of land of the first class—lands qualified to fatten readily the finest oxen—have a plain course to pursue. Theirs it will be to depasture with cattle of a high order; to put cattle in high condition, and requiring no great length of time, on good pastures, to prepare them for the butcher, and to bring them up to the first quality of meat. The next order of lands would be the prime sheep-pastures. These cannot be put to better purpose than in depasturing sheep of good age and condition, and the quantity of mutton and wool produced per acre goes well-nigh to exceed in profit the somewhat superior bullock-lands. Be that as it may, each variety of land is best to be kept to its order of grazing—"bullocks" to bullock land, "sheep" to sheep lands.

'The great difficulty that graziers have to contend with, is to make the most profit of the intermediate lands, and rotation seeds and clovers. Speaking generally, these had better be appropriated to breeding purposes, dairying, and the grazing of young stock. Most of the "sweet lands" in the Midland and other counties are well adapted for dairying uses, and nothing can pay better where conveniences accord. The produce of the dairy and the rearing of the young cattle are doubly remunerative; but there are exceptions; the majority of common grazing lands are not well adapted for dairying. These are best devoted to breeding purposes; or if some of the most fertile of these second-class lands are appropriated to fattening uses, it should be in conjunction with artificial aids. Cattle and sheep on such lands will fatten satisfactorily if liberally supplied with linseed-cake—from four to six pounds for a bullock, and from half-a-pound to a pound for a sheep, depending much upon the size and weight respectively.'

Independently of remedying the inconveniences above specified, a variety of circumstances concur to prove that the practice of *soiling*, or feeding cattle during the summer with different green and succulent vegetables that are cut and carried to them—and of box and *stall-feeding* them in the winter season with dry fodder, in conjunction with various nutritive roots—will in general prove most economical. The terms 'soiling' and 'stall-feeding' are in one sense synonymous, as in both of the systems the leading feature is the *housing* of the cattle. The term 'house-feeding' is therefore used by some writers; but inasmuch as there is actually a distinction between the kind of food used in the summer and winter feeding, we treat the two systems as distinct in character, denoting however the one as 'summer soiling,' the other as 'winter box or stall-feeding.' We will, therefore, proceed to say a few words on both these important subjects. Before proceeding to this, however, we think that a brief notice will be valuable of the principal points of the paper recently read by Mr. Owen Wallis before the Central Farmers' Club, on the 'Feeding of Stock on Pasture Land.' After pointing out that a very great proportion of the cattle at present sent to market are very insufficiently fed—and after quoting the opinion of the eminent cattle salesman of London, Mr. William Collins, that with very little additional feeding the cattle sent to market might average ten stones per head more than they do now—Mr. Wallis proceeds to discuss the remedies proposed to meet this state of matters. He refers at once to the mode of using the oil-cake, and other artificial food in conjunction with summer grazing, as the best means to give satisfactory results. But before this system of fattening can be adopted, Mr. Wallis points out the necessity of having proper accommodation in the way of shelter sheds for the cattle in the pasture fields—and further, that the large fields should be divided so as to feed a limited number of beasts in each division. As to the advantages of shelter sheds or hovels, Mr. Wallis is of opinion that they are as much required in summer as in winter. He says: 'We all know how much cattle often sink, in hot weather, in consequence of racing about the fields when gadding. If they were tied up in sheds during that time, and fed with a portion of either cake or meal, and a small quantity of good hay or chaff given to them, this waste would not only be prevented, but they would be rapidly gaining flesh.' Again, as to the importance of dividing large fields so as to limit the number of beasts in each part, Mr. Wallis says that unless this is done before the whole could be eaten out, the first portions would be taken, and the weaker animals would be mastered by the stronger and deprived of their fair share of food. Fifteen cattle is the best number to put together in one field, but twenty is the maximum. The cake is best given in boxes, laid down here and there in the field; one box to each beast.

CHAPTER X.

SUMMER SOILING OF CATTLE.

THE advocates of this system support it by the following arguments, which certainly deserve the closest attention of the grazier in every part of the kingdom.

I. By introducing the practice of soiling, *a very considerable saving of land* will be effected. We do not coincide in the extravagant opinions of some theoretical writers, or assert that one acre of cut grass soiled is equal to three acres used as pasture; yet, in some particular crops, the saving would be very great, from the absence of all poaching during the growth of the crop, and from the young leaves and blossoms being permitted to reach their full development. There are likewise particular seasons of the year when the advantages of soiling are very great. Sir John Sinclair states that thirty-three head of cattle were soiled from May 20 to October 1, 1815, on seventeen acres and a half, whereas fifty acres would have been necessary had they been pastured.[1]

II. There is also a very *considerable saving in the quantity of food consumed*, as well as a greater variety of plants eaten, and consequently prevented from running to waste; for when animals are suffered to go upon the field, many plants are necessarily trodden under foot and bruised, or partly buried in the earth; in which state they are greatly disrelished by cattle, and are suffered to run to waste—a circumstance that never could occur if the practice of cutting were adopted.

If a close consumption of plants is the object principally to be regarded, it is evident that the benefit to be derived from soiling will be very great; for experience has clearly proved that cattle will eat many plants with avidity, *if cut and given to them in the house*, which they never would touch while growing in the field; such are the dock, cow-parsley, thistles, nettles, and numerous

[1] Code of Agriculture, p 487.

others. It is also well known that many of our best and finest grasses, that when young afford a most palatable food to cattle, are, if once suffered to get into ear, so much disliked by them that they are rarely or never touched, and their produce is lost to the grazier; whereas, if cut down by the scythe in proper time, not one plant would be suffered to become dry and unpleasant to the cattle, and consequently no waste could be sustained from this cause.

In addition to the preceding observations it may be remarked, that the few plants that are totally rejected by one class of animals are not, on that account, less acceptable to others, but greatly the reverse. Grass, and other food that has been *blown* or *breathed upon* for a considerable time by one description of stock, seems to have acquired additional relish with stock of another variety. Nay, even greater defilement by one animal seems to render food more acceptable to others; for straw, which in a clean state has been refused by cattle, acquires a taste or smell, if employed as a litter for horses, that induces them to seek it with avidity. Hence it often happens that the sweepings of the stalls of one class of animals will supply a pleasant repast for others, and thus plants are consumed in the house which must have been lost in the field.

III. With regard to the influence produced on the *health and comfort of cattle*, the balance is clearly in favour of soiling. They are not liable to be blown or hoven, or to be staked or otherwise injured by breaking the fences. They are not incommoded by the heat or annoyed by swarms of flies and gnats, and, most of all, they are not driven to a state little short of madness by that most dreadful of all persecutors *the gad fly*,[1] a circumstance which, to an unthought-of extent, frequently impedes their thriving. Neither at other times are they injured by chilling blasts or drenched by rains, things which retard their thriving. Under proper management, and in well-constructed stalls, all these evils will be removed, and the animals be kept in a uniform state of coolness and tranquillity; and thus the same quantity of food which one beast would devour or destroy while grazing will suffice for the soiling of two, if not three.

Lastly, by judiciously mingling green and succulent vegetables with dry and nourishing food as circumstances may require, and by varying the different articles so as to provoke an appetite, not only the health but also the thriving of the stock will be greatly augmented beyond what could have been done by any other mode of treatment. On the whole, the superior condition of the cattle, and the absence of accidents, and many diseases consequent on their exposure to our variable climate, are strong arguments for

[1] The *Œstrus bovis* of Linnæus, commonly called the *breeze*.

the practice of soiling, at least so far as their health and comfort are concerned.

The period of soiling usually commences after the animals have passed their first year. It is not at all improbable that they would retain their health as well as when they were allowed to pasture at large, and would attain a greater weight of carcase and aptitude to fatten, if they were soiled from the period of their being calves; but, as exercise and liberty seem to be natural to cattle during the first year, it may, at least in the present state of our knowledge upon the subject, be advisable for the farmer to suffer his young stock to run at large during that period, if he has the necessary facilities for so doing.[1]

IV. The increase of manure obtained by soiling and stall-feeding further evinces the superiority of the systems over pasturing. *Manure* is the very life and soul of husbandry, and, where tillage is an object of attention, there can be no comparison between the advantages of the two modes of consumption; especially if we regard the manure obtained by soiling live stock with green food during summer, for the increased discharge of fæces and urine during that season speedily converts any species of the litter into manure. There is little doubt but that the quantity of manure made during the summer can, by constructing proper resorvoirs for the reception of the stale, and by throwing this at leisure times over the litter, be made to equal, if not exceed, the amount of the dung accumulated during the winter. The *quality* must depend on the nature of the food.

V. With regard to the *quantity of herbage* afforded from the same field, under the *cutting* or *grazing* systems, the balance will be found equally in favour of the former. All animals delight more to feed on the young and fresh shoots of grass than on such as are older. Hence it invariably occurs, that those patches in our pastures which happen to have been once eaten bare in the beginning of the season, are kept very short throughout the year by the animals preferring them to other parts of the field where the grass is longer, while the latter are often suffered to continue in a great measure untouched.

Another circumstance, not very generally known, is, that grass—even the leafy parts of it—when it has attained a certain length, becomes stationary; and, notwithstanding that it will retain its verdure in that state for some months, yet, had it been cut, it would have continued in a constant state of growth, proportioned to the frequency of its being cropped.[2] Several experi-

[1] Lewis's Observations on an Experimental Farm.

[2] See Dr. Anderson's Essays on Agriculture, &c., vol. ii. Disquisition v., where this interesting fact is corroborated by experimental proofs, which our limits forbid us to introduce.

ments have been brought forward to prove that with clover, rye-grass, lucerne, and tares, at least *double the number* of cattle may be supported in much better condition when the crops are cut than when they are pastured; hence there cannot be any doubt that, by judicious management in this respect, the profits of the grazier can be greatly augmented.

The practice of soiling and stall-feeding cattle has been adopted to a considerable extent on the Continent by Baron von Bulow and others; the results of whose experience are inserted in the first volume of the 'Communications to the Board of Agriculture,' by Dr. Thaër, Physician to the electoral court of Hanover, and which, he observed, has proved the following facts to be incontrovertible.

1. 'A spot of ground that, when pastured upon, yields sufficient food for only *one* beast, will abundantly maintain *four* heads of cattle in the stable, if the vegetables are mowed in proper time, and given to the cattle in a proper order.

2. 'The stall-feeding yields at least double the quantity of manure from the same number of cattle, for the best and most efficacious summer manure is produced in the stable, and carried to the fields at the proper period of its fermentation; whereas, when dropped on the meadow, and exhausted by the air and sun, its power is materially wasted.

3. 'The cows used to stall-feeding will yield a much greater quantity of milk, and increase faster in weight when fattening than those which go into the field.

4. 'They are less subject to accidents—do not suffer by the heat, or from flies and insects—are not affected by the baneful fogs that are frequent in Germany, and bring on inflammations; on the contrary, if everything is properly managed, they remain in a constant state of health and vigour.'

Possibly the best recent authority on the subject of cattle-soiling is Mr. Josiah Quincy, an American farmer, who has carried it out on an extensive scale, and who has written a treatise on the subject, of which we have elsewhere given the following account. Mr. Quincy, after stating that the system effects a saving of *land* and *fences*—the same extent of land which is required to feed one under the old system being able to feed from three to seven, according to circumstances—proceeds to point out the other advantages named in the extract from the paper above alluded to, and now reproduced here.

As to the third point, the *economy of food*, Mr. Quincy states that there are six ways by which cattle can and do waste their food; first, by eating—this, by the way, we may characterise in Irish style as a saving destruction; second by walking on; third, by dunging on; fourth, by standing on; fifth, by lying down on;

and sixth, by breathing on the food. The five last ways of destroying food are exercised by cattle in pastures without any 'check or compensation,' but can, by the exercise of even the most moderate care, be prevented when the cattle are housed.

As to the fourth advantage obtained by the adoption of the system—*the better condition and greater comfort of the cattle*—Mr. Quincy points out that regularity of feeding, a most important matter, as our readers well know, can be obtained to the greatest nicety by the soiling system, all being capable of being regulated by intelligence, not left to chance, as in the case of pasture feeding. The latter, moreover, is always open to this objection, that droughts, according to their severity, will more or less deteriorate its feeding value.

Now all feeders know the importance of not checking the fattening process; once begun, it should be carried on till completed. All checks are losses; irregular feeding brings with it, inevitably, irregular and uncertain gains.

One great objection urged against the soiling system, is, that, from the perpetual housing which it enforces, the health of the animals suffers. The truth is, however, that two hours' quiet exercise in open and shady yards in the forenoon, and the like each afternoon, forms an essential part of the system. Those who know stock know the yearning after ease which they have if left in pasture; they are not observed to be frolicking up and down; but while eating they walk slowly—very slowly—from point to point; and when appetite is appeased they lie down to ruminate. This quietness, so essential to secure economical feeding, is obtained as perfectly as can be in the soiling system, and all the requirements of open-air exercise are met by the plan above described. When fed in the stall, and kept there the chief part of their time, 'cattle are wholly protected from eating any noxious vegetables, from drinking bad water, from all injury, from being worried by dogs, or one another; they are kept through the heat of the day under cover, protected from flies,' and in the severity of winter from the effects of cold.

On the fifth point—the *greater product of milk*—it seems to be the general opinion that, although the soiling system may be good so far as its helping to maintain the good condition of the animal is concerned, still it does not favour the production of milk so much as the pasture-feeding system. Mr. Quincy explains his notions on this point, derived from his own experience. During the first flush of food in the pastures, there being plenty to choose from, the cattle take it easy, and the product of milk is great, an equality existing between the pasture and the soiling system so far as regards the milking. But after the first month or so of the pasture feeding the equality ceases, the pastures fail, or loose their nutritive value; whereas, by careful adjustment of crops, the regularity of feeding, and the supply of food, are attended with the utmost precision by the soiling system.

As regards the sixth advantage of the soiling system—namely, the *attainment of manure*—there can be but one opinion; this is its great characteristic, and its most striking benefit. 'In pasturing,' says Mr. Quincy, 'the summer manure is almost wholly lost. It falls upon rocks, among bushes, in water-courses, on the sides of hills. It is evaporated by the sun, or is washed away by the rain; insects destroy a part. The residuum (a dry hard cake) lies sometimes a year upon the ground, often impeding vegetation and never enriching the earth in anything like the proportion it would do if deposited under cover, and kept free from the action of the sun, in appropriate and covered receptacles.' The saving of the summer manure of cattle is variously stated by writers on the subject, but there can be no doubt, says Mr. Quincy, that it is 'unequivocally very great and important, and well worthy the solicitude of every farmer.' Mr. Quincy gives in his work some very valuable remarks as to his practice, quantity of land given to the crops, the kind of crops, and how much. It will be useful to give these remarks here.

'As to "my practice" in soiling, it relates, first, to the quantity of land to be cultivated for the purpose of preparing succulent food; second, to the particular articles to be thus cultivated; and third, to the times they are to be sown, so as to effect a regular succession of such food.

'1. As to the quantity of land to be cultivated. According to my experience, *one square rod of land* of rich loam in high tilth in grass, oats, barley, or Indian corn, is enough for the support of a cow a day, if cut and delivered to her in the barn. As, however, there is a great difference in the state of land and its productive power, and as it is important there should be no failure in succulent food, my practice has been to cultivate *one and a half square rods* of land per day for each head of cattle I intend to "soil," and, on this basis, I make my calculations in the spring of the year. For the quantity to be sown at every succeeding period, when to secure a regular succession of such food, a new sowing is required. To make this calculation sufficiently exact, the length of time it will take the article sown to come to maturity so as to be fit to cut, and the length of time it will afterwards continue succulent, are to be considered. The time it comes to such a state of maturity is, of course, the time it may be relied upon for "soiling." A like reliance may be placed on the time it will continue succulent. The general knowledge of practical farmers and experience will easily give information on both points.

'If any article sown in the spring will come to maturity on the 1st of July, and will continue succulent *ten* days, fifteen square rods of succulent food will be wanted for each cow "soiled." *One* cow will therefore consume fifteen square rods during that period, and ten cows will require one hundred and sixty rods, or about an acre of such food, for their support. On this basis of calculation, I have always found the number of square rods to be sowed, for such a period of succulency of the plant, is sufficient for about such a period of feeding, viz. *ten days*. On this calculation, I have safely "soiled" from *thirty* to *thirty-five* head of cattle, adding one acre of preparation for every ten head.

'Should anyone, however, adopt this practice for the first time, I should advise the preparing *two square rods* for each cow, to guard against every contingency to which a first attempt may be liable; for nothing will be lost, if the food should be proved more than was required. The surplus becomes a resource for the winter keeping, after it is too rank for "soiling."

'2. As to the particular articles to be thus cultivated, I have tried many besides those above mentioned, such as millet, lucerne, cabbages, peas, the tops of carrots, beets, or turnips. Each may be usefully applied in its proper season, particularly the three last. And whoever keeps milch cows will find roots an important auxiliary for milk in the winter season; and, of course, will find their tops a like important aid to "soiling" in the later months of autumn. But I think it best to enumerate only the fewest, the simplest, and the best known to all farmers, of the articles which, from experience, I have found the surest and the best to be relied upon for a successful conduct of the system. These are those already enumerated: oats, barley, Indian corn, sown broadcast or in drills for fodder.

'3. The time in which the above articles are to be sown. The usual period in this country for turning out cows to pasture is from May 29 to June 1. Antecedent to this period, no succulent food can be obtained for "soiling." Preparation, however, may be made the autumn previous, by sowing winter rye, according to the proportion required for "soiling" from the 10th or 15th of the month of May to the 1st of June. This could be done with advantage; but I have never practised it more than once, because, although I have always had rye fit for cutting at this time, yet it is too valuable, as grain and straw, for me so to use it, regarding as I do winter rye, at the usual prices of *grain and straw in this vicinity*, to be the most profitable of any grain product.

'The reliance on the "soiling" system, for succulent food, between May 20 and July 1, is *grass* cut and delivered in the stable; and, according to my experience, one and a half square rods per day for each cow "soiled" is ample for this purpose.

The grass thus cut was usually that which is the least likely to be preferable for winter keep; such as that growing by the side of my farm roads, or under trees, or that having the rankest fibre.

'The food sown and cultivated for soiling, in this climate, must have exclusive reference to the summer and autumn months, commencing with July 1. And the following is the order of sowing, according to my practice, justified by experience; the preparation of land sowed at each successive period being, as above stated, *one and a half or two square rods per day for each cow soiled.*

'To produce a sufficient quantity of succession of succulent food, sow—

'1. As early in April as the state of the land will permit, which is usually between the 5th and the 10th, on properly prepared land, oats, at the rate of four bushels to the acre.

'2. About the 20th of the same month, sow either oats or barley, at the same rate per acre, in like quantity and proportion.

'3. Early in May sow, in like manner, either of the above grains.

'4. Between the 10th and 16th of May sow Indian corn (the flat, southern being the best) in drills, three bushels to the acre, in like quantity and proportions.

'5. About the 25th of May sow corn in like quantity and proportions.

'6. About the 5th of June repeat the sowing of corn.

'7. After the last-mentioned sowing, barley should be sown in the above-mentioned quantity and proportions, in succession, on the 15th and 25th of June, and on the 1st or early in July; barley being the best qualified to resist the early frosts.

'The results of the above sowing in succulent food may be expected to be as follows, seasons of extraordinary droughts excepted.

'The oats sowed early in April will be ready to cut for "soiling," between the 1st and 5th of July, and will usually remain succulent until the 12th or 15th of this month.

'Those sowed about April 20 will be ready to cut between the 15th and 20th of July, and will last nearly or quite till August 1.

'Those sowed early in May will be ready to succeed the preceding, and last till about the 10th of this month. The corn sown on the 10th and 25th of May, and early in June, will supply in succession succulent food of the best quality, until early in September.

'The barley sown in July will continue a sufficient supply until early in November; at which time, and often before, the tops of roots, carrots, beets, or turnips, are a never-failing resource.'

The facts and inferences above stated fully prove the advantages of soiling. It ought not, however, to be concealed, that there are some inconveniences attendant on the soiling and stall-feeding of cattle, such as the additional labour and expense incurred by cutting and carting the green vegetables home to the sheds, both in winter and summer; but these are more than counterbalanced by the saving in food that is effected—by the increased productiveness of the land and the diminished waste—by the thriving of the cattle—the making of the dung under cover, and having reservoirs in which to preserve the urine. Under proper management one good acre of turnips will produce an excellent dressing for at least an acre of land, and, with a very small portion of hay, will completely winter-fatten an ox of fifty score pounds. If fed on the land, two acres of tolerable grass may fatten an ox; but not so well, nor will he be forwarded so fast in flesh, if exposed to the weather in all seasons, as if kept dry and moderately warm; the dressing, also, will be very partial and precarious.

It has also been objected, that where large quantities of food are accumulated for a considerable time they are liable to fermentation, and of course to waste. Such is the case with cabbages, turnips, and other roots, but it may to a very considerable degree be obviated, by paying due regard to the storing of the various vegetable crops, and their economical consumption.

It has likewise been objected by the opponents of soiling and stall-feeding, that the cattle are heated by being confined during the summer months, and that their health is injured; but this will never be the case where stalls are so constructed as to admit a regular circulation of air, and yet afford shelter from the attacks of flies. The cattle may also be allowed the freedom of an open yard; indeed, in that season, *fold-yards*, with open sheds, are by many preferred to stalls. This is the practice in Yorkshire, where the management of stock is well understood; and there is no scientific grazier who is not a strong advocate for perfect ventilation even during the inclemency of winter. Plenty of good and wholesome air is indispensably necessary to the preservation of the health and the speedy fattening of animals.

When grass (whether natural or artificial) is to be given, it should be cut in the morning for the evening food, and in the afternoon for the morning. The afternoon crop should be carried to the barn, or some other convenient place, and spread out in order to exhale its superfluous moisture; and in rainy weather both crops should be taken off the ground. Attention, however, should be paid to the due proportion to be cut; and, until this is ascertained, it is a good plan to measure each mess, and to chalk down the quantity *in weight*, which the basket, cart-body, or other vehicle employed for carrying food, contains. This practice will, at least, have a tendency to teach farm-servants to observe *method*, the value of which is of considerable importance in all business, and in none more so than in the various subjects that are connected with husbandry. In the early part of the season, when tares and clover are either inadequate to the support of the stock, or it may be thought expedient to change them gradually from dry to green food, a portion of these grasses may be mixed with the hay or other provender on which the cattle are fed; and if the mixture is made up over-night, the dry provender will be found to have acquired a sweet and pleasant scent, and to be rendered so moist and palatable as to be readily eaten.

As the various grasses peculiarly calculated for grazing or soiling cattle will be particularly detailed in a subsequent part of the work, we proceed now to enter on the subject of winter or stall-feeding, or box-feeding.

In concluding our remarks on the subject of summer soiling of cattle, we would caution our readers on one or two points connected with it. Like all other departments of practical farming, its success depends upon, and is greatly modified by, circumstances of locality, soil, and climate; so that a system which may be well adapted for one place will not be so for another. It would, for example, be in vain to expect good, or at least economical results, from the adoption of the system in hilly districts, where the pastures are not only poor, but uncertain in growth, and the climate variable and ungenial. In such localities the best that can be made of the land is to graze it, the farmer using his best judgment as to the kind and quality of stock best adapted for the pasturage.

Soiling, to be successful, must have fine rich land for the raising of that succession of crops which is the very foundation of the system; and this land must be kept in perpetual good heart. So that another element of success is good farming. Climate has also a good deal to do with the system, and the best is that not so much characterised by high temperature alone as by an alternation of warm sunshine with light and refreshing showers. This aids best the cultivation of the succulent plants and grasses demanded by the system. Where the temperature is normally high, yet the locality not much favoured on the average with rain, it is obvious that the application of irrigation will yield good results.

Another point to be looked to is the labour one. The system obviously is one in which a great deal of work on the part of the attendants is demanded. This is not heavy, but it is constant. The right direction and management of labour, then, will largely decide the success or non-success of the system. Labour-saving appliances should be unsparingly used.

CHAPTER XI.

OF WINTER, BOX, AND STALL-FEEDING CATTLE.

THERE are various opinions as to the best and most profitable way of accomplishing this branch of the grazier's occupation. The commonest way is to keep the stock in sheds surrounding open folds or yards, and to tie up the actual fattening cattle, and leave the others at liberty; but here the rain and the rain-water from the roofs of the sheds descend upon the manure and wash all the finest particles away. Stalls or sheds in which the fattening cattle are tied up in couples, or sometimes singly, is the next system. Here the litter is changed twice or thrice a week, and consequently, unless the reservoir for the manure is very well arranged, loss must ensue.

In well-arranged stalls there are shutters which may be used whenever the weather is inclement, and the cattle and stalls are regularly cleaned and attended to.

'Mr. Dobito,' as we have elsewhere remarked, 'is a great advocate for the *stall-feeding* system for ordinary purposes. He does not recommend it, however, for young beasts that are to be summered again, or for prize oxen. The young beasts should have well-sheltered yards, with high fences, to keep them from looking over, and good shelter-sheds. The prize oxen should be housed in loose boxes, with plenty of room in each for the animal to walk about in. If well arranged, Mr. Dobito says that there is no system equal to that of stall-feeding; it is the abuse of it which has got it into disrepute with some. The fattening-house, or stall-feeding tire, should be provided with underground drains with gratings to carry off the liquid manure into tanks provided for its reception. Shutters should be placed in the walls to regulate the heat, and wide passages at their heads to clean the mangers and feed them readily. The advantages of the stall-feeding system are the small quantity of litter required, which makes the manure better, the easy regulation of the temperature, and the quiet secured to the animal, so that he can eat his share in peace. The disadvantage is, that the animal cannot freely rub or lick herself: this, however, is got over by using the round brush, which is recommended.

'Mr. Dobito thinks that stall-feeding is not commenced early enough. As soon as the weather becomes damp and the days shorten, say in October, the grass begins to lose its fattening properties; the sooner, therefore, your stock is housed the better. When put up thus early they receive turnips of the large-formed description, such as the "red tan kind." Along with the turnips they have given to them half a stone of pollard or bran, with an equal quantity of hay or straw chaff. The bran, although considered loosening, Mr. Dobito finds to have the singular property of preventing the loosening action of the watery turnips. This style of feeding, although it does not fatten the beasts, yet brings them into the condition best fitted to enable them to make the most of that artificial style of living which is to take them through the winter.

'Early in November the food was to be changed to swedes, oil-cake, &c., in the following rations:—Morning's meal, one bushel of swedes, well cleaned from dirt, cut small by machine; then the refuse pieces being well cleaned out, a dry bait consisting of 2 lbs. of oil-cake, 3 lbs. of pollard, and a little hay chaff. While feeding, the manure and litter to be cleared, the floor swept clean, and plenty of fresh litter put in: every bullock is then to be well brushed with a dandy-brush, that is a brush made with whalebone. After all this, the animals are to be left quiet till after dinner, when another bushel of swedes is to be given to them in small quantities, followed by a dry bait of cake, pollard, and chaff, with the addition of 3 lbs. of bean-meal: this is left with them at night. The shutters should be closed or opened according to circumstances, the object being to maintain an even temperature—warm without inducing perspiration. It is essential to have the manger well cleaned out after every meal. After a month or so feeding on the above, the quantity of cake may be increased, and if more convenient the swedes may be changed for mangold-wurzel. Never change, says Mr. Dobito, from mangold-wurzel to swedes, or the animal will not get on so fast; but if mangolds are more plentiful than swedes, and you therefore begin to use the mangolds earlier, you have only to leave them exposed to the air for a week or two to wither, and they may be used as early in the season as you require.

'Cleanliness, warmth, and quiet are what Mr. Dobito insists upon, of course coupled with good feeding; but he says that very many tons of good oil-cake are wasted through the comfort of the animals not being attended to. He also claims the credit of introducing a cheap food in the form of pollard, or miller's offal, as it is otherwise termed.'

The newest system, however, is that of box-feeding. This consists in enclosing the cattle in boxes about eight or ten feet square and twelve feet high. The animals are not tied up. These boxes are sunk in the ground from two to three feet, and in the excavation, or tank, thus formed, the manure is suffered to accumulate until it rises to the level of the external soil. Thus a mass of straw saturated with excrementitious matter is obtained and preserved intact until it is required for some portion of land; all that is necessary is to strew about 18 lbs. of fresh straw over this bed of manure every day, and not a particle of fertilising matter will be lost. The animals, being free to move about, trample the whole into a compact mass, and will lie down on it without appearing inconvenienced by the exhalations from it, and certainly without suffering in appearance or health. Indeed, numerous experiments tend to prove that this is one of the most economical and advantageous ways of feeding cattle for the butcher. It is not, however, adapted for breeding cattle, as they require more air and exercise to develop their powers.

These objects are attained by the system of 'hammel-feeding,' as it is termed. A hammel consists of a small shed generally having about 144 or 150 square feet of surface; this opens out to a small court-yard about the same size as the shed, having a gate leading into it through which the hammel is supplied with straw, and the feeding-troughs—one in the shed and the other in the court: a water-trough is generally placed in the latter—(see the chapter on the Farm Yard Structures)—with food. In the hammel, while shelter is given to the animal, it has at the same time the great advantage of air and exercise. The great weight of practical evidence is in favour of the system of hammels as opposed to stall and box-feeding. Thus, to quote from one only of the many reports on the subject, Mr. Templeton of Clanbage, Holywood, Ireland, in a Prize Essay in the 'Transactions of the Highland and Agricultural Society of Scotland,' on the 'Best Modes of Housing, Soiling, and Pasturing Cattle,' says, 'that the cattle in all cases made the greatest improvements in the hammels, and the lots which had 3 lbs. of linseed-cake per day made a fair return for the cake consumed.' The litter used in hammels is moreover less by one-third than that required for stall-feeding.

As giving some details of feeding, and as bearing upon the subjects of the pasturing and stall-feeding of cattle, the following, from a Prize Essay by William Adam Eye, of Ranna, Aberdeen, in the Transactions of the Highland and Agricultural Society of Scotland, will be useful:

'The cattle experimented on were twelve two-year-old queys, crosses between the Aberdeen and short-horned breeds. They were brought in about the middle of June 1851, and after having been kept in the same pasture till July 10, were divided into three lots (four in each lot) of as nearly the same value as possible, by the reporter's farm-overseer and an experienced butcher, both considered good judges.

'The *first lot* of four were pastured out of doors, in a field of excellent first year's grass, consisting of rye-grass and clover, but principally of red clover. The part of the field railed off for this lot consisted of 3 acres 2 roods 6 poles. It was well sheltered on the north and north-east by a belt of thriving wood, and had in it an abundant supply of good spring-water. It had been well laid down after turnips, and afforded a good supply of food for the lot put upon it up to October 12, 1851, when they were removed and very soon after sold, along with the two other lots, to the same butcher.

'The *second lot* of four were tied up in stalls (two and two in a stall), and received daily as much of the same description of green cut rye-grass and clover as they could eat during the same period (from July 10 to October 12, 1851). They were regularly fed at stated intervals during the day, and watered once a day, and had an abundant supply of litter. They were also curried once a day. The extent of ground required to supply this lot with grass, part of which was cut twice, and part three times, was 1 acre 2 roods 35½ poles.

'The *third lot* of four were also tied up (two and two) in stalls, and received as much of the same description of rye and clover grass cut green as they could eat, with a like supply of water and litter. They were also curried once a day, and, in addition to the cut grass, each of the cattle composing this lot received daily a small allowance, by measure, of bruised oil-cake, and of bruised linseed and light oats. The extent of ground required to supply this lot with green provender, during the period of the experiment, was 1 acre 2 roods 35½ poles.

'All three lots throve exceedingly well, but it soon became apparent that the lot receiving the oil-cake and bruised linseed and oats, were advancing before the other two lots, although it was doubtful so much as to justify the expense of this food. The progress of the first and second lots seemed so equal during the period of the experiment, that no two judges who saw them could agree as to which lot had the advantage of the other; but the third lot continued to maintain its superiority during the whole period of the experiment.

. . . .

'It thus appears that there was a gain on the lot fed in the house on cut grass alone, over the lot pastured in the fields, of 3*l.* 16*s.* 8*d.*, and that on the lot which received the addition of oil-cake and crushed linseed and light oats, there was a gain over those pastured in the field of no less a sum than 8*l.* 8*s.* 2*d.*, and over the lot fed in the house on cut grass alone, of 4*l.* 11*s.* 6*d.*, proving beyond a doubt that high house-feeding is the most remunerative to the farmer.

'It may be proper to add that as the whole grass on the farm had been pastured by sheep during the winter, and till far into spring, and very closely eaten, it was later in the season before it could be either pastured by cattle or cut for soiling than otherwise it would have been.'

Stall-feeding usually commences about the end of October, and lasts nearly seven months, or until the commencement of May. Of all vegetable productions *good hay* is undoubtedly the best for fattening cattle; yet, except on the most luxuriant soil, a sufficiency of it can rarely be obtained for finishing them off for the market; hence it becomes necessary to have recourse to other things in combination with it, as cabbages, carrots, parsnips, turnips, or other succulent plants, or oil-cake. Barley, rye, oat or pea-meal, if mixed together, in about equal proportions, with the occasional addition of a small quantity of bean-meal, may likewise be given with advantage, if the price will admit of it, in the ratio of a quarter, or at most half a peck, to each beast, in conjunction with cut hay. Of the last-mentioned article it may be observed, that the hay made from grass mowed after the cattle, is usually employed for feeding live stock at the beginning of winter, the best being reserved for the spring; and where a few pounds of salt have been thrown over each load, when stacked, it is so grateful to cattle, that they have been known to prefer poor hay *salted* to good hay *untouched*. Salt acts as a condiment; it assists digestion; and evidently is eaten with avidity by most ruminating animals. The last few seasons having proved more than usually wet, a large quantity of hay was obtained in such bad order, that many modes were proposed by which it could be made more valuable for feeding purposes. From those proposed we select that recommended by Mr. Bowick, an experienced authority, in 'Bell's Weekly Messenger:'—

Fennygreek (powdered) . .	112 lbs.
Pimento . . .	4 ,,
Aniseed . .	4 ,,
Carraway	4 ,,
Cumine . .	2 ,,

These to be mixed, and the mixture strewed on the hay in layers, as it is built in the stack. Mr. Bowick does not offer this as the best to be made, but he gives it with confidence as a safe, reliable, and valuable compound for the purpose indicated.

The most luxuriant of all vegetable productions, perhaps, is the *cabbage* with its numerous varieties, which, when combined with cut pea or oat-straw, has been found singularly useful as winter fodder for *store stock*; and which, with the addition of good hay, will fatten oxen or bullocks rapidly, besides yielding a larger quantity of manure than almost any other article used for winter feed.

Dr. Voelcker says that no green food cultivated on the large scale contains so much nutritious matter as cabbages. Cattle, moreover, are very fond of them; and for calving cows they are specially valuable, as they increase the flow of milk.

Kohl Rabi is rapidly coming into favour as a feeding material, especially for milch cows. This root is more nutritious than white turnips, and 'fully equal if not superior,' says Dr. Voelcker, 'to swedes and mangolds. . . I may remark, with respect to the kohl rabi, that it is an excellent food for milch cows, inasmuch as it produces rich and good milk: the butter made of such milk has a pleasant taste, altogether unlike the disagreeable flavour that characterises butter made from the milk of cows fed upon turnips.'

Mr. Thomas Baldwin, Inspector of the Agricultural Schools in Ireland, who has contributed so many papers of value on farming subjects, has experimented exclusively on the feeding value of kohl rabi, and he has detailed the results in the 'Irish Farmer's Gazette.' These do not show the high value which some put upon this root. The cattle did not like the roots, and Mr. Baldwin concluded that, weight for weight, swedes were superior to them. Moreover, upon the farm land upon which the two crops were sown, the swedes yielded 25 tons, the kohl rabi only $13\frac{1}{2}$ tons per acre.

Parsnips have been employed not only for feeding store cattle, but particularly for fattening oxen, which eat them most advantageously; the benefit thence derived being, in the estimation of some graziers, nearly equal to that obtained from oil-cake; but they are apt to cloy the appetite, and should therefore be given with other food, or if alone, they should not be continued for a long time together. The flesh of animals fed on parsnips is said to be of rich flavour and juicy.

Next to parsnips we may class the *Carrot*—a most useful root, more grateful to cattle, and better calculated to be a constant food than the turnip. It is particularly valuable for feeding horses.

Mangold-leaves and turnip-tops are often used as food for cattle, but they do not rank high as a nutritious food; they are apt to scour the animals partaking too freely of them; they should therefore be given only in moderate quantities and along with other more binding food.

It is only of late years that the value of the mangold-wurzel has begun to be justly appreciated. It bids fair to rival the Swedish turnip. Mr. Hillyard, an excellent authority, thus speaks of it: 'I have often been asked which I preferred, this or Swedish turnips; my answer has invariably been, for some purposes I prefer one, and for some the other. For stall-feeding until the spring, turnips are the best; but at that season the turnips having lost a portion of their nutritive quality, and the mangold-wurzel, from keeping, having lost much of its watery particles, and thus improved, I then prefer the latter.'

'Mangolds should not be given to stock for some time after being taken up—say towards the latter end of December, or the beginning of the year—as, when first taken up, they possess an acrid principle which has a tendency to scour the animals. This disappears after a few months' keeping, and the nutritive value of the root is increased. The superiority of old stored to newly-taken-up mangolds must not, however, be attributed solely to this, but in no small degree to the change of the pecten into sugar. Dr. Voelcker mentions the fact, that his experience shows that mangolds are the worst description of roots that can be given to sheep. "Two years ago I found this to be the case, when feeding various lots of sheep, with a view of ascertaining practically the relative value of different feeding materials. For several days the sheep refused to eat the sliced mangolds, and were content with the small quantity of hay which was given to them at the same time; and only after four weeks they became in some degree reconciled to the taste of mangolds, but did not get on well upon this food. Although these sheep were supplied with a fixed and limited quantity of hay, and as much sliced mangolds as they would eat, I found at the end of four months that they had not increased a single pound, whilst my experimental sheep, fed upon swedes and hay, increased, on an average, at the rate of 2½ lb. per week. On further inquiry, I have learned that this observation is confirmed by many practical feeders. . . . This peculiarity of mangolds thus shows that a feeding substance which, like this root, is justly esteemed on account of its fattening properties when given to beasts, may not possess any great nutritive value when given to sheep. Another direct proof is here afforded of the fact that the chemical composition of food does not solely determine its adaptation to a particular purpose; for, like mangolds, other feeding materials may be rich in nutritive substances, and valuable when given to fattening beasts, whilst it does not agree at all with the constitution of sheep."'

Turnips supply a nutritive article of winter food, although, from their peculiarly moist nature, they require to be combined with cut hay, to which a little barley or oatmeal may occasionally be added.

When the fattening process commences, the *white* turnip will perhaps be preferred. It is cooling and slightly aperient. The quantity allowed for each beast should be, on the average, a bushel and a half per day. To this should be added twenty-four pounds of cut hay, and about two quarts of meal mixed with the hay. The *white* turnip, however, must soon be changed for the swede, one of the most useful plants that was ever brought into our country.

The old Norfolk farmers used to give these turnips whole, and with more freedom from accidental choking than would be thought possible. It sometimes, however, happened that the turnips would stick in the throat and threaten to suffocate, or actually destroy the animal. The following were the means of relief usually had recourse to in these cases:—The farmer or the carter took the cart-rope, or oftener still the cart-whip, the handle downward. This he introduced into the mouth, and passing it down the gullet, hammered away until he had driven the turnip into the paunch, or ruptured the gullet, or bruised the parts, and set up a degree of inflammation that destroyed the animal. The most efficient and only proper instrument in such a case is a *probang*. It costs but little, and may be had of any of the veterinary instrument-makers, and particularly of Read in the Regent Circus, Piccadilly, in London. It consists of a leathern pipe kept from collapsing by coiled wire, and contains a movable whalebone stilet, that can be worked up and down within it, and made to protrude an inch and a half from the lower end. The rounded extremity of the probang is introduced into the mouth gently at first, then with gradually increasing, and at length with considerable but never violent force, pressed upon the obstruction. If that does not yield, the stilet is to be worked up and down, and made to tap or gently hammer upon the turnip, when, in the great majority of cases, it will gradually give way.

Should it, however, be firmly fixed, the instrument must be withdrawn, and half a pint of olive-oil poured down the throat. The fingers being then applied externally, and the turnip grasped, it will be practicable to force it upwards, the gullet being rendered slippery by means of the oil. Being forced up to the back part of the mouth it may be removed by the hand, the mouth having been held open by a piece of wood with a hole sufficiently large to admit the passage of a small hand.

Should the turnip still obstinately stick in the gullet, a veterinary surgeon must be summoned, who will cut down upon the obstruction, and remove it without difficulty. But turnips are now almost always sliced for stall-feeding. The lazy and dangerous practice of giving them to the cattle whole has almost entirely passed away.

When the beasts begin to thrive, oil-cake may be resorted to if the convenience of the farmer will permit it. This is thought to be a dear food, but, where the carriage does not cost too much, it will, on account of its fattening property, answer the farmer's purpose well. The quantity of turnips should remain the same; the hay should be diminished one-third, the meal one-fourth, and two or three crushed oil-cakes daily substituted.

Linseed has been given by some graziers instead of the oil-cake;

from its oleaginous nature, however, it requires to be mixed with other and less nutritious substances. Some bruise and steep it four or five days in cold water, or two days in hot water, until it becomes a jelly.

The Swedish turnips may be continued until after Christmas, and then, as they will have lost much of their nutritive power, and the mangold-wurzel have improved, the latter should be given chiefly or entirely.

The *Stone* turnip is an excellent root, but it is more calculated for sheep than for cattle.

Among the various vegetable productions that have been appropriated to the stall-feeding of cattle, none have occasioned greater discussion than *Potatoes*. They furnish an excellent supply, particularly when cut and steamed; and, as will be seen from the subsequent facts, they appear adequate to the fattening of neat cattle in combination with a comparatively small portion of other food.

In the eleventh volume of the 'Annals of Agriculture' we meet with the following statements relative to these roots, from Mr. Campbell, of Charlton. He observes, that '100 bushels of potatoes and seven cwts. of hay are generally sufficient to fatten any ox that thrives tolerably well. The roots should at first be given in small quantities, and gradually increased to one or two bushels per day; dry food being always intermixed, and the proportion of hay being uniformly regulated by the effect which the potatoes produce on the bowels. There should be at least *five servings* in the hay; and, according to the quantity of roots which a beast can be induced to eat with appetite, will be the rapidity of his fattening, the diminution of expense, and the increase of profit. The hay should be cut once or twice along the truss and three times across it, so that it will be in square pieces of eight or ten inches, in which state the cattle will eat and digest it more readily, while their fattening is considerably expedited.' The potatoes, however, according to Mr. Campbell, need not be cut, except at first, in order to entice the beasts to eat them; but they should always be *fresh* and clean. No corn or meal is necessary; yet, if it can be procured at a moderate price, it will contribute materially to facilitate, and of course to render more profitable, the whole system of cattle-feeding. Should purging be brought on by the use of raw potatoes, which frequently happens, the quantity of meal or other dry food should be increased until the beasts have become accustomed to the roots, when this inconvenience will generally cease.

Potatoes, however, being an article of constant consumption in our markets, and having been of late years diminished by disease, are more subject to variations of price than any of the other roots commonly used in fattening cattle. The grazier must, therefore, be governed by the consideration of their comparative cost, as well as quality. The cultivation of potatoes is also expensive; and there is no doubt that they exhaust the land. In consequence of this they are seldom resorted to as a fallow crop, even on soils best adapted to them, while in some of the best grazing districts the ground is too strong and heavy for their growth. It should also be remarked, that they have often been found prejudicial to the health of cattle, when given for any length of time in a raw state.

In some districts where winter food is with difficulty procured, *heath* may be advantageously resorted to. In a paper on this subject communicated to the Board of Agriculture by James Hall, Esq., he states that, in the course of numerous experiments on furze, broom, rushes, bean-straw, and other neglected articles, he had discovered that, if heath is cut when young and in bloom, and the finer parts infused in hot water, it produces a liquid very grateful to the taste, eagerly drunk, and extremely wholesome.

Being anxious to know how far young heath might be useful to cattle, he tried the experiment on a cow. When first tied up, she refused to eat any of the heath, except the very finest part, nor did she appear to relish an infusion of it when set before her; hunger, however, compelled her first to drink the infusion, and then to eat the heath; and on this food alone she lived for nearly a fortnight, during which time her milk was reduced in quantity, although its quality was much improved.

Satisfied from these experiments that cattle may be long supported by young heath, Mr. Hall proceeded to ascertain how far the plant was capable of retaining its valuable qualities when dried and laid up. He therefore cut some at the end of the summer, and dried it in the shade; and, at the end of two years, it produced an infusion as strong and well-flavoured as at first. The effect was the same at the end of three years.

Young heath may be procured by burning the old which remains on the ground. The ashes afford an excellent manure, and generally cause a fine young crop to spring up, that will afford nourishment for the stock in the ensuing months of August and September.

As food for sheep, it forms the chief portion of their sustenance on mountain pastures during the latter part of autumn and the beginning of winter.

Furze, as a butter food for dairy cows, is considered very valuable by some farmers. Cows are very fond of it, and it is said to counteract the bad flavour given to milk by turnips. From an account of a farm in Warwickshire, where furze is grown and used, we gather the following particulars. The furze meadow consists of ten acres. Its produce—with a feed, every twenty-four hours, of turnips, mangold-wurzel, potatoes or grains, given to counteract the richness of the furze, and without any hay—supported for the winter half-year twenty-one head of milch cattle and six horses of the large German breed, all of which were in high condition. The cows milked remarkably well, the milk and butter being of excellent flavour. The owner had also sold off the same field 25 tons of furze, at 20*s*. per ton, and having about as much more left he had it cut and burned, as it is necessary to cut it every year. The saving of hay alone was calculated at 100*l*. per annum. The furze prickles require to be broken by a furze breaker or machine, before being given to the cows.

The Rev. Mr. Townsend, near Cork, who has been for many years a persistent advocate of furze as a feeding material, writes as follows on the subject to the 'Mark Lane Express'—

'I have endeavoured, for half a century, to induce farmers to cultivate furze for fodder for their cattle in winter, knowing from experience of many years that it is the best food; much cheaper and more nutritive than hay, less than a quarter of an acre producing sufficient for one horse or one cow, from November 1 to May 1, which would require the hay of one acre of meadow. It has many advantages. Thick-winded and broken-winded horses are free from their infirmity while fed on it. It is best for milking cows, giving their milk and butter the taste and colour of that produced from grass-fed in summer; and, if fed on turnip, there is no turnip taste. A half hundredweight of turnip is an ample supply for an animal fed on furze, where 1 cwt. is required with hay. Once sown it is perennial; lasts for twenty and more years; improves by annual mowing, and requires no renewal of seed, no cultivation, no manure. It is cheaply prepared for the use of cattle by a Richmond and Chandler, or a Picksley and Sims 10*l*., 7*l*., or 5*l*. straw-cutter, run once through the cutter. Where worked by donkey, horse, or water power, the expense per head is the merest trifle. Half a hundredweight of turnip crushed or steamed given daily with four bushels of furze is ample food for a horse at farm work. A farmer who has furze is enabled to husband all his hay and straw, and a large portion of his root crop for late spring use, and hay and straw for cutting in equal quantity with early vetches, young clover and Italian rye grass, which makes them, instead of a softening, loosening weak food, to be a firm, solid, good food as horse can get, and on which a cow can eat to repletion without fear of hoving; and by cutting these crops as soon as the scythe can catch them, and top-dressing with guano, phosphate, or dung, getting an additional crop of soiling. By having furze, a large increase of cattle can be kept always in house, best fed. There is vast increase to the manure heap, the farmer's magic wand. It grows in high, dry, poor, shingly, rocky land, if the ground is well ploughed and dug, and the seed sown either after a fairly manured grain crop, or dressed with ashes, or 1 cwt. of guano, and 2 cwt. of phosphate, 35 lbs. seed sown to the statute, 52 lbs. to the plantation acre; requiring no further manure or culture, or expense of any kind, but always to prevent the ingress of any animal, to cut every year, and annually to cut and come again. All prefer it to hay, and while feeding on it are in best condition. When it is all used, and they put on hay and oats, they will not keep in the same condition. If it was general on every farm, cultivated as directed, the one-tenth of the farm, whatever be its size, appropriated to it, the increase of cattle would be fivefold what they are. Much of the land it would grow well on now produces nothing. The better the land, the better the furze in quantity and quality. If rich grassy land is trenched, the surface buried, and the friable earth and some of the subsoil thrown on the top, and manured as before directed, there will be one animal kept for the winter six months for every two acres the farm consists of, without any aid in hay, straw, or pasture from the other nine-tenths of the farm. The same mode of sowing as for clover; either after the corn is sown, or when in grass corn. The quantity of seed 25 lbs. to the statute, 52 lbs. to the plantation acre. The time for sowing—March, April, or May. Sown in 1862, it will be fit for use in November 1863, and thenceforth every year. The quantity for a horse, two bushels by day and two bushels by night. Cows do not consume so much. The mode of preparing, cut by the straw-cutter. Furze so cultivated requires no crushing or pounding. Cattle eat it freely with this preparation. For calves it is good to cut it twice: the second time put a little hay in the trough of the cutter, to carry on the cut furze. The kind, French furze: the price is 10*d.* per lb. for a large, 1*s.* per lb. for a small quantity. Give it a fair trial, or visit those farms in the county of Cork where it is used, and you will receive a benefit you who are without it little calculated on.'

Fir-tops, or the young and tender shoots of fir-trees, have likewise been employed with effect in cases of emergency, as a substitute for other articles.

A correspondent states, that, being in great want of provender, and having scarcely any hay, he was compelled to feed his beasts on fir-tops, and though he had more than two hundred head of neat cattle, he did not lose more than *four or five* out of that number; while many graziers, farmers, and breeders lost one-half, and several of them nearly the whole of their live stock. There is one circumstance, however, that should never be forgotten by the farmer—that, valuable as stall-feeding is, it will not suit all cattle, and particularly lean cattle.

The stall-feeding system should not commence until the animal is half or three parts fat. The grass will seldom carry him farther, and the season is approaching in which he would necessarily decline.

Straw of the cereals and of beans has been much written about lately, as a feeding material for cattle.

'The composition of the straw of the cereals,' as we have elsewhere remarked, 'is very similar in all. Yielding a large percentage of woody fibre, and but a small one of flesh-formers, they possess but a low nutritive value. But this is not precisely the way to judge the matter: the important matter of bulk must not be overlooked. This is, indeed, essential, for without it health would not be maintained; hence the value of the straws, when used in conjunction with food richer in flesh-formers and heat-givers. As regards oat straw, it is worthy of note, that when cut green—the ear, however, being fully formed—it is highly valuable as a feeding material, its value being increased one-fourth. When used, it should be cut into half-inch lengths.' 'Oat hay,' says Dr. Voelcker, 'or oats cut green, contains a larger proportion of soluble substances, readily digestible, but which become insoluble, and less readily digestible, when allowed to ripen. Animals fed upon young shoots of vegetables, which are soft and eatable, thrive well, but can scarcely maintain themselves upon matured food, which becomes woody and indigestible, and passes through the intestines in a great measure unchanged. The reason of this difference is, that the starch, gum, sugar, and other soluble and readily digestible substances which we find in the young shoots of vegetables and roots, are partly rendered insoluble, and gradually changed into indigestible woody fibre, which substance increases with the age of the plant.'

From the above analysis of the straws, it will be noticed that those of beans and pease are much more valuable as feeding-stuffs than the straws of the cereals; cut into short lengths, and mixed with the chaff of cereal straw, they will add value to the latter.

Dr. Voelcker has thoroughly investigated the subject of the feeding-value of straws as compared with hay, and has published, in a recent paper, a number of analyses of the various straws.

It appears from these analyses:—

1. That hay, especially clover hay, is much richer in albuminous or flesh-forming compounds, than straw.

2. That it contains also more oil and fatty matters.

3. That both clover and meadow hay, when well made, are much richer in sugar, and other soluble matters, than straw. Good meadow hay, especially, contains a good deal of sugar, and is sweet to the taste.

4. That the proportion of indigestible woody fibre, particularly in meadow hay, is much smaller than in straw; and

5. That good meadow hay contains more digestible fibre than clover hay.

For these reasons, both clover and meadow hay are, as feeding substances, superior to straw.

The kinds of straw that approach in composition the nearest to hay, are green oat straw and pea-haulm.

It has been stated already that the state of maturity in which straw is harvested materially affects its composition and feeding value; likewise, that probably the climate and character of the land have great influence in producing the most nutritious kinds of straw. It is, therefore, impossible to pronounce, in a general way, whether wheat, oat, or barley straw is the most valuable for feeding purposes. Assuming, however, the land and climate to be equally well adapted for producing the best kind of straw in each case, and the crops to have been harvested in the same stage of maturity, I am inclined to place the different kinds of straw in the following order, beginning with the most nutritious, and ending with the least valuable for feeding purposes:—

1. Pea-haulm.
2. Oat straw.
3. Bean straw, with the pods.
4. Barley straw.
5. Wheat straw.
6. Bean straw, without the pods.

The refuse of the cereals, as bran and malt-dust, or combs, is highly valuable for feeding purposes; both bran and malt-dust are used by Mr. Horsfall in his well-known system of feeding dairy cows.

Dr. Anderson has also closely investigated the subject of the feeding value of straws, and shows that the value is much higher than has been generally supposed. There can be no doubt at all events that the using it as fodder, merely that is as bedding in stalls, or to be trampled under foot in courts, is not the most economical way to use straw, and Dr. Anderson has done good service to agriculture in pointing out how best straws can be used. After giving analyses of straws all referring to various points, this eminent authority has the following:—

'Passing from these points to the more general considerations regarding the nutritive properties of straw, it must be observed that their value is much higher than might have been expected. The position in which they stand may be best rendered obvious by a comparison with the turnip. That root contains on the average from 1·2 to 1·4 per cent. of albuminous compounds, and 4 or 5 of respiratory elements, of which 3 or 4 are soluble in water. It will be observed then, that, as far as nutritive matters are concerned, straws generally stand far above the turnip, surpassing it slightly in the albuminous, and enormously in the respiratory, elements. As a source of these elements they must hold a very high position, and in this respect are surpassed only by the grains and some few other substances. When compared with roots and grains, however, a very marked difference may be observed between the relative proportions of these two great classes of nutritive elements. The ratio of the albuminous to the respiratory compounds is, in the turnip, as 1 to 3 in round numbers, and in the grains as 1 to 7—that is to say, for every pound of albuminous compounds contained in a grain, as wheat for example, there will be about 7 pounds of respiratory compounds. In the straws the proportions are very different, the total respiratory compounds being never less than 10, and sometimes nearly 30 times as abundant as the albuminous. If the soluble portion of these substances only be considered, then the ratio approaches nearer to that observed in the more concentrated foods, though on the whole the excess of respiratory elements is very marked.

'Returning now to the comparison between the turnip and straws, it is obvious that though the latter greatly exceeds the former in the amount of substances which *may* be absorbed, no one would for a moment think of asserting that straws are therefore of greater nutritive value. The reverse is undoubtedly the case, and the cause of this is to be found in several considerations. 1st, It must be attributed in part to the unsuitable proportion of those classes of nutritive substances; for if highly nutritive substances, such as the turnip and grains, contain a relatively much larger proportion of albuminous compounds, then it may be expected that in the straw the small quantity of these substances will cause the assimilation of only a proportionate quantity of the respiratory elements, and the surplus will be wasted. Hence, also, the use of highly-nitrogenous foods, such as oil-cake and bean-meal, along with straw, must be considered good practice. 2nd, It may be fairly anticipated that the insoluble portion of the nutritive matter will in general be of little, or possibly sometimes of no, use. 3rd, Owing to the difficulty with which the soluble matters pass into solution in water, a considerable part of them may escape digestion. And in this respect, the contrast between straw and turnip is very marked. In the latter, the larger proportion of the constituents are not only *soluble*, but already *dissolved* in the 90 per cent. of water present; but in the former they are not dissolved, but are in the solid state in the dry straw, and must undergo the process of solution, which is effected during mastication and rumination. The difficulty of dissolving the soluble matters of straw in cold water has been already adverted to, and even when warm water is used the process is slow, and requires considerable time. From this it may be concluded that straw ought to be well moistened and steamed before being used. 4th, The large proportion of woody fibre existing in all straws must interfere materially with the production of the full effect of its nutritive element.

'Notwithstanding these drawbacks, the general conclusion to be drawn from this inquiry is, that straw, and more especially oat straw, possesses a very considerable nutritive value, but that it is most advantageously used along with the more highly nitrogenised foods. It must be observed, also, that, in a mechanical point of view, it may even have its uses in the intestines, and by giving bulk and firmness to the mass of food contained in them, assist the process of digestion and absorption. Such are the conclusions to which analysis leads; and I will only add, that a minute and careful series of feeding experiments with straw, under different circumstances, would be a great boon to practical agriculture.'

The use of straw as a feeding substance for live stock has largely increased since the issue of the last edition of this work, and with results at once economical and beneficial. Given in its natural form, or long condition, the lowest results are, as may be supposed, obtained, for not only is much of the straw wasted by being trampled under foot by the animals; but it is presented to them in the least convenient form, so to say, and certainly in that which is far from being the most palatable. To overcome the dislike which some cattle have for it, and the difficulty which all display at first eating it, the practice of cutting the straw into 'chaff,' as it is called, or short lengths by the straw-cutting machine, has been of late introduced. This, although better liked —and less wasted—by the animals, cannot at the best be said to be a 'toothsome' or tempting article of food; and there is a difficulty to get some animals to take to it at all—kindly they never do. To overcome the difficulty, the chaff is mixed with other and more palatable feeding stuffs, as meal, ground oil-cake, crushed grain, bruised oats, beans, &c. But even in this state the food may be, and is, taken by the animals, but it is easy to see that it is not so with that readiness which betokens a keen relish. If moistened with water the ingredients are better liked, still more so if salt be added to them. But it is when fermentation is allowed to set in, all to be covered in for a time longer or shorter as the case may be, that the relish we have referred to displays itself. It is not known to whom agriculture owes the introduction of this new method of treating food—the fate apparently of all things nearly connected with the art—but, judiciously availed of, it promises to create quite a revolution in the practice of feeding with foods in which straw is made to form a principal ingredient. Many indeed can scarcely fail to have noticed the fact how with such eagerness pigs devour the food given to them which has gone sour, or in which fermentation has advanced to a considerable stage of progress. This may have given rise to thoughts connected with the application of food in a like condition for stock; we ourselves applied it years ago with decided success.

But the mere fermentation of the mixed foods named above is not that alone which decides the economical use; it is the kinds of food which are mixed, and the way in which they are treated, which constitutes the feature of the best system. And that system owes its introduction to Mr. Samuel Jonas, of Crishall Grange, Saffron Walden. Briefly described, the system consists in cutting large weights of wheat straw into chaff, placing it in large bins, mixing it with green food cut also by the machine, such as rye or tares, in the proportion of 1 ton of wheat-straw chaff to 1 cwt. of the green food and 1 bushel of salt. When the whole is thoroughly mixed the mass is pressed closely together into the bins, in the early spring months, as soon as the green food is ready to be cut, and allowed to remain till October, when it is begun to be used, its use being continued throughout the winter months. What may be called the chemical result of this process is described by Dr. Voelcker in a very practical paper in the 'Royal Agricultural Society's Journal,' vol. vii., part 1, No. 13, thus—'The addition of the green stuff causes the straw chaff mixture to heat; the volatile and other flowery principles produced by the fermentation are retained by the straw chaff, itself undergoing a kind of slow cooking process; and they impregnate the whole mass with an extremely pleasant flavour, scarcely inferior to that which characterises well-made meadow hay.' But although the mass, or mess, does possess this flavour, it is not of course equal to hay in nutritive properties. Dr. Voelcker, therefore, recommends some nutritive food, such as ground oil-cake, to be sprinkled over the mass. At the same time it is worthy of remark that there is really not much practical difference between the mass and good hay. The cake used for this purpose should be rich in albuminous compounds. Green German rape-cake or decorticated cotton-cake will bring the mixture up to a relative value as regards those compounds equal to that of good meadow hay. About 2 cwt. of the rich cake ground into meal, added to 1 ton of the mixture, will be found a good proportion. In Dr. Voelcker's paper, analyses are given of the mixtures, and of their separate constituents, with several remarks of practical value worthy of being attended to. The opinion of this eminent authority is wholly in favour of the plan introduced by Mr. Jonas, and he expresses the hope that that plan will be used 'throughout the length and breadth of the land.' As we have already stated, much can be done by the farmer in making the most of the materials he has at command by judicious mixing of them. We have indeed much to learn as to food and feeding.

CHAPTER XII.

OF ARTIFICIAL FOOD FOR CATTLE. PREPARATION OF FOOD.

HAVING thus stated the different vegetable productions which have been advantageously employed in feeding and fattening neat cattle, we will proceed to speak of other articles and compounds which may also be used with benefit.

At the head of these stands linseed, and there is nothing comparable to it for feeding or fattening cattle, or even for increasing the milk of cows.

Various experiments have tended to prove that linseed, when given whole, passes through the animals without undergoing much, if in some instances any, alteration: hence it cannot have done them the least good; and when crushed and given raw, it often produces purgation. It therefore becomes evident, that to obtain from the use of it those beneficial effects which it is so capable of producing, it is necessary that it shall undergo some process. The form in which it is most ordinarily given is that of linseed-cake, which is a mass of linseed whence the greater part of the oil has been crushed, and this provender certainly is most nutritious. Nevertheless many experiments have been made with the view of discovering whether or not a still more advantageous use may not be made of linseed. Mr. Curtis, of West Rindham, Norfolk, fed several bullocks on chopped straw, over which he poured linseed-oil, and mingled the mass well together. He began with half a pint of the oil, and, as the animals became accustomed to it, and ate it freely, increased the quantity gradually to a quart a day, and was satisfied with the effects it produced. We regret that we have been unable to obtain any data verifying the positive results of this experiment.

Preparations of linseed have been in use for the last sixty years. Mr. Hillyard used to steep the seed, after having crushed it, in cold water, in order to extract the mucilage; but as this process was tedious, often occupying at least a week, he tried hot-water, and found that by its means he produced a better jelly, and in one quarter of the time: but even this did not satisfy him, so he tried what boiling the linseed would do, and ended by adhering to this last system.

But it is Mr. Warnes, of Trimingham, to whom should be awarded the merit of drawing attention to the best modes of using linseed, and to the importance of flax-seed as an adjunct to the system of fattening cattle. He ground it into meal and mixed it with boiling water, in the proportions of a pound of meal to a gallon of water,[1] and then mixed it with other substances, as given singly it was too oleaginous, and apt to disagree with the animals. The following are some of the compounds proposed by Mr. Warnes for feeding animals put up to fatten :—

1st. A mixture of three parts bean, pea, oat, or barley meal is incorporated with one part linseed meal. This latter is first reduced to a mucilage in the manner above described, and the other meal then incorporated with it. Bran, the chaff of corn or flax, or cut grass or turnips, according to the season, may be added. The mixture is not given to the cattle until cool. It will keep for a week, if the air is excluded from it.

2nd. Turnips, carrots, mangold-wurzel, cabbage, or potatoes may be taken, cleansed from dirt and sliced, then put into a boiler with enough water just to cover them. As the roots are cooked they should be removed a little at a time into a strong vessel close at hand, and there mashed by one person, while another strews linseed meal over them, so that it may become thoroughly incorporated with the mass. When the whole is mashed, and the proper quantity of meal intermixed, it should be rammed down and the vessel covered over, in order that the heat may be retained sufficiently long to dissolve and amalgamate the meal with the other ingredients.

3rd. Take clover or any other grass, or bean or pea haulm, or hay or straw, and chop them up fine, or chaff or bran, and mix them with the linseed mucilage, either separately or conjoined, so as to form a consistent mass. Cover it up close, in order that the heat may be retained as long as possible, and thus partially cook the whole, and give it to the animals when it begins to cool.

The quantity of these compounds to be given per day will depend upon the size and condition of the animal, but in all circumstances it is better to give a little and often than to run the risk of nauseating the animal by large meals.

Mr. Nicholls, from whose excellent paper on 'Box Feeding with Linseed Compounds' we have been quoting, describes Mr. Warnes's system as being one of the best and most economical that can be practised for feeding cattle, both from its excellent effects on the animals and from the quantity and superior quality of the manure it yields.

Mr. Marshall's compound for fattening cattle is as follows :—

$3\frac{1}{2}$	gallons of water.
2	lbs. of linseed meal.
5	lbs. of barley meal.
10	lbs. of chaff.

The above is the allowance per day for each animal.

[1] Royal Journal of Agriculture, vol. viii. p. 480.

Mr. Hillyard gave his cattle

9 lbs. of cut hay.
2 lbs. of boiled linseed.
2 lbs. of boiled potatoes.
$\frac{1}{4}$ lb. of molasses.
$3\frac{1}{2}$ gallons of barley and bean meal mixed.[1]

The *adulteration of seed oil-cakes* is unfortunately carried out to such an extent as to render the following remarks of Dr. Voelcker, on the testing of them, peculiarly valuable :—

'Let me point out how you may examine cake, so as to be able to form some opinion as to its qualities. An excellent way of examining all descriptions of cake is to reduce them to powder. I should recommend for the purpose a common kitchen grater. You should grate it till you have about half an ounce of powder. It is better to powder it in the way I have mentioned than to reduce it in a mortar to a fine powder, for in that case you would be likely to destroy the character of the seeds of weeds, and reduce the bran, if there is any present, into a condition too fine for examination. The powder should be mixed with about five ounces of water. With good American cake the mixture is transparent, light-coloured; it produces a stiff jelly, which is very agreeable to the smell and the taste. The cake is so nice that one might almost eat it with pleasure. If, however, you examine foreign cakes, which in nine cases out of ten contain other descriptions of oily seeds besides linseed, you will find the jelly to have a very disagreeable smell, often very much like a canary-bird cage; it smells like the refuse of canary-bird seed. This peculiar smell arises chiefly from the camelina seed in such cakes. Then I would also observe that the colour is quite different in good, clean, or bad cake. The latter has a dirty grey colour, and if you examine it with a pocket microscope you discover readily the particles that are not linseed. By diluting the thick paste with water and stirring it up, you can recognise the sand, which then subsides better. Then above the sand generally floats the bran, which can be recognised by its structure. Indeed, by the simplest solution, or rather suspension in water, you can recognise a great many foreign matters in cake, and to some extent likewise recognise its condition. Then in addition to this examination, I would observe that in the case of rape-cake you ought to take half an ounce of the powder and mix it with six ounces of cold water, keeping the mixture in a stoppered bottle, and then examine it after the lapse of twenty-four hours—not before. It is a singular fact that rape-cake, even when containing a very large proportion of mustard,

[1] Farmer's Magazine, 1850, vol. xxi. p. 191.

has no smell whatever, nor is the smell developed immediately on mixing with water. The fact that the smell of mustard does not appear within an hour, or even two or three hours, does not prove the absence of mustard. But if you place the bottle in a tolerably warm room, or even in a common sitting-room, and do not find a strong smell after the lapse of twenty-four hours, you may safely conclude that there is not an injurious quantity of mustard present. If the smell is very strong, more particularly if the taste is strong, mustard is present in injurious quantities. I lay particular stress upon the last remark, if the taste is strong, because all rape-cake is to a certain extent pungent; indeed all the seeds belonging to the Brassica species develop a strong smell, but you do not get anything like that pungent taste in the specimens I have sent round. It bites you on the tongue, and rape-seed never does that. Of course there are occasions when a more perfect examination is required, and there are other tests of a more chemical character which I have noticed, but as they are more difficult of manipulation, I thought it best to remain silent respecting them, pointing out only the simple test which I have given, one that is really very useful, and can be handled by every man. I have given you a brief outline of the method which, after all, I am myself frequently obliged to follow, in addition to the chemical examination to which I submit the cakes when sent to me for that purpose.'

Rape-Cake is gaining rapid favour amongst feeders as a substitute for oil-cake (linseed), as it is so much cheaper—by nearly one half—while its nutritive value is nearly equal. Cattle do not, however, relish it like linseed-cake, and require to be coaxed by various modes into partaking of it; once habituated to it, they partake of it freely. Dr. Voelcker says he believes 'the pungent principle in rape-cake arises from the presence of mustard-seed, which is often contained in considerable quantities in foreign rape-cake. Mustard and rape-seed belong to the same family of plants; and in Germany, at least, I am sorry to say, our rape-fields are often very foul with mustard. That boiling water prevents the pungent acrid smell is fully explained by the chemistry of mustard-seed. That seed does not contain any volatile or essential oil of mustard, the cause of the pungency of mustard taste; but it does contain two peculiar principles, which, in contact with cold or tepid water, generate essential oil of mustard—the one is called by chemists "myronic acid," the other "myron." The latter is a substance like albumen, and, when moistened with cold water, acts as a kind of ferment upon myronic acid, producing the acrid oil of mustard; whereas boiling water coagulates myron like albumen. In a coagulated state myron loses its efficacy as a ferment, and consequently no pungent or acrid smell is produced when cake containing mustard is mixed in boiling water. . . However, the practical result of mixing rape-cake with boiling water deserves to be generally known, for even pure mustard-cake will lose its poisonous character—or, more correctly, its poisonous qualities will not be called into existence—if it be mixed with water at the temperature of 22° Fahr.'

While on the subject of oil-cakes, it will be interesting and valuable to give here a *résumé* of the experiments of Crusius, to determine the influence of the oily matters in food on the fattening of stock: for this, with the accompanying remarks, we are indebted to the pages of the 'Scottish Farmer':—

'For this purpose twelve oxen, as nearly similar as possible, were selected and divided into two series of six each. These were supplied with mixtures of different foods, so adjusted as to contain as nearly as possible the same quantities of dry matter, nitrogenous compounds, and woody fibre, but so that the first set got a large and the second a small quantity of fatty matters. So general is the distribution of fat, that some difficulty was experienced in finding substances sufficiently free from it to produce a proper contrast; and it was only by the use of malt-dust on the one hand, and of rape-cake mixed with oil on the other, that it was possible to obtain the requisite difference. The feeding was divided into three periods, and the nature and quantity of the food given will be best understood from the subjoined table:—

Table showing the Daily Quantity of Food given to the six Oxen of each Series.

	1st Period		2nd Period		3rd Period	
	1st Series	2nd Series	1st Series	2nd Series	1st Series	2nd Series
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Hay	60	54	60	60	60	60
Rye Chaff	24	24	36	36	36	36
Malt Dust	18	18	18	24	...	...
Peasemeal	24	12	24	36	12	12
Bran	...	12	...	12	42	42
Potatoes	42	170	124	124	216	216
Rapecake	36	...	30	...	...	...
Oil	8	...	3	...	6	...

'These quantities were so arranged as to give as nearly as possible the same amount of nutritive matters to each series, except that the first got about twice as much oil as the second. This is more distinctly seen in the following table, calculated from the analyses of the different foods, and giving the exact amount of each nutritive element consumed per head:—

	Dry matter	Nitrogenous substances	Non-nitrogenous substances	Total nutritive matters	Woody fibre	Fat
	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
1st Period, 1st Series . .	24·7	5·03	12·98	18·02	6·3	1·82
,, 2nd ,, . .	24·4	3·44	14·86	18·30	4·8	0·75
2nd Period, 1st ,, . .	29·1	5·09	16·52	21·51	5·9	1·80
,, 2nd ,, . .	29·5	6·16	16·72	22·88	5·8	0·90
3rd Period, 1st ,, .	30·6	3·75	20·07	23·82	5·5	1·90
,, 2nd ,, . .	30·6	3·75	19·07	22 82	5·5	0·90

'Without entering into the details of the weighings at each successive period, which were made with great minuteness, it may suffice to give an abstract of the results, which were as follow:—

	1st Series	2nd Series	Excess of gain in weight of 1st over 2nd Series
	lbs.	lbs.	lbs.
Original weight of the animals . .	6,688	6,963	—
Gain during 1st Period (21 days) . . .	368	301	67
,, 2nd ,, (21 days) . . .	577	318	259
,, 3rd ,, (14 days) . . .	326	241	85
Total gain	1,271	860	411

'Looking at these results, it seems impossible to doubt that the larger gain which appears throughout the whole of the first series must be due to the excess of fatty matters supplied in the food. And this is very strikingly seen in the last period, when exactly the same quantities of the same substances were given to each series, except that the first received 84 lbs. of oil more than the second, and the conclusion is irresistible that the surplus gain of 85 lbs. must have been produced by it. Neither can it be doubted that the 259 lbs. by which the first series exceeds the second during the second period is caused by the additional 113 lbs. of fat contained in the food.

'Not only does the first series increase more rapidly than the second, but it appears that the animals make a better use of their food, and digest and assimilate a larger quantity. Thus, for example, during the second period, the first series require 467 lbs. of nutritive matters to produce a gain of 100 lbs. of live weight, while the second series require 906; and this corresponds also with the composition of the dung, for Crusius finds that of the first series to contain daily 1 lb. of solid matter less than that of the second.

'It is clear, then, that the addition of fatty matters to the food is useful, not only by supplying that necessary element, but also in so far as it promotes the assimilation of its other constituents; but it still remains to be determined whether it will pay. Into the consideration of this point also Crusius enters very minutely, and shows, from the actual cost of the food and prices the animals realised in the market, that the profit derived from each pound of live weight acquired by the animals amounted to $1\frac{1}{3}d.$ It must be borne in mind, also, that the question of economy was not considered in fixing the nature and quality of the food, the object being to effect the most complete comparison between substances differing only in the oil they contained, and hence it became necessary to employ oil itself, of which the cattle, in the course of the experiment, consumed about two cwt., at a cost of 4*l.* 10*s.*, while, had it been possible to disregard the composition of the food in other respects, it might have been supplied at one-tenth of this price.

'These experiments, although they by no means exhaust this subject, are peculiarly interesting because they show that a positive advantage is gained by increasing the quantity of fat in the food, and they justify the preference which the feeders of this country have always shown for oil-cakes of different kinds. They open up also the question of whether oil itself may not be at times an economical food. It is perfectly conceivable that there may be a mixture of foods the digestibility of which may be so greatly increased by the addition of a comparatively small quantity of oil as to render its use remunerating. We have been informed, indeed, that linseed oil was used to some extent in feeding sheep during last winter, and with excellent results.'

The *pulping of roots* is one of the most recent improvements in cattle-feeding. The following is an account, by Mr. W. Karheck, of the mode of feeding adopted on the farm of R. Davy, Esq., M.P., where the pulping is part of the system:—

'We found thirty-two North Devon cattle kept in separate boxes in two houses recently built. They were fed in wooden troughs, eighteen inches wide by twelve inches deep, with a mixture of grated turnips and straw chaff, in the proportion of 90 lbs. of the former to 7 lbs. of the latter, mixed in the following manner:—The grated turnips (swedes) are intimately mixed with the chaff in a bin sufficiently large to supply the cattle with one day's food. These ingredients are allowed to remain in the bin three days, during which time fermentation and heat are produced on the mass, sufficient to cook the whole, as if it had been submitted to the power of steam. We observed that an odour is emitted, during the fermentation, similar to fresh brewers' grains, evidently the consequence of the saccharine matter evolved from the roots and chaff. There were three bins constantly at work in this manner, so as to afford a regular daily supply. 97 lbs. of this mixture is given to each animal, and 4 lbs. of linseed-cake per day, in the following manner: —1st feed, 6 o'clock A.M., mixture of chaff and turnips; 2nd feed, 9 o'clock A.M., mixture of chaff and turnips; 3rd feed, 12 o'clock noon, 4 lbs. of cake; 4th feed, 1 o'clock P.M., mixture; 5th feed, 4 o'clock P.M., mixture. In addition to this, about 3 lbs. of dry chaff is given during the evening. The cattle are exceedingly fond of this mixture; so much so that there has been some difficulty experienced in getting them to eat the linseed-cake. In ordinary feeding with turnips, it is always observed that cattle will consume the cake in preference to roots; but not so in this case, as the mixture is preferred to the cake.

'The cost of feeding cattle in this manner was estimated by Mr. Tresawna, Mr. Trethewy, Mr. H. Croggan, and Mr. Whitford (who accompanied me on my first visit to Polsue farm), at six shillings per week, which includes turnips, chaff, and oil-cake. This system of feeding evidently agreed with them in a remarkable manner, as the whole number were in an exceedingly good, thriving condition. They were purchased thirteen weeks since at the Truro fair, placed in the boxes on this system of feeding eleven weeks. We find they cost on an average 17*l.* each, total 544*l.*, and were at the present date all fit for the butcher, averaging, according to Mr. John Kendall's valuation, 7½ cwt. each, which, at the present price of beef, say three guineas per cwt., would produce 23*l.* 11*s.* each—total, 752*l.* Deducting the cost of keep at six shillings per week, 105*l.* 12*s.*, from the present value, it would leave a clear profit of 102*l.* 8*s.*, or 3*l.* 4*s.* per bullock in eleven weeks, and this, too, exclusive of the valuable rich manure manufactured in the boxes. Some idea may be formed of the value of the manure. Each box was 8½ ft. square; the dung was allowed to accumulate in the box for two months; and on its removal, some three weeks since, each box averaged six loads of rich well-made manure, containing all the elements necessary for the healthy and luxuriant growth of all the different cultivated plants on a farm.'

Lord Kinnaird instituted a most elaborate set of experiments to ascertain the advantages of pulping roots, which, although not very conclusive, showed a saving of roots and an increase of weight by the use of pulped roots.

Since the date of the detailed experiments above alluded to in the use of pulped food for cattle, it is necessary to state that the opinions of many who then held that pulping was an economical method of preparing food, and that pulped food was beneficial to animals, have received very considerable modifications; so considerable indeed that pulping is carried out to a very much less extent than it was. One of the best, at least one of the most striking evidences of this, is to be met with in the implement department of our show yards. Some years since pulping machines were to be seen everywhere, and the sale of them was very large. Although still used, and therefore still sold, the sale has fallen off so considerably that it is a somewhat difficult thing to find specimens on 'stands' at which they formerly were a decided feature. When a very considerable change takes place in any practice there are good reasons for it, and it is worth while to enquire into its cause. In this case it is specially so, not only from its practical importance, but from the interesting physiological points connected with it. Turnip slicing and turnip pulping come under two different classes of processes, and are designed to serve two different ends; although, to a certain extent, root slicing embraces both. In the slicing of roots economy is chiefly aimed at, for in eating a whole root not only has the animal a difficulty to get hold of it, and this chiefly on account of its spherical form, which gives it a continual tendency to slip out of its mouth; but the process of munching it, so to say, is consequently so tedious that after a while the animal gets tired of it and leaves it. Now when once food is thus left by cattle it is worthy of remark that they will not return to it; or if they do, it will only be under the pressure of hunger. The probability is that the continued breathing of the animal upon the root, and its being covered with the saliva which issues so plentifully from their mouths during the process of eating, gives it a peculiar odour or flavour that they have quite a dislike to. Be this as it may, the fact remains that to give cattle whole roots is a very wasteful way. Hence it was seen at a very early stage in the history of modern farming that some method of dividing the roots so as to enable the cattle to get an easy bite at them would result in some saving. At first this was done simply with a knife, or with the part of the old sickle used to top the turnips, or rid them of the shaws or leaves. This was a slow process, so slow that it could not be applied where the cattle were numerous. Hand-wrought lever slicers were next introduced; these greatly aided the cutting process, but still the full work done by them, even with the most active of cattle-men, was far behind the requirements of large, indeed even of comparatively small, establishments. At length the ingenuity of our machinists, urged by the necessities of the case, and by the no less forcible appeal made to their pockets by the certainty that if a good machine was designed to do the work it would meet with a large sale, resulted in machines, more or less effective, being introduced capable of doing work on the large scale; and these were gradually improved, till we now have them capable of giving the maximum of work with the minimum of labour.

When the system of slicing roots became a regular part of the work of the cattle-feeder, it was soon noticed that not only was there a great saving effected in the consumption of roots, by the avoidance of the waste above noticed, but it seemed as if the sliced roots 'went further,' as the phrase goes, in feeding than did the whole roots, as the animals required or, at all events, took less to produce the same results. Another advantage was obtained from the system—namely, that it enabled the sliced roots to be easily mixed with other feeding materials. Amongst those were cut straw or hay; the cutting of which by machinery introduced about the same period as the slicing of roots by the same agency, seemed to 'fit in' very aptly, enabling the feeder to carry out quite a new system of giving food.

Seeing, then, the benefits in more ways than one of dividing or slicing the roots given to cattle, it seemed to some feeders that it was only necessary to carry the principle farther by mincing the roots—that is, cutting and cross-cutting them till they assumed the form of small pieces. Others, again, conceiving that the principle could be carried even to its utmost limits with advantage, adopted the system of 'pulping' roots, after the same manner as carrots are grated by the cook. The idea being that the finer the subdivision the more rapidly would their assimilation into the system be, and that therefore the less weight would be consumed to give the same results.

From experiments made in the feeding with pulped roots (see par. above), it was shown that this system of pulping was successful in some instances. But it was gradually noticed that cattle did not advance so rapidly or thrive so well on the finely divided roots as on the simply sliced ones. And a little study of the physiological condition of the case would show how this was likely to arise. An ox or a cow has a very large stomach. It requires, therefore, bulk in its food in order to fill it; and it is only when filled, or moderately so, that its functions are performed properly, and rumination aided. Now the pulped food being capable of compression, and lying closely together, did not possess the necessary bulk. But another point was discovered in connection with pulped food; it being presented to the animal in a finely comminuted condition, it was capable of being swallowed without being first masticated; and the animal, as a rule, was found so to swallow it that mastication was neglected. Now we know that mastication in itself produces very healthy effects, and hence the necessity of its being encouraged. We do not here pretend to give this statement as that of the facts as they actually came up in the sequence of practice, and as those which influenced the question of pulping, and caused it to be much less frequently used than it was at one time; but the probability is that they followed pretty closely the line we have indicated. That line we have been somewhat careful to explain fully, inasmuch as it may be taken as an example of how certain practices may be analyzed, so to say, and the reasons made clear why they are either followed out more and more exclusively, or, on the other hand, gradually given up. That pulping may be useful on some occasions in feeding stock is clear enough; and by a judicious use of it along with other methods of giving food, the disadvantages it presents, as named above, may be got rid of. One lesson, however, may be learned from the facts we have stated—that it is not good practice to adhere closely to any one system to the exclusion of others; that as we have seen changes of food to be good, so also does it appear to be that changes in the methods of preparing and of giving it are also good.

On many farms, in some seasons, the stock of roots and hay for various reasons is but scanty; the best efforts of the feeder are therefore demanded in order to find out some economical mode of supplementing them, if not of finding substitutes for them. A substitute or supplement of a valuable kind has been found in bruised linseed and bean-meal in equal proportions mixed with damped cut hay, or if hay is very scarce, with straw chaff. Where a copper or boiler is on the premises, the cooking of the food may be adopted with advantage. In this case, to every quart of boiling water stir in one pound of bean-meal; this should be mixed with the quantity of linseed-meal intended to be used, and also with the chaff. It appears that, according to the estimate, 4 lbs. of this food is equal to 19 lbs. of roots. As to the comparative profit derivable from the various kinds of food used, the following results of a carefully conducted set of experiments recorded in the Transactions of the Highland and Agricultural Society of Scotland will be useful:—

'Six bullocks that were bred upon the farm were equally divided into single boxes; they were supplied with cut roots—the first month swedes, the second swedes and mangolds mixed; latterly, mangolds; in addition they had 6 lbs. of rough or low meadow hay cut into chaff, and 5 lbs. of oil-cake, or value to that amount. They were divided into three lots of two each: lot 1 had 5 lbs. of oil-cake each bullock; lot 2, barley and wheat-meal to the same value; and lot 3, bruised linseed. The oil-cake cost 10*l.* 10*s.*, barley and wheat meal 8*l.* 15*s.*, and the bruised linseed 13*l.* per ton. The experiment lasted four months, or 112 days; each bullock was weighed before putting up, and every successive month. It was found that the increase at the end was as follows:—

Lot 1.	Oil-cake gained live weight	637	lbs.
Lot 2.	Wheat and barley-meal do.	669	„
Lot 3.	Bruised linseed do.	718	„

It is thus shown that linseed gave most weight for value consumed, and oil-cake the least. As already stated, the experiment was continued for 112 days; we therefore find that each bullock during the time consumed 5 cwt. oil-cake, or value to that amount, 6 cwt. of hay chaff, and 90 cwt. of roots. It is found that the average increase was 337 lbs. each live weight, which is equal to 16 stones (14 lbs.) dead. The feeding statistics will stand as follows:—

	£	s.	d.
5 cwt. of oil-cake at 10*l.* 10*s.*	2	12	6
6 cwt. of low meadow hay at 60*s.* per ton .	0	18	0
16 weeks' attendance at 6*d.* per week . .	0	8	0
	3	18	6
16 stones of beef gained, at 8*s.* per stone .	6	8	0
	£2	9	0

thus leaving us 49*s.* 6*d.* for 90 cwt. of roots consumed, or 11*s.* per ton.'

Brewers' grains are sometimes given to cattle in an acid state; but *distillers' grains* differ from them in having a proportion of rye frequently mixed with the malt, rendering them more than naturally sour. Acid mixtures, however, can only be considered as preparatory to the more forcing and essential articles of dry food, without which it is impossible that any bullock can acquire the firmness of muscle and fat which is so deservedly considered as the criterion of excellence. Brewers' grains are much used in certain districts for dairy cows.

The *wash*, or refuse of malt remaining after distillation, which was formerly applied exclusively to the feeding of swine, has of late years been used with some success in the stall-feeding of cattle. It is conveyed from the distillery in large carts, closely covered and well jointed, in order to prevent leaking. The liquor is then discharged into vats or other vessels; and when these are about two-thirds filled, a quantity of sweet hay, previously cut small, is immersed in it for two or three days, in order that the wash may imbibe the flavour of the hay before it is used. In this state it is carried to the stalls, poured into troughs, and there eagerly devoured by the cattle. Sometimes, however, the beasts are at first averse to this mixture, in which case it has been recommended to sprinkle their hay with the wash. Thus, having the smell continually before them, and seeing other animals eating with avidity the same compound, they not only gradually become accustomed to it, but begin to relish it and fatten speedily.

One of the most successful instances recorded of this mode of fattening cattle was that of Messrs. Hodgson and Co., the proprietors of Bolingbroke-house distillery, Battersea, near London.[1]

[1] Malcolm's Compendium, vol. i. p. 355.

Between October and April they fattened about 450 cattle, having generally about 350 in the house tied up at one time, and 100 in an adjoining orchard, which were afterwards taken in to replace those that were sold off. There was no stated period for fattening these bullocks, that being regulated entirely by the state of the markets; but from ten to sixteen weeks was the usual time, and the cattle were found to gain, upon an average, the extraordinary weight of from two to three stones per week. Their food was wash, grains, and hay—sometimes meadow and at others clover hay—and occasionally alternated with oat or barley straw, which was sometimes, although not regularly, cut into chaff. Hay or straw was given to them twice a day, in order that they might ruminate, and they had as much grains and wash as they could eat. In general they readily took to this kind of food, but some were four or five days before they lost their aversion to it.

The stock fattened at the distillery above named consisted of cattle of every sort and size. There were many Scotch cattle, or Kyloes, as well as those reared in Northumberland, Wales, and Herefordshire, but none of the Sussex or Devonshire breeds, which Messrs. Hodgson and Co. judged too dear for them. According to their quality the cattle are supposed to pay from *five* to *twenty shillings* per week.

Messrs. Smith and Harrington, of Brentford, fattened 810 oxen on the refuse of 25,750 quarters of barley, with a certain quantity of hay. They were in tolerable condition when taken in, and averaged about 110 stones. In twenty weeks they acquired flesh at the rate of about 35 stones each.

In the preceding facts and statements we have referred chiefly to the feeding and fattening of middle-aged and old cattle; *young stock*, however, require particular attention lest their growth should be impeded, and therefore should be fed on the best and most nutritive food which the farm can supply. A beast that has been starved when young, can never be made profitable for any purpose.

During the winter they should have hay, turnips, and other roots, and oil-cake or bean-meal: or, if straw is substituted for hay, the proportion of other food should be increased, and given with considerable care. In summer, their food varies so little from that already described, as to require no particular details on this head.

Oxen, as before stated, are now rarely used in this country for draught, with the exception of a few districts in which the system is still persisted in; but in cases where they are used they ought to be well fed while they are kept in constant employment, particularly at the commencement of spring and in autumn, when their labour is most wanted. During those seasons, they should be supplied with plenty of cut hay and straw, or a good allowance of steamed potatoes, turnips, cabbages, or carrots, proportionate to the work, and to the quality of the fodder as well as of the roots. If the labour is unusually severe, a moderate quantity of oats, with bran, or some bean or pea meal, should be allowed. In summer, the beasts may be soiled with green food, and in the winter stall-fed.

A most important object in the feeding or fattening of cattle is that such arrangements should be made, and such a supply of food provided for winter consumption, that the grazier may be enabled to keep them throughout that trying season, and sell them when meat brings the highest prices, viz. from the beginning of February to the close of May. Thus he will not only obtain more for them than the autumnal markets would produce, but his stock will go off freely, and every market be in his favour. He will also obtain a considerable quantity of manure, and consequently be enabled to conduct his business to the greatest profit.

The *relative proportion of food* consumed by fattening cattle necessarily varies according to the size of the animals, and the nutriment afforded by the respective vegetables. It has, however, been found, that an ox will eat nearly one-sixth *per diem* of his own weight of cabbages. Fattening beasts require from half a hundredweight to 75 lbs. of turnips daily, besides an adequate allowance of dry meat to counteract the superabundant moisture of these roots. For middle-sized animals a bushel or a bushel and a half of distillers' or brewers' grains will be sufficient, if combined with an ample portion of cut hay, chaff, or bean straw, given in the intervals of the distribution of the grains. Bullocks varying from forty-five to sixty stones consume about eight or ten stones of carrots or parsnips per day, besides an additional quantity of dry provender, that is, in the proportion of one-sixth part of their own weight; and, as an acre of good carrots will yield 400 bushels, or 22,400 lbs., it would support such an animal 160 days, a period sufficiently long for beasts to be kept that have had the summer's grass. If they are half-fat when put to carrots, an acre would probably be sufficient to fatten two such beasts. Of potatoes, small cattle—such as those of Wales and Scotland—eat every day about a bushel per head, in a raw state, with the allowance of a truss of hay divided between four beasts. To an animal of 7 to 8 cwt., from 3 to 6 lbs. of oil-cake are given daily, but where bean-meal is used along with the oil-cake, 3lbs. of each may be given. A good allowance to each beast during winter will be 75 to 90 lbs. of turnips, 14 to 20 lbs. of hay, and 3 lbs. each of oil-cake and bean-meal. Mr. Kennedy gives a bullock of 7 cwt. 60 to 70 lbs. of swedes daily, and from 16 to 20 lbs. of cooked food; 1 lb. of linseed or 2 lbs. of linseed meal, boiled into mucilage, and mixed with 2 lbs. of bean meal, 2 lbs. bruised barley or oats, 10 to 12 lbs. of cut hay, 14 lbs. of straw chaff and some salt, being the ingredients of the cooked food. The whole, when mixed, is allowed to lie for some hours till the dry portions absorb the mucilage. Wherever it can be conveniently arranged, the animals should not be confined to one sort of food. To mingle the food judiciously benefits the beasts and saves the farmer money; for an animal will thrive better and cost less if fed on hay, turnips, and oil-cake, given in the proportions of one part cake, four parts hay, and seven parts turnips, than he would if suffered to eat the whole amount in one only of these matters.

Whatever articles of food may be given, they should be apportioned with as much regard to *regularity of time and quantity* as is practicable; and if a portion of it is at any time left unconsumed, it should be removed before the next meal, otherwise the beast will possibly refuse or loathe his food.

In stall-feeding, it is too common a practice to give a certain allowance every day, without regard to circumstances; but it is well known that a fattening beast will eat with a keener appetite on a cold day than in warm, damp weather; and his food should be proportioned accordingly. By giving the same quantity every day, the animal may be cloyed. His appetite will become impaired, the food will be wasted, and several days will pass before he feeds heartily again. Three periods, at least, of the day, and as nearly equidistant as possible, should be selected as the feeding hours, when only such an allowance should be given to each animal as he can eat with good appetite. As he fattens, his appetite will probably become more delicate, and he will require more frequent feeding, and the food in smaller quantities; thus the beast will improve progressively and uniformly, while only a trifling quantity of the food will be lost. In proportion to the nutritive matter contained in the food, the animal will generally be found to improve; and, in order that this important branch of rural economy may be properly conducted, the young grazier will find it useful to weigh each beast once a fortnight, at the least, before he gives the morning allowance, by which he will be enabled to form an accurate estimate of the real progress his cattle are making. If they do not continue to advance according to the result of former weighing, it will be necessary to change their food. It will, perhaps, be satisfactory to weigh the cattle that are considerably advanced in the fattening process quite as often, or oftener than this. A more adequate idea of their thriving may thus be formed, and also the real profit and loss may be ascertained.

Of equal importance with regularity in feeding, is *cleanliness*, a point which is admitted, by all intelligent breeders, to be most essential to the health and thriving of the cattle. Animals, also, that are not at stall-feeding, should not only be supplied with plenty of pure water, but likewise, whenever they are brought home, either from pasture or work, their feet should be washed, lest any filth should remain about them, to soften and produce disease of the hoof. Frequent washing after hard labour—in the case of 'yoke' wrought oxen—or at least once in the week, should always take place; and though the practice of currying and combing, or of friction with brushes, cannot, perhaps be adopted where the beasts are numerous, yet it would be of considerable advantage if they were rubbed with a wisp of straw. The mangers and stalls should likewise be kept as clean as possible; and the former, if they cannot often be washed, should be cleared every morning from dust and filth, which may be easily effected by means of a common blunt-pointed bricklayer's trowel. They otherwise acquire a sour and offensive smell from the decay of vegetable matter left in them, which will nauseate the cattle, and prevent their feeding.

It still remains a disputed point whether cattle thrive best in stalls whence the litter is removed and replaced by fresh straw every second or third day, or in boxes where it is suffered to remain for weeks, and only has fresh straw scattered over the surface. In the former case, it is evident that some of the most essential portion of the manure must inevitably be wasted, even supposing the manure heap to be well protected from rain; while in the latter, the whole is compacted into a solid mass of fertilising matter. But under all circumstances a good and sufficient bed of litter is indispensable, especially during the winter season, and the farmer cannot be too careful of his straw if he would avoid being compelled to buy for the purpose of bedding his cattle.

It has been found that forty-five oxen, well littered, while fattening, with twenty waggon-loads of stubble, have made *two hundred loads*, each of *three* tons, of manure, the greatest and most valuable portion of which would have been lost, had it not been mixed with, and absorbed by, the straw. Every load of hay and litter, given to beasts fattening on oil-cake, yields at least ten tons of dung; and, on comparing the dung obtained by feeding on oil-cake with that of the common farm-yard, it has been found that the effects produced by spreading *one* load of the former on an acre considerably exceeded those of *two* loads of the latter. The value of the manure will invariably be found to be in proportion to the nutriment contained in the aliment. It is an old and a true proverb, 'No food, no cattle; no cattle, no dung; no dung, no corn;' or, indeed, any other good crops.

The following Table, giving the results of experiments instituted by Mr. J. B. Lawes, will show the dependence of the value of the manure obtained from cattle, on the food they consume:—

TABLE *showing the estimated value of the Manures obtained from the consumption of one ton of different Articles of Food, each supposed to be of good quality of its kind.*

Description of Food.	£	s.	d.
1. Decorticated cotton seed-cake	6	10	0
2. Rape-cake	4	18	0
3. Linseed-cake	4	12	0
4. Malt dust	4	5	0
5. Lentils	3	17	0
6. Linseed	3	13	0
7. Tares	3	13	6
8. Beans	3	13	6
9. Pease	3	2	6
10. Locust beans	1	2	6
11. Oats	1	14	6
12. Wheat	1	13	0
13. Indian corn	1	11	6
14. Malt	1	11	6
15. Barley	1	9	6
16. Clover hay	2	5	0
17. Meadow hay	1	10	0
18. Oat straw	0	13	6
19. Wheat straw	0	12	6
20. Barley straw	0	10	6
21. Potatoes	0	7	0
22. Mangolds	0	5	0
23. Swedish turnips	0	4	3
24. Common turnips	0	4	0
25. Carrots	0	4	0

In connection with the subject of cattle-food, three points have been much discussed of late years—namely, the 'cooking of food,' the 'pulping of roots,' and the use of 'condimental foods.'

With reference to the *cooking of food*, opinion was at one time pretty much divided as to its utility; evidence, however, is pretty well established that cooking of food is upon the whole beneficial to the animal, and economical in its results. The following is a statement of the results of experiments of Colonel M^c^Doull, instituted with a view to decide the economy or otherwise of cooking food :—

'Showed, amongst other things, that one feed of cooked food per day, with two feeds of raw swedes, returned the most profit—more so than three feeds of raw swedes; but when two feeds of cooked food were given, and only one feed of raw swedes, there was a loss. The food consumed daily by each animal, when two feeds of turnips and one feed of cooked food were given, was as follows :—"84 lbs. of swedes and one feed of cooked food at noon, consisting of 3 lbs. cut straw, boiled along with 3 lbs, of bean meal;" the latter, the bean meal, being increased towards the conclusion of the experiment to 5 lbs. daily. The same kind of cooked food was given to the lot, which was allowed two prepared feeds per day, but in this case the daily quantity of turnips consumed by each beast amounted only to 42 lbs.'

The *pulping of roots*, of which we have already given a description, is of comparatively recent introduction. Its utility, as we have seen, is pretty generally admitted by some, although much has been stated in opposition to it by others. The practice has been long in use in Belgium, where agriculture, if not scientifically, is at least beyond a doubt most practically and successfully pursued. A very complete array of evidence as to the advantage of the system will be found in vol. xx. part 2, of the 'Journal of the Royal Agricultural Society of England.'

The use of *condimental foods* is a comparatively new feature of practical farming, and has given rise to a controversy which has not always been conducted with the calmness befitting an important scientific discussion. It is impossible, within the limits of the present volume, to go fully into all the details of the question. Much has been said and can be said on both sides, and space only permits us, of the 'pro' and the 'con,' to give the following. The leading disputants are the scientific and the practical men. The former, almost as a rule, go against the use of these foods; the practical men are rather disposed to believe there may be 'something' in their use; although, of course, many practical men are convinced of their inutility, while some men of science, on the contrary, think them beneficial.

The following is an opinion of Dr. Anderson, chemist to the Highland and Agricultural Society of Scotland. After referring to the character which was, upon their first introduction, claimed for them, that they were concentrated foods, containing in a very small bulk a large proportion of nutritive matter, and that of course small quantities might be used, Dr. Anderson says:—

'A minute examination of a number of them recently made in the laboratory, which will appear in the forthcoming number of the "Transactions," has shown that there has been no attempt to concentrate in the sense in which that word is usually understood, for they all contain just as much water and woody fibre as other vegetable substances, and are, in fact, mixtures of the most ordinary materials, consisting of Indian corn, rice, bean-meal, ground carob beans, and other similar substances, along with small quantities of aromatic seeds, and in nine instances a bitter substance, apparently gentian. It is absurd to suppose that the contents of a small tin measure holding about half-a-pint of these substances can be used to replace one-half of the ordinary food of an ox or a horse; and their inventors, seeing that as soon as these facts become known to the farmer their position would become untenable, have taken refuge behind the aromatics and bitters they contain, and have asserted that their effect is condimental, and that they act by promoting digestion, and causing the animal to extract and assimilate a larger quantity of the nutritive matters of its ordinary food. They have obviously gone upon the commonly-received opinion which attributes to salt and similar substances this effect—a view which the facts which I have already detailed by no means countenance. There is, in fact, not the slightest reason to suppose that the substances contained in these foods have any such effect. They consist, in addition to the grains already mentioned, chiefly of fenugrec and caraway-seeds, and one of those I examined contained so large a quantity of turmeric that it might almost be described as a curry-powder. Nothing definite is known regarding the action of these substances on the system, there being no experiments such as those by which the effects of salt have been determined; and there is no evidence to support the view that they are capable of producing a more complete assimilation of the food, but every reason to believe the reverse. In fact, when a dispassionate view of the matter is taken, I think it can scarcely be doubted that, if small quantities of caraway or other aromatic seeds were given to animals, and their weights carefully determined, it would be found that they are quite without effect. It must be noticed that there have been no attempts on the part of the "discoverers" to produce such accurate experiments in support of their views, although *there have been plenty of general testimonials, such as every quack medicine can produce by the score, and abundance of vague declamation regarding their wonderful effects.* The plain fact is, that science does not give the slightest support to the idea that these substances have any effect whatever, and in saying so I am only stating an opinion in which all chemists will concur, and which has, indeed, been often stated before. Its accuracy has just as often been denied by the makers of these articles, but it has never been disproved, nor will that be possible until they can produce the precise results of trustworthy experiments in support of their substances. But even admitting the accuracy of all the statements put forth by the makers of these foods, there is another question which merits attention, and that is the price at which they are sold. I have already mentioned that they are composed chiefly of some of the more familiar foods, mixed with a small quantity of aromatics. The exact proportion in which these latter substances exist in them cannot be accurately determined, but it is not large, and does not generally exceed 10 per cent. Indian corn, carob beans, &c., cost about 8*l.* or 9*l.* per ton, and fenugrec and caraway-seeds about 20*l.* to 25*l.* A mixture of nine tons of the former and one of the latter should therefore be sold at 10*l.* or 11*l.* per ton, in place of 20*l.* or 30*l.*, the price actually charged; so that now, if these goods do produce the alleged effect, the farmer is made to pay for them three times their intrinsic value. The fact is of itself a sufficient comment on what has been already stated, and *the truth is that the "discoveries" of which the makers of these foods boast are confined to the art of extracting money from the pockets of the farmer.* The general conclusions to be drawn from what has been now said may be summed up in a very few words: 1st. Common salt, the most important condiment, has no effect in promoting the assimilation of the food, and, when used in *larger* quantity, has rather a tendency to produce a waste of nutritive matters. 2nd. Both it and phosphate of lime, and probably other mineral substances, may exercise a beneficial effect on its health when the quantity existing in the food is less than the animal requires. 3rd. There is not the slightest reason to suppose that the so-called condimental foods produce any effect in the animal, as they consist only of ordinary grains mixed with small quantities of aromatic and bitter substances, which, so far as our present knowledge goes, do not in any way affect the nutrition of animals.'

Taking the view that analysis will not alone decide the question, and that physiological considerations must also have their weight, the editor of the present edition of this work, in the 'Mark Lane Express,' after showing that various circumstances, as the 'condition or state in which the nutritive substances of a food are,' &c., &c., exercise an influence upon its feeding value, gave the following remarks, to which he would venture to ask the thoughtful consideration of the reader:—

'All these considerations point out, I think very clearly, that the cattle-food question is not to be decided from chemical dicta alone. Chemistry can give us chemical facts, but it can give us no information as to the bearing of them upon the organism. Physiology is a matter with which the cattle-feeder has more, I believe, to do than with chemistry. And when we know more about this science, we shall then, I firmly believe, have the obscurity cleared up which now enshrouds the subject. Amongst other questions which will thus be enlightened will be the *condimental food* already alluded to. However this is to be decided, either *pro* or *con*, of this I feel convinced—that it will not be decided, I repeat, by chemistry alone. Whoever believes that analysis alone decides the absolute nutritive value of any food or combination of food, and that the condition or state in which this combination is placed has no influence upon it, and that the organism moreover in which it is to be assimilated has not also an important influence in the assimilation of the food, I for one am crotchety enough to say that I do not believe all this. On the contrary, I believe that the body in which the food is to be assimilated does play an important part in the economy of food, that the condition of our food is also important, and that while analysis can tell us the constituents of a food, it can give us no trace of that mysterious yet essential something which alone makes that food nutritious.'

Whatever may be advanced against the use of condimental foods from a purely scientific point of view—and that there may be, and is, much which can be so, must be admitted on a candid review of the whole of the statements made—still facts must not be overlooked. And one fact is, now at this the date of the present edition, beyond all dispute—that the number of highly practical farmers and breeders and feeders of the highest eminence who use these foods is on the increase. And this not after merely occasional use of them, as if by way of 'analysing' or tentative experiment, but after the steady persistent employment of them as part of the feeding materials used in the daily practice of the farm. Taking, then, a merely common-sense view of the matter, it is somewhat difficult to bring one's mind to believe that a class of men well known to be particularly careful, and said to be anything but open to the 'allurements of new things,' should not only continue to use these foods, but that the number of them who do use them is, as we have stated, on the increase. We have no desire to take a one-sided view—as we have no interest in doing so—of the matter. We have a simple plain duty to perform to our readers, and this is done by putting both sides of the question before them; leaving them to judge for themselves on the points at issue between the purely scientific and the purely practical man.

We cannot conclude this department without referring to a condiment used in food which has an important influence in the health of stock; we refer to salt.

Some of our older readers, who can go 'back a bit,' may remember a pamphlet which was most extensively advertised under the curious and catching title of 'Salt, the forbidden fruit;' although how the author made salt out to be a fruit we cannot tell, as we neither had the curiosity nor the cash to spare to buy it, to see what he had to say for himself in the matter. What we have now to say on the subject is, that the belief of many stock-breeders seems to be that, if not a fruit, salt is at least a substance which is forbidden in the creed of cattle-feeding—so rigidly is it kept out of all foods given to their stock. Perhaps they proceed upon the principle of a believer we knew of in the pamphlet we have above alluded to, that as all vegetable produce contained salt, each contained exactly the right proportions which nature intended to give to it; and that it was wrong to add more to it. Seriously, salt plays a most important part in the animal economy; and although it be true that if given in excess it may be injurious, at least may be made indirectly so by inducing a thirst which lead the animals to 'drink more than is good for them', that is no true or valid reason for not using it in proper quantity.

One thing alone would seem to point to the conclusion that salt is good for stock, namely, the very great liking they have for it—a liking so pronounced that it amounts in some (as for example horses) to almost a passion. We have known horses go back for weeks to an old trough, left by mistake in the fields, which had contained salt or salted food, and lick it by the hour, and that long after all flavour had apparently gone out of it. Now it is held to be a pretty good indication that substances agree with the animal economy of which the animals have a strong desire to partake, more especially if the desire steadfastly continues. This seems on all sides to be admitted as physiologically correct.

The whole of the points connected with the use of salt as an addition to animal food have been made the subject of special investigation; and the result of this has proved beyond a doubt that by its regular and proportioned use their health is improved and —other things being equal—maintained. The proportions to be given vary of course with the size of the animal. But salt, being found from these investigations not merely to be agreeable to the animals, but to exercise a very remarkable influence upon their system, it will be well here to notice how it acts in this way. And this is all the more necessary, that we see such a wide-spread indifference to, or prejudice against its use, by the breeders of live stock. The blood is made up of certain organic constituents which, if maintained in what may be called their 'normal condition,' the animal maintains its health, or at least is in the condition in which health is likely to be maintained by being able so far to resist external or internal causes predisposing to disease. Supposing for the moment that the 'germ' theory of disease is correct, we can conceive of animals in such a state or condition that they have within their organisms the pabulum, so to say, upon which those germs fasten, or by which they are fed, if the expression is allowable. These are present in the blood, which is then in its abnormal condition—and to bring it into its normal condition above described is the aim and object of all the varied and ever-varying applications and agents of the medical man. Amongst those agents, the researches of the very ablest of our chemists, such as Liebig, Boussingault, and Carpenter, have shown that salt—its chemical or scientific name being given may make some think more favourably of it as a medical agent—or chloride of sodium ranks very high in value. If present in the blood in sufficient quantity, it 'protects the animal economy,' says a writer on the subject in one of our leading agricultural journals, 'against abnormal changes in its chemical constituents.' Dr. Carpenter, the eminent physicist and physiologist, points out that it is required not merely as a condiment—for which small quantities may suffice—but in such bulk or quantity as to act or serve as a component not only of the solid tissues generally, but also of all the secreted fluids, for 'the excretions of urea, the ultimate product of organic change of matter by the kidneys, has a closer relation with the presence of common salt than is generally supposed.' And Liebig, in enlarging upon the same view with relation to certain valuable experiments of Boussingault, says: 'In the urea, which had only as much salt as was contained in their fodder, the quantity of salt was insufficient for the secretory process. There was wanting the means of transport for a number of substances which out of the body excite disgust; their whole frame, the blood, the flesh, and all the juices, were loaded with them, &c., and were but waiting for a supply of salt to carry them off.' If those views be correct—and it is difficult, if not impossible, for those of such high and scientific standing to promulgate them if they are not—they throw quite a new light upon the value of salt for live stock of the farm. The writer above referred to, however, believes that the true way to give the salt is not in the food in the solid form, but dissolved in water—at the rate of two ounces to the gallon—which the cattle should habitually drink. This, he says, permits of the salt being quickly taken up by the system, while it prevents the usual thirst following upon the eating of salted food, and any injurious effects in the way of scurvy, &c. We confess, however, to feeling inclined to think that in the first place the quantity of salt is too great to the gallon of water; in the second place, the habitual use of salt water involves a risk—occasional draughts would be better; and in the third place, that the best way to give salt is always with their food, and only in such quantity as to make the food tasty and relieve it of that insipidity which all food has without it.

This opens up for consideration in a word or two the point as to how it happens that we who dislike saltless food have never thought it probable, to say the least of it, that our domestic animals would do the same. We are far too apt, in the treatment of live stock, to forget that physiologically they present very much the same kind of what may be called living characteristics as ourselves. Forgetfulness of this has, we do not hesitate to say, done more to keep back advanced ideas of live-stock treatment than anything else. And it will only be when we apply them that we shall find out the mistakes we have for so long been making. In dismissing this subject we have one word of caution to give. Let the salt be *cooked* with the food. Salt so treated is a very different thing from that which is merely added to the food after it is cooked. Any good cook will bear us out in this remark, which we know beyond all doubt to be correct. We have much to learn also as regards the chemistry of cooking—indeed, we might say all or everything to learn—for we know nothing about it.

The Messrs. Proctor and Ryland, of Birmingham, have published a valuable treatise on the relative value of various kinds of food. From this we take the following extract, which is suggestive of several points which have been described in this chapter:—

'Among the advantages resulting from a knowledge of the composition of food, we may mention that of being able to select food according to the requirements of the animal at its several periods of growth. Throughout life a mixture of food is very desirable, but it is manifest that during the period of growth there will be a greater demand for flesh-forming matter, whilst in the latter stages the fat-producing food should be in excess. The great object to be persevered in is to keep the animal steadily progressing through each stage of its growth, thereby becoming better adapted for making subsequent progress. As an illustration of this fact, we may take an animal which is being fattened, and it is notorious that (within ordinary limits) it progresses more rapidly the fatter it becomes; and the cause is the same in each case.

'When fat accumulates on the body it is stored away in a beautiful tissue, known as the adipose tissue. It is evident that this tissue must be formed before fat can be accumulated, and hence the sound policy of getting an animal into thriving condition before giving it strong food. As an indication that an animal is to thriving, we handle the coat, and if we find it soft and supple the touch, we are satisfied that this condition of the skin is due to the adipose tissue beneath it, which is invariably present when an animal is progressing favourably. Nothing tends so much to the growth and quality of flesh as for this condition of the skin to be maintained through life, and this is obtained by regularity in the supply of food, attended by a steady improvement in quality, care being taken to select that description of food which is best suited to the age and condition of the animal.

'Intimately connected with the judicious selection of food for an animal is the influence which it exerts upon the product. Active exertion, from bringing the lungs into rapid work, causes much of the fat-producing matter present in the blood to be consumed, and hence we find an excessive amount of exercise a great check upon the accumulation of fat. For these reasons quietness and rest are looked upon as desirable conditions for any fattening animal. It must, however, be borne in mind that the formation of fat is not the only increase which an animal has to make. In the growth of flesh we have a demand for exercise, because muscular growth cannot be made without it. Every movement of the body causes a waste of some portion, but this loss is more than replaced by an appropriation of the nutritive matter supplied in food. Thus we find that animals leading the most active lives, provided food is abundant, have always the largest and best developed muscles, whereas any portion of the body becomes weak and feeble from not being used. Compare the arm of a smith, accustomed to wield the sledge-hammer, with the arm of another person which has been carried in a sling for an equal length of time, and there is evidence of the fact that exercise is decidedly favourable to the growth of flesh. There are, consequently, two opposing claims—rest for favouring the production of fat, and exercise to stimulate the growth of flesh; and between these rival claimants a judicious line of management has to be marked out. Many persons, looking only at the former, and considering an economy of fat the chief object to be kept in view, have adopted systems of management whereby exercise has been reduced to its lowest degree, and loss from exposure brought to a minimum; but this has been attended by a weakness of growth and a constitutional debility seriously affecting the value of the animal, whether intended for feeding or breeding purposes. It does appear more desirable, during the early stages of growth, rather to favour the growth of flesh by moderate exercise, even if it be attended by some loss of fat-producing food, and in the latter period of growth a preference may be given to the opposite claimant; but throughout life there will be ample scope for carrying out a judicious course of management by economising the food, so far as may be consistent with the health of the animal.

'It will be interesting to some of our friends if for a moment we notice the influence which the facts we have named have upon the value of chemical analysis. It is with pleasure that we have shown many instances of its value in relation to the use of food; but the reader has probably observed one weak point which needs further notice. It has been held a rule amongst chemists that the proportion of nitrogen which a food contains indicates its nutritive value. If anyone will glance at the table we have given [not here added], and bear in mind that the figures given in the second column, showing the percentage of flesh-forming matter contained in the several kinds of food there named, represent the standard of nutritive value which has been accepted by chemists, he will at once see that these estimates do not agree with the feeding value we have shown them to possess. We have seen similar quantities of barley and linseed-cake, each producing an equal increase of weight, and yet, whilst the former contains 13 per cent. of nutritive matter, the latter contains 30 per cent. If this standard of valuation were correct, why should a mixture of peas and linseed-cake, or beans and linseed, produce double as much increase of weight when given together as when they are used separately? The reader who compares the composition of food with the results attendant upon its use, will see that there is a general line of evidence showing a marked discrepancy between the estimates formed by chemical analysis and the weight of flesh each food has produced. Are we, therefore, to condemn analysis as of no value in the examination of food? Certainly not. It is exceedingly valuable for judging of the purity and quality of each kind of food; but it leads to most erroneous conclusions when estimates are made as to the effects it will produce.

'In the case of food, as well as many other commodities, experience and discretion will enable a person to obtain the same result in a more economical manner than it can be done by another who has neither judgment to appreciate nor perseverance to elicit that assistance which nature gives him in the right use of experimental research.

'It is quite unnecessary for us to make any comments upon the great importance which is attached to the economical use of food. None are in a better position to judge of this point than those for whom this pamphlet has been prepared. We have introduced this enquiry with as much brevity as possible, because we wish it to be considered as a means whereby further information may be elicited, rather than as being complete in itself. There is, however, one point to which we may here be allowed to make reference, and that is the important influence which a regularity in the supply of food exerts upon the progress of any animal. This is too often overlooked, and although in cases of great neglect we have various diseases thus produced, still under less aggravated circumstances the progress of the animal is seriously interfered with. An animal which has been advanced to a certain stage of growth and development, and then, in consequence of a more limited supply of food, is allowed to lose condition, must thereby be entailing a loss upon the feeder, because the decrease thus resulting is in reality a loss of flesh and fat which will have to be produced a second time. This regularity in the supply must not in any way interfere with a judicious change of food, which is in itself most desirable, but the care of the feeder should be directed to see that the food is not less nutritious and fattening than it may have been previously. Indeed, we might advance one stage farther, and record the experience of some of our best feeders who successfully practise this principle, and who also take especial care that the food gradually improves in quality. In this manner the health of the animal is preserved, and there is none of that double production of flesh and fat which is observable when stock are allowed to vary in their condition by an uncertain supply of food. It is manifestly the most economical plan to produce flesh and fat in the least expensive manner, and it does appear, from the facts we have brought forward, that by a judicious selection and mixture of foods the weight of meat produced upon our farms may be considerably increased; but it is equally certain that this advantage will be sacrificed unless such a course of management be adopted as will secure the meat thus produced from being again taken up into the system of the animal for its own support, thus discharging a duty which should have been performed by a more regular and liberal supply of food.'

CHAPTER XIII.

OF THE SALE OF CATTLE.

HAVING now stated the leading facts and experiments that have been made on the subject of feeding and fattening neat cattle, we shall conclude this division with a few remarks on the *sale* of beasts, when properly prepared for that purpose. In order to ascertain this point, the following hints may, perhaps, afford some assistance. First, when the general appearance of the animal shows high condition, and each bone is covered with flesh in the manner required to constitute as perfect a degree of symmetry as can be attained by a thoroughly fat animal, it may be concluded that the beast is well fed; especially when his hip and *huckle*-bones are round, and his ribs, and flanks, and rump, and buttocks well filled up, and his scrotum or purse largely developed and round. The ends of the fingers should be pressed upon him in various parts, on the ribs, the hips, the rump, and the purse. If there is an evident elasticity of these parts, and they spring back when the fingers are removed, that mingled firmness and softness, well described by the term mellowness, exists, and this is a sufficient assurance that the flesh is of thoroughly good quality. It is of consequence that this examination should take place; for animals which possess these qualities will alone find a sale in the metropolitan market, or possess that state of health which will enable them to support the journey they are soon to undertake.

The following account of the ox is not a little interesting:—'The head should be fine and tapering to the muzzle, which should be thin. The neck should be free from coarseness, large where attached to the shoulder, and tapering to where it joins the head. The breast should be wide, and projecting well in front of the fore-limbs. The shoulder should be broad, but joining without abruptness to the neck before and the chine behind. The back and loins should be straight, wide, and flat; the girth behind the shoulders should be large, the ribs well arched, and the distance between the last rib and the hook-bone small. The hook-bones should be far apart, and nearly on a level with the backbone from the hook-bone to the rump; the quarters should be long and straight; the belly should not hang down; the flank should be well filled up; the legs should be fleshy to the knee and hock, but below the joints they should be tendinous. The tail should be on a level with the back; broad at the top, and tapering to near the extremity. The hoofs should be small; the horns fine and pointed, and slightly attached to the head; the ears thin; the eyes prominent and lively.'[1]

After all the attention and labour, however, which the grazier may have bestowed, his expectations will, to a considerable degree, be disappointed, unless he selects a proper time for the disposal of his fat cattle. The most common season for beef is from Michaelmas to Christmas; but the markets are then more abundantly and more cheaply supplied than at any other period, because cattle that have been fattened on luxuriant pasture grounds are then ready for sale, and many farmers are under the necessity of raising money in order to meet the demands of the close of the year. Hence the attentive grazier, who has sufficient capital to hold his stock over, will find it most beneficial, at this time, to dispose only of such part of it as, being thoroughly fat, would not pay for longer keeping. The increase of prices in the spring will generally be found to remunerate him well. During the whole of December large heavy cattle are in much request at Islington Metropolitan Cattle Market, and will produce remunerating prices; but at other times they hang on hand, and fetch an inferior price. Middle-sized handsome cattle, or those not exceeding seventy or eighty stones, will find the most ready sale. Under forty stones there is a prejudice against them, unless the meat is particularly good.

In drawing off lots of cattle for sale, it is the general practice to dispose of the fattest animals, and to keep those which do not fatten kindly for additional feeding. As a general rule this is proper; but there will occasionally be exceptions to it. If the system which the grazier usually pursues is that of corn or oil-cake, or any other expensive article, or there is a probability of an insufficient supply, and he is fully convinced that he has a beast that is not kindly disposed to take on fat, or is an *ill-doer*, the *first* loss is obviously the best, and he should dispose of the unthrifty animal at the earliest opportunity.

In the country, a mode of selling cattle by *lots* for slaughter is sometimes adopted. In this case, in order to prevent dispute between the parties, care should be taken to fix the precise time in which any particular lot is to be drawn, in order that no unnecessary food may be consumed. It is a proceeding which gives a manifest advantage to one of the parties; for the farmer, unless he

[1] Low's Practical Agriculture.

has been accustomed to weigh his beasts during the progressive states of their fattening, can only have a very uncertain idea of their weight; while the butcher, from his continual practice, is enabled to form a tolerably accurate estimate. Hence some have killed a beast out of a particular lot, with a view to ascertain the average weight of animals in such lot; but, in order to obtain a perfect equality between the buyer and seller, it would be better to dispose of every beast by weight, and that can be easily ascertained by the steelyard.

There are two ways of ascertaining what is called the 'carcase' weight—by weighing the animal in the weighing machine, and by measurement. The 'carcase' weight means the weight of the animal when dressed for sale, the 'offal' being cast out of the reckoning. The offal consists of the 'hide,' the 'fat' or 'tallow,' 'entrails,' and 'stomach,' with the blood. The proportion which the 'carcase' weight of the animal when cut up for the shambles bears to the full weight of the animal when alive is estimated by eminent authorities to be 60 per cent. Much, however, depends upon varying circumstances of breed, constitution, and age. In the short-horn breed, steers of 150 stones, 14 lbs. to the stone, yield on an average 68 to 70 per cent. of beef of the live weight; of 100 to 120 stones, 64 to 68; and of 70 to 90 stones, 55 to 60. The mode of ascertaining the carcase weight by measurement is as follows:—

The farmer passes a string round the beast just behind the shoulder-blade, and then measures the length of that string. This is, in simple language, taking the girth of the animal, and he writes it carefully down. Next, from that bone of the tail whence a line would fall perpendicularly, just touching the buttock, he measures along the back to the fore part of the shoulder blade, and he registers the amount of this.

He has now the girth and the length of the beast. He multiplies them together, and he has the number of square superficial feet which the exterior of the beast comprises. He next multiplies the product of this by twenty-three—the number of pounds allowed to each superficial foot in all cattle measuring less than seven and more than five feet in girth, and he obtains the sum of 713 pounds, which, allowing fourteen pounds to the stone, is fifty stones thirteen pounds, or, according to the old computation of eight pounds, eighty-nine stones and one pound.

Suppose the animal weighed to be less than nine and more than seven feet in girth, thirty-one is the number of pounds to each superficial foot, and under five feet, eleven pounds. For a half-fatted beast, one stone in twenty must be allowed, and one stone in the whole weight for a cow that has had calves.[1]

[1] For ascertaining the weight of cattle, we know of few more useful manuals than

With regard to *fat calves*, we should observe that, in general, by weighing the animal alive at the time of sale, and from the gross weight deducting eight pounds from every score to be allowed to the butcher, the remainder will be equal to the weight of the four quarters. Thus, if a farmer wishes to ascertain the value of a calf at 8*d*. per pound—properly securing him so as not to do him any injury—he weighs him with scales or a steelyard, or in a weighing machine, and perhaps finds the weight to be ten score, or 200 lbs. From this he deducts eighty pounds, or eight pounds from each score, and the remainder, 120 lbs., will be very nearly the weight of the four quarters; and which, at 8*d*. per pound, will be 4*l*. As this rule will not, in general, vary more than four ounces or half a pound, in a quarter or side, it will be found to answer sufficiently well for general use.

The cattle of the farmer, unless he resides at a very great distance, are usually sent to the metropolitan market for sale. A few years ago they were always driven the whole distance; and many an accident, and occasionally loss of life, and the certain diminution of weight to a very considerable extent, was the result. Now the convenience of railway carriage greatly obviates this disadvantage.

Some preparation should always be made for the commencement of the journey, where the animals have to be driven far. Their food should undergo some change. The green food should be diminished, and the dry food increased, in order to prevent diarrhœa on the road. They should be loosened from their stalls a short time twice in the day, for the two or three days previous to their setting out, in order to accustom them a little to exercise, and prevent that giddiness by which they would probably be attacked after being so long confined, and also to prevent any of the dangerous pranks which they may be inclined to play upon the road. That farmer would be wise who put them in the trevis, and had them shod, for where the journey on foot is long several of almost every large herd are usually left behind, and become expensive, or are sold to great disadvantage, on account of their hoofs being worn through by the roughness of the roads. They should start slowly, and during the first two or three days should not be driven more than seven or eight miles per day. In winter they should be put into some open court or shed at night, and in summer turned into some pasture. Gradually the day's journey may be increased to twelve or fourteen miles, but it will be dangerous to extend it beyond that distance. Plenty of time should be allowed for its completion; for if the cattle are hurried on the road, even

Renton's 'Grazier's Ready Reckoner,' a small pamphlet consisting of tables calculated to determine the weight of any animal within certain limits, sinking the offal; and accompanied with rules for taking such measurement.

although they do not exceed the number of miles just mentioned, they will be distressed and off their feed, and the foundation may be laid for serious disease. It is scarcely credible how different will often be the state of droves that have performed their journey in the same number of days. There will be a stone difference in the weight of each beast, and double the value of that in the quality of the meat. It is impossible to estimate the extent of the mischief when cattle have been over-driven, and he who is acquainted with them will be very cautious how he purchases animals having that appearance.

The travelling of the Scotch cattle towards the metropolis is exceedingly well managed. At two years or two years and a half old they begin to move from the northern counties, and are pastured in Dumbartonshire. At three years old they reach the northern counties of England, and at three and a half they are driven or conveyed on to Norfolk and Suffolk and other counties. At each remove they find a milder climate and a richer pasture. They are exposed to no sudden or violent change. Their rapid growth and continued improvement afford a reasonable profit to each grazier through whose hands they pass, and at length they attain their full size, and reach the butcher in prime condition.

This is not the case with regard to cattle destined to a longer journey. The driving of a fat beast from Norwich to Barnet would cause it to lose six stones of beef and one of tallow, amounting at least to thirty-six shillings. If a beast comes from a greater distance, the loss will be greater still; and in order to restore the condition of the ox, and make him fit for slaughter, he will require a month's feeding in good pasture. This, at five shillings per week, will make a total exceeding in amount the expense of conveyance by railroad.

Since the establishment of steam-vessels a great many cattle and sheep are sent to London on board of them. If possible, the hay on which they are fed while on ship-board should be provided by the owner, or by some one on whom he can depend, in order that it may be of the best quality. Some of the animals will then have begun to feed on it before the expiration of the voyage, and will arrive at market in good heart, and handle well, and be readily sold; but, otherwise, if they have been fasting a couple of days, they will feel out of condition, and sell at an inferior price, or not be sold at all. The principal objection to this mode of conveyance is, that they are sometimes forced into too small a space, and therefore are rarely if ever at their ease, and become occasionally and considerably out of condition.

A similar objection can be offered to conveyance by the railroad, which is now becoming so general. The animals come in in comparatively good plight, and are ready for the market and for slaughter as soon as they arrive. The reviser of the previous Edition lived near the terminus of one of the railroads. His profession used to make him a judge of the flavour of the different meats, and he fancied that there was a manifest difference in the quality of that, whether of the ox or the sheep, which came by the railroad, and that which was driven to market in the old way. Most certainly there were not so many bruises or cruelty spots. At the same time it should be remembered that every day the evils connected with the transport of cattle by railway are increasing. Grave fault, indeed, is to be found with railway management in this respect. Cattle are put into dirty trucks containing the dung, perhaps, of diseased animals which have been previously carried; they are knocked grievously about during the process of 'shunting,' which takes place very frequently during a long journey, and which process is most carelessly performed. The cattle are exposed in the open trucks, at sidings and stations, and subjected as well to the horrors of thirst and hunger as to cold and wet. On principles of humanity as well as business policy, a change of all this is imperatively demanded. We are glad to see the agricultural public becoming daily more alive to the importance of railway managers carrying out a more humane and more economical system of cattle transport.

The cattle and sheep having reached the metropolis are consigned to a salesman for disposal. He is a middle-man between the farmer and the butcher, who disposes of the cattle to the best advantage, and at a moderate charge. He has to pay to the banker and money-taker certain dues.

Mr. Hillyard, who used for some years to sell his own stall-fed beasts in Smithfield, thus speaks of the salesman:—'The amount of the graziers' or stall-feeders' profit much depends on the salesmen they employ. Theirs is an office of great trust and confidence; and, in justice to those employed in this part of the country, or, in fact, in any other part that I am acquainted with, I must say that I never heard any untrue return made of the prices that beasts or sheep have sold for. Salesmen, from being regularly in the market, must be good judges of the weight and quality of the meat of the beasts or sheep they have to sell for their employers. Besides having good judgment, a Smithfield salesman ought to be a man of good temper, to bear the great undervalue biddings of some of the butchers in an overstocked market. He ought to have capacity to form a quick and correct judgment, when, from the state of the market to give way in the prices he has asked, and when to be firm; and he ought at no time to spare either pains or trouble to do the best in his power for those who employ him. I am quite satisfied that a clever painstaking salesman, who regularly attends the market, can on the whole, make more of graziers' and stall-feeders' beasts than they themselves can, provided he has not too large droves. Objections, however, are reasonably and fairly made to those who are in the habit of jobbing.'

TABLE FOR THE EQUALISATION OF DIFFERENT WEIGHTS.

Scores	Stones at 14 lbs.	Stones at 8 lbs.	Scotch stones, 16 lbs.	Hundreds, 112 lbs.
	st. lbs.	st. lbs.	st. lbs.	cwt. qrs. lbs.
20 equal	28 8	50 0	25 0	3 2 8
25 „	35 10	62 4	31 2	4 1 24
30 „	42 12	75 0	37 4	5 1 12
35 „	50 0	87 4	43 6	6 1 0
40 „	57 2	100 0	50 0	7 0 16
45 „	64 4	112 4	56 2	8 0 4
50 „	71 6	125 0	62 4	8 3 20
55 „	78 8	137 4	68 6	9 3 8
60 „	85 10	150 0	75 0	10 2 24
65 „	92 12	162 4	81 2	11 2 12
70 „	100 0	175 0	87 4	12 2 0
75 „	107 2	187 4	93 6	13 1 16
80 „	114 4	200 0	100 0	14 1 4

The weights *per stone*, commonly used for cattle in different parts of the kingdom, are as follow, viz.:—

Smithfield . . .	8 lbs. of 16 oz. each
N. Country . .	14 lbs. „
Common Scotch . .	16 lbs. „
Glasgow Tron . . .	16 lbs. of 22 oz. each
Ayrshire .	16 lbs. of 24 „
Dutch .	16 lbs. of 17½ „

Of these, the stone of 14 lbs. is chiefly used in calculating live weight, and that of 8lbs. for the carcase.

A great deal of dead meat is brought by railways from different parts of the kingdom, as well as by the steamers from both the eastern and western coasts, and from Scotland and Ireland. A hint or two may be of service to those who send it. The sheep should be slaughtered and dressed with all the attention to cleanliness that is found in a London slaughter-house. This is not so much regarded as it ought to be. The carcase of the sheep usually comes whole, but that of the ox is too often sadly disfigured. The meat is not packed in so cleanly a manner as it ought to be, nor has it been suffered to hang until the muscles and the fat become set. Mutton should hang eighteen hours, and beef thirty, before they are sent away. They are often stowed away far too closely. Nay, the carcase of the sheep is sometimes enclosed in that of the ox, and in consequence of this the meat is heated, bruised, and acquires an ill flavour.

TABLE OF PRICES.

Per Score of 20lbs.—the difference being calculated at One Farthing per lb.

Scores at	3¾d.	4d.	4¼d.	4½d.	4¾d.	5d.	5¼d.	5½d.	5¾d.	6d.	6¼d.	6½d.	6¾d.	7d.	Difference
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1	0 6 3	0 6 8	0 7 1	0 7 6	0 7 11	0 8 4	0 8 9	0 9 2	0 9 7	0 10 0	0 10 5	0 10 10	0 11 3	0 11 8	0 0 5
2	0 12 6	0 13 4	0 14 2	0 15 0	0 15 10	0 16 8	0 17 6	0 18 4	0 19 2	1 0 0	1 0 10	1 1 8	1 2 6	1 3 4	0 0 10
3	0 18 9	1 0 0	1 1 3	1 2 6	1 3 9	1 5 0	1 6 3	1 7 6	1 8 9	1 10 0	1 11 3	1 12 6	1 13 9	1 15 0	0 1 3
4	1 5 0	1 6 8	1 8 4	1 10 0	1 11 8	1 13 4	1 15 0	1 16 8	1 18 4	2 0 0	2 1 8	2 3 4	2 5 0	2 6 8	0 1 8
5	1 11 3	1 13 4	1 15 5	1 17 6	1 19 7	2 1 8	2 3 9	2 5 10	2 7 11	2 10 0	2 12 1	2 14 2	2 16 3	2 18 4	0 2 1
20	6 5 0	6 13 4	7 1 8	7 10 0	7 18 4	8 6 8	8 15 0	9 3 4	9 11 8	10 0 0	10 8 4	10 16 8	11 5 0	11 13 4	0 8 4
25	7 16 3	8 6 8	8 17 1	9 7 6	9 17 11	10 8 4	10 18 9	11 9 2	11 19 7	12 10 0	13 0 5	13 10 10	14 1 3	14 11 8	0 10 5
30	9 7 6	10 0 0	10 12 6	11 5 0	11 17 0	12 10 0	13 2 6	13 15 0	14 7 6	15 0 0	15 12 6	16 5 0	16 17 6	17 10 0	0 12 6
35	10 18 9	11 13 4	12 7 11	13 2 6	13 17 1	14 11 8	15 6 3	16 0 10	16 15 5	17 10 0	18 4 7	18 19 2	19 13 9	20 1 4	0 14 7
40	12 10 0	13 6 8	14 3 4	15 0 0	15 16 8	16 13 4	17 10 0	18 6 8	19 3 4	20 0 0	20 16 8	21 13 4	22 10 0	23 6 8	0 16 8
45	14 1 3	15 0 0	15 18 9	16 17 6	17 16 3	18 15 0	19 13 9	20 12 6	21 11 3	22 10 0	23 8 9	24 7 6	25 6 3	26 5 0	0 18 9
50	15 12 6	16 13 4	17 14 2	18 15 0	19 15 10	20 16 8	21 17 6	22 18 4	23 19 2	25 0 0	26 0 10	27 1 8	28 2 6	29 3 4	1 0 10
55	17 3 9	18 6 8	19 9 7	20 12 6	21 15 5	22 18 4	24 1 3	25 4 2	26 7 1	27 10 0	28 12 11	29 15 10	30 18 9	32 1 8	1 2 11
60	18 15 0	20 0 0	21 5 0	22 10 0	23 15 6	25 0 0	26 5 0	27 10 0	28 15 0	30 0 0	31 5 0	32 10 0	33 15 0	35 0 0	1 5 0
65	20 6 3	21 13 4	23 0 5	24 7 6	25 14 7	27 1 8	28 8 9	29 15 10	31 2 11	32 10 0	33 17 1	35 4 2	36 11 3	37 18 4	1 7 1
70	21 17 6	23 6 8	24 15 10	26 5 0	27 14 2	29 3 4	30 12 6	32 1 8	33 10 10	35 0 0	36 9 2	37 18 4	39 7 6	40 16 8	1 9 2
75	23 8 9	25 0 0	26 11 3	28 2 6	29 13 9	31 5 0	32 16 3	34 7 6	35 18 9	37 10 0	39 1 3	40 12 6	42 3 9	43 15 0	1 11 3
80	25 0 0	26 13 4	28 6 8	30 8 0	31 13 4	33 6 8	35 0 0	36 13 4	38 6 8	40 0 0	41 13 4	43 6 8	45 0 0	46 13 4	1 13 4
85	26 11 3	28 6 8	30 2 1	31 17 6	33 12 11	35 8 4	37 3 9	38 19 2	40 14 7	42 10 0	44 5 5	46 0 0	47 16 3	49 11 8	1 15 5
90	28 2 6	30 0 0	31 17 6	33 15 0	35 12 6	37 10 0	39 7 6	41 5 0	43 2 6	45 0 0	46 17 6	48 15 0	50 12 6	52 10 0	1 17 6
95	29 13 9	31 13 4	33 12 11	35 12 6	37 12 1	39 11 8	41 11 3	43 10 10	45 10 5	47 10 0	49 9 7	51 9 2	53 8 9	55 8 4	1 19 7
100	31 5 0	33 6 8	35 8 4	37 10 0	39 11 8	41 13 4	43 15 0	45 16 8	47 18 4	50 0 0	52 1 8	54 3 4	56 5 0	58 6 8	2 1 8
N.B.—One half, as above, is . .		2d.	—	2¼d.	—	2½d.	—	2¾d.	—	3d.	—	3¼d.	—	3½d.	

When on ship-board the necessary care has not always been taken to keep it cool and dry, and protect it from beastliness of one kind or another.

This trade is increasing, and, could the consumer be assured that the animal was in good health, that the manipulations of the slaughter-house had been conducted in a proper manner, that the vehicles in which the meat is brought were clean and wholesome, and that no nuisance had been suffered to come *in contact with it*, the trade would be still more extended, and almost rival the traffic in live meat.

Much live meat is also now imported from abroad; but our graziers will do well to be very cautious how they purchase these animals for fattening purposes, and, above all, how they mingle them with their stock, for many come over in ill health, and others contract disease during their journey. It is the opinion of scientific men that some of the cattle scourges which have made the last few years so unfortunately famous, have been originally attributable to the intermingling of foreign cattle with our native stock. We could fill a goodly-sized volume with all the matter *pro* and *con* which has been given only within the last two or three years on the subject of the 'Foreign Cattle Trade,' and its influence upon British agriculture.

The following statistics, prepared specially for the pages of 'Bell's Weekly Messenger,' and from which we originally took it, will be interesting as showing the extent of the cattle traffic on railways. Since it was prepared there has been, of course, an enormous increase in the traffic; but, given originally as merely an indication of what that traffic is, and of the importance to the community of the art and practice of grazing, we prefer to retain it in the present edition, rather than to excise it, simply because the figures are not available by which we could bring it up to date:—

'The movement of live stock on British railways has attained astonishing dimensions. Thus, in the year ending Dec. 31, 1861, 2,085,418 oxen, 6,085,745 sheep, and 1,204,156 pigs passed over railways in England and Wales, as compared with 1,926,214 oxen, 5,881,512 sheep, and 1,351,770 pigs in the previous twelve months, ending Dec. 31, 1860. In 1861 the Scottish railways conveyed 442,451 oxen, 1,412,959 sheep, and 79,695 pigs, as compared with 353,552 oxen, 1,068,502 sheep, and 72,227 pigs in 1860; and the Irish railways carried 393,001 oxen, 435,257 sheep, and 732,001 pigs in 1861, as compared with 337,039 oxen, 407,492 sheep, and 685,195 pigs in 1860. The combined totals for the three kingdoms were consequently 2,920,870 oxen, 7,933,961 sheep, and 2,015,852 pigs in 1861, as compared with 2,616,805 oxen, 7,357,506 sheep, and 2,109,192 pigs in 1860. It will be noticed that there was a decided increase in the number of oxen and sheep carried, but a diminution in the movement of pigs, arising wholly in England. In Scotland and Ireland there was an increase in every class, and it is gratifying to note the progress in wealth and comfort of which the return for Ireland may be taken as an indication. The receipts derived from the carriage of live stock in England and Wales amounted to 473,479*l.* in 1861, as compared with 443,674*l.* in 1860; in Scotland, to 58,876*l.* in 1861, as compared with 48,246*l.* in 1860; and in Ireland, to 89,027*l.* in 1861, as compared with 79,060*l.* in 1860. The total receipts for the three kingdoms under this head consequently amounted to 621,382*l.* in 1860, as compared with 570,980 in 1861. The details do not appear to be quite complete so far as the numbers of the stock conveyed are concerned, no return on that point having been received: for instance, from the Midland system, which derived last year 30,101*l.* from this branch of traffic.

'Having given this general preface, we may now proceed to notice in detail the cattle traffic on 20 of the leading systems. The Bristol and Exeter Railway carried last year 21,835 oxen, 128,030 sheep, and 2,090 pigs, producing a revenue of 5,965*l.*; the Great Eastern carried 262,022 oxen, 820,867 sheep, and 207,988 pigs, producing a revenue of 75,491*l.*; the Great Northern carried 159,557 oxen, 547,207 sheep, and 97,003 pigs, producing a revenue of 32,497*l.*; the Great Western (including also the South Wales and West Midland) carried 199,783 oxen, 530,086 sheep, and 155,301 pigs, producing a revenue of 41,047*l.*; the Lancashire and Yorkshire carried 222,416 oxen, 508,069 sheep, and 76,409 pigs, producing a revenue of 23,131*l.*; the London and North Western carried 487,208 oxen, 1,405,243 sheep, and 488,214 pigs, producing a revenue of 150,196*l.*; the London and South Western carried 57,597 oxen, 284,746 sheep, and 34,944 pigs, producing a revenue of 17,863*l.*; the London, Brighton, and South Coast carried 16,893 oxen, 134,839 sheep, and 9,489 pigs, producing a revenue of 5,515*l.*; the Manchester, Sheffield, and Lincolnshire carried 55,740 oxen, 134,049 sheep, and 42,212 pigs, producing a revenue of 11,130*l.*; the Midland, which did not enter into details of its cattle traffic, earned from that source 30,101*l.*; the North Eastern carried 216,313 oxen, 674,741 sheep, and 91,234 pigs, producing a revenue of 51,022*l.*; the South Eastern carried 35,907 oxen, 180,546 sheep, and 8,545 pigs, producing a revenue of 8,608*l.*; the Caledonian carried 77,327 oxen, 302,498 sheep, and 9,136 pigs, producing a revenue of 13,946*l.*; the Edinburgh and Glasgow carried 50,953 oxen, 122,462 sheep, and 12,011 pigs, producing a revenue of 4,676*l.*; the Glasgow and South Western carried 42,270 oxen, 221,238 sheep, and 8,694 pigs, producing a revenue of 6,183*l.*; the Great Northern of Scotland carried 55,121 oxen, 34,997 sheep, and 6,903 pigs, producing a revenue of 4,413*l.*; the North British carried 55,500 oxen, 220,742 sheep, and 25,314 pigs, producing a revenue of 8,012*l.*; the Scottish Central carried 56,208 oxen, 167,740 sheep, and 1,938 pigs, producing a revenue of 8,337*l.*; the Great Southern and Western (Ireland) carried 112,460 oxen, 131,422 sheep, and 188,278 pigs, producing a revenue of 28,325*l.*; and the Midland Great Western of Ireland carried 88,481 oxen, 175,001 sheep, and 113,479 pigs, producing a revenue of 29,632*l.*

'The relative importance of the cattle business of these companies may consequently be stated as follows:—

	System	Cattle traffic receipts
1.	London and North Western	£150,196
2.	Great Eastern	75,491
3.	North Eastern	51,022
4.	Great Western	41,047
5.	Great Northern	32,497
6.	Midland	30,101
7.	Midland Great Western of Ireland	29,632
8.	Great Southern and Western of Ireland	28,325
9.	Lancashire and Yorkshire	23,131
10.	London and South Western	17,863
11.	Caledonian	13,946
12.	Manchester, Sheffield, and Lincolnshire	11,130
13.	South Eastern	8,608
14.	Scottish Central	8,337
15.	North British	8,012
16.	Glasgow and South Western	6,183
17.	Bristol and Exeter	5,965
18.	London, Brighton, and South Coast	5,515
19.	Edinburgh and Glasgow	4,675
20.	Great North of Scotland	4,413

'The North Western, as was to be expected, thus heads the list—a fact due first to its immense mileage, and secondly to its receiving all the lean Scotch and Irish beasts *en route* for the British grazing districts. The Great Eastern comes next and reveals glimpses of rich flocks and herds fattening for the Metropolitan and local markets in the counties of Norfolk, Suffolk, Cambridgeshire, Essex, and Hertfordshire. The North Eastern, which has Yorkshire for a *pièce de resistance*, occupies a respectable but not a brilliant position. The Great Western, considering its very extensive territory, rather disappoints. The two Irish arterial lines evidently do an excellent cattle business. With respect to other systems, we may leave them to speak for themselves.'

As already stated, the result of all our enquiries, made in the best and most trustworthy quarters, have ended in proving that we can gain nothing new to the information which was gathered by our able authority—who has, we believe, discontinued his researches and enquiries into the subject. And when we turn to such brief enquiries as have been instituted by Government, we find that the information they deal out is not only of the vaguest and most untrustworthy character, but even such as it is, is arranged in so careless and haphazard a style that it is worse than useless either to attempt to reduce the hopeless mass of figures to anything like order, or when so treated, to place any reliance on their trustworthiness.

From such a state of matters it is some relief to turn to the record of a trial which has been recently made, with many hopes of ultimate success, to add, if not to the supply of home-bred and home-fed stock, at least to those which will supplement them and tend to make them cheaper and more easily obtained. We refer to the importation of animals from America both alive and in the form of 'dead meat.' There has been a considerable number of animals brought over alive from America to this country—as many we believe as 154 having been presented in the Glasgow market in the month of June last (1876), and which brought a price—33*l*. per head—which proved not only the weight of the beasts but the good, nay, the high quality of their meat. The trade in this department is, however, we fear, not likely to increase if we take into consideration all the difficulties connected with it—the cost of freight, the bulk or space taken up by each animal being considerable—the cost of 'keep,' the weight of the 'offal,' and the risk attendant upon the animals from sickness or deaths: not to lose sight of another important point, the deterioration in the condition of the animals during the voyage—averaging, according to one estimate, one sixth, or 2 cwt. in a 12 cwt. bullock.

There are more favourable points connected with the 'dead meat' system. In this there is no offal—at least, if this was brought over at all, it would be simply bought and sold as such—it takes up much less space, requires no attention like live animals; and the system upon which it is transported seems to be so effectual that it is in as good condition nearly—in many respects better when compared with some meat exposed for sale—as where the animals are bred and fed in this country. The system by which the meat is preserved during the voyage is very simple, and consists simply in packing or placing the cut-up meat in chambers specially prepared and placed in convenient situations in the hold of the ship. Into these chambers air artificially cooled is introduced, and circulating and remaining amongst the interstices of the meat, keeps it fresh and cool for a considerable length of time. It is, we believe, to Professor Gamgee that the public are indebted for this system, which of all those yet introduced offers, we believe, the greatest chances of ultimate success, and seems to us infinitely preferable to the 'tinned meat system,' to which the British public, so hard to please in the matter of the palate, has never taken kindly, and put up with only as a kind of '*dernier ressort*.'

BOOK THE SECOND.

ON THE ECONOMY AND MANAGEMENT OF THE DAIRY.

CHAPTER I.

OF MILCH KINE.

THE value of the respective breeds of milch kine having been already stated,[1] it will rest with the farmer to make his selection, according to the nature of the soil, and the particular branch of dairying which he means to pursue; for, if his object is to sell milk or to suckle calves, quantity must be the material consideration; and quality, if he means to produce butter and cheese.

It is a general observation that the richest milk is produced by the red cow; while the black variety is reckoned best for the purpose of breeding, as the calf is usually both stronger and more healthy than the offspring of the red species. This, however, is one of the errors that have been transmitted through a long series of years. The red cows have, indeed, been long celebrated for the excellence of their milk, and the calves of black cows have been proverbially deemed good; but colour is in this respect a matter of no moment: the *breed* alone should claim the farmer's attention. It is that which gives excellence to both colours and for both purposes.

Cows of the same and of the best breeds will not always yield the same quantity of milk, and the milk of those that yield the most is not unfrequently deficient in richness. These points, however, which are of great importance to the dairy, may be easily determined by keeping the cows on the same food, weighing the quantity consumed by each, measuring their milk, and then keeping and churning it a few times separately. Thus, reckoning the cost of the provender, and the produce of the milk of each,

[1] See Book i. chap. i.

and comparing the result, it will soon be discovered which is the most profitable animal. Comparisons of this kind are not often made, for farmers usually purchase whatever stock they can most conveniently or most cheaply obtain, and are then content to keep them so long as they turn out tolerably well. This, nevertheless, is exceedingly bad economy, for an indifferent cow will eat as much, and require as much attendance, as the best, and occasion a daily loss that will soon exceed any probable saving in the original price. The man who takes the pains to acquire a good stock, and has the sense to keep it, lays the sure foundation for doing well.

In point of quantity of milk yielded, large cows, of whatever breed, will generally be found to have an advantage over the small ones. In this particular the short-horn breed excels; but they require a rich soil, and consume a great deal of food, though perhaps not more than they honestly pay for in the quantity of milk. They are not, as was long believed, exclusively of the old Durham stock, but have no little share of the improved blood of the short-horns. They yield nearly as much milk as their unthrifty neighbours used to do, and when they begin to get old, are prepared for the butcher with a degree of rapidity of which the old tribes could never boast. Cows of this breed have been known to give as much as twenty quarts of milk a day, and there are instances of even more. These were of the old Yorkshire stock. They do not belong to the improved breeds of short horns, and their milk is not equal in richness to the Devon or the Kyloe.

Two experiments, in order to ascertain their comparative merit, are said to have been made in the county of Durham, by persons of impartiality and experience. Each obtained two ounces of butter from a quart of Kyloe milk, while a quart from the short-horned breed produced, in one instance, only an ounce, and in the other but very little more. From a further experiment on six cows of the short-horned improved breed, it, however, appeared that the product of a quart of milk from each was as follows:—

	oz.	dr.
No. 1	3	0
2	1	6
3	1	12
4	1	10
5	1	14
6	1	6

The great difference between No. 1 and the remainder is accounted for by the age of the former being six years, and that of all the others only two; for the produce of butter increases to a certain age, and cows are most productive from four to seven years old. This is more particularly the case with the short-horn cattle.

The result of other trials of the *value* of the milk of the two breeds varied, but the *quantity* was uniformly in favour of the Yorkshire. This no doubt accounts for this being the almost universally adopted breed with the London dairymen, with whom quantity is the object most valuable.

Many instances of superior productiveness are cited in the county reports, and other publications, which it would be tedious to enumerate; but one of them is too curious to be omitted. It is that of a cow belonging to Mr. W. Cramp, of Lewes, in Sussex, which during four successive years afforded the following produce, viz.:—

	Milk.	Butter.	Profit.
1805	9421 qts.	541 lbs.	£41 5 11
1806	4137 „	450 „	30 16 1
1807	5782 „	675 „	51 13 1
1808	4219 „	466 „	29 19 7
		Thus leaving a net profit of	£153 14 8

after deducting the expense of feeding; but the charges of management are not included, and dairy produce was then high.

An experiment was also made by Mr. Calvert of Sandysike, near Brampton, on the quantity of butter yielded by one of his cows. It was churned separately from that of the other stock, and, in the course of 32 weeks, produced 373 pounds of butter.

Both of these were short-horns, and there is no doubt that, where the soil is sufficiently good to maintain them, or where sufficient provender can be easily procured, they beat all other cattle in the quantity of milk produced, although perhaps the milk is inferior in quality to that yielded by the Ayrshire, Alderney, or North Devon milch kine; they rival the best of them, too, in the quantity of butter; to which should always be added, their tendency to fatten when they are becoming too old for the dairy.

It will generally be found that, supposing the food to be the same, those cows that yield the least in quantity have the richest milk; yet both quantity and quality constantly vary, even in individuals of the same breed, age, and appearance, and are always affected by the mode of feeding. When kept on old meadow grass, the butter will have a better flavour than when cows are fed on artificial grasses, or even on land that has been newly laid down to pasture; and, although grains, cabbages, turnips, and other succulent roots will increase the quantity of the milk, yet hay, corn, oil-cake, and meal will add most to its richness. Lean cows never yield either so much or so good milk as those which, without being actually fat, are kept in proper condition; and all gradually fall off in quantity after calving, until they become dry.

CHAPTER II.

OF THE PASTURE AND OTHER FOOD BEST CALCULATED FOR COWS, AS REGARDS THEIR MILK.

THE feeding of milch kine is divided into two branches, viz. *pasturing* and *house-feeding*.

In order to obtain an abundant supply of good milk, where the pasturing of cows is adopted, it is not alone requisite that the grass should be plentifully produced, but also that it is of that quality which is relished by the cattle; and this property will generally be found in old natural pastures that have been properly managed. Much attention, moreover, is necessary, in order to eradicate the crow-garlic, or wild garlic, and similar weeds, which, when eaten by cows, uniformly impart a rank flavour to their milk, and consequently to the butter that is made from it. It is likewise worthy of note, that although the long rank grass, growing in orchards or other places, in general feeds well, and produces a flush of milk, yet such milk will neither be so rich, nor carry so much cream in proportion, as the milk of the cows that are fed upon short fine grass; nor will the butter be so good.

The quantity and quality of milk is materially affected by driving them to a distance from one pasture to another; hence it will be proper to have the cow-sheds in as central a part of the farm as possible. It is also of essential importance to have pastures well sheltered and enclosed, as the produce of milch kine will be greatly improved, or deteriorated, according to the attention or disregard bestowed on this point; for, when confined within proper inclosures, they not only feed more leisurely, and are better protected against bad weather, but are also less liable to disturbance than when they wander into other fields. Moderate warmth and quiet are also greatly conducive to an increase of milk.

At a recent meeting of the 'Central Farmers' Club,' Mr. James Dumbrell, of Ditchling, Sussex, in a paper on 'Dairy Management,' gave an account of his system of tethering cows while at pasture. From this paper we give the following extract:—

'Each cow is provided with an iron stump, 18 inches in length, with a tolerably stout chain attached, 12 feet long, at the end of which is a ring; also a leather-headed halter, with a chain lead, about 4 feet in length, at the end of which is a T, so that it can readily be fastened to the 12 feet of chain before mentioned; each animal, therefore, has a range of 16 feet. The cows are staked down at equal distances, so that they do not touch each other. While the grass is very short, it is necessary they should be moved twelve or fourteen times a day; as the food becomes more abundant, they require moving less frequently. It is essentially necessary that only a small portion should be given them at a time, 12 or 18 inches being quite sufficient. In fact, the cows should not be allowed at any time to place their feet on the grass they are about to eat; hence arises one of the advantages of tethering, no grass under proper management being wasted. A plan for tethering is recommended in a French treatise on dairy management, which states: "If the pasture is short, the cows may be left at liberty; but if abundant, and consists of artificial grasses, such as lucerne, vetches, clover, &c., the cows should be confined by a rope to a picket or post in the field, where they are kept till they have eaten the grass, and for some time after, or until they have ruminated; they are then fixed in another spot. This change should take place five or six times a day." Now the objection to this plan is, that the animal would trample down and soil a great portion of the feed, almost as much as though she were turned loose; whereas, in the system I have endeavoured to explain, this is obviated. The grass should be eaten so close as to have the appearance of being mown. The cows must be led, or have water brought to them, twice a day. The Jersey breed are so docile that a man can lead five or six at one time. By the time that a dairy of say twenty or twenty-five cows have been staked over eight acres of meadow land, it will usually be found that the grass upon that part of the field where they first began will be sufficiently grown to be gone over again: indeed the same ground may be pastured three times in one season, particularly on a farm where the liquid manure is utilised, and which can be used nowhere with so much advantage as where the cows are tethered. Eight to ten acres of fair meadow land will be found sufficient, in an average of years, for twenty-five cows, from the time they leave the stall until after hay-making. A great assistance to this system is the addition of some artificial green crops, as rye, trifolium, tares, &c.; for, during very hot weather, and when the fly is troublesome, milch cows are much better under cover in their stalls than out of doors; they should then be tethered during the night and the cooler parts of the day. Having, I trust, explained this system with sufficient clearness, I will endeavour to point out the advantages of it. First, the stock can be taken out of their stalls earlier in the year; second, no grass is wasted; third, a greater quantity of produce is realised, as the feed is uniform in quantity and quality, and the butter is better; and, lastly and chiefly, because, by economising the grass, a greater quantity of hay can be saved for winter use. I make no claim to having originated a new system of feeding; I merely wish to speak with the authority of eighteen years' experience to the complete success of the plan, strengthened by the facts that it was received in my neighbourhood with quite the fair share of ridicule that is usually attached to new schemes, and is now frequently adopted, particularly by small occupiers, who are perhaps more anxious to economise feed than larger holders. To proceed: we may suppose that our tethering carries us to quite the end of June or middle of July, and now is the time, just before the growth of the after-grass, when some care is required, and for which time some artificial provision is needed. Backward sown tares is the best food to meet the difficulty; with this assistance the after-grass may be allowed to get a good head before it is begun. This brings us to the end of July, and the after-grass will carry us well through August, and this is the best month of the whole year for butter-making. Through the month of September mangold leaves will be found serviceable. For the end of September or beginning of October, white turnips should be provided. Towards the end of October, a little hay, morning and night, is indispensable, and, as the weather becomes cold and wet, cows must be taken into stalls at night. Lying out in wet weather is detrimental in every way to dairy stock, but no weather is so injurious to the produce of milk, besides being likely to cause abortion or slinking, as white frosts, and the greatest care should be taken that cows in calf should not feed out at that time. White turnips, with the remainder of the autumn grass, will carry us to the end of November, after which time drum-head cabbage must be provided for at least two months. On dry pasture land cows may leave the stalls in fine weather the whole of the winter, and the exercise and air will be found beneficial to them. On wet cold land, unless in very exceptional years, they cannot go out after the end of December. Cabbage is very valuable winter feed, as it assists the colour of the butter, and is highly nutritious. Through February and March swedes may be used, and will be found to produce more butter than any other root. During all this winter season a liberal supply of good hay, not heated, is requisite. At the beginning of April mangold comes in, and, if the weather is fine, some old grass reserved from the autumn is very useful, with the addition of spring rape or late sown white turnips; this, with rye, which must be used sparingly, brings us to our starting point. You will observe in these remarks no calculation is made for the use of artificial feed, such as oil-cake, meal, grains, &c. Speaking from my own experience, I have never found it profitable; for although the animal may give an increased yield of produce for the additional feed, it is not sufficient to repay the outlay. There are times, of course, when adverse circumstances must necessitate the use of artificial food, but, as a rule, it cannot be recommended.'

We shall see, in the next chapter, that Mr. Dumbrell is at variance on this point with the highest modern authorities on Dairy Management.

With regard to the housing of milch kine during summer—the general practice is, where there are proper enclosures, to send them out in the evening, in order that they may lie out during the night, while during the day they are kept more cool and quiet in the cow-sheds than in the fields. The advantages resulting thence are, that they breathe a purer atmosphere, and there can be little doubt that, at this season, they yield more and better milk than if they were wholly confined.

In some of the most exposed situations in the west of Scotland, the cows are turned into the fields every day throughout the year, unless in very stormy weather; and some persons keep them constantly out, both day and night. Although we cannot recommend the latter practice, yet it is certain that animals uniformly thus treated are much more hardy, and less exposed to injury from sudden changes of the weather, than when they are kept too warm.

They are also said to yield more milk. In proof of this assertion is the common observation, that when cows, accustomed to lie out, have been housed at night, they have been found more dried up in their milk on the following morning, than others which have even been exposed to a storm.

In the winter, however, milch kine are usually fed in houses, and, where the practice of keeping them in stalls does not prevail, it will be proper to have warm sheltered yards, furnished with open sheds, in which they can feed without exposure to the severities of the weather. The latter is the preferable practice, for pure air is indispensable to health; but if stalls are used, the cow-houses should be well ventilated, and situated adjoining to a pasture, or a yard into which the cows could be frequently turned.

'On whatever plan the stalls are arranged,' says Mr. Dumbrell, 'there are four desiderata that must not be lost sight of—warmth, light, cleanliness, and perfect ventilation. For Alderney cows, pens 6 feet 6 inches square will be found sufficient room for two. This includes the manger, which is on the ground. The water trough should be 2 feet from the ground. Behind the cows should be a drain 18 inches wide, to convey the liquid portion of the manure into an adjacent tank; also a path 4 feet wide. A frequent application of whitewash conduces materially to health. The cows should be combed and brushed daily, not only for the sake of cleanliness, but also because it promotes circulation.'

In the management of milch kine it is essential that they should, at all times, be kept in high health and good condition. If they are suffered to fall in flesh during the winter, it will be folly to expect an abundant supply of milk by bringing them into high condition in the summer. If cows are lean when calving, no subsequent management can bring them to yield, for that season, the quantity of milk they would have furnished had they been well kept throughout the winter. It is not easy to persuade farmers to afford high feeding to unproductive stock; nor is it requisite for cows that are dry; but the common practice of keeping them during that period on the poorest fodder is very objectionable, and the injury to the future produce of the cow will greatly exceed the saving in provender. During the winter, therefore, some nutritious food should be provided for them, and the animals be kept moderately warm; for they will thrive more and eat less when kept warm than when they are shivering with cold. When fed on straw, or coarse hay alone, without any green food, until towards the time of calving, the vessels secreting the milk become inert and powerless, and will not afterwards yield either much nutriment or of good quality, until the beasts are turned out to pasture. The milk of lean cows is always poor, and as deficient in quantity as in quality; it is, therefore, important that milch kine should be maintained, at all times, not only in good condition, but in what may be termed a *milky habit*. For this purpose, a small quantity of any of the succulent roots will be found sufficient in addition to their usual dry food. A few Swedish turnips and a small portion (say 3 to 4 lbs. per day) of oil-cake will be essentially useful in preventing costiveness, hide-bound, and the drying up of the milk; and will be conducive, not only to the present health of the animal, but to her preservation in that state of constitution in which she will be most fit to profit by the superior nourishment to be obtained in the spring.

In Holland, where it is well known that the management of cows is carried to the highest perfection, they are curried in the same manner, and kept as cleanly, as horses in a stable.[1] If this is an error, it is at least one on the right side, and the invariable high condition of all Dutch dairy stock is the surest proof of their superior management, the chief features of which are—care in keeping the cattle dry as well as clean, and attention to the purity of the water. This latter point is considered of such importance that the water is not even suffered to be tainted by the breath of the beasts. And yet it is a known fact that cattle frequently prefer the water of ponds impregnated with the urine of other animals; a circumstance probably arising from the saline matter which this water contains, and which instinct points out as beneficial to their health. (See a preceding note on salt in food, and a succeeding one on water for stock.)

It has already been intimated that the best summer food for

[1] Baron d'Alton, in Communication to the Board of Agriculture, vol. i.

cows is good grass, spontaneously growing on sound meadows; but when these are shut up, *tares*, *lucerne*, and *clover*, either cut or pastured, may be very advantageously substituted. There is a prejudice against tares, from their being supposed to render the milk *ropy*; but we have been assured by a farmer who kept twenty-one cows of a mixed breed on the verge of Epping Forest, that he soiled them night and morning on tares during a great part of the summer, without any other assistance than the common pasture of the forest, and that not only was there no appearance of ropiness in the milk, but it was far richer than when the cows were fed on meadow grass, the butter likewise being of the finest quality.

Beans given in conjunction with good pasturage are excellent for keeping cows in milking order, and also in good condition. The beans should be ground, and from three to four pounds of the meal given per day.

Good sweet hay is the staple winter food of a milch cow; the accessories are those usually employed in feeding and fattening cattle. Swedish turnips, pea or bean meal, and oil-cake, will render the milk richest. But carrots, mangold-wurzel, and potatoes may be given.[1] Indeed on the Continent the mangold-wurzel is preferred to other roots for feeding cattle,[2] and many accounts are given of the nutritive powers of the potato; one bushel of them *per diem*, with good meadow hay, are said to cause a milch cow to yield as much milk as she would when fed on the finest pasturage.

Cabbages are likewise of great service in this respect, but they require to be given with a considerable portion of sweet hay; and, like *turnips*, are apt to impart an unpleasant flavour to butter, unless great care is taken to remove all the decayed leaves. *Fog*, or *rowen* grass, is reserved for winter use. To these may be added, as occasionally useful, pulverised *oil-cake*, *linseed jelly*, and *grains*.[3]

[1] In the Island of Jersey, about 35 pounds of parsnips are given daily to the cows, with hay. They are found to improve the quality of the cream, which is more abundant than from an equal quantity of milk from cows differently fed—*seven quarts producing as much as seventeen ounces of butter*—and the flavour of the latter is superior.—*Quayle's General View of the Norman Isles.*

[2] Mr. Harley, at his dairy at Willowbank, put the comparative value of mangold-wurzel and Swedish turnips satisfactorily to the test. He took a correspondent weight of each, and gave them to two lots of cows of equal numbers, great attention being paid to the quantity and quality of the milk produced, and the improvement in the condition of the cattle. In these respects, however, there was found to be little or no variation. The quantity and quality of the milk and the improvement of the cattle were much the same; but the Swedish turnips were ultimately preferred on account of the deep soil which the mangold-wurzel required.—*Harley's Dairy System*, p. 71.

[3] Mr. Harley thus speaks of *grains*:—'When they were plentiful and cheap—which was generally the case in winter—a large portion of them were given with the more succulent food, but they were apt to make the cattle grain-sick. It has been ascertained that if cows are kept long upon grains or distillers' wash, their constitution will soon be destroyed, and cattle thus fed should not be kept longer than eight or

By a judicious use of these various articles, together with a due mixture of dry food, considerable nutriment will be thrown into the system, the regular secretions will be excited and the quality of the milk very materially improved.

But in some districts farmers object to the use of roots or green food for milch cows, alleging that it spoils the milk; they feed this portion of their stock entirely on the best hay and oil-cake during the winter.

Malt has been highly recommended, the animals fed on it being said to yield better flavoured and richer milk than can be obtained from any kept on roots or cabbages. The expense, however, will always prevent this article of food being used to any extent.

Steamed food is generally admitted to produce more and better milk than raw.

In some parts of Flanders, after the corn crops have been reaped, the ground is lightly ploughed and sown with *spurry*. The cows are tethered on it in October, and a space allowed to each proportioned to the crop and the size and appetite of the animal. The butter from the milk thus obtained is called *spergule butter*. It is not of equal quality with that produced from the common food.[1]

The following mode of feeding milch cows is practised to a great extent in the county of Middlesex, from which the inhabitants of London chiefly derive their milk. During the night the cows are confined in stalls, and about three o'clock in the morning each has a half-bushel basket full of grains given to her. When the operation of milking is finished, each receives twice that quantity of turnips, and shortly afterwards one truss of the finest, softest, earliest made, and greenest meadow-hay is divided amongst ten cows. These various feedings are usually made before eight o'clock in the morning, when the animals are turned into the cow-yard. Four hours after this they are again tied up in their stalls, and supplied with an allowance of grains similar to that which they received in the morning. On the conclusion of the afternoon milking (which generally continues until nearly three o'clock), they are served with a similar quantity of turnips; and in the course of another hour, with a like allotment of hay. This method of feeding usually continues throughout the turnip season, that is, from November to March. During the remaining months they are fed with grains, tares, cabbages, and the proportion of rowen, or second-cut meadow-

ten months. A little boiled linseed was considered to be the best antidote in preventing distillers' wash from injuring the health of the animals; and wheat-straw, cut short and mixed with the grains, prevented the cows from being grain-sick.'—*Harley's Dairy System*, p. 74.

[1] Sir John Sinclair's Hints on the Agriculture of the Netherlands, &c.

hay, already mentioned. They are supplied with equal regularity until they are turned out to grass, when they pass the whole of the night in the field; and even during this season they occasionally have grains, with which some cowkeepers mixed common salt, with a view to preserve them longer in a sweet and wholesome state. This practice, however, has much declined, as the parties who tried the experiment did not meet with an adequate return for their labour and expense,[1] although it has been asserted that the mixing of salt with the food of cows (who will eat it with great avidity) both increases the quantity and improves the quality of the milk, while it contributes to promote the health of milch kine.

In Yorkshire, milch cows are allowed the best pastures during summer, and are usually housed about Martinmas, when their food is turnips and straw, or, where turnips are not cultivated, hay: but a difference is made between those which are rather fresh of milk, and those which are nearly dry, the former having a larger portion of turnips, with the addition of hay, while the latter are put off with little else than chopped straw until within a few weeks of calving, when hay is allowed. In Essex, the system is nearly the same, except that, the produce of the dairy being chiefly butter, turnips are seldom given. Rowen hay, as being the softest and greenest, is preferred, and the consumption is calculated at two loads (of eighteen cwt.) in the winter, with two acres of summer pasture, and some straw, while drying off.

In the neighbourhood of London distillers' grains and wash are extensively given to milch cows, and with advantage as regards the quantity of the milk; these articles do not, however, improve the quality.

In the course of the preceding statements, the *stall-* or *house-feeding*, of cows during the winter in Holland has been mentioned; and from the remarks of Baron d'Alton, it appears that this method of feeding is there adopted throughout the year with greater profit than can be obtained from pasturing. The Baron, certainly, says that cows must be early trained to the confinement of stall-feeding, otherwise they do not thrive; but, as the advantages of soiling and stall-feeding are so great, there can be no difficulty in adopting it, and where it is intended to keep cattle

[1] Middleton's Agricultural Report for the County of Middlesex, 8vo. This intelligent reporter further states that brewers' grains may be preserved, in a sound state, from March till summer, when brewing is discontinued, by tightly treading them down in pits below the surface of the ground, and covering them over with a layer of earth, in order to exclude the air and prevent fermentation. They are, in fact, preserved during a much longer period, and are said to have been found sweet and in good order after a lapse of years. The grains increase the *quantity* at the expense of the *quality* of the milk; but this answers the purpose of the London cowkeepers, to whom the quality is a secondary consideration. The same may also be said of *common* turnips, though *Swedes* may be used without disadvantage.

thus the calves may be easily reconciled to the confinement from an early age.

Mr. Horsfall's system of dairy management, recorded with such fulness and accuracy of detail in the Journal of the Royal Agricultural Society of England, has deservedly attracted considerable attention. We give here his own description of it:—

'My dairy is but 6 feet wide by 15 long, and 12 feet high; at one end (to the north) is a trellis window, at the other an inner door, which opens into the kitchen. There is another door near to this, which opens into the churning-room, having also a northern aspect; both doors are near the south end of the dairy. Along each side and the north end, two shelves of wood are fixed to the wall, the one 15 inches above the other; 2 feet higher is another shelf, somewhat narrower, but of like length, which is covered with charcoal, whose properties as a deodoriser are sufficiently established. The lower shelves being 2 feet 3 inches wide, the interval or passage between is only 1 foot 6 inches. On each tier of shelves is a shallow wooden cistern, lined with thin sheet lead, having a rim at the edges, 3 inches high. These cisterns incline downwards, slightly towards the window, and contain water to the depth of three inches. At the end nearest the kitchen, each tier of cisterns is supplied with two taps, one for cold water in summer, the other with hot water for winter use. At the end next the north window is a plug or hollow tube, with holes perforated at such an elevation as to take the water before it flows over the cistern. During the summer the door towards the kitchen is closed, and an additional door is fixed against it, with an interval between well packed with straw; a curtain of stout calico hangs before the trellis window, which is dipped in salt water and kept wet during the whole day, by cold water spurted over it from a gutta-percha tube. On the milk being brought in, it is emptied into bowls. (The bowls are of glazed brown earthenware, standing on a base of 6 or 8 inches, and expanding at the surface to nearly twice that width. Four to five quarts are contained in each bowl, the depth being 4 to 5 inches at the centre.) Some time after these bowls have been placed on the cistern, the cold water taps are turned till the water rises through the perforated tube, and flows through a waste pipe into the sewer. The taps are then closed so as to allow a slight trickling of water, which continues through the day. By this means I reduce the temperature, as compared with that outside the window by 20°. I am thus enabled to allow the milk to stand till the cream has risen, and keep the skimmed milk sweet. Having heard complaints during very hot weather of skimmed milk, which had left my dairy perfectly sweet, being affected so as to curdle in cooking on being carried into the village, I caused covers of thick calico (the best of our fabrics for retaining moisture) to be made; these are dipped in salt water and then drawn over the whole of the tin milk-cans; the contrivance is quite successful, and is in great favour with the consumers. I have not heard a single complaint since I adopted it.

'Finding my butter rather soft in hot weather, I uncovered a draw-well which I had not used since I introduced water-works for the supply of the village and my own premises. On lowering a thermometer down the well to a depth of 28 feet, I found it indicated a temperature of 43°—that on the surface being 70°. I first let down the butter, which was somewhat improved, but afterwards the cream; for this purpose I procured a movable windlass, with a rope of the required length; the cream jar is placed in a basket 2 feet 4 inches deep, suspended on the rope, and let down the evening previous to churning. It is drawn up early next morning, and immediately churned; by this means the churning occupies about the same time as in winter, and the butter is of like consistency. The advantage I derive from this is such that, rather than be without it, I should prefer sinking a well for the purpose of reaching a like temperature.

'When the winter approaches, the open trellis window to the north is closed, an additional shutter being fixed outside, and the interval between this and an inner shutter closely packed with straw, to prevent the access of air and cold; the door to the kitchen is, at the same time, unclosed, to admit warmth. Before the milk is brought from the cow-house, the dairymaid washes the bowls well with hot water, the effect of which is to take off the chill, but not to warm them; the milk is brought in as milked, and is passed through a sile into the bowls, which are then placed on the cisterns. A thermometer, with its bulb immersed in the milk, denotes a temperature of about 90°. The hot water is applied immediately, at a temperature of 100°, or upwards, and continues to flow for about five minutes, when the supply is exhausted. The bowls being of thick earthenware—a slow conductor—this does not heighten the temperature of the milk. The cooling, however, is thereby retarded, as I find the milk, after standing four hours, maintains a temperature of 60°. This application of hot water is renewed at each milking to the new milk, but not repeated to the same after it has cooled.'

The following is the mode of feeding adopted during a milking competition of Ayrshire cows:—

One bushel 'draff' (distillery 'grains' or spent malt, 'dreg' is the liquid refuse or wash), mangold, bean-meal, oatmeal, mangold-juice with oatmeal.

Mangold boiled and bean-meal.

Cut grass with 2 lbs. bean-meal, 1 lb. oatmeal, 1 lb. bran, and ½ lb. oil-cake.

Grass during the day, and mangold night and morning, with 3 lb. of oatmeal, and 3 lbs. of bean-meal each. One refused to eat the meal.

Bean-meal, as we have shown, is used by Mr. Horsfall in his system of feeding milch cows; pea-meal is used by several dairymen with good results. The following is a description of one method of giving it:—

'Take a bushel of chaff and eight or ten sound yellow or Swedish turnips, having the tops and tails carefully taken off, and boil them together four or five hours. Add as much water as will cause the hand to move easily through the mass. Squeeze down the turnips, and add three pounds of pea-meal. Give this to a cow in the morning, and the same in the evening, with as much sweet hay as she will eat up clean five times a day; and, without much expense, her butter will be as rich and of as fine a flavour as can be produced in winter. Should the peculiar flavour of the turnip be detected, which is not likely, a small quantity of saltpetre put to the cream will remove it.'

The plan of feeding adopted by one of the greatest dairy farmers in Scotland, the late Mr. Ralston, of Fine-View, is as follows:—Until the grass rises and affords a full bite the cows are kept in their houses, but are then sent out to pasture. In hot weather they are fed on cut grass in the house from six in the morning until six in the evening, and are out at pasture all night, as the soil is dry and sandy. When rainy weather comes house-feeding is discontinued. In harvest, when the pastures begin to fail, the cows are fed partly on second clover, and partly on turnips scattered over their pasture. As the weather becomes colder in October, they are housed at night, and, in severe weather, during the day; also throughout the day receiving oat-straw with turnips. These roots are partly stored, and the supplies of them managed so as to protract the feeding. When they fail, Swedish turnips and potatoes follow, with dry fodder. Chaff, oats, and potatoes are boiled for the cows after calving; and the calves get rye-grass and clover-hay during the latter part of the spring. The cows employed are of the Ayrshire breed.

It is now the opinion of the best breeders that the mixture of salt with the food is beneficial to the health of stock. Some, indeed, have a lump of rock-salt placed in the manger, at which the cattle may lick when they feel inclined. This is a practice which we should strongly recommend to be adopted. (See a preceding note on the use of salt in food, in chapter on Foods.)

CHAPTER III.

OF THE SITUATION AND BUILDINGS PROPER FOR A DAIRY.—DAIRY UTENSILS.

A DAIRY-HOUSE ought, if possible, to be so arranged that its lattices may never front the south, south-west, south-east, or west. A northern aspect is the best, and there should be openings at each end of the building, in order to admit a free current of air. These lattices, which are in every respect superior to glazed lights, may be covered in summer with gauze wire, or oiled paper, pasted on packthread stretched for that purpose, so as to admit the light, whenever it may be necessary to exclude the cold or wind.

The *situation*, for the sake of convenience, should be near the cow-house as well as the farm-house; but care should at the same time be taken that it is not exposed to the effluvia of the cow-house, stables, or farm-yard, as any bad scent might taint the milk, and give an unpleasant flavour to the butter. It frequently happens that the dairy adjoins the cow-house; in such case, however, no communication should exist between them.

If it can be so managed, it should be well sheltered by trees or by the situation of the ground, on the north, the south, and the east. The grand principle of its construction should be to preserve, as much as possible, an equal temperature both in summer and in winter. This is managed in Switzerland and in some parts of France by the dairy being constructed in the heart of a rock. In Switzerland, particularly, the business of the dairy is removed as far up the mountain as convenience will permit, and sometimes, at a considerable distance from the cow-house and the residence of the farmer. A pump should always open into the dairy. In a level country, however, like those districts of England in which our largest dairies are found, it will be for the convenience of the farmer to have the dairy as near to the cow-house and his own residence as possible, but—and the importance of the arrangement will be sufficient excuse for the repetition—there may be proximity, but there should be no direct communication between the cow-house and the dairy.

Where the produce of the dairy is the principal object of the farmer, a little extra expense in the construction of the dairy-house will be ultimately more than repaid by the superior quality of his butter and cheese. The walls of the dairy-house should be of considerable thickness, so as to preserve, as much as possible, the proper temperature, varying from 50° to 55° Fahrenheit's thermometer. Some have recommended double walls, leaving a space of one or two feet, or more, between the wall and the lath and plaster. We should recommend the newly-invented hollow bricks for the walls of dairies. These are less liable to damp, from not being absorbent—the air enclosed within them gives them this peculiarity—and retain a more equal temperature within the walls by impeding the transmission of heat or cold.

Mr. Marshall advises that the wall should be constructed six feet thick, one foot on the inside to be of brick or stone, the outside to be of sod, and the intermediate space to be closely filled with earth. The roof, which should be constructed of thatch, should be at least three feet thick, and should project completely over the walls on each side; and, as all these materials are non-conductors of heat, he is of opinion that a dairy thus built would, if provided with double doors, preserve the degree of heat above mentioned, without any great variation, throughout the year. If the floor were sunk a few feet below the surface of the ground, an equal temperature would be still further ensured; but then it should be strictly ascertained that the ground is perfectly free from damp —dryness and ventilation being the most important object in the construction of this building. The dairy should be neatly paved with stone, or, if this cannot be procured, with red bricks or polished tiles laid on a gentle declivity, and the joinings should be well cemented together, lest any water should stagnate. It will also be proper daily to wash the pavement during summer, but great care should be taken to dry it immediately, as damp rapidly promotes the putrefaction, or turning of the milk.

If a small current of water could be conducted through the premises, by means of a pipe, and it could be so introduced as to fall from some height on to the pavement, and run off in a constant stream, it would be of great advantage; as it would contribute much to preserve the air continually pure, fresh, and cool. Some writers on dairy husbandry have recommended the construction of an ice-house adjoining the dairy, that the temperature may be prevented rising too high in the spring or summer months, but this would form an apparatus far too complex, and would be altogether beyond the reach of the common farmer. (See a succeeding chapter on the Factory System of Dairy Working.)

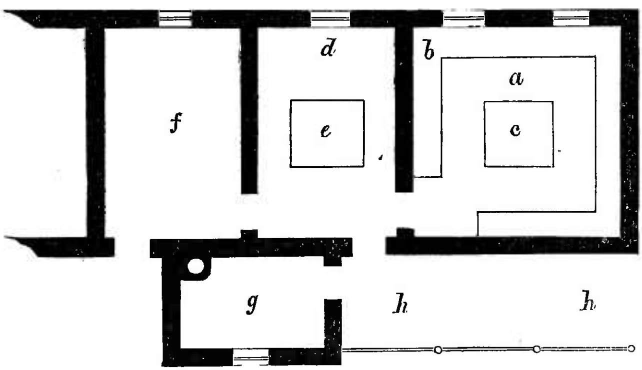
In winter, it is equally important that the requisite degree of heat should be constantly maintained. If the building forms part of the house, it will generally be found sufficiently warm without the addition of ARTIFICIAL heat; but in very cold weather, and in detached dairies, unless they are constructed as already described, it will be difficult to preserve the proper temperature without the aid of a stove. In large dairies the expense would be of no consideration, when put in comparison with the advantage; but great attention is required in the management of this, for if too much warmth is generated, it will be as injurious as too little, and it will be altogether useless if neglected during the night, for if the dairy is once allowed to become too cold the injury done to the milk cannot be repaired by afterwards warming it.

As the greatest cleanliness is requisite in the various departments of the dairy, a well-arranged building should have separate divisions in order that its business be properly performed. A *butter dairy* should comprise three distinct compartments below, with lofts above; one for receiving the milk, another for performing the operation of churning, and a third for containing and cleansing the various utensils. For a *cheese dairy*, four rooms will be requisite, viz. a milk-room, as before, another for making and pressing the cheese, a third for salting it, and a fourth (which may be commodiously placed as a loft over the others) for storing and preserving them until brought to market. The receiving-room, however, should not communicate with the others by interior doors or windows, for the milk would be injured by the heat and steam arising from them. An open shed formed by the projecting roof of the building will generally be found sufficient to scour and dry the vessels in. The churning-room should be provided with a boiler, of dimensions suitable to the number of cows kept; this will be employed for warming water, milk, and whey, and there should also be sufficient space for the convenient performance of all the operations of the dairy, whether it is devoted to the manufacture of butter or cheese. Where a dairy is confined to the sale of milk, two apartments will suffice, one for containing the milk as it is brought in, and another for serving it out, scalding, and keeping the utensils. As these, however, are rarely to be found in the common dairies, it will be the more necessary to pay the strictest attention to order and neatness in those that do not possess so many conveniences. Should the temperature of the milk-room become affected by carrying the newly-drawn milk, it may easily be reduced to a proper degree by suspending a small quantity of ice at a considerable height from the floor. If, during winter, the cold should become too great, and it is not provided with a stove, a barrel of hot water closely stopped, or a few hot bricks placed on the floor or table of the milk-room, will readily counteract any bad effect. On no account whatever should a chafing-dish with burning coals be used, as it will certainly impart a bad taste to the milk.

In fig. 41 we give the plan of a dairy, in which *a* is the milk-house, with stone shelves *b*, and stone milk-table for cream *c*; *d* the churning room, with table *e*; *f* the store room; *g* the boiler for preparing hot water to wash the utensils in; these being placed out to dry under the verandah *h h*. This building, with the addition of a loft, will be suitable either for a butter or a cheese dairy.

The UTENSILS of a Dairy comprise pails, sieves, coolers, churns, creaming-dishes, cheese-vats, ladders, and presses; all of which are so familiar to every dairy-woman, that it would be only waste of time to describe them. To these should be added a Fahrenheit's thermometer, which should be suspended in a central part of the milk-house. Wood is the material usually employed, but, even with the greatest care, these are apt occasionally to be damp, and acquire a faint musty smell; the closest attention in scouring and scalding every time they have been used is requisite, as the smallest drop of milk left in them, or the least taint of acidity or musti-

FIG. 41.



PLAN OF DAIRY.

ness, may spoil the next milking. In some dairies wooden vessels lined with lead are used. Wherever the size and shape of the utensil will admit, earthenware vessels properly glazed, or glass utensils, will be least troublesome, and now glass being so cheap places these latter within the means of most dairy farmers; but lead, copper, or brass utensils, as well as earthenware vessels glazed with lead, although found in many dairies, are to a certain extent objectionable, for the acid contained in milk that has been long exposed to the air combines with these metals, and forms an injurious compound with them, which, although perhaps not deleterious in any serious degree, has occasionally been found to impart a disagreeable flavour to the milk. Cast-iron, although it does not form an absolutely poisonous compound with the milk, is by no means unexceptionable, because the result may, in a considerable degree, affect or change the taste and quality of dairy products. This, however, may be perfectly prevented by a due regard to cleanliness.

The following remarks by Professor Voelcker, on the shape and size of milk-pans, will be useful. He says, that 'according to the experience of good dairymen, shallow vessels were the best. They threw up more cream, and preserved the milk better, which were very important considerations. Milk could not be kept together of any depth without its getting heated and spoilt. It was an erroneous view to take, to say that excess of air was injurious to milk. He would recommend that the air should be allowed to penetrate the milk and come in contact with it freely. If, too, they could maintain a current of air through the dairy, it would be all the better; but what would prove very injurious was to have the damp air resting upon the milk. Recently, a little work had been published in Sweden, which recommended that the milk should be exposed in shallow vessels of a peculiar shape, handy construction, and freely admitting the air. A part of the author's plan was to have a fire in the dairy whenever it was required; and he was informed that when a thunderstorm was seen approaching, instead of keeping the milk cool, a fire was at once lighted, and steam got up, to drive out the additional quantity of moisture. That might be a curious proceeding; but he could readily understand it. It was the damp, moist, heavy air that spoiled the milk. Remove that air by any means, and the milk would keep. It was of the utmost importance to have a dry air in the dairy; and they could now understand why good dairymen always kept the floor as dry as possible. When a thunder-storm approached, the air generally became saturated with moisture, and that moisture had a great deal to do with spoiling the milk. If, however, they drove off the moisture, and with it the excess of water, the milk would keep; so that even in hot weather, when a thunder-storm occurred, an additional fire would preserve the milk good. The fact was a curious and an instructive one.'

As regards material, the Professor states that, 'in his experience, he had found that a common brown earthenware pan, glazed on the inside, threw up more cream than any other. He had also used iron pans, enamelled on the interior, and they, too, threw up the cream very well, but not so much as the common brown earthenware.'

Slate makes very good milk-coolers, and in some of the midland counties the common flag-slate is employed for this purpose. But were it not for their fragility, glass and Wedgewood ware would be unrivalled.

Dairy utensils should always be most carefully cleansed with hot water, and afterwards well rinsed with cold water, and kept in an airy place, in order that every possible degree of acidity may be removed.

The churn in most common use is that denominated the *plunge-churn*. It is made of any size, from ten gallons to nearly a hundred, when worked by hand: but in large dairies, where the system of churning from the whole milk is adopted, it is frequently wrought by horse-power, and is then much larger. The tedious

Fig. 42.

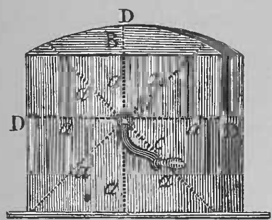
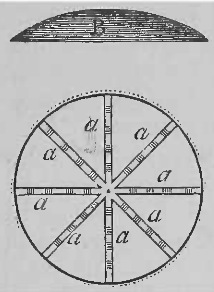


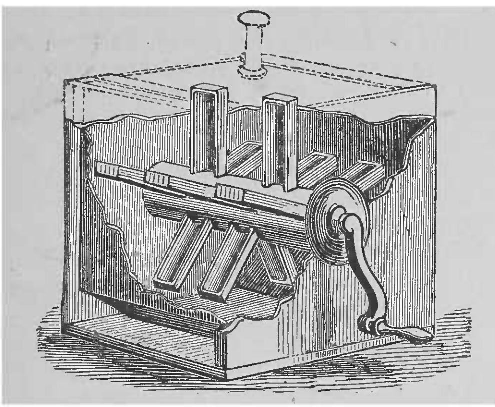
Fig. 43.



AMERICAN DASHER CHURN.

manner in which it operates has occasioned the invention of many others, among which the *barrel-churn* has been most generally adopted, in consequence of the superior ease with which it is

Fig. 44.

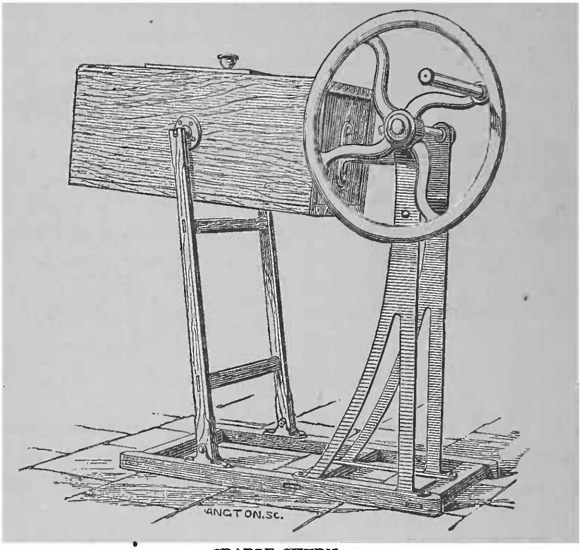


IMPROVED AMERICAN DASHER-CHURN.

worked; there is, however, a prejudice against it in many dairies; it is considered that it does not extract the butter so well as the old and more laborious method. That which is represented in the above cut is manufactured by Messrs. Wright and Co., of Philadelphia. See figs. 42 and 43.

It is made in the form of a cube with vertical dashers, as delineated at *a, a, a, a, a, a, a, a* (fig. 42). B is the top, which takes off. *c* the spindle or handle, that passes through and turns the dashers,

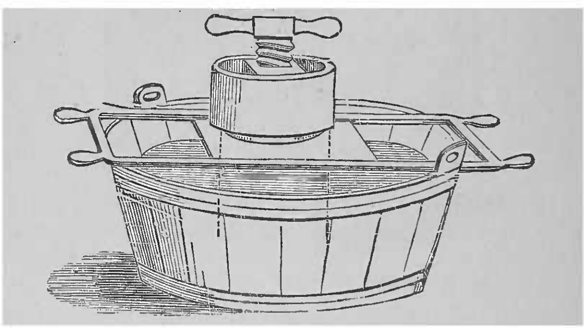
Fig. 45.



CRADLE-CHURN.

a, a, a, &c. D D D describe the form of the churn each way. From this mode of construction considerable power is gained, and

Fig. 46.



HANCOCK'S BUTTER-MAKER.

much time saved in working the churn, which is a simple and effective contrivance. The latest introduced American churn is very similar in principle and form. When exhibited before the council of the Agricultural Society it transmuted five quarts of cream into $5\frac{1}{4}$ lbs. of butter in the short space of eight minutes. The peculiarity of this churn is the mode in which the atmospheric air is brought rapidly and at a certain temperature to act mechanically on the cream. This form of churn is illustrated in fig. 44. Fig. 45 illustrates the vibratory or cradle-churn. Fig. 46 illustrates Hancock's (of Gloucester) butter-making machine: the butter, as it is taken from the churn, is put into the central receptacle, and squeezed through apertures in the bottom by means of the screw. This apparatus saves the labour of hand-working. In Chapter VII., and in that treating of the Machines and Implements of the Farm, will be found notes on the utensils of the dairy, supplementary to those now given in a general way.

CHAPTER IV.

OF THE MANAGEMENT OF MILK AND CREAM, AND THE MAKING AND PRESERVATION OF BUTTER.

'MILK is an opaque fluid secreted by the mammary glands of the females of animals belonging to the class mammalia, and adapted to the nourishment of their young. It is of a specific gravity somewhat greater than that of distilled water.' The milk of the cow, according to Professor Way, consists of

Casein (pure curd)	4·48
Butter	3·13
Milk Sugar	4·77
Saline Matter	0·60
Water	87·02
	100·00

'Milk from which the supernatant fluid or cream has been removed, is termed skim-milk, and still retains a considerable quantity of coagulable or caseous matter, which may be separated from the serum or whey, by means of a rennet or some acid. This coagulated portion constitutes the curd, and is the basis of cheese. If a rennet is used, and all the portion coagulated by its means be separated, the addition of vinegar will cause a portion of what was left to coagulate. What remains after both of these coagulated principles have been removed is *whey*, containing sugar of milk—some azotized substance—lactic acid, and various salts, chiefly consisting of oleaginous and albuminous matters.'[1]

The quality of milk greatly depends on the quantity which the cows will yield and the nature of the food. The former is, to a certain degree, influenced by the manner in which the cows are milked; and it behoves the dairy-man to pay a little more attention to this introductory process than he is generally accustomed to do. If a cow is roughly handled, it is not only painful to her, but will also cause her to withhold a portion of her milk; whereas, if it is gently drawn, she will yield it freely. It is of importance that it should be drawn to the last drop, for although we do not absolutely believe what has often been asserted, viz. that the last half-pint is richer in cream than the whole of the rest, we fully admit that whatever milk is left in the udder is liable to coagulate and injure the udder, as well as lessen the subsequent 'meals of milk.'[2] It sometimes happens the cows are restless and fidgety; but they should by no means be harshly or severely treated at such times. If the udder is hard and painful, it should be fomented with lukewarm water, and gently stroked, by which simple expedient the cow will generally be brought into good temper, and readily yield her milk. It is also proper to feed the cows at the time of milking, for, while eating, they give out their milk with greater freedom. They are also prevented, by the motion of their jaws, from the habit of withholding their milk, which, if it be not properly prevented, will soon cause them to become dry.

In this country, it is the general practice to milk cows twice in the course of twenty-four hours throughout the year; but in summer the proper periods may be three in every day, and at intervals as nearly equidistant as possible, viz. very early in the morning, at noon, and a little before the approach of night. It is a well-known fact that cows, when milked thrice in the day, yield more in point of quantity, and milk of as good, if not better quality, than they will under the common mode of milking them only in the morning and evening. Very particular directions should be given that the cows are driven slowly to the place of milking. If they are hurried, in ever so slight a degree, the separation of the milk into its constituent parts will not so readily or perfectly take place. On this account, if the pasture is at a considerable distance, it may, perhaps, be better to milk them in the field than drive them home. If cleanliness were attended to as much as it ought to be, the teats would be washed with a sponge and water, before the milking commenced.

After the milk is drawn from the cow, it should be carefully

[1] See article MILK, Penny Cyclopædia.

[2] See, on this subject, 'Book of the Farm,' part ii. p. 522.

strained through a gauze or linen cloth, stretched on an open-bottomed wooden bowl or milk-sieve, into the cream-pans, which should never exceed three inches in depth, although they may be made so wide as to contain any quantity required. The milk-pail should then be rinsed with about a quart of cold water, which also may be poured through the sieve into the milk-dish. If any ill flavour is apprehended from the cows having eaten turnips, &c., the addition of one-eighth part of boiling water to the milk, before it is strained into the dishes, will in a great degree tend to remove it, or the solution of nitre may be used, as already recommended. These pans, when filled should be set upon the shelves, there to continue until the cream is removed.

In the process of milking it should be borne in mind that the milk first drawn from a cow is always thinner, and inferior in quality, to that afterwards obtained, the richness of which increases progressively.

It should also be recollected in the after process, that the portion of cream rising first to the surface is richer in point of quality, and greater in quantity, than that which is yielded in the second equal space of time, and so of the rest; the cream continually decreasing, and becoming thinner and poorer.

Thick milk produces a smaller proportion of cream than that which is thinner, although the cream of the former is of a richer quality. If thick milk, therefore, is diluted with water, it will afford more cream than it would have yielded in its pure state, though its quality will be inferior.

Milk carried about in pails, or other vessels, and thus agitated, and partially cooled before it is poured into the milk-pans, never throws up such good and plentiful cream as if it had been put into proper vessels immediately after it came from the cow.

From these fundamental facts several important inferences, some of which have already been hinted at, as serving to direct the proceedings of the dairy, may be deduced.

1. It is evidently of much importance that the cows should be milked as near to the dairy as possible, in order to prevent the necessity of carrying and cooling the milk before it is put into the dishes; and as cows are much hurt by far driving, it must be a great advantage in a dairy-farm where the practice of house-feeding is not adopted, to have the principal grass fields as near the dairy homesteads as possible.

2. The practice of putting the milk of all the cows of a large dairy into one vessel, as it is milked, there to remain until the whole milking is finished, before any part is put into the milk-pans, is highly injudicious, not only on account of the loss sustained by the agitation and cooling, but also because it prevents the owner of the dairy from distinguishing the good milk from the bad, and guiding

him with respect to the profit that he derives from each cow. A better practice, therefore, is to have the milk drawn from each cow put separately, or to have that from only two or three cows put into the creaming-pans as soon as milked, without being mixed with any other. If these pans were labelled with the cows' names, the careful *dai*[1] would be enabled to ascertain, with little trouble, the quantity of milk afforded by each cow every day, as well as the peculiar qualities of the milk.

A small quantity of clear water, cold in summer, and warm in winter, put into the bottom of the milk-pan, will assist the rising of the cream; some persons put a very weak solution of carbonate of soda. (See Chap. VII. for a note on the new methods of cooling milk.)

3. If it is intended occasionally, or generally, to make butter of an *extra fine quality*, the milk of all the cows that yield cream of a bad or inferior quality should be rejected, and also the milk that is first drawn from each cow.

It is a matter of some importance to determine in what way the inferior milk, thus set apart when *fine butter* is wanted, can be employed with the greatest profit. In the Highlands of Scotland a practice has been adopted that answers many good purposes. As the rearing of calves is there a principal object with the farmer, every cow is allowed to suckle her calf with a portion of her milk, the remainder only being employed for the purposes of the dairy. In order to give the calf the proportion regularly allotted, it should be *separated* from the cow, and put into a small enclosure made on every farm for the express purpose of confining the calves. At regular times the cows are brought to the door of this enclosure, where the young ones fail not to meet them. Each calf is then separately led out, and runs directly to its mother, where it is allowed to suck until the dairy-maid judges that it has had enough; it is then separated, the legs of the mother having been previously shackled by a very simple contrivance, to oblige her to stand still while the dairy-maid milks off what was left by the calf. They proceed in this manner until the whole of the cows are milked, and thus they obtain a small quantity of milk, it is true, but that of an exceedingly rich quality; which, in the hands of those who know how to manage it, is manufactured into the richest marrowy butter that can be produced. The richness of the Highland butter has been ascribed to the old grass which the cows feed upon in those remote glens: but it is, in fact, chiefly to be attributed to the practice here described, and which has long prevailed in these districts.

Whenever the making of cheese and of butter of the highest and purest quality are aimed at—and surely it should be so with

[1] A provincial word, denoting the person who has the chief concern in a dairy.

every dairyman and with the manager of every factory—it is of the first importance to have the milk absolutely free from all impurities. It has long been known that there is scarcely any substance with which we have to deal so liable to be tainted as milk. Hitherto it has been considered that all that was necessary to prevent this tainting was to have the most perfect cleanliness in everything used in connection with milk, to see to the condition of the cow-houses, their distance from places where bad odours were created, the cleanliness and thorough ventilation of the milk-room, the cleanness, sweetness, and purity of the vessels used for keeping the milk, of the churns and the cheese-vats. But despite the closest attention to all these points—and they are of such vital importance that attention to them cannot well be dispensed with—recent experience has shown that there are other causes of tainting, and which are even perhaps more dangerous in their effects than those named. Such extra taints, if so they may be named, no doubt have been noticed so far as their effects were concerned, but their causes remained unknown; and it is curious to note that those causes have been brought into prominence in consequence of the introduction of new methods of using milk on the large scale, prominent amongst which stands the process for making 'Condensed or Preserved Milk,' a trade now of great commercial importance. The same gentleman who reported for the Royal Agricultural Journal on the Baltic factories and America—Mr. Willard, of the Cornell University, and of the Maine Agricultural College—in a subsequent report (vol. 8, part 1, No. XV.) on the American milk condensing factories, goes somewhat fully into the tainting of milk.

Mr. Willard points out the general results of the investigations of the learned Hallier and Pasteur, who by means of microscopic observations of the most elaborate character were enabled to show the nature of those causes which are in operation, which change milk from its normal condition, or which render it filthy and unwholesome. These investigations, as may be known to many of our readers, were made in connection with the 'germ' or 'fungi' theory of disease, with which perhaps more markedly or popularly the name of Pasteur is associated. The theory proceeds on the assumption that the atmosphere is filled with germs or fungi of the most minute description, yet possessed of functions which cause them to increase at an absolutely bewildering rate of progress. For example, one kind or species runs its course in forty-eight hours, leaving behind it hundreds of 'spores,' each of which after running its similar course leaves its hundreds, and so on. But this is not alone the remarkable feature of these germs; thus the species now alluded to, in addition to leaving spores of its own kind, gives to those apparently the power to produce in one hour two spores of another species, each of which in another hour produces two more, and so on. Now both of these species have a wonderful influence in causing putrefaction in any body, substance, or organism into which they enter or by which they are taken up; one more especially, the micrococcus, if appearing in matter rich in nitrogen, at once causes putrefaction.

Now from the instant the milk leaves the cow these fungi begin their work, and increase with the rapidity we have above alluded to. But a very great difference between the condition in which those fungi appear and do their work in milk in its after products must be here noticed, as it bears closely upon the very point we have now under consideration, namely the tainting of those products. Thus if the elements of the fungi are already in pure milk, to begin with, or are added to the rennet if cheese be made, the fungi appear to do no harm, but in the case of cheese, at all events, seem rather to act in a legitimate way, if it may be so termed; as giving or imparting the peculiar flavour by which the cheese is distinguished. But if the fungi come from putrid matter, and gain access to the milk in cheese, they exercise a highly prejudicial influence. Those putrid-bearing fungi find in the milk a substance precisely fitted to aid in them further and rapid development; and which accounts for the amazing readiness with which we all know that milk becomes tainted, and the quickness with which decomposition goes on when once it has begun. So insinuating—if the phrase may be allowed—are these fungi, that if present in the air in large numbers, as they are in badly ventilated or air-contaminated byres in cow-houses, the cows inhale them, and the milk becomes tainted actually before it leaves the udder.

This has been proved again and again; and, as Mr. Willard points out, dairymen may take it as an accepted fact that they cannot allow the cows to inhale contaminated air—arising from, or caused by, putrefying organic or animal matter—without the milk being contaminated also. These emanations, so acting on the milk, impregnate it with the germs of disgusting matter of the same character as that of the putrefying substance from which they originate; in other words the putrefying matter is reproduced in the milk. This is an exceedingly important point, and explains much in connection with the condition of the air of byres and of the health of the cows confined in them, which have often puzzled even the most patient of investigators.

We have already adverted to the importance of keeping the bodies of the cows thoroughly clean by currycombing or by wiping them down with straw; but this was chiefly in view of the advantage of aiding the functions of the skin—a matter of great importance, which cannot be neglected with impunity. But a new view has arisen since these germ investigations have been made; for it appears that from dirty matter adhering to, and lodging between, the skin and folds of the udder, &c., and becoming dry, it falls into the milk-pail during the process of milking, and by thus introducing the germs into the milk causes decomposition therein. Not only, therefore, should cows be carefully kept what housekeepers call 'body clean,' by currycombing, so that all adhering matter be taken off them, but the practice so often permitted of allowing the animals to pass through or stand in mud at gates, edges of water ponds, &c., should not be allowed. This mud is almost invariably mixed with ordure, and the liquid exuvia of the animals cannot indeed be otherwise, when so mixed, and being allowed to remain for perhaps months and months, becomes tainted in the highest degree. Now when this gets fixed, so to say, upon the animal, drying it will, as stated above, fall into the milk and cause it to putrefy. From this will be seen the importance therefore, not only of having the interior of the cow-byres clean, the animals themselves and all the vessels thoroughly clean, but also all the 'surroundings' of the dairy—roads, ponds, &c. The same remark applies also to the courts into which the cows are turned for fresh air, when housed for the winter or when kept on the summer soiling system.

There is still another pregnant source of evil in connection with the germs which infest the milk and so much detoriate it. This is the water supply. Now, as a rule, on farms the proper degree of attention is not paid to this; anything almost in the form of water being thought good enough for the stock to drink. On this point the reader will find some remarks in another chapter in this work. Here it is sufficient to say that stagnant water, impure water—even although that be not stagnant but running water—well water, all of which contain in many instances decaying or decayed organic matters, will, when taken into the system, give rise therein to fungi, which, passing into the milk, will greatly injure its quality. These fungi often indeed are so numerous that even a comparatively slight examination of the milk will betray their presence, and in a larger number of instances a microscope even of low powers will do so.

We have shown enough to prove that there are causes existing around us—which, occult or hidden as they may be said to be from the ken of ordinary observation, are therefore all the more dangerous—calculated to deteriorate the quality of the milk of one cow to such an extent as to render the value of its after products very much lower than they would otherwise be. Enough has also been said to show the necessity which exists for the most scrupulous attention being paid to a cleanliness which will embrace objects which have hitherto escaped the notice of the dairyman, or been considered as exercising no influence of a deleterious character. We have shown the error of this belief. But before we conclude we have to point out one thing which is of great importance; namely, the readiness with which diseased milk—if we may so term it—that is, milk infested with fungi or spores, inoculates pure milk not diseased. Thus by putting into a pail of pure milk a very small quantity of milk infested with fungi, and mixing the whole, the mass will in a very short space of time be wholly infected with organisms of the same character as those put into it. Another cause of germs, or one which predisposes the animals to be infested with them, is the heating of the blood by excitement, by over-driving them in going to and from the fields, or subjecting them to the attacks of insects in hot weather, which so excites them that they run wildly about under their maddening attacks. A 'gadded cow,' as one is sometimes termed which has been bit by the gad-fly, is sure to give unhealthy milk, and that which is peculiarly liable to be attacked by spores—or, in other words, is in that condition which affords the necessary pabulum or medium in which they can best develope themselves. We have elsewhere animadverted on the cruelty displayed to flocks by allowing boys and dogs to over-drive them, and also the cruelty of exposing them to the attacks of insects, and have shown that cruelty is costly. We have here given another reason, or two other reasons, in its proof. We should be delighted to think that anything we have said would be the means of reducing, however slightly, the instances in which cruelty is displayed; or the amount, however slight, of that cruelty in any one of those in which it is so unfortunately and so frequently exercised.

Butter.—Milk consists of three component parts, the *butyraceous*, or oily substance of which butter is composed; *caseous* matter, from which cheese is formed; and the *serum*, or whey. The comparative value of different dairies, and of different cows in each dairy, consists not only in the quantity of milk—the compound of these three substances—but also the quantity of butter or cheese in a given quantity of milk. These three ingredients differ materially in specific gravity or weight, and to separate them is the chief object of the dairy. The cream is the lightest, next in specific gravity is the whey, and the curd is the heaviest. The manufacture of butter consists in the separation of the butyraceous part, and that is a mere mechanical affair. The milk is left undisturbed, and thus the lightest portion mechanically quits the heavier one, and floats on the top. The separation of the curd from the serum—the manufacture of cheese—is generally considered to be a chemical process, and effected by means of a peculiar acid.

The cream, having separated from the other component parts of the milk in about twenty or two-and-twenty hours, in a medium temperature, is carefully skimmed, and poured into a vessel, until enough is obtained for churning, or the milk is let off by taking out a plug in the bottom of the pan. When the cream has been thus collected, it should be placed in a deep, covered vessel, for the action of the air on the surface dries it. It should also be stirred with a stick or spoon, every time a fresh quantity is added, until made into butter. The object of this is to produce a slight acidity, by means of which the after process of churning is much accelerated. The time of keeping it depends on the weather. If the cream from each milking has been kept separate, it may remain from two to four days, in warm weather, without being injured; but if sweet cream is mixed with that which is sour, they ferment and soon become putrid if the churning is delayed beyond three days. This may be in some degree prevented by the stirring; but it is generally considered best to keep the cream from every milking apart, and thus allow each to become sour of itself. The contrary practice should never be adopted, unless it be intended to churn as soon as the whole mass has become acid.

In some counties the separation of the cream from the milk is not thought to be sufficiently complete by this mechanical process, but, after the milk has stood from twelve to twenty-four hours in the pan, it is put over a slow fire, where it remains until it begins to *simmer*, or is about to boil. As soon as the first bubble raises the surface of the cream, the pan is taken off from the fire, and put carefully away for eighteen or four-and-twenty hours, in order to cool. At the end of this time, if the quantity of milk is considerable, the cream will be an inch or more in thickness upon the surface. It is then divided with a knife into squares of a convenient size, removed by means of a skimmer, and called *clotted* or *clouted* cream. It is more solid than the cream obtained in the usual way, and has a peculiarly sweet and pleasant taste. It is the usual companion of the breakfast table, and much valued as an addition to the fruit pie, or some kinds of fruit in their raw state, or in the manufacture of that unrivalled Devonian compound, the syllabub. The milk thus treated yields one-fourth more cream than is produced in the common way, but this is at the expense of the remaining milk, of which little is left but the watery particles that entered into its original composition. It more readily churns than cream produced in the usual way, and forms a butter retaining the peculiar taste of the *clouted* cream.

The cream thus preserved consists of the butyraceous portion of the milk with some quantity of the serous fluid, and these must be separated from each other. This has been found to be best effected by agitation. It might be contrived, on a small scale, by means of a bottle, but it is better accomplished by the help of a machine termed a *churn*. This is either formed of a revolving barrel, or of an upright one, wider at the bottom than at the top, and with a moveable cover affixed to it, pierced by a hole. In this hole works a stick or pole, four feet in length and two inches in diameter, to the bottom of which is affixed a circular board, somewhat smaller in diameter than the upper part of the cask, and pierced with several circular holes. The cream is poured into the churn until it is about two-thirds full, the stick with the circular board is then introduced, and the cover placed over it, admitting the end of the stick to pass through the aperture in its centre. The churner now grasps the stick in both hands and moves it rapidly and forcibly upward and downward. The cream is violently agitated, and broken into the smallest particles. The churner works patiently on until some small particles of butter begin to appear, or, in the language of the dairy, the butter *begins to come*.

There is considerable art connected with this apparently simple manipulation. The churning must not be too rapid or violent, nor must it be too slow and gentle. In the first case, and especially in summer, it would ferment and become ill-tasted—in the latter it would not form at all. The temperature should be carefully regarded. In summer it will be necessary to immerse the pump-churn—the one that has been just described—about a foot deep in cold water, or to throw water over the revolving churn. In winter it will be necessary to add a little warm water. The manipulation is continued, until the particles of butter that have begun to appear and accumulate unite at the bottom of the churn, and form a solid mass, to which, at length, there are no further additions. The butter is then removed into another vessel, and the fluid—the *butter-milk*—is set aside for the pigs.

After the butter is formed, the usual practice is to *wash it* in several waters until all the milk with which it was mixed is removed; but care should be taken not to knead or beat it too much, for the less it is handled, after once being made, the better. Some advise that the milk should be forced out of the cavities of the butter by means of a flat, wooden ladle, furnished with a short handle; but the beating of the butter with the hand is so established in all dairies, and so decidedly the most effectual process, that any attempt to abolish it would be fruitless.

The person who thus carries on the manipulation should have a cool hand, and it should be kept cool by frequently dipping it in water.

In the neighbourhood of *Epping*, which has long been celebrated for the quality of its butter, the following is the common process:—The milk, after standing twenty-four hours, is *fleeted*, or skimmed, and the skimmed milk is drawn off into vessels of an increased depth, which is called *doubling*. There it remains for twelve or twenty-four hours more, as the weather permits, and during which period, as the cream rises, it is fleeted two or three times. It is then *trebled*, or put into deep tubs, where it is again occasionally skimmed, and kept as long as any cream forms on the surface. The butter made from these after-fleetings is of a paler colour and inferior quality to that procured from the first cream; it is, therefore, usually churned apart.

In making the first quality, when the butter is *come*, the dairy-woman throws it first into clear water, and then upon a board, and with her hand squeezes out all the water; sprinkling, at the same time, a little salt over the whole mass, which is then divided into pounds, and then rolled out to the length of about fourteen inches. So far, the method nearly accords with that in most other districts; but there is this peculiarity in the management of the Epping dairy-women, that they consider a small proportion of acid, either natural or artificial, necessary to ensure a good churning; and for this purpose they either mix sour cream with the sweet, or they employ lemon-juice, or, occasionally, rennet. This practice merits attention on dairy farms that possess pasture of a short and sweet character; but where the herbage is coarse, or the cows are fed on roots, or other succulent artificial food, the fresher the cream is churned the more valuable will be the butter.

Butter, thus freed from the remaining milk, is called *fresh butter*; and, when sold on the spot or in neighbouring markets, is formed into rolls weighing half a pound or a pound, or even into lumps of 24 ounces, termed *dishes* in Somersetshire and some other parts of England. When it is intended to be kept, or sent to a distance, it is salted by the process immediately to be described, and put into casks, containing 28, 56, or 84 lbs., and usually denominated half-firkins, firkins, and tubs. Previously to putting the butter into these vessels, especial care should be taken that they are well seasoned by frequent washing and exposure to the air during two or three weeks.

As it is very difficult to season new firkins, it will always be preferable to employ those that have been already used, where they can be returned to the dairy-owner. The most speedy method of seasoning the firkin is by the use of unslaked lime, or a large quantity of salt and water well boiled; with which it should be repeatedly scrubbed, and afterwards thrown into cold water, to remain there three or four days until wanted.

It should then be scrubbed as before, and well rinsed with cold water; and, before the butter is put in, every part of the inside of the firkin well rubbed with salt.

The ordinary process of *salting butter*, after the milk has been forced out of it in the manner described, is, to work into the butter, salt, in the proportion of about an ounce of the latter to a pound of the former, so thoroughly that it shall be equally incorporated with the mass; for, if it is not equally mixed in every part, the butter will acquire two colours, becoming yellow where the salt has fallen, and white where it has not. In some places this is termed 'pyety' or 'pinsowed.' The salt employed for this purpose should be of the purest kind, well dried and broken down, but not completely pulverised. If the salt is pure, the butter will retain its flavour as long as it is wanted, but bad salt will soon cause it to become rancid. Dr. Anderson recommends the following preparation as not only preventing the butter from becoming tainted or rancid, but also improving its colour, while it imparts a sweeter or richer taste than could have been effected by the use of common salt only:—

'Let two parts of the best common salt, and of sugar and saltpetre each one part, be completely blended together by beating, and add one ounce of this mixture to every pound of butter. Incorporate it thoroughly in the mass, and close it up for use.

'It will be necessary to keep butter, thus prepared, for two or three weeks before it is used, otherwise it will not taste well; but, if properly cured, according to the above prescription, it will continue so perfectly sweet for three years or more, as not to be distinguished from newly-made salted butter.' It is said that in Holland the salt for butter that is intended to be kept is mixed with the milk before it is churned, by which means both its flavour and preservative qualities are more effectually imparted.

Before the butter is put into the firkin it should be made as dry as possible. A thin layer of salt should then be strewed on the bottom of the cask, and each successive layer of the butter thoroughly moulded into that beneath it. When the cask is full, more salt should be strewed over it, and the head put on. If the butter has been previously well freed from the milk, and the salt moulded into it quite dry, it will not shrink in the cask. This is always regarded as one criterion of the goodness of the butter.

The best butter is that which is made during the latter part of the spring; but, with the addition of a certain portion (which experience only can determine) of the juice expressed from the pulp of carrots, or some ground anotto-root, to the cream previously to churning, winter-made butter will acquire the appearance, though not the flavour, of that which has been churned during the prime part of the summer season.

The process of making butter by churning *milk and cream together*, and which is much practised in Holland, is usually as follows:—

The milk is put into deep jars in a cool place, each *meal* or portion milked at one time being kept separate. As soon as there is the least appearance of acidity, the whole is placed in an upright churn. When the butter begins to form in small kernels, the contents of the churn are emptied on a sieve that lets the butter-milk pass through. The butter is then formed into a mass, as before described.

In Ireland the process is similar, but the milk is allowed to arrive at a greater degree of acidity. This is a defect.[1]

In the greater part of the dairy district of Scotland the manufacture of butter is as follows:—

The milk when drawn from the cow is placed for from six to twelve hours in coolers. When it is completely cooled, the whole meal is emptied into a large vat or tub. If the vat is sufficiently capacious, and a second meal of milk has become cold before the first exhibits any acidity, the two may be mixed together. A lid or cover is then put over the vat, which is allowed to stand undisturbed, not only until the milk has acidified, but until it has formed *a lapper*—the dairy term for coagulation. When it has arrived at that state, it is fit to be churned, or it may be allowed to stand over until there is sufficient for a large churning, for the milk will not be injured by remaining in a coagulated state two or three days, provided the *lapper* is not broken. If, however, that should happen before the churning is commenced, the serum will separate from the butyraceous and caseous parts, and the whole will be spoiled.

After the clotted milk has been put into the churn and agitated for a few minutes, merely to break the coagulum of the milk, as much hot water should be poured into it as will raise the temperature to a little above 70°. The process of churning will then occupy from two hours to two hours and a half, and the butter will be sweet and good.[2]

When the cream and milk are thus churned together, considerably more butter is produced, but it excludes the making of skim-milk cheese, which is a profitable object of dairy economy; and if it is true that more butter has been obtained in this manner than in the other, it must also be evident that there cannot be so much nutriment left in the butter-milk as in the skim-milk. In Scotland and Ireland, however, butter-milk is an object of great consumption as food for the peasantry, by whom it is preferred to skim-milk; it can be preserved longer for use. In large dairies the labour of churning the milk and cream together is very considerable; but, on the other hand, so is the trouble of skimming when the cream is to be churned alone. As the object of both processes is to extract as much as possible of the substance

[1] Penny Cyclopædia, art. Butter.

[2] Quarterly Journal of Agriculture, 1834, p. 350.

of the milk, it would probably be found, on a minute comparison, that, whether it be effected in the shape of butter, of cheese, or of nutritive food in the milk or whey, either process, when equally well performed, would be nearly equally profitable.

Butter is a most valuable article of commerce. It is produced in the greatest perfection in Holland and in England, and from the former more than 100,000 cwts. are yearly exported to England alone. The whole quantity that is manufactured in England is consumed at home.

Of the average quantity of butter produced from one cow, or from a dairy of cows, it is impossible to give any accurate estimate. It would vary with the breed, the pasture, and the management. From 3 to 4 gallons—12 to 16 quarts— will generally produce about a pound of butter, and a good cow, in order that dairy husbandry may remunerate the farmer, should yield 200 lbs. at the least, in the course of the year, this being produced from 647 gallons of milk. A cow, including pasture and hay, can scarcely be fully provided for from less than three acres of tolerably good land, the rent of which, with the taxes, costs, casualties, servants' wages and food, will scarcely leave more than a moderate remunetion to the farmer. For most interesting and valuable statistics as to the yield of *milk and butter* of cows, the reader is referred to Mr. J. Chalmers Morton's work on 'Dairy Husbandry,' published by Longmans.

The American Government and the various American Agricultural Societies have for several years paid great attention to the development of the butter-making resources of American farms. The following extract is from a report to the Massachusetts Agricultural Society. It contains several valuable hints worthy of notice by our readers.

'*How to make good Butter.*—To make the best of butter requires many pre-requisites; but for all practical purposes, two main points cover the whole ground, viz.: 1st, neatness; 2nd, skill. If any dairy-woman expects to make nice butter without the most scrupulous neatness, she will find herself greatly disappointed. From the moment when the rich and luscious fluid is first drawn from the cow's udder to the time when the butter is ready for the connoisseur, the least dirt, the least dust or unpleasant flavour in the atmosphere of the room, and the least speck of foreign matter of any kind, must be absolutely and perfectly kept out during all its stages of manufacture: in fact, neatness is the *sine quâ non* of the butter-maker's art. As well may we suppose that any of the laws that regulate the physical world will be reversed, as to suppose that good butter can be made without the most scrupulous neatness in every particular. The second indispensable qualification of the perfect butter-maker is skill—a word of quite extensive signification when applied to this subject. To acquire that skill requires a clear and discriminating judgment, a well-educated and experienced mind, and a minute and accurate observance of the physical laws which regulate the various conditions of the milk and cream while undergoing the transformation into butter. To be a successful butter-maker, therefore, requires no inconsiderable degree of education, intellect, and ingenuity. Let us, then, analyse this skill of the butter manufacture, and see what are its most important elements. To begin, then, we must first have good milk, and to have good milk we must have good cows, and to have good cows requires a good selection of the best breeds and of the best milkers from the best breeds for that purpose. But that carries us into another department of agriculture, which we have no time here to discuss. Assuming, then, that we have good milk, the next thing is to place it in shallow pans (tin is usually preferred), and in a degree of temperature neither very warm nor very cold. About 62° of Fahrenheit is supposed to be the state of the air in which cream will rise most perfectly. And here let us remark, that every housewife who aims to make the best of butter, should have a thermometer constantly at hand, and should be a frequent observer of its condition. If milk is kept in a temperature much below 62°, the cream will not rise so rapidly and so perfectly. If kept in a state of the air much above 62°, the milk will become acidulated too quickly, and the quality of the cream will thus be injured. Equalisation of temperature and a free circulation of pure air are among the important elements of the butter-maker's skill. The time requisite for cream to rise naturally and perfectly varies with the temperature from 24 to 40 hours. As soon as the cream has all risen to the surface, it should be separated from the milk, and with much care; for the less milk that is taken up with the cream, the better will be the butter. Churning is the next operation, and it is one that determines in no small degree the quality of the butter. If cream is put into the churn in a state much colder than 62° of the thermometer it will require much more time and labour to convert it into butter, and the butter will never be of as good quality. Let the cream, then, be brought to an even temperature of 62°, and the often laborious operation of churning, especially in the winter, will become comparatively easy. If the cream is much warmer than 62°, the butter will be too soft, too white, and in most particulars quite poor. As soon as there is a perfect separation of the particles of the cream which makes the butter from the more watery parts of the milk, let the butter be taken from the churn, and then comes the quite difficult and delicate operation of working over and salting it, both of which require great accuracy and judgment. For if the milk is left and mixed in with the butter one thing is sure—the butter will never have that compact and smooth appearance that is one of the sure indications of good butter; and, what is yet more important, butter left in that condition will not keep long without becoming musty or frowsy. Everyone then that aims at making the best of butter must separate entirely the particles of the milk from the butter immediately after churning. Washing the butter with cold water is practised by some, but the most skilful butter-makers complete the separation of the solid from the fluid portions by manipular labour alone. The form in which butter is prepared for the table or for market is one indication of the skill of the maker. Butter put up in small cakes of oval form, and stamped with a device of flowers, leaves, or diamond figures, is the most beautiful, and seemingly adds to the good flavour of the article. In order to sell for the highest price, it should always be put up in that form, or in oblong pieces of about a pound each. Such are the main requisites of the skilful manufacture of good butter, without which we venture to assert, with great confidence, that the best of butter cannot be made. Does any good housewife, when she has read this report, say, "I knew all that before"? If she does, then we ask her with no small degree of assurance, "Madam, do you practise all these rules for making good butter? If you do, why is it that so large a proportion of the butter that is sent to our markets is so very poor?"'

CHAPTER V.

OF THE MAKING AND PRESERVATION OF CHEESE.

THE goodness of cheese, as well as of butter, depends on the quality of the milk, although the season, and particular process adopted in making it, have a considerable influence.

The best *season* for this purpose is from the commencement of May until the close of September, or, under favourable circumstances, until the middle of October, during which interval cows are, or can in general be, pastured. In many large dairies cheese is often manufactured all the year round, but the winter cheeses are generally much inferior in quality to those made during the summer months, although it is probable that good cheese might be made throughout the year, provided the cows were well fed in the winter. It is worthy of attention that milk abounds most in caseous matter during the spring, and with the butyraceous in summer and autumn.

After milk has been exposed for a certain time to the air, generally two or three days, according to the season, it becomes sour and coagulates. The curd which is thus formed may then be either made into butter, by the process of churning, as detailed in the preceding chapter, or it may be merely broken, when the serum or whey will separate from it, and, by means of pressure it is converted into cheese. The curd thus formed, and being composed of the caseous and the butyraceous matter combined, constitutes the richest, or what is commonly termed *full-milk cheese.* That produced by the curd remaining after the cream has been taken off is necessarily poorer in consequence of the abstraction of the butyraceous substance, and is termed *skim-milk cheese*; but there is little difference in the mode of making.

It having been found that cheese manufactured from sour milk is hard and ill-flavoured, means have been devised to curdle it while sweet. With this intention various substances have been employed, but the most effectual one hitherto discovered, and consequently the most universally used, is taken from the stomach of calves, and denominated *rennet.* It is the gastric juice of that animal.

The first process of digestion in the fourth stomach of the calf, and of every other young animal that is nourished by the milk of its mother, is the coagulation of that milk in its stomach. There are numerous glands scattered in and about the stomach that secrete a fluid, which readily and almost immediately accomplishes this coagulation. They are always full of it. Even after the animal is dead they remain filled with it, and, if the stomach is preserved from putrefaction, this fluid retains its coagulating quality for a considerable period; therefore dairy-women usually take care of the maw or stomach of the calf, and preserve it by salting it, and then, by steeping it, or portions of it, in warm water, they prepare what they term a rennet. After the maw has been salted a certain time, it may be taken out and dried, and then it will retain the same property for an indefinite period. A small piece of the maw thus dried is steeped overnight in a few spoonfuls of warm water, and this water will *turn* the milk of four or five cows.

In cases of emergency, where no good rennet can be procured, a decoction of the yellow flowers of the 'cheese rennet or yellow lady's bed straw' (*Galium verum*, L.) which blossoms in July and August, may answer every purpose for coagulating milk. The acetic and muriatic acids, if judiciously employed, may be used for this purpose, and are so in many parts of Holland and Germany.

All acids coagulate with milk, but the acetic and muriatic are the most effective. If the dairyman has any reason to doubt the power of his rennet, he may always put it thus to the test. Let him take a portion of the milk, heated to 95°, and add a small quantity of the water in which the stomach has been soaked; by the quickness of the curdling of the milk, and the form of the flakes produced, he will, after a little experience, form a very accurate judgment of the strength of the rennet, and of the quantity which he must pour into the milk.

The mode of manufacturing cheeses in most general use in this country is chiefly as follows, although there are many slight variations in the practice of different dairies even in the same county.

Cheshire Cheese.—The evening's milk is set apart until the following morning, when the cream is skimmed off; it is then poured into a pan heated by being placed in the boiling water of a boiler, in order to become warm.

The new milk obtained early in the morning is poured into a large tub, together with the warmed cream, the temperature of the mixture being 75° Fahr. Into this is placed a piece of rennet, which had been kept in warm water since the preceding evening, and in which a little Spanish anotto (a quarter of an ounce is enough for a cheese of sixty pounds) is dissolved. Marigolds, boiled in milk, are also used for colouring cheese; to which they likewise impart a pleasant flavour. In winter, carrots scraped and boiled in milk, and afterwards strained, will produce a richer colour; but they should be used with moderation, on account of their taste. The whole is now stirred together, and covered up warm for about an half an hour, or until it becomes curdled; it is then turned over with a bowl, and broken very small. After standing a little time, the whey is drawn from it, and as soon as the curd becomes somewhat more solid, it is cut into slices and turned over repeatedly, the better to press out the whey.

The curd is again removed from the tub, broken by hand or cut by a curd-breaker into small pieces, and put into a cheese vat, where it is strongly pressed both by hand and with weights, in order to extract the remaining whey. After this it is transferred to another vat, or into the same if it has in the meantime been well scalded, where a similar process of breaking and expressing is repeated, until all the whey is forced from it. The cheese is now turned into a third vat, previously warmed, with a cloth beneath it, and a tin hoop, or binder, put round the upper edge of the cheese, and within the sides of the vat; the former being previously enclosed in a clean cloth, and its edges placed within the vat. These various processes occupy about six hours, and eight more are requisite for pressing the cheese, under a weight of 14 or 15 cwt. The cheese during that time should be twice turned in the vat. There are several holes bored in the vat which contains the cheese, and also in the cover of it, through which long skewers pass in every direction, the pressure being still continued. The object of this is to extract every drop of whey. The pressure soon obliterates all these punctures, and the cheese is at length taken from the vat, a firm and solid mass.

On the following morning and evening it must be again turned and pressed; and also on the third day, about the middle of which it should be removed to the salting chamber, where the outside is well rubbed with salt, and a cloth binder passed round it, which serves as a lining to the vat, but it is not turned over the upper surface. The cheese is then placed in brine, extending half-way up it in a salting-tub, and the upper surface is thickly covered with salt. Here it remains for nearly a week, being turned twice in the day. It is then left to dry for two or three days, during which period it is turned once, being well salted at each turning, and cleaned every day. When taken from the brine, it is put on the salting-benches, with a wooden girth round it of nearly the thickness of the cheese, where it stands about eight days, during which time it is again salted and turned every day. It is next washed and dried; and, after remaining on the drying benches about seven days, it is once more washed in warm water with a brush, and wiped dry. In a couple of hours after this it is scoured all over with sweet whey butter, which operation is afterwards frequently repeated; and, lastly, it is deposited in the cheese or store-room, which should be moderately warm, and sheltered from the access of air, lest the cheese should crack, and turned every day, until it has become sufficiently hard and firm.[1] These cheeses require to be kept a long time; and, if not forced by artificial means, will scarcely be sufficiently ripe under two or three years.

The Dutch make their cheese nearly in the same manner, excepting that they substitute the marine acid, or spirit of sea-salt, which imparts to *Dutch Cheese* that peculiarly sharp and salt flavour by which it has long been characterised. They also leave out the cream.

In making *Gloucester Cheese*, the milk is poured into the proper vessel, immediately after it has been drawn from the cow; but being thought too hot in the summer, it is lowered to about 84 or 86 degrees by the addition of skimmed milk, or sometimes by pouring in water. The rennet is then added at the rate of a pint to 100 gallons of new, or 150 of skimmed milk. When the curd is *come*, it is cut with the curd-breaker, this being drawn repeatedly through the mass. The whey is then taken out, the

[1] The cheese-rooms in Cheshire are generally situated over the cow-houses, and the cheeses are often placed on a floor strewn with rushes. This is done in order to afford them, from the heat of the cattle below, that uniform and moderate degree of temperature which is deemed essential to the proper ripening of cheese.

curd pressed by hand, and crumbled into small pieces like peas. The curd is then put into vats, that are submitted to the action of the press for ten minutes or a quarter of an hour, until the remaining whey is extracted. It is next removed into the cheese-tubs, again broken small and scalded with a pail full of water lowered with whey in the proportion of three parts of water to one of whey, and the whole briskly stirred.

This operation should be performed with great nicety, or the curd is liable to be toughened instead of simply rendered firm. The fluid intended to scald the curd should not be above 96 degrees of heat, nor should the curd be warmed beyond about 84 degrees. After standing a few minutes for the curd to settle, the liquor is strained off, and the curd collected into a vat; and when the latter is about half filled, a little salt is sprinkled over it, and worked into the cheese. The vat is now filled up, and the whole mass of cheese turned twice or thrice in it, the edges being pared, and the middle rounded at each turning. Lastly, the cheese is put into a cloth, and, after undergoing another pressure, it is carried to the shelves, where it is generally turned once a day, until it becomes sufficiently close and firm to admit of being washed.

In the manufacturing of these cheeses, the curd is not so often broken as in the Cheshire—the cheese is not skewered while it is in the press, and part of the cream is usually taken away in order to make butter. The scalding is to wash out any remaining whey or, perhaps, to dissolve any portion of butter that might have been separated before the rennet had coagulated the milk.

Cheddar Cheese is made in Somersetshire, by the following simple process:

When the morning's milk is brought home it is immediately strained into a tub mixed with the last evening's milk; the temperature being 80°, and the rennet added, in the proportion of about three table-spoonfuls to a quantity sufficient for a cheese of 28 pounds; after which it remains undisturbed about two hours, when it becomes curdled and is then partially broken to pieces. That being done, part of the whey is taken out and warmed, and afterwards put into the tub for about twenty minutes. The whole whey is then again placed over the fire, made nearly scalding hot, and returned into the tub, in order to scald the curd for about half an hour longer, after which part of the whey is again taken out, and the remainder left with the curd until it is nearly cold. The whey is then poured off; the curd broken very small, put into the vat and pressed; it remains there nearly an hour, and is then taken out, turned, and put under the press again until the evening, when it is turned again and left until the next morning. It is then taken out of the vat, salted, put into it again with a clean dry cloth round it, and it remains in the press until the following evening, when it is once more taken out, salted, put into the vat without a cloth, and pressed until the next morning. It then finally leaves the press, and is salted once a day for twelve days.

Stilton Cheese has only been introduced since the middle of the last century. It was first manufactured by a Mrs. Paulet, who resided in the Melton quarter of Leicestershire, and who, being a relative of the landlord of the Bell Inn, at Stilton, on the great North Road, supplied his house with cheese of so singularly superior quality, that it became in demand beyond the consumption of the house, and was sold for as much as half-a-crown a pound.[1] It thus acquired the name of Stilton Cheese; but the mode of making it having been soon discovered, it is now generally manufactured through all the neighbouring counties, and the sale is no longer confined to that place. There is a great deal of imitation Stilton cheese comes to market, which, though good, is of a very inferior quality to the real Stilton. Its richness depends both on the breed of cows employed, and the quality of the pasture on which they are fed, as well as upon the quantity of *cream* used in the manufacture of it; for, unless a large portion of this is added to the milk, the cheese will be deficient in the essential qualities for which it is celebrated.

It is commonly made by putting the night's cream to the milk of the following morning with the rennet, great care being taken that the milk and the cream are thoroughly mixed together, and that they both have the proper temperature. The rennet should also be very pure and sweet. As soon as the milk is curdled, the whole of it is taken out, put into a sieve gradually to drain, and moderately pressed. It is then put into a case or box, of the form that it is intended to be, for, on account of its richness, it would separate and fall to pieces were not this precaution adopted. Afterwards it is turned every day on dry boards, cloth binders being tied round it, which are gradually tightened as occasion requires. After it is removed from the box or hoop, the cheese must be closely bound with cloths and changed daily, until it becomes sufficiently compact to support itself. When these cloths are taken away, each cheese has to be rubbed over with a brush once every day. If the weather is moist or damp, this is done twice a day during two or three months. It is occasionally powdered with flour, and plunged into hot water. This hardens the outer coat, and favours the internal fermentation, and thus produces what is called the ripening of the cheese. Sometimes it is made in a net like a cabbage-net, which gives it the form of an acorn.

[1] Marshall's Midland Counties. 2nd edit. vol. i. p. 320.

Stilton cheeses are not sufficiently mellowed uutil they are two years old; and are not accounted to be in good order unless they are decayed, blue, and moist. It is said, that in order to accelerate their maturity, it is no uncommon thing to place them in buckets, and cover them over with horse-dung. There can be no doubt, however, that small pieces of a mouldy cheese are often inserted into them by means of a *taster*, and that wine or ale is frequently poured over them. Large caulking-pins are also stuck into them to produce the requisite mouldiness. Much of this is bad policy, for they are in the highest perfection when the inside becomes almost as soft as butter and there is not any mouldiness.

In making *Wiltshire Cheese*, the milk is used as soon as it is brought from the cow; or, if it is too high a temperature, it is lowered by the addition of a little skimmed milk. The curd is, in the first place, broken with the hand to various degrees of firmness, according to the kind of cheese intended to be made. For *thin* cheese, it is not reduced so fine as in the Gloucestershire; for the *thick* kind, it is broken still finer; and for *loaves* it is almost crushed to atoms. In the first breaking of the curd, care is taken to let the whey run gradually off, lest it should carry with it what is there called the 'fat of the cowl.' As the whey rises, it is poured off, and the curd pressed and pared or cut down, three or four times, in slices of about an inch thick, in order that all the whey may be extracted. It is then scalded in the same manner as the Gloucester cheese. In some dairies it is the practice, after the whey is separated, to rebreak the curd, and salt it in the liquor; but in others it is taken out of the liquor while warm, and then salted in the vat. The thin sorts are disposed of, with a small handful of salt, in one layer; thick cheeses, with two handfuls, in two layers; and loaves, with the same quantity, in three or four layers, the salt being spread and uniformly rubbed into the curd. In general, Wiltshire cheese is twice salted in the press, beneath which it continues, according to its thickness.

Dunlop Cheese is made in the counties of Ayr, Renfrew, Lanark, and Galloway, of various sizes, from twenty to sixty pounds. After the milk is brought to a certain degree of heat—85° to 90°—it is mixed with the cream which had been previously skimmed, and kept cool. The milk is then poured into a large vessel, where the rennet is added to it—this not being sweet or fresh—and the whole is closely covered up for twelve or fifteen minutes. If the rennet is good, it will have effected a coagulation of the milk, which is gently stirred. The whey then begins immediately to separate, and is taken off as it gathers, until the curd becomes tolerably solid. It is now put into a *strainer*, the cover of which is pressed down with any convenient weight. After it has thus stood for some time, and is tolerably dry, it is returned into the first vessel or dish, where it is cut into very small pieces by means of a cheese knife. It is thus turned up and cut every ten or fifteen minutes, and also pressed with the hand until all the whey is extracted. The curd is now once more cut as small as possible, and salted, care being taken to mix it minutely with the mass. Lastly, it is put into a *cheesitt* or *chessart*, a stout dish with iron hoops, that has a cover fitting exactly into it—a cloth being placed between the curd and the vessel. In this state it is submitted to the action of the cheese-press, whence it is occasionally taken and wrapped in dry cloths, until it is supposed to have completely parted with the whey. It is then laid aside for one or two days, when it is again examined; and, if there is any appearance of whey remaining, the pressure and application of cloths are repeated. As soon as it is ascertained that the whey is extracted, the cheese is kept for a few days in the farmer's kitchen, in order to dry it before it is placed in the store, where a smaller degree of heat is admitted. While there, it is turned three or four times a day until it begins to harden on the outside, when it is removed to the store, and turned twice in the week afterwards. When the cheese is cured, various modes are adopted to polish it for sale, but which are rather injurious than beneficial, nothing further being requisite, besides turning it, than to rub it occasionally with a coarse cloth, especially after harvest, for at that time it has a tendency to breed mites.[1]

In some dairies the cream is carefully separated from the milk, while in others the milk is not allowed to cool, but thickened as taken from the cow; it being thought that, 'if the milk is allowed to stand until the cream separates from it, it can never again be completely blended with it, or retained in the curd when set, and the cheese will seem to be considerably poorer.'[2]

Green Cheese is made by steeping in milk two parts of sage with one of marigold leaves and a little parsley, all well bruised; and then mixing it with the curd which is preparing for the press. It may be mixed irregularly or fancifully, according to the pleasure of the maker. The management is in other respects the same as for common cheese. Green cheeses are most frequently manufactured in Wiltshire.

Skim Cheese is chiefly made in the county of Suffolk, whence it is often called *Suffolk Cheese*. The curd is broken in the whey, which is poured off as soon as the former has subsided. The remaining whey, together with the curd, being thrown into a coarse strainer, and exposed for cooling, is then pressed as closely as possible. It is afterwards put into a vat, and again pressed for a few

[1] Farm. Mag., vol. iv. p. 381. See also, the Ayrshire Report; and Aiton on the Dairy Husbandry.

[2] See the Library of Useful Knowledge, Farmer's Series, No. xii. p. 45.

minutes, in order to extract the remaining whey. The curd being thus drained from the whey, is taken out once more, broken as finely as possible, and salted, and submitted to the press. The other operations do not materially vary from those adopted in the cheese-making districts; but they are more easily performed on the curd of skim-milk, as it is more readily coagulated and separated from the whey, and require less subsequent care and pressure than that of milk and cream united. The Suffolk cheese forms, in general, part of every ship's stores, because it resists the effects of warm climates better than most of them; but it is characterized by 'a horny hardness and indigestible quality.' A better kind is made in Dorsetshire, although the only perceptible difference in management consists in the rennet and the milk being put together cooler; for, by having the milk hot, and immediately applying the rennet, the whey drains so quickly as to impoverish the cheese and render it tough.

Cream Cheese is generally made in August or September, the milk being at that time richer and better than at other periods. Cream cheeses are more liable to accident than the poorer sorts, from being chilled or frozen before they become hard, for when the frost once penetrates a cheese of this kind it destroys every good quality, and either makes it ill-tasted or generates putrefaction. Hence this kind of cheese should always be kept in a warm situation, and particularly preserved from the frost, until it has sweated well, otherwise all the advantage of its rich quality will be completely lost.[1] Cream cheese, however, is in general only wanted for immediate use; and that kind commonly so called is, in fact, little else than thick sweet cream dried, and put into a small cheese-vat about an inch and a half in depth, having holes in the bottom to allow any whey that may exude to pass, and having rushes, or the long grass of Indian corn, so disposed around the cheese as to admit of its being turned without being broken. It is thus that the celebrated *Bath* and *York* cream cheeses are made, but the greater number of those commonly sold are composed of milk.

The process of making cheese is much more difficult than that of manufacturing butter, and the quality depends as much, perhaps, on the mode of performing that operation as on the richness of the milk. The temperature at which the milk is kept before it is formed into cheese, and that at which it is coagulated or turned into curds, are objects of considerable importance in the management of a cheese dairy: the former should not exceed 55° nor be under 50° of Fahrenheit's thermometer, and for the latter it should be occasionally from 82° to 90°. If the milk is kept warmer than 55° it will not throw up the cream so well as at a lower degree.

[1] Twamley on Dairying, p. 64.

It is also subject to become sour, and give a bad taste to the cheese. If it is allowed to be much colder it becomes difficult to separate the curd from the whey, and the cheese made from it will be soft and insipid. If the curd is coagulated too hot, it becomes tough; much of the butyraceous matter is carried off with the whey, and the cheese is hard and tasteless. The thermometer should, therefore, be employed in every dairy, and, although the servants may at first be prejudiced against it, its evident utility and great simplicity will eventually reconcile them to its use.

The greatest care should be taken thoroughly to extract every particle of whey from the curd, for cheese is apt to heave where any whey remains; and if any part becomes sour, the whole will acquire a disagreeable flavour. Similar effects are produced by the use of an immoderate quantity of rennet. It is also apt to fill the cheese with small vesicles or holes, which sad imperfection will likewise be produced if it is allowed to remain too long on one side.

The cracking of the cheese usually arises from the exterior drying too fast, before the interior has become firm. This usually arises from the atmosphere of the cheese-room being kept too dry, and at too high a temperature.[1]

A new species of cheese called the 'Oleomargarine Cheese, has been recently introduced into American dairies—the object being to economize the skim milk. The following description of this, the latest thing introduced in dairy practice of cheese-making, we borrow from the pages of 'The Farmer':—

'This cheese is made from milk which has been set for cream and skimmed, the cream being turned into butter, and oleomargarine added to replace the material fat of the milk which has been taken off for butter making. The object of adding oleomargarine is to so improve the skimmed milk that a cheese may be made from it which is mellow and palatable, and which will resemble in texture and meatiness a whole-milk cheese. Oleomargarine can be bought at about 14 cents per pound, and as a much less quantity is added to the skimmed milk than the original butter taken off, the difference in price as well as quantity of the two articles constitutes the profit to be derived from the management of milk on this system as compared with whole-milk cheese making.

'But, first, how is oleomargarine made? A gentleman who has recently paid a visit to an oleomargarine factory in Hartford, Connecticut, writing in an American contemporary, says:—"Only the very best fresh beef suet from the caul and kidneys is used at this establishment, and of this there is bought and used daily about 600 lbs., which is procured fresh every morning from the

[1] Farmer's Magazine, vol. xx. p. 534.

slaughterer. This fat is first mechanically cut up by means of a machine, which rapidly reduces it to a pulp, so finely ground that it resembles thick cream in consistency. It is then placed in open tanks of sheet iron holding 700 lbs. each, which are heated by steam. This thoroughly dissolves out all the oily matter from the cellular tissue, the fatty matter floating on top being drawn or skimmed off carefully and allowed to cool in large vessels. By slow cooling the fat crystallizes, and the more solid margarine and stearine are separated from the oleine, which remains diffused through the mass. The semi-solid mass is then put into strong bags of new cotton cloth, the variety known as "Pequot A" being used for this purpose. These bags, which hold about two pounds each, are then placed in a powerful press, which separates the lighter oil, forming the essential principle of butter, from the stearine, which is the harder and heavier product. As it flows from the press the oil is clear, yellow in colour, tasteless, and without odour, having been so refined in the several manipulations that all smell or taste of suet is entirely removed from the oil. The residue in the bags, which is stearine, is sold to be used for hardening lard sent to the Southern market and warm climates."

'This yellow, tasteless, odourless oil is what is used in the skimmed milk for making the so-called oleomargarine cheese, and when prepared as above stated, there is no reason why it is not as clean and as wholesome as the butter fat which comes from the udder of the cow. The most scrupulous neatness is observed in its production, the greatest care being taken to use only the freshest and best suet to be obtained from healthy fat animals slaughtered for beef. Indeed, old, tainted, refuse grease cannot be successfully employed, and if such were used the oleomargarine business would soon come to an end.

'The oleomargarine cheese is said to be a good-flavoured meaty article, having remarkable keeping qualities, and retaining its flavour much longer than the whole-milk cheese. The novel method of improving skimmed milk by the use of oleomargarine is so effective that it is believed a considerable quantity of the new kind of cheese will soon be thrown on the American markets from the creameries. In commenting upon it, the editor of *Moore's Rural New Yorker* says:—"From all we have been able to learn concerning oleomargarine, we have seen nothing as yet that would seem to prove that it is unclean or unwholesome; and as a further proof of our confidence that this is so, we may add that for several months past we have been using freely oleomargarine cheese on our table, and find it not only very palatable but wholesome. We believe that all foods, however, should be sold under their proper name, and so of oleomargarine cheese; and while there may be nothing in the flavour or texture to distinguish it from other cheese, it is just and proper that the consumer should know what he is buying, and thus, if we have prejudices against any particular kind of food, he may have full liberty to avoid it."'

Ripening of Cheese.—An experienced dairyman[1] is of opinion that from nine to twelve months are requisite to ripen cheese of any kind, if from fourteen to twenty pounds weight; and he lays it down as a rule, in the process of making cheese, that the hotter it is put together the sounder it will be; and the cooler, the richer, and more apt to decay.

It is a good practice to strew a little dry moss or fine hay upon the shelves on which the cheeses are laid, because when new they sometimes adhere to the board, and communicate a dampness to it that is prejudicial. It also promotes their drying. At a more advanced stage they may be laid upon straw, but at first this would sink into and deface the surface. To which we will add, as general maxims, that great cleanliness, sweet rennet, and attention to the heat of the milk and breaking the curd, are the chief requisites in cheese-making.

We have given this long account of different cheeses, because many people think that there is a great deal of mystery attending all these manipulations. The only mystery consists in the cheese being honestly made of the milk, cream and all, in particular attention being paid to the temperature of the milk when the rennet is added; in that being accurately ascertained, not only by the dairymaid's thermometer, the tip of her finger, but by an actual thermometer, which no dairy should be without; and, finally, in the cheese being dried in a cool place, without any sweating or rubbing but with grease or oil.

CHAPTER VI.

ON THE PRODUCE OF A DAIRY.

THE produce of a dairy is to be regarded in a twofold view, as it respects *quantity* and *value*. Both depend in a great degree upon management; for if the cow is injudiciously treated, or the butter and cheese badly made, both the product and the price will be materially diminished. There is no part of farming more steadily profitable than the dairy, but, at the same time, none which demands greater judgment and attention.

Of the three objects of the dairy, in *selling the milk*—or, as it

[1] Mr. Parkinson, Treatise on Live Stock, vol. i. chap. i. sect. 12.

is commonly called, *cow-keeping—making butter and cheese*, and *suckling*, the first is generally the most profitable, at the usual price obtained for the milk. It can, however, only be carried on in the immediate vicinity of large towns; and even there the expense of providing fodder and the fluctuations in its price, together with the injury to the health, and the consequently diminished value of the cows from the close confinement to which they are usually subjected, and the nature of the food supplied for the purpose of producing an extraordinary flow of milk, often render it a hazardous and always an unpleasant business. It has been calculated that in a well-managed dairy each cow should yield on an average from 500 to 600 gallons of milk annually. The price used to be put down at 2*d.* per quart in summer, $2\frac{1}{2}$*d.* in winter: when sold to dealers, $1\frac{1}{2}$*d.* and 2*d.*; but dairy produce, like every other article of household consumption, is greatly risen in value, so that milk sold to consumers brings as much in the provinces as 3*d.* to 4*d.* in the summer months, higher in the winter months. In the metropolis, and the larger and manufacturing towns, prices rule high.

The making of butter and cheese, which may be distinctively termed *the dairy*, ranks next in the scale of profit. A well-fed cow, of a good breed, will produce, on an average, 200 lbs. of butter in the season; and this, where there is an immediate market for it, together with the value of the skim-milk, either in feeding pigs or making skim-milk cheese, will pay better than cheese alone. The common calculation is 150 lbs.;[1] but that has regard to mixed stock, which afford no certain data. In the Epping district, where no particular attention is paid to the selection of stock, and where there is an indiscriminate mixture of Devons, Suffolks, Leicesters, Holderness and Scotch, the calculation, in a well-managed dairy, amounts to 212 lbs., viz.:—

	lbs.
6 lbs. per week, during twenty-six weeks . . .	156
4 lbs. per week, during fourteen weeks . .	56[2]
	212

in forty weeks, which is fully four weeks sooner than they need be generally allowed to go dry. There is no doubt that with proper care in the choice of the cows, and proper pasture to support them, this calculation would be realised in good years. It might not in parching seasons, but then all dairy produce equally suffers.

[1] In the Sussex Agricultural Survey there is an account of the produce of the Duke of Richmond's dairy, from which it appears that the cows, all Suffolk, produced an average of only 136 lbs. in the season; but it does not mention how they were fed. Probably they were pastured in the park.

The same Survey mentions a Sussex cow, that, for some weeks after calving, gave 10 lbs. of butter and 12 lbs. of cheese per week; and another is mentioned in the Hampshire Report, that yielded from 15 to 16 lbs. during part of the season, besides many other instances of equally extraordinary produce.

[2] Essex Agricultural Survey, vol. ii. p. 289.

Mr. Aiton's calculation is, 250 lbs. per annum, or 1lb. of butter from every 10 quarts of milk; but that is for the best milkers of a very superior stock; and although it may be difficult to reach that quantity in any other than a very select dairy, there can be little doubt that, with proper attention to breed and feeding, the Epping average may be maintained.

The average product of *full-milk cheese* in the best English dairies, where the whole milk and cream are used, cannot be estimated at more than four cwt. In Leicestershire and other deep grazing soils that carry heavy stock, a well-managed cow is reckoned to make from three to five cwt.,[1] besides supporting her calf until it can be weaned; but such cows require full three acres of the best meadow land, for summer and winter keep, and it is not in the power of every farmer, even if he has the stock, to procure such land to maintain them. In Somersetshire the average is four cwt. and a half;[2] in Essex not so high;[3] and Mr. Marshall states that of all the midland counties at something more than three cwt.[4]

The cows of Wiltshire are reckoned to yield from three cwt. and a half to four cwt. of cheese all the year round, besides a pound of whey butter during the summer season.[5]

Suckling is generally considered the least profitable, as well as the most precarious division of dairy farming, both from the accidents to which calves are liable, and the more variable price of veal than of butter and cheese. It is, however, the least troublesome; and probably, from the making of butter being combined with it, would be the most advantageous. Supposing a steady weekly demand for butter throughout the year, the most advisable plan might be to keep such a number of cows as would supply that demand during the winter; and in summer, when butter is cheap and veal in request, to apply the extra milk to suckling calves, either for the market or for stock, as may best suit the ulterior views of the farmer. This must, however, depend on the situation of the farm; for that may not always afford an opportunity for the purchase of a succession of calves for suckling, or a market for them when fat; or it may not be adapted for the rearing of stock; and, in such cases, the best application of the skim-milk is either to feed pigs or to make skim-milk cheese. The usual time required for fattening calves for the butcher has been already stated to be from ten to twelve weeks:[6] perhaps it would be less in summer, when the milk is abundant and rich, and more when it decreases

[1] Leicester Agricultural Survey, pp. 154 and 227. Cheshire ditto, p. 271.
[2] Somerset Agricultural Survey, 3rd edit. p. 251.
[3] Essex Agricultural Survey, vol. ii. p. 271.
[4] Rural Economy of the Midland Counties, 2nd edit. vol. i. p. 326.
[5] Report of 'Times' Commissioners.
[6] See Book i. chap. vii.

in quantity and quality; but as the calf does not require the entire milk of the cow for some weeks after its birth, she will, for a short period, support two; and two cows, calving at different periods, may be calculated to fatten seven calves in the course of the year.

Compared with *grazing*, every branch of dairy-husbandry will be profitable; but the trouble and difficulty of management so far exceeds the mere feeding of cattle for the shambles, that it can only be carried on, in most instances, to a much more limited extent. It has also this superiority in other points of considerable importance on farms where the mixed system of tillage and grazing is adopted—it does not require so rich a soil as that for beasts, and it produces food for pigs, or calves, and thus, by nourishing more animals, creates additional manure and a profitable consumption of the crops on the spot. It has been calculated that the herbage that will add 112 lbs. to the weight of an ox will enable a dairy cow to yield 450 gallons of milk, which, upon reference to our previous statement of the average produce of milk in butter, and cheese, or veal, and pork, will be found to exceed the return in meat, after making every fair allowance for the additional expense of management.

In *feeding pigs*, it has been found that four cows will, in the course of the season, fatten a pig from forty pounds weight to twelve score pounds, which is fifty pounds to each cow, besides keeping the calves until weaned. Pigs have been fattened to great weights upon milk alone.

Some dairymen allow two hogs to five cows, also rearing the calves; but experience proves that two cows will support a two-year-old hog until he is put up to fatten. In the neighbourhood of a good market, it will, however, be most profitable to fatten porkers. (See a note on the feeding of pigs with dairy produce in next chapter.)

Of *skim-milk cheese*, the quantity may be calculated at two cwt. from each cow; but in comparing the two modes of employing the milk, there must be deducted from the product of this application of it the value of the dung that would have been made by the pigs.

Throughout the system of dairy management, the vigilant eye of the principal should be carefully employed, for the husbandry servants will rarely give that minute attention to every particular which is so indispensably necessary in order to ensure success. On this account, it is more likely that a dairy-farm of a moderate size—one, for instance, that keeps from ten to twenty cows—will, *if properly managed*, afford a larger proportionate profit than another of greater extent, because, in the former case, the farmer's wife and daughters can more easily superintend, or perhaps perform, a considerable part of the dairy operations themselves; and this will always be better done by them than hired servants. No branch of husbandry deserves and requires such unremitting attention. Sir John Sinclair very justly remarks, 'that if a few spoonfuls of milk are left in the udder of a cow at milking—if any one of the implements used in the dairy is allowed to be tainted by neglect—if the dairy-house is kept dirty or out of order—if the milk is either too hot or too cold at coagulating—if too much or too little rennet is put into the milk—if the whey is not speedily taken off—if too much or too little salt is applied—if the butter is too slowly or too hastily churned—or if other minute attentions are neglected—the milk will be in a great measure lost. If these nice operations occurred only once a month, or once a week, they might be easily guarded against; but, as they *require to be observed through every stage of the process, and almost every hour of the day*, the MOST VIGILANT ATTENTION must be kept up throughout the whole season. This is not to be expected from hired servants. The wives and daughters of farmers, therefore, having a greater interest in the concern, are more likely to bestow that constant, anxious, and unremitting attention to the dairy, without which it cannot be rendered productive.[1]

CHAPTER VII

THE FACTORY SYSTEM OF DAIRY WORKING—AMERICAN, FOREIGN, AND HOME SYSTEMS.

It will be not only interesting, but it will serve important practical purposes, if we glance, however briefly, at those methods in use for making dairy produce in countries other than our own; and at the systems upon which this work is conducted.

Dairying in the United States of America has long been celebrated for the system with which its details has been carried out, even on farms which we should consider as very small—a system which embraces not merely their arrangement of the buildings, but their fitting up with various contrivances, and the application in working of different kinds of appliances; all calculated to economise time and save labour—both necessities of the situation in which American farmers find themselves, and have long been in, with respect to the difficulty of securing farm servants. As

[1] Sir John Sinclair on the Husbandry of Scotland, vol. ii. p. 124.

our readers are generally aware, the United States Government have, wisely or unwisely—according to the opinions of our readers on this point, which are on this side of the Atlantic essentially antagonistic and largely political in their bearing—a department which concerns itself wholly with agriculture. This department has done a vast deal of work since the date of its establishment, in the way of appointing commissions of practical men to enquire into various subjects exciting attention amongst, and likely to be of service to farmers, publishing reports, &c. Convinced of the importance of attending to the production of butter and cheese—with a view to get rid of the necessity of importing from foreign countries supplies of these—a commission was despatched many years ago to Europe, with a view to institute inquiries in all the countries in which there were districts or localities celebrated for their dairy produce. The report published by the commission, which extended over a very wide range of countries and of districts, was perhaps the most valuable ever issued on any agricultural subject; and this being widely and wisely distributed through the United States, gave an impetus to dairying which it has never since failed to feel the force of. This gave rise to the systematic working to which we have already alluded; and the latest and most successful phase or outcome of which is the 'factory system,' of which doubtless the majority of our readers have heard, and of which there are now in this country numerous examples, and which are daily increasing.

As usual in the case of all new movements, so in this; the proposal to establish the system met with great opposition. That was not to be wondered at when it came from quarters from which it might with some reason be expected to flow, where an interference with private enterprise was expected and feared; but that it should come from those who had not this excuse, if indeed any, to make, was a matter of surprise to some and disappointment to many. But to some minds all innovations are bad; and it is only when they become successes that they are considered in the more favourable light.

That the factory system is possessed of great advantages, even in a commercial point of view, a fair and candid review of all the circumstances connected with it will lead the majority of inquirers to admit; but that there are difficulties in the way of carrying it out in some districts, and that in a few it is not at all applicable, even its warmest supporters will readily allow. It would indeed be a singularly successful movement which was found to be applicable to all circumstances and all localities.

We cannot, from lack of space, give a full account of all the features connected with the system; nor, if space were at command, would that be necessary, as not coming within the scope of our work. We can only glance at its leading features, and of these, those chiefly which carry with them points of practical interest applicable to general practice. That there will be many such points may readily be conceived; as the experience of so carefully conducted places as factories are, in which every detail is carefully calculated and carried out, must have resulted in the deciding of hitherto disputed points of practice, or in the discovery of new ones. No one at all desirous of excelling, no matter what the circumstances of his dairy may be, but what ought to be—and the majority of such doubtless will be—too glad to avail himself of such results of a practice more extended, at all events, if not more carefully carried out than their own. As that well-known authority, Mr. J. C. Morton, excellently well puts it: 'Even on estates already well equipped, the practice of the best and most successful manufacturers ought not to be lightly thought of, either by the landowner or by the farmer.' And when we learn that one result of the working of the factory system has been the raising of the market value of cheese—where cheese is the principal if not the only produce made in the factories—ten shillings the cwt., as compared with the best home-made cheese on the finest farms in the same neighbourhood, one may well endorse the statement further made by Mr. Morton, 'if the great staple agricultural manufacture of any country can be improved so as to largely increase the value of its annual produce—the fund out of which rent, labour, and the tenant are all paid—it must be pronounced mere sentimental folly to oppose the improvement because estates have been recently equipped at some cost for the former less profitable process.'

This is putting the case fairly, candidly, and honestly; and any system which has produced such results should be welcomed by all as a new power adding to the wealth of the community. But the benefits of the factory system—great as they have been—and it may be reasonably anticipated that with advancing experience and greater means at the disposal of those adopting it they will be greater in the future—in this way of improving the value of the produce, do not rest here, at what may be called a commercial point. For it is to be noticed, and that with no small degree of satisfaction by those interested in the progress of agriculture, that wherever a factory is established the *farming of the neighbourhood* begins to advance, and to rise in the scale of effective working. This, after all, is what but little thought is necessary to show would be a natural result. It is an absolute necessity of the factory system that the milk supplied to it by the farmers of the neighbourhood shall be of best possible quality; other than this will not do for the results they aim at; other than this, therefore, will not be bought by them. This, on the other hand, necessitates the exercise of the greatest care by the farmer in every detail of his dairy farm—the greatest care of his stock, and those of the best breeds he can obtain—the highest style of feeding—the most scrupulous attention to cleanliness—the best food and the finest pastures. Now these are not compatible with—cannot be indeed secured by—bad or slovenly farming and management. The best produce can only be obtained by the best practice; the two must go hand in hand. So that here, again, we find that the factory system may fairly claim for itself the position of a public benefactor; and that, founded upon the well-known aphorism which praises him who makes two blades of grass to grow where but one grew before, what praise must be due to the system which makes *many* to grow?

In the American factories the practice, as may be supposed, varies considerably; still there is a general principle which runs through them all, so far as the working details, both commercial and farming or dairying are concerned. We do not consider that commercial details come so much within the scope of the present work as those connected with the practical making of butter and cheese, as from these the probability is that our readers may pick up some points of utility in their own practice, or may have suggestions thrown out to them. What we shall give, therefore, on the subject, will be confined merely to such. Those of our readers who wish to go fully into the subject may find it detailed in papers in vols. vii. and viii. of the New or Second Series of the Journal of the Royal Agricultural Society of England; in two papers read before the London Central Farmers' Club; one by Mr. Jenkins, Secretary of the Royal Agricultural Society, and the other by Mr. John Coleman, manager of a cheese factory in Derbyshire; together with the papers alluded to and named in other parts of the present chapter.

Taking the papers of the Journal of the Royal Society, vol. vii. as our guide, we find the following is the routine of daily work, and a description of the arrangements of the buildings and the appliances used. The cooling of the milk is the first and one of the most important parts of the operation carried on. It is generally done by the aid of water obtained from wells or springs, yielding water of as low a temperature as possible. The methods in use for securing such supplies of course depends upon the local features of the springs or wells, and the relation of their level to that of the buildings. In one factory—and amongst the first erected—the springs were so situated that the vats were constructed so as to enclose them. The excavations required were lined with solid masonry, and the depth of the vats or 'pools,' as they are termed, is such that the level of the water in them is never higher than that of the floor of the spring-house. Racks are ranged near the bottom of the pools, on which the milk-cans or pails are placed, the water flowing through these racks and above them, to the height of seventeen inches.

In cases where a spring cannot be had in the spring-house itself, the 'pools' or tanks are sunk in the floor of the latter, and the water brought in to them from the 'spring' by pipes. The bottom and sides of the pools or tanks are cemented water-tight, and covered with stone flagging or oak plank.

The milk is placed as soon as received at the factory in the milk-pails, which are made of tin, the depth being from 20 to 22 inches, diameter 8. Two pails on the average are required for one cow's milk delivered. The milk is made to reach within four or five inches of the top of the pail, which is immediately placed on the rack in the water-pool, so that the level of water and that of milk is equal. Each pool is arranged to hold about 2,040 quarts of milk.

The cold water is kept passing through the pool in a continued stream, and if the temperature of the water be properly arranged, the milk should be cleared thoroughly from all animal heat in about the space of an hour. The best temperature of the water is about 50° Fah.; it should not be lower than 48° nor higher than 57°. As showing the diversity of practice—shall we say of opinion? —the ice process of cooling the water described in connection with the Swedish factories in another part of this chapter, and there so highly thought of, is not approved of in the American system now under consideration, the butter made with ice-water being found to be, or supposed to be, more sensitive to heat than that made with cold spring-water.

To continue the description of the American system, it is considered of great importance to expose as little of the surface of the milk to the air as possible, in order that the top of the cream may not get dry; this dryness 'flecking' the butter, and injuring its flavour. Here, again, a diversity of practice is shown, as compared with that described in connection with the English factory system, where aëration of the milk is deemed of great importance. The milk (in the American system) of one day is left in the pools till next morning, giving 24 hours for the morning delivery, and 12 hours for the evening, for the cream to rise. A little funnel-shaped vessel, with a long handle fixed to one side, is used to raise the cream from the pails. As soon as the blue milk level is reached no more cream is taken out.

The cream in autumn and spring is churned sweet as soon as it is taken out of the pails; in summer it is put into pails and kept in the pools till it has acquired a slightly acid taste, when it is churned. In some factories the cream, as a rule, is churned sourish, the butter-milk going to the cheese-vats with the skimmed milk, to be made into 'skim-milk cheese.'

The churning is generally done by steam power, and it is worthy of note that the old plunger or piston-churn is preferred to any other; and further that quick churning, to which we have in another place referred, is not desired, as butter when churned too quickly is injured. A period of from half to three-quarters of an hour is considered the best. The quantity put into the churn at a time is from 60 to 70 quarts, and with this quantity of cream from 12 to 16 quarts of water, to dilute and thin the cream, and to bring it to a temperature of about 60°.

Some makers prefer to pass the cream through a sieve—previously diluting it with water—before putting it into the churn. This is done in order to keep back any knotty particles, and ensure a perfect equality in the thickness of the cream. For if the butter does not come evenly, but is mixed with small particles of cream, it soon deteriorates. This mode of working is deemed of great importance by some makers of the best qualities of butter, and who also prefer the thin cream got by putting the milk in deep, to the thick 'seething cream' obtained by putting it up in shallow vessels, which is not evenly churned. The dashers of the churns are arranged to go within an inch of the bottom of the downward, and to rise above the cream in the upward stroke. The temperature of the cream during churning should not be kept below 65°. If at the finish the butter-milk be above this, the butter will be injured both in flavour and colour. In cold weather the temperature of 62° is the best.

The working up of the butter after being taken out of the churn is a most important process, much of the quality being dependent upon the way in which this is done. There are various ways of carrying out the process, some dairymaids preferring the hand working, and this perhaps is the most general way adopted with us. Others prefer to use instrument butter-workers, those being most highly esteemed in America. Some dairymaids have always warm and often hot perspiring hands. In such cases there can be no doubt as to what should be done; they should never use the hand process. But where they have cool clean hands, we incline to think that there is nothing which can surpass the delicate munipulative power of the hand working, after some experience is gained. Cold water of the purest quality is essential in butter-working. In the American butter factories, they use, in some instances, a water sprinkler, which is simply a miniature watering-pan with a fine rose, which delivers the water to the butter in finely divided and numerous streams. The great point to be aimed at in butter working is the thorough expelling of the butter-milk and whey, and the giving to the butter 'firmness and pureness of texture and a wax-like appearance when produced.' The drawing shown in fig. 46 is an illustration of a form of butter-worker used at some of the American butter factories. Other and more complicated butter-workers are in use, amongst which what is known as the 'burcka' has perhaps the highest reputation. This is a butter-bowl of wood—the usual butter-bowl employed in simple butter-working—placed on a stool, in front of a lever apparatus, so constructed that almost every variety of movement, vertical, horizontal, and any combination of these, can be at once and with great facility carried out. After the butter has passed through the operation of this apparatus, it is removed to the table figured in fig. 46 and there finished off.

The salting of the butter is a process which has to be done with care, so that it be of uniform flavour. Formerly, and indeed often now, butter is salted to that degree that few people can eat it with pleasure; but a purer taste is gradually coming in, and a mild saltness is more frequently a favourite than formerly. With us but far too little attention—in many cases it may be truly said that none—is given to the quality of the salt used. In the American factories the greatest care is taken to have salt of the purest; tests are applied to discover the presence of chloride of calcium—if discovered, the salt is discarded, as this substance gives a bitter taste to the butter. When the butter is removed from the churn, it is lifted with ladles into wood trays of an oval shape, and the butter-milk is rinsed out with cold water, the ladle being lightly used, so that the water comes off the butter-milk from one end of the tray. This gentle working with the ladle, and washing with the cold water, is repeated till the butter-milk is wholly washed out. The salt is now added—in the proportion of 18 ounces for 22 lbs. of butter—and well worked in. It is then allowed to stand till evening—the above processes being of course part of the morning's work—when a second working is given to it, and it is packed for market.

The packing in the American factories is done in a most careful style, every detail being admirably wrought out both in the mechanical appliances used and in the way in which they are used; but coming more under the head of commercial working, we do not deem it necessary to describe them; contenting ourselves by referring the reader to the paper in vol. vii. part 1, No. 13, of the Journal of the Royal Agricultural Society for full particulars.

In the cheese factories where the whole-milk process is carried out, *whey-butter* is now being made from the whey. Of course the quality of this is far below that of ordinary butter; still, by the new process, it is very palatable; and indeed so good that, as is named in the Report, experienced dealers having the two kinds offered them without remark being made as to 'which was which,' the whey-butter has been chosen by them as the best of the two. This, however, may not be worth much—would in some of our markets not be worth much at some stalls—the ordinary butter being of a quality 'very ordinary' indeed, so that the best whey-butter might well excel it. Whey-butter, however well made, spoils rapidly, so that it is only fit for immediate use.

In the American factories the process of making whey-butter is as follows. A vat of copper is employed, 12 feet in length, 3 in width, and 20 inches in depth. This is set over an arched furnace, in which wood is the fuel used. The level of the vat and furnace is a little lower than that of the milk vat, so that the whey can be easily drawn off from the latter. When the vat is filled to its proper height with the whey, 'acid' (presently described) is added to the mass in the proportion of 1 gallon to every 50 gallons of sweet whey. If the whey has itself an acid flavour, less 'acid' is added in proportion; and if the 'acid' itself be not sharp, 1 lb. of salt is added to the above quantity. As soon as the acid is added to the whey, heat is applied to the copper vat, till the temperature is raised to from 170° to 180° Fahr. The cream begins to rise and is skimmed off with a tin scoop, and when wholly removed it is set aside in proper vessels till it cools, and left to stand for about 24 hours. The cream, thus cooled, is then churned at a temperature of from 56° to 68°, according to that of the weather; and when it comes it is taken out and finished off in the usual way. About 20 lbs. of butter are thus obtained, on an average, from 500 gallons of whey. The 'acid' used, as stated above, is made by taking whey which is devoid of cream, heating it to the boiling point, and adding 1 gallon of whey which is thoroughly sour to every 10 gallons of boiling whey. The casein and albumen in the mass collects together and can be removed, and the residue is allowed to stand for 24 or 48 hours, according to circumstances, when it is fit to be used as the 'acid.' Singular to say, the whey left after the butter has been made from it is said to be better adopted for swine-feeding purposes than ordinary whey; this is owing to the sugar of milk being retained longer in the mass without change.

Having now described the process of butter-making on the factory system, we shall glance as briefly as may be at the details of cheese-making, taking as our 'model' the example afforded by the Holms factory in Derbyshire, which is fully described by Mr. Morton in the paper we have already quoted from, and named below.

We have in another part of this chapter described the ice method of cooling milk for a butter-making factory, as adopted in Sweden. We here describe the 'cooling' system as adopted in a cheese-making factory at Shearn, near Ashborne, in Derbyshire, full particulars of the working of which will be found in a valuable paper from the well-known writer Mr. J. C. Morton, given in the Journal of the Royal Agricultural Society of England, vol. xi. part 1, No. 20, p. 261.

The cooling vats are of timber, having a milk-holding capacity of 500 gallons each, the length of each vat being some 14 feet, width 4, and depth 20 inches. Each vat is lined with tin, or rather has an interior tin vat, the dimensions of which are so much less than those of the main or timber vat, that a hollow space or jacket is left at the bottom and sides. The milk is placed in bulk within the tin vat, and cold water is passed into the jacket at one end, passes through the whole length of the jacket and out at the other. The evening milk is thus surrounded with cold water, is placed in the vats, and kept exposed to it all the night through. To prevent the cream from rising and also to aërate the milk, and to get rid further of any bad animal or other odour which may be present in it, wooden stirrers which are sunk to a depth of two inches in the milk in the vats—are caused to move to and fro at stated intervals. The stirrers are moved by an ingenious arrangement. The issuing water from the vat, entering one of the floats or water-wheels, fills this till it has weight sufficient to give the wheel half a revolution on its axis. By means of a crank and connecting rod, this motion is communicated to the stirrer.

The milk delivered in the evening, and thus set aside to cool, is reduced in temperature by, and generally before, morning to that of 60° or 65°. The morning's milk being produced under somewhat different circumstances—especially in the summer time, when there is not the same likelihood of its being over-heated by the cows in the fields, &c.—does not require to be passed through the same long cooling process, but is at once mixed with the evening's milk. When mixed, steam is introduced under vat No. 1—the cold water having been of course previously withdrawn—and the temperature of the milk raised to about 80° in the summer or warm, and 82° in the winter or cold weather. The rennet—which is proportioned to circumstances, but which if in proper condition should be at the rate of half a pint to every 100 gallons of milk—is then put into the vat, and well mixed; and the vats are then covered up with a cloth, to keep in the heat and maintain a uniform temperature. If the rennet is good, it should thicken the milk perceptibly in a quarter, and thoroughly coagulate it in one hour.

Coagulation is completed when the curd will break cleanly over the finger when a small portion is taken out. The curd is then cut by the curd-cutter, the cutting being done slowly from one end of the vat to the other, and repeated till the whole mass is cleanly cut, not bruised and broken. The curd thus cut is allowed to remain quiescent for a few minutes, till the whey rises and covers the surface, when the curd-cutter is again passed through the mass, but in a direction at right angles to the previous or first cut; thus leaving the curd in the form of cubical blocks, or rather parallelopopedons, say half an inch square on the side. The whey is then allowed to escape from the vat, and the curd gradually descends or falls to the lower part of the vat. Allowed to remain quiet thus for a short time, the mass is gently turned over by the hands, and then it is cut into small square blocks by the equally gentle use of the curd-cutter. These and all succeeding movements of the curd must be done with the utmost care—tenderness, as Mr. Morton well expresses it—for it is essential to retain as much as possible all the fatty matter in the curd, and to allow the minimum only to pass off along with the whey. A little steam is now turned into the empty water space, and as soon as the temperature is a little raised by it, the curd, acquiring more firmness, can be manipulated a trifle more freely, and turned about faster; this brings out the whey more quickly, and correspondingly reduces the bulk of the curd. More steam is turned on, and the curd is mixed more quickly than before, to prevent any over-heating of the mass at the bottom of the vat. The whey being by this time nearly wholly expelled from the curd, the latter has become hard and tough, and the curd-rake is freely used to keep its particles in motion. When 90° Fahr. of temperature is reached, the steam is turned off, and the curd is kept stirred till the bottom of the vat has gradually cooled. It is then allowed to remain quiescent for about ten minutes, when the steam is again turned on at full pressure, and the curd is then kept in continual motion. When 100° Fahr. are reached, the steam is for the last time turned off and the curd kept worked till the vat has gradually cooled down. The curd is now left till the 'souring process' is completed, the time for effecting which is dependent upon circumstances, and is decided by the experience of the manager. A good test that the souring is completed is by taking out a piece of curd and applying it to a piece of hot (not red-hot) iron, if it draws out into stringy pieces of about an inch long the curd is in good condition. The whey which has collected is run off from the vat by a syphon pipe; and still further to get rid of what remains, the curd is gathered up towards each side of the vat, till a space is left in the centre into which the whey runs. The curd, now adhering in a mass, is cut into pieces, and turned over and over till all the whey is expressed. It is then taken out of the vat, put into the curd-mill, and reduced to a species of coarse-grained powder, like raisins in size; this has then salt added to it—at the rate of 2 lbs. to every 1,000 lbs. of the milk from which the curd powder has been made, autumn-made cheese having a higher proportion of salt, about 2½ lbs. The salted curd-powder is next vatted, and subjected to the pressure of screw presses till the last portion of whey present in it is expressed. In these presses it remains till next morning, when it is taken out, and conveyed to the lower curing-room and weighed, has some tissue-paper attached to the flat sides of what is now a formed cheese, and is placed on the cheese-shelves to cure and ripen. Here it is turned each day for a few days, when it goes to the upper curing-room, on the shelves of which it is turned every other day.

The vat alluded to above, into which the salted curd-powder is placed to be pressed, is technically called the 'dry vat;' it is in length about 16 feet, 3 feet 10 inches wide, and a foot deep. It is provided with a false perforated bottom, on which a cloth strainer is placed to facilitate the pressing out of the whey. The round form of the cheese, so well known, is gained by using strong circular hoops of galvanized iron, the diameter being on the average 15 inches and depth 20. The hoops are placed on a movable board at the bottom of the press. The curd is filled into the hoop by means of a tube, and carries a cloth with it to the bottom of the hoop, the cloth being of course first placed over the hoop. When the hoop is filled with curd another cloth is placed over it, then a small board, and the whole slipped under the platten of the press, which is then brought down by the screw, and the pressure applied slightly at first, and then gradually increased till the pressure reaches that of four tons. When the curd is solidified, it is ready to receive the permanent bandage or cover—which is of 'tiffany cloth'—in place of the tissue-paper above described as used at some factories. This bandage is so arranged that it covers the cheese with an overlay at top and bottom. When covered it is then returned to the hoop, and again subjected to pressure for about 18 to 24 hours, when the cheese is taken out and carried to the curing-room. In the factory in which the process now being described is carried on, the cheese, after being removed from the hoop, is rubbed daily over with whey-milk butter in a melted state—for two or three days. This is done to prevent the outer skin or rind of the cheese cracking. The uniform temperature of the curing-room is of great importance; this for the first six weeks should be from 70° to 75°, when it should be gradually reduced to about 65°, at which it should remain for two weeks.

In the American factories where the butter is made from sweet cream—not soured or lappered—the skim-milk, being also sweet, is available for the making of skim-milk cheese, which forms part generally of the operations of butter-making factories. The milk vats for this product are of various kinds, and treated upon a variety of principles. One kind very popular has the heating apparatus below the milk-vat. The ordinary heater is made up of a series of wrought-iron pipes, screwed together and placed in a chamber so as to go backward and forward before the place of final issue is reached—thus presenting a very large amount of heating surface in small space, and requiring a very small quantity of fuel to warm the whole mass to the desired temperature.

In making the skim-milk cheese, the milk is set in the vat at a temperature of 82°, and sufficient rennet added to coagulate the mass in 40 or 60 minutes. The process throughout is very similar to that we have above described.

A new *form* of cheese has been introduced into the butter factories of America; this, in place of being round, is oblong, and possesses, mechanically speaking, many advantages over the round. For example, it dries quicker, the whey percolates towards the bottom of the cake—for it is in reality so—each time it is turned, and this only a fourth of a revolution, the whey in place of running to the centre as it would do in the case of a round cheese, is turned at right angles to the centre, and has therefore a constant tendency to come to the outside, from which of course evaporation is more speedy. Another advantage it possesses is that it does not require greasing with the whey-butter to prevent cracking, as the whole can be completely covered with the bandage. And the shape obviously facilitates not only handling but packing, as a greater number can be put into the same bulk without any of the vacant spaces formed of necessity by round cheeses. They can be made in a much greater variety of sizes than round cheeses, as the size is regulated by the mere cutting of the larger blocks first made. And by the use of a very simple appliance the cutting can be very easily done. The moulds and presses for oblong cheeses are very simple and easily worked. Such a form might with advantage be introduced into the dairies of this country, as they are obviously very useful for families, inasmuch as small slices can be cut off one end easily—thus exposing the minimum of surface to the air—while the cloth or bandage can be at once put over the cut part. We have in fact the form exemplified in our cream cheeses, which are thus made.

Butter factories have been established in Sweden with marked success. As the farms are as a rule small, and the herds of cows kept equally so, the direct delivery of the milk to the company or factory is not available. We have alluded to this difficulty as existing in this country, and as being one urged by many farmers against the factory system. In Sweden one company gets over this difficulty by purchasing the cream only, leaving the skimmed-milk in the farmer's hands to be dealt with as his circumstances may dictate, as in the making of skim-milk cheese, feeding of calves, pigs, &c. In order to facilitate the collection and disposal of the milk, even of the smallest farms, the company have at various points erected small milk receiving houses. These are fitted up with the appliances necessary to cool the milk, receive and retain the cream, with washing or scalding-room to cleanse the vessels—a cheese-making room if necessary—and accommodation for the dairymaid. 'This system has,' says the author of a paper on the subject in the eighth volume, second series, part 2, No. 16, p. 268, of the 'Journal of the Royal Agricultural Society of England,' 'decidedly promoted the further development of the factory system, and at the same time opened the way to a useful and profitable branch of industry to those who occupy themselves with collecting pure milk from the smaller farmers, whose produce is too limited to allow the cream obtained from it to be treated in the manner which will make it saleable to the dairy company, or from such larger producers of milk as do not care to take the pains necessary for obtaining the cream, or for the further preparation of the skimmed milk.' It appears to us that the adoption of some such plan as this here described would be useful in districts where the farms are small.

The importance of cooling the milk as soon as possible after it comes from the cow is fully recognised by the company, and means are provided in each of the 'milk receiving houses' for having this process carried out quickly and efficiently. A room is provided with a cold-water cistern, from which is drawn the supply necessary to fill the cooling vats in which the milk-pails are placed. If water cold enough is not obtainable, ice is used to reduce its temperature; and, indeed, so much more satisfactory are the results of ice-cooling, that it is now generally used.

Mr. Willard, in a recent paper, while referring to this practice of ice-cooling, thus explains the theory upon which its undoubted success in the making of butter of superior quality is based. The theory owes its existence to the celebrated Fleischman, who has made investigation into the properties of milk his special study. Taking the specific heat of water as 100°, that of cream is 0·78°, and that of an average specimen of a number of qualities of milk is 0·847°. By the term 'specific heat' is meant the amount of heat which each substance takes or requires to be raised to a certain temperature. Thus, in the above instances, while a certain quantity of water took a certain quantity of heat to raise it to a given temperature, which quantity is represented by 1°, cream only took 0·78°, or only one-fourth less heat, to raise it to a certain temperature. The point of maximum density of milk is found to be 1 deg., or more correctly $1\frac{4}{5}$ deg. of Fahr., above the freezing point of water. From these facts it appears that milk grows denser as it cools, till it reaches a point 1 deg. above freezing point; when water reaches this point it expands; in cooling below this, currents upwards and downwards are produced in the mass. Such currents are not produced in milk which is cooled, so that cooling helps rather than retards the rising of the cream.

As bearing upon various practical points connected with butter-making, &c., we shall here give a brief *résumé* of the facts detailed in the paper above alluded to. The ice used to cool the water in the supply cistern is broken into pieces some three or four inches square, as the cooling action is found much increased by this. The cooling vats in which the milk-pails are placed are about 9 feet long and 3 feet wide, and with a depth of about 2 feet. A false grated bottom is provided to each cistern, and upon this the milk-pails are placed. A vat of the above dimensions is capable of cooling about 115 gallons imperial of milk. The pails were originally about 24 inches deep, and about 18 inches in diameter; but as it has been found that the quicker the milk is cooled the more completely is the cream separated from it, the size has been reduced to 20 inches in depth and about 9 in diameter, thus holding each about 3½ gallons. The depth of the iced water in the vats should be such that in summer time it is equal to the height of the milk in the pails—that is the level of each should be coincident. The cream in this arrangement, as it rises, forming a layer above the level, is kept cool; but in the winter season the level of the surface of milk in the pails should be above that of the water in the vat by some inches. The proportion of the ice used in cooling the water to the milk to be cooled varies, but on an average the quantities of each are about equal. By careful management the ice has been reduced to one-third; thus, in the Central Company at Stockholm, 1,500 cwts. of ice were used to cool the milk necessary to produce 2,500 cwts. of butter.

On the milk being delivered at the receiving-houses, it is measured, skimmed, and a small sample put into a graduated glass cylinder, which is left for cream setting along with its bulk, so that an idea may be had of its quality. The milk is then strained into the pails, and these are placed in the vats with about three inches interval between them. The temperature of the milk-room—the ice-water in the vats, and that of the milk itself—deciding the rising of the cream, the time taken for this varies. On an average the milk will be ready for creaming in about 10 to 12 hours, with a temperature of 35° of the ice-water, but better cream is got by allowing it to stand for 18 or 24 hours. The temperature of the milk-room should be as low as possible in summer, never below 50° in the winter. The sooner the cream is churned the better, is the experience of the Swedish factories—or, as their reporter puts it, 'the fresher and absolutely sweeter the cream is, the better will the butter be.' As we have seen from experience in this country, opinion differs on this. On arrival at the factory the cream is put into the ice-water vats at once to keep it cool and sweet. The average results of working may be stated thus: 2·65 gallons of milk yield 0·44, nearly half a gallon of cream; this churned gives 0·93, or nearly one English pound of butter. Or, in round numbers, six gallons of milk yield one gallon of cream. The temperature of the cream found best for churning varies with the quality of the cream, temperature of the churning-room, &c. There is one great advantage obtained by using iced-water in place of cold well-water—even if that can be obtained at a temperature sufficiently low—and this is that while the well-water in the cooling vats requires to be constantly changed, the iced-water need not be changed oftener than a few times in the year. The surplus water from the melting of the ice is carried off by a small pipe, the orifice of which is near the upper edge of the vat.

The ice is not stored in a regularly built house, but simply heaped up in a pyramidal form, in the open air generally, but sometimes in a shed, and covered with saw-dust, tanners' bark, or other good non-conducting material. Great care is taken to keep down the number and size of the spaces or interstices between the blocks of ice, and those where they exist are carefully filled up with sawdust. When ice is removed from the heap it is taken from the top, working downwards, and the spaces made by the removal are carefully filled up with sawdust. The lowest layer, or the bottom blocks, rest upon a layer of the non-conducting material at least a foot in depth. The loss sustained by melting of the ice thus stored is about one-fourth per cent.

The following are illustrations of a few of the appliances used in the American butter and cheese factories, which will be practically suggestive to our readers. As already stated, the form of churn used is the ordinary dasher, or plunger, or piston form, worked at the rate of from 40 to 42 strokes per minute. As the way in which the cream is operated upon, and the butter as it begins to come, exercises a very great influence upon the quality of the finished produce, the form of the dasher or piston is of great importance—and a very great number of designs of this part have consequently been brought out. At last, after many efforts, a form has been discovered which has given the best results of any yet introduced. In fig. 47 we give part of this, A being part of the lower side, B that of the upper side. The cross-pieces are 20 inches long—a little less than the diameter of the barrel of the churn—and 6 inches broad; they are joined by a half lap joint at the centre, giving a flush surface at this part, and retained together by the vertical handle passing through the hole *a*. Apertures *b b* are made of $1\frac{7}{8}$-inch diameter; but these can scarcely be called apertures, as they do not go through the whole thickness of the wood of the arm, but penetrate only to a certain depth, as shown at C, or 'countersunk' as at D, the true aperture being at the bottom of this, and is $\frac{5}{8}$ths of an inch in diameter, as shown at C and D. Other holes, as *c c*, are made in a similar way, and are connected with a groove as at *a a* in E, which is cut only to a certain depth in the upper surface of the dasher-arm;

the groove being finished at bottom with a narrow slot *b*, going right through the arm, and connecting the two holes *c c*.

Fig. 48 illustrates the form of butter-worker already described. Fig. 49 the 'curd agitator.' Fig. 50 a form of strainer to draw

FIG. 47.

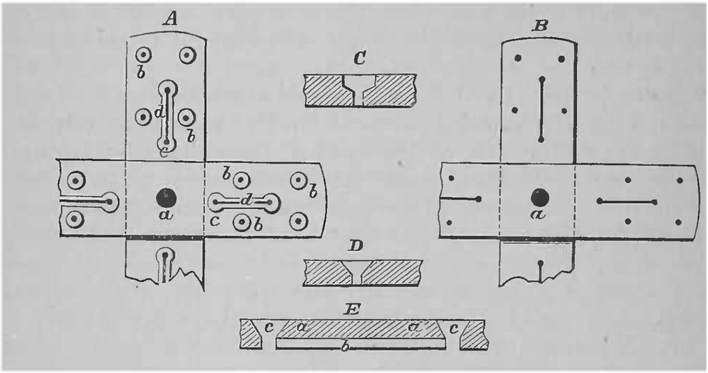


FIG. 48.

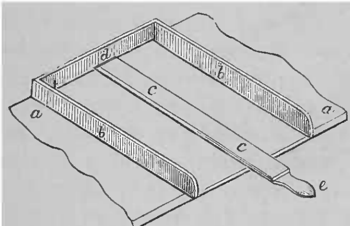


FIG. 49.

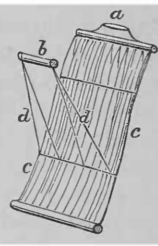


FIG. 50.

FIG. 51.

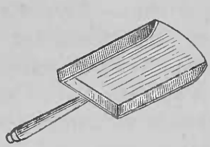
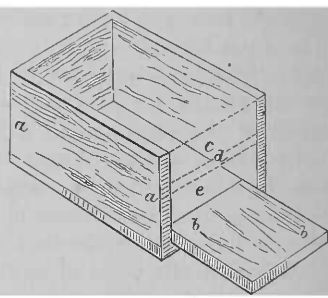
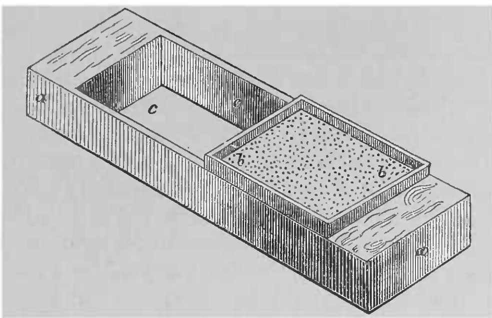


FIG. 52.



off the whey from the curd without agitating it. Fig. 51 illustrates a form of 'curd scoop.' Fig. 52 illustrates the form of press used for the oblong cheese already described. When the curd is ready for pressing, it is placed in the rectangular mould *a a*—the front or one end of which is hinged to the body of the mould, so that it can fall down to admit of the removal of the cakes when they are pressed. After the curd is pressed into a broad flat cake, it is cut vertically with a fine saw into two or more blocks as *c c*, and these are bandaged with a muslin cover. They are then put into the mould with a board *d* between them, and again pressed till the whey is out of them. When this is accomplished the cakes are taken from the mould by letting down the falling front or end board *b b*, and removed to the curing-room. In some factories the milk delivered in the evening is not put together in large bulks in the vats, as already described, but a large shallow wood pan is used instead, as in fig. 53, this being covered with movable covers of netting to keep out flies, dust, &c. Two pans are set at a time in the cold-water vats, with a space between them for the water to flow round them.

FIG. 53.



The length of the pans *a c*, fig. 53, is some 8 to 12 feet, the width 2 to 3, and the depth of milk 2 to 3 inches. The milk is drawn off from each by an orifice in the bottom.

In America, and on the continent of Europe, where the dairy factory or large farm dairy system is carried out, *pig-keeping* is generally part of it. To some, but perhaps not to the same extent, is this the case in this country. The three products of the dairy useful for pig-feeding are whey, skim-milk, and butter-milk. The whey being the refuse, if such a name can or should be given to such a product of the cheese-making, where that is part of the dairy work—the skim-milk and butter-milk being the residue of the butter-making process—skim-milk where the cream only of the milk is churned—the butter-milk where either the whole milk or the cream are churned. In the neighbourhood of large towns, there is no difficulty in disposing of the dairy produce of the two last kinds, a ready and profitable sale being had both for skim and for butter-milk; for the latter especially in manufacturing towns.

But many dairies and dairy factories are naturally situated in the rural districts, and for obvious reasons; and, being thus far from towns, the produce must be used near the farm or factory. Like all other agricultural questions, that of, Do pigs pay? is answered both for and against; and in both cases, oddly enough, the facts and arguments are, or seem so conclusive, that the answers seem complete. Yet both cannot be right. The probability is that some point has been left out by an oversight or by carelessness, or some details omitted which should have been given, and if so given would have materially altered the aspect of the answer. *Primâ facie* it appears a difficult thing to be able to make out why pigs do not pay; other live stock do, and they have some points in their favour which other animals have not. (For these see the chapter on Pigs.) In the paper by Mr. Morton, elsewhere alluded to, the question of pig-feeding at dairies is freely discussed, and the curious discrepancy of opinion just noted is there exemplified; for while one farmer informed Mr. Morton that he would gladly give his whey away for nothing to anyone who would come to his dairy to take it, another valued it so much that he estimated that it was worth thirty-five shillings a year to him; and another so attaches the very highest value to the whey, 'that he justifies by its use the expenditure of 300*l.* a year for the purchase of feeding materials to be used along with it.'

These discrepant and bewildering statements on a point which one would naturally suppose to have been decided long ago, considering the amount of experience obtained through a long period, would seem to indicate, we incline to believe, that, in the cases in which pigs do not pay, or seem to pay, as hinted at a few lines back, there is some error of calculation forgotten or overlooked—or that in many cases the pigs are so kept that it is not possible that they can pay. The very same principles of scientific treatment and feeding which are applied to other live stock of the farm with profitable results, are applicable also to pigs; and would, if applied, produce or go far to produce, results of like character. But are they so applied generally? Let anyone who has had the opportunities of extended observation as to the way in which pigs are kept—including in this housing, littering, and attention to the health and bodily condition of the animals—answer this question. We do not hesitate to say that this answer would be in the negative in a very large number of instances. Indeed when we draw to recollection what we have seen and what we believe is the very widely extended practice in the kingdom, we should be inclined to say that, seeing what this practice is, it would be a remarkable thing if pigs did pay. Apply the same scientific principles of treatment and feeding to them as applied to other animals, and we believe that they will pay. We know that they can be made to pay, and why not? They take 'kindly to their food,' they have small offal when on the butcher's block, and the meat brings high prices in the butcher's shop; and this *independent* of the *manure* they yield.

There is for the skim-milk a new outlet, when used for feeding purposes, recently introduced—or rather we should say two new outlets—first for the feeding of calves, second for the feeding or fattening of cattle, a recently introduced system, but which seems to be more applicable to Dairy Cows, as it adds considerably to the yield of their milk. In the paper on Swedish butter factories, from which elsewhere we have culled some interesting facts on dairy management, there is a notice of the method of using the skim-milk for the feeding of calves, which lays before the reader some suggestive facts. From this notice it would appear that the use of skim-milk for this purpose has been eminently successful; the only drawback to it being that it gives a darkness to the flesh. This is however, avoided by feeding the calves—when killed for veal—on sweet milk for the last fortnight before being killed.

In American cheese and butter factories, the piggery is generally looked upon as part of the concern, although it is not always situated at or near the factory; being sometimes placed at the farm. When forming part of the factory buildings, it is so placed that the smells usually arising from the pigs do not reach or at least reach in minimum quantity, the milk and other working rooms of the factory. The whey is conveyed from a reservoir—in which it is stored up as it passes from the cheese-room—to the piggery in troughs, the quantity supplied being regulated by a tap. As there are various 'patrons' of the factory who keep pigs, the piggery is arranged so that so many styes or pens are given to each patron, a yard in common to them all being used for exercising ground for the pigs, or each patron may have his own yard. The proportion of pigs allowed to be kept is one for each four or five cows of which he delivers the milk. When the whey is used along with solid feeding materials, as bran, meal, &c., the quality of the pork is greatly improved, and often a very considerable profit is realized from their keep. Fed on whey alone, while they take on fat and increase in weight, the pork is light and watery. It is the old story we have so often to repeat, that pigs will not, cannot pay, if they are carelessly or badly fed, and as carelessly and badly attended to in the way of housing, littering and body-cleaning. The difficulty met with is the smell or odour arising from the pigs, and various contrivances are adopted to overcome this. In some factories the piggeries are abolished wholly, and the pigs kept at the farms, the whey being conveyed in a pipe to a reservoir at a distance from the factory, so that no smells can reach it from this. From the reservoir carts convey it to the farms.

It is clear that, from what has been said, we have yet a great deal to learn in respect to the keeping of pigs, especially on the large scale. We strongly incline to the belief that the 'evil odour' attached to this is influenced greatly by the way in which they are fed and housed, and that a well-fed pig will be in every respect a sweeter animal than an ill-fed one. Then, again, as to housing. We do incline strongly to the belief that where the floors are of a non-absorbent material they will be sweeter than when one of absorbent. Soft absorbent floors lick up and retain the excreta, no matter how frequently they are cleansed on the surface, and these will often be found at a considerable depth, so that in certain states of the atmosphere there will be continued streams, so to say, of foul air rising from the ground. Now by the use of non-absorbent materials, and by the repeated and liberal use of water in cleaning out not only the styes and food-vessels, but dashing the water on the animals themselves, the odours will be to a very great extent diminished.

BOOK THE THIRD.

ON THE BREEDING, REARING, AND MANAGEMENT OF FARM-HORSES.

CHAPTER I.

INTRODUCTORY AND COMPARATIVE VIEW OF THE DIFFERENT BREEDS OF FARM-HORSES.

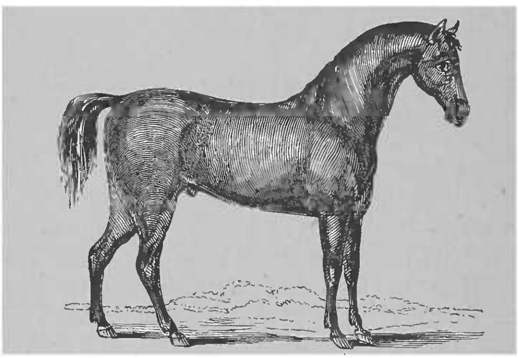
WE have no knowledge of the form and probable qualities of the primitive horse, except what we can collect from figures of him on the friezes of the ancient Egyptian and Grecian temples, and from some of the remains of Roman architecture. He seems to have been a strongly-formed, courageous, and noble animal; but, in the early periods of the world, he was used only in the chase and in war, and not disgraced, as it would then have been deemed, by the labours of commerce or of agriculture.

The wild horse of the present day is descended from those who had escaped from the tyranny of man, and wandered uncontrolled over various deserts in both the Old and New Worlds. Many of them retain evident traces of the noble blood from whence they have sprung; and, generally speaking, they are easily subdued, and become the valuable, docile, attached servants of man.

In no country have the various qualities of the horse, as it regards the turf, the field, and the road, been brought to such perfection as in England; and, not excepting even the pure Arabian, there can nowhere be found a breed to compare with the English race-horse. The subject of thorough-bred horses is, however, beyond the scope of this treatise, which, being intended for the use of farmers, we must confine to a description of the species of draught cattle best suited to their purpose; and these may be ranked under the several denominations of the Cleveland Bay, the Suffolk Punch, the Clydesdale, and the Old English Black or Lincoln cart-horse.

I. The CLEVELAND BAY, delineated below, is bred in various parts of Durham, Northumberland, and Yorkshire. The latter county, and especially the North Riding, has been long famed for its superiority in breeding horses of every description. The prevailing breed is that adapted for the saddle or for the coach; but, in the district of Cleveland, whence, as well as from their common colour, the breed immediately under consideration derives its name; and in the vale of Pickering, in the East Riding, they are taller and stouter than the others, more powerful, and better adapted for draught. They are, accordingly, much used in the North for agricultural purposes, and are there considered quicker in step,

FIG. 54



THE CLEVELAND HORSE.

more handy, and in all respects more useful than the heavier cart-horse of the South, while they are also believed to consume less food.

They carry a fine coat, with black mane and tail, and although rather coarse-headed, they have a noble fore-hand, with a well-set shoulder and neck, a deep chest, and round barrel. Measuring from sixteen to seventeen hands in height, they have a stately appearance, and on this account were in much demand as coach-horses while the heavy family carriages of former days were in vogue. Good hunters for heavy-weights were also formerly bred from the mares when covered by thorough-bred stallions; but, since foxhounds have been trained to run with their present speed, and the barouche has been substituted for the coach, these have been condemned to the collar, and hunters are now only to be obtained from the second, or even the third, cross with the thorough-bred horse.

The Cleveland Bay is better calculated for slow draught than for any other purpose. For rapid work, his carcase would be too heavy or his limbs, and he would be deficient in the elasticity requisite for quick action. When, however, he is not pressed, he will support a long continuance of fatigue, and has been known to travel the extraordinary distance of sixty or seventy miles within twenty-four hours, with heavy loads, three and even four times a week, besides being occasionally employed on the intermediate days.[1] There is, indeed, no better animal for farm labour; and the mares are the best species of stock for the double object of work and breeding.

It is right, however, to state, that this opinion is not shared in by some authorities, who look upon the Cleveland Bay rather as a carriage than a farm-horse. A dash of breed in a farm-horse is not to be despised; as remarked by Mr. Wilson, 'One needs only to see how such horses get along at turnip-sowing, or with a heavy load in a one-horse cart, to be convinced of their fitness for the general work of a farm.'

There is a mixed breed in other parts of Yorkshire, obtained by crosses with black and blood horses; but, for the general purposes of farming, they are not equal to the original stock.

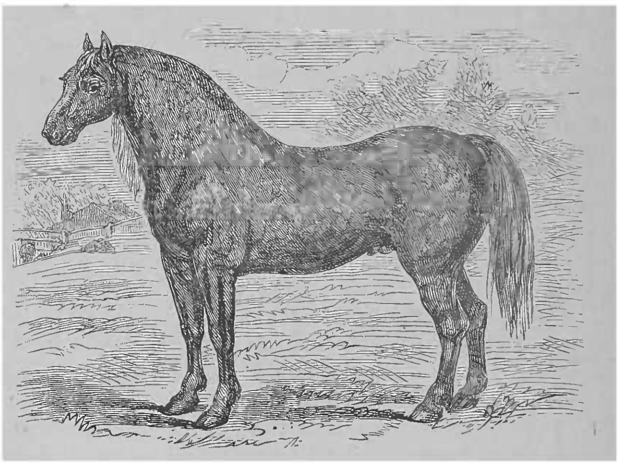
II. The CLYDESDALE or LANARKSHIRE race are strong, active, hardy animals, of the middle size; remarkably steady, true pullers, usually of sound constitution, and well adapted for all the purposes of husbandry; indeed, for the purposes of the farm, they cannot be surpassed. They are, therefore, deservedly in esteem among the northern farmers, particularly on heavy soils; they are not, however, so active, nor so well adapted for light land, as the Clevelands; neither are they so handsome. Their prevailing faults are a tendency to length of limb and lightness of body, and they are apt to become heated by their work; but, apart from this, they are valuable farm-horses, and will work with more strength and continuance than almost any other kind; but they also require a larger amount of food than others. They are said to have descended from a cross, by one of the Dukes of Hamilton, between some Flemish stallions, imported many years ago, and some Lanarkshire mares, and they derive their appellation from the district on the Clyde where they are chiefly found. The story of their origin is, however, denied by a very intelligent writer on the subject,[2] who considers them an improved breed of the old Lanark species. They have, long ago, made their way into the bordering counties of England, and there can be little doubt that, when their good qualities are more truly appreciated, they will travel still farther south. They are indeed becoming more and more appre-

[1] See the Agricultural Survey of Durham, p. 257.
[2] Mr. William Aiton.

ciated in all the southern parts of the kingdom; and there is scarcely a 'show' at which one or more splendid specimens are not to be met with. There is, indeed, scarcely any breed which for general farm purposes is more on the increase. There is scarcely a finer sight to lovers of horseflesh than to see the 'entries' of 'Clydesdales' made at these shows for trial, competition, and hard work.

This valuable breed of horses is described by Mr. Aiton as being from fourteen to sixteen hands in height. If beyond that they are generally unshapely, and deficient in spirit—the effect of crossing small jaded mares with overgrown stallions. They are round, fleshy, well-proportioned, strong, and heavy, without being too coarse or clumsy. The head is in due proportion to

FIG. 55.



THE AMERICAN ENTIRE CLYDESDALE HORSE.

the body; rather small than large, yet somewhat plain, and not so full and prominent below the eyes as some of the English breeds: nevertheless, the nostrils are wide, the eyes full and animated, and the ears erect. The neck is strong, thick, and fleshy, with a good curvature, and the mane strong and bushy. They are broad in the breast and thick in the shoulders, the shoulder-blades being nearly as high as the chine, and without that direction backwards which is so important in the saddle-horse. The arm tapers to the knee; the leg is short and strong, but well-shaped and clean. The hoof is round, of a black colour, tough and firm, with the heels wide, and no long hair on the legs except a tuft at the fetlocks; the body round and heavy, yet not disproportionately so; the belly of a medium size, neither hanging down nor tucked up, and the flank full. The back is straight and broad, but not too long; the loin broad and a little elevated; the haunch bones are visible, but not prominent, and there is but a short space between them and the ribs. The sides, from the shoulders to the hips, are nearly straight; the thighs large, and so close to each other as to leave only a small groove for the tail to rest on. These latter points often give a certain plainness to the horse.

This description combines most of the best points peculiar to the heavy draught-horse, but they will seldom be found united in the same animal.

FIG. 56.

THE SUFFOLK PUNCH.

The prevailing colour of the Clydesdale horse is black, but there are some browns and many greys. The market at Rutherglen and the Whit-Monday fair at Glasgow are the chief depôts for them; and as these are attended by dealers from most parts of the north, young sound horses usually fetch from 40*l.* to 50*l.*, and not unfrequently still higher prices. They were sometimes used in gentlemen's carriages, but are not suited to the fashion of the present day.

This breed has much improved since the middle of the last century, and might become still more so if a more careful selection of mares and stallions were uniformly made. In fig. 55 we give an illustration of a celebrated American entire horse of this breed, which was the progeny of very fine specimens—sire and dam—of the breed imported into North America.

III. The Suffolk Punch (fig. 56), which is so denominated from his peculiar shape, and said to have originated from a cross between a French stallion of a breed that has been long celebrated in Normandy, and a Suffolk cart-mare, is a true farm-horse. This breed has been preserved more pure than many others; and, being neither handsome enough for a gentleman's carriage, nor weighty enough for a London cart or waggon, it is seldom employed for any other than agricultural labour. The old Suffolk Punch is now rarely to be met with. He was rather a plain-made horse, with large head, coarse muzzle, low fore-hand, straight back, flat side, shoulders too far forward, hind quarters rather high about the hips, deep-bellied and full in the flank, round legs and short pasterns.

This is the account which Mr. Culley gives of them; and we immediately recognise in this description the horse that could throw his whole weight into the collar, and stand, without shrinking, a long day's work.

The present breed possesses many of the good qualities of its predecessors, but it has a considerable portion of Yorkshire blood mingling with it, and often an evident cross of the Flemish horse.

The following is an accurate description of the best horses of the present breed. The colour is almost invariably a bright chestnut, the head somewhat coarse, with ears standing wide apart and the fore-hand low, with a heavy shoulder, and no great depth in the chest. To counterbalance these defects in shape, the back is straight and broad across the loins, the hind quarters and thighs are large and strong, the fore-arm sinewy, and the lower joints and pasterns short. The body is, perhaps, rather too full in the flank and flat in the sides; but the shoulder, though thick and standing forward in an unsightly manner, is yet well placed for the collar; and this, in fact, is one of the best points. His size rarely exceeds fifteen hands and a half, but his compactness and activity render him particularly serviceable where heavy draught is required. Some good horses of that description termed *cobs*, have been obtained by crosses with the breed. The excellence of the present Suffolk Punch, like that of his predecessor, consists in his activity, and in the honesty and continuance with which he will throw himself into the collar at a dead pull.[1]

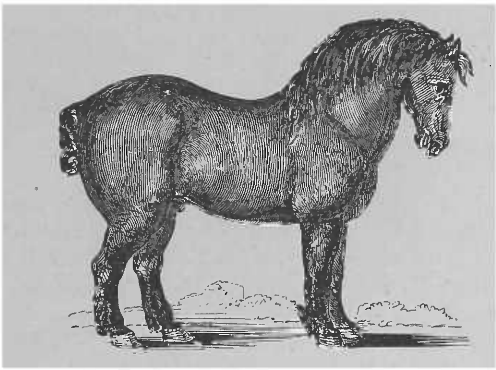
The figures on the preceding page are portraits of a pair of capital Punches, which formerly belonged to that eminent farmer,

[1] Mr. Raynbird, in his excellent Report 'On Farming in Suffolk,' says, 'Suffolk has long stood pre-eminent for its breed of horses, and the unvaried success it has had in carrying off the prizes of the Royal Agricultural Society sufficiently proves that the Suffolk horses have not deteriorated in their value as the best for agricultural purposes. Six years out of eight Suffolk beat all England in this respect.'—*Journal of the Royal Agricultural Society*, 1847.

Mr. Wakefield, of Burnham, in Essex, who was remarkably successful in breeding this stock, and at one time was in possession of a stallion of the breed—Britton—for which he refused 400 guineas.

IV. The BLACK CART-HORSE *par excellence*, the 'Old English Black' (fig. 57), of which the annexed is a delineation, is mostly bred in Liecester, Northampton, and Lincoln, and some of the neighbouring counties; but the largest kind, and that principally used in brewers' drays and other heavy road-work, is chiefly reared in the fens of Lincolnshire. These counties have been from time immemorial in possession of a celebrated breed of black horses, from the lighter kind of which some of our heavy cavalry were formerly mounted.

FIG. 57.

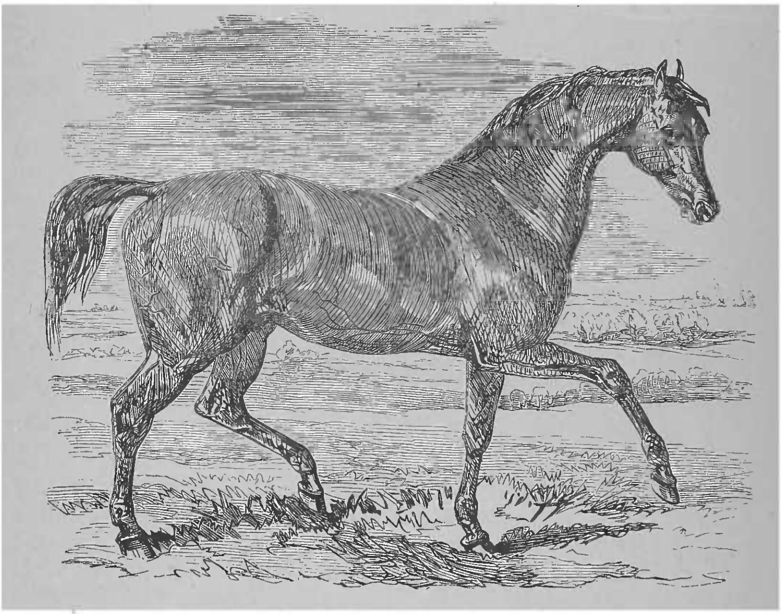


THE BLACK CART-HORSE.

An improvement upon the original stock is said to have been effected by the late Earl of Chesterfield, who, during his embassy at the Hague, sent over six Zetland mares to Bretby, his lordship's seat in Derbyshire, whence their descendants found their way into Leicestershire, and were further improved by an importation of West Friesland mares, by Mr. Bakewell. From a cross between these and a native stallion, that gentleman produced some noble cattle. By this mixture of blood Mr. Bakewell got rid of much of the length and looseness of form, and the long, thick, hairy legs attributed to the original breed; and obtained a more compact and short-limbed animal, possessed of greater activity, and, as he alleged, of a better constitution, being more hardy and better able to stand constant work. If he carried this to a somewhat extravagant length, and sacrificed a little too much of that bone which, in every horse of strength, must have considerable development for the attachment of muscles, this defect has been rectified, and in that respect there is at present no deficiency in the breed. By an inspection of the Flanders horse now constantly imported, and by means of which a great improvement has evidently been effected in the cart-horse, it will be seen that our present stock is far superior to that by which it was said to have been improved.

Although the black colour, with a blaze on the face, and some white on the legs, may be regarded as the distinctive marks of this race, yet, in consequence of various crosses, they are now to be found of all colours. They are generally small-headed compared with their size, short-necked, with thick shoulders, short in the back, deep and round in the body, with broad back and loins,

Fig. 58.

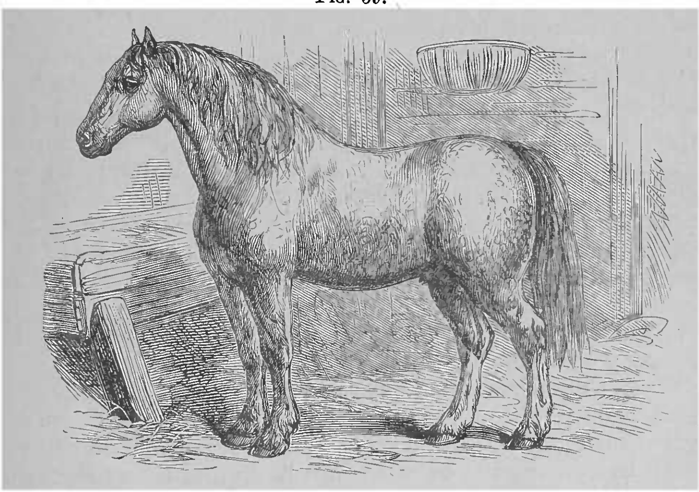


THE ENGLISH HUNTER.

the quarters thick, the thighs and fore-arms peculiarly strong, and the legs short, with large round hoofs; they possess great strength, and, although very slow, and apparently sluggish in their action, are not deficient in bottom; but from their weight, as well as their natural power, go through draught work that could be performed by few other animals. That particular species commonly known as the *Dray-horse* is more especially a model of symmetry and strength combined. Not the least of his perfections is his extreme docility, which cannot fail of being an object of admiration to everyone who witnesses his performances in the crowded streets of the metropolis.

These are the principal breeds of farm-horses, properly so called, but there are in almost every county useful working animals of no definite race; there are also, unfortunately, mongrel breeds, whose only claim to be designated 'farm-horses' arises from their not being fitted for any other purpose. The perpetuation of these half-bred ill-formed animals tends greatly to depreciate the good old breeds with which they are too often mixed: The mixture or rather infusion of the 'blood' of high-bred animals, such as the 'English Hunter,' of which we give in fig. 58 an illustration, is advocated by many authorities as likely to be con-

Fig. 59.



FOREIGN BREED.

ducive to the great improvement of the breed of horses ordinarily used on the farm. Whether such high-bred 'blood' as that of the hunter be so used or not, certainly in view of the wretched 'screws' which are too often used for the sake of economy to raise stock with, some decided reform is obviously required. There has been a great deal written lately on the subject of the improvement of farm horses, much of which is worthy of being well considered by those interested in this important department of farm economics. The papers of Mr. Henry Corbet, late Secretary of the Central Farmers' Club, may be named here as being specially valuable and suggestive on this important subject. In fig. 59 we give an illustration of a foreign breed.

CHAPTER II.

ON BREEDING HORSES.

THE *breeding of horses*, as a distinct concern, can only be carried on with any prospect of success in those districts where a farm comprises an extensive tract of coarse pasturage, which cannot be advantageously appropriated to the fattening or grazing of other animals. Of this description are part of the North Riding of Yorkshire, the fens in the county of Lincoln, the pastures of Leicestershire, and some of the midland counties. In such case the same attention must be paid to symmetry of form, purity of blood, and individual excellence, as in the breeding of cattle. It is unnecessary to repeat that which has already been said of the principles of breeding generally, but it must never be forgotten that in every species of animal, and including both the male and the female, 'like produces like.' If they are not incompatible, the form and the qualities of both the parents will descend to the offspring; and it is from the care with which animals of different sexes are selected, generation after generation possessing certain excellences and certain predispositions, that these results, in process of time, become the distinguishing characteristics of certain breeds.

From this arises another circumstance that should never be forgotten—opposite qualities in the parents are to a certain degree neutralised in the offspring. If a large heavy horse covers a small light mare, the offspring will be lighter than the sire and heavier than the dam. Thus we have the power of remedying many serious faults in the one and the other. Let it therefore be remembered that the entire attention should not, as is too commonly practised, be confined to the stallion: without going so far as to say that as much depends upon the mare as upon the horse, in regard to the form and other good qualities of the progeny, we would impress on everyone the fallacy of breeding from a mare that is good for nothing else. The weaknesses, vices, or disease of such an one, is sure to be inherited by her offspring. No idea can be more erroneous either, than the too common one of breeding a good hunter from a blood-stallion and a cart-mare; nor can anything be more ridiculous than to suppose that the qualities of each will be so equally blended in their offspring as to constitute a happy medium between both, thus producing a colt in which the speed and liveliness of the sire shall be combined with the strength and continuance of the dam. On the contrary, we shall see a perceptible degeneracy in both; the mongrel breed rarely possessing in any considerable degree the power or size of the one, or the spirit, activity, and fine bone of the other, but rather exaggerating the defects of both parents.

It frequently occurs that horses, as well as other domesticated animals, *breed back*, not to the sire and dam, but to some remote parent of the stock, by which accident some old defect, that was supposed to have been got rid of, is unexpectedly revived. This is more commonly observable in breeds that have been crossed than in those in which the original blood has been preserved pure. It is therefore advisable, when the mare has any good points, to select a stallion as similar as possible in form, for then it will be probable that the foal will possess them in still greater perfection.

The horses passing under the denomination of hunters, and the common crosses for roadsters and hacks, can by no means prove so generally profitable to the breeders as when they confine themselves to one particular stock. When all contingencies are taken into consideration,—the length of time which the colts are obliged to be kept on hand and maintained—namely, at least three years, with the unfavourable changes they may possibly undergo before they can be brought to the ultimate market most applicable to their different qualifications — the unavoidable difficulties and dangers of the serious operations of cutting, breaking, backing, docking, and nicking, and the fickleness of taste in purchasers, where as much depends on appearance as real merit—this branch of breeding will be attended with much uncertainty. Independently of these general considerations, it must be borne in mind that different counties differ much in the circumstances that render breeding profitable;[1] and that in many, horses of size, and other desirable qualifications, cannot be produced without incurring an expense amounting to nearly treble their real value. Therefore, our advice is, breed animals best adapted to the locality they are destined for, and breed from the soundest and best you can obtain.

A brood mare having been obtained, corresponding in size, frame, bone, and strength with the wish of the breeder, and found, upon accurate examination, to be perfectly free from natural blemishes and defects, the choice of a stallion becomes an object of attention. In him should centre all the points and qualities that it is possible for a good horse to possess; for, notwithstanding the influence of the mare on the constitution and nervous system

[1] See John Sebright's Essay on the Improvement of the Breeds of Domestic Animals, pp. 11 to 14; and Communications to the Board of Agriculture, vol. ii. p. 185.

generally, the produce, whether male or female, much more frequently acquires and retains the shape, make, marks, and external conformation of the sire than of the dam. This justifies us in rejecting stallions with the slightest appearance of disease, blemish, or bodily defect; at least if there is the most remote probability of its being transmitted to the offspring. It is even necessary to descend to the minutiæ of the symmetry of the head, neck, shoulder, forehead, ribs, back, loins, joints, and pasterns, attending also to a strict uniformity in the shape, make, and texture of the very hoofs; and, if possible, even the temper and disposition should be ascertained. It is also proper to examine the state of the wind, and to endeavour to discover whether there is any tendency to spavins, curbs, cracks, grease, corns, thrush, bad conformation of the feet, or long and narrow-heeled hoofs. Either of these would furnish sufficient reasons against him as a breeder, however recommendable he might be in other respects.

Blind stallions may sometimes get colts with good eyes, yet breeding from them had better be avoided, as a hazardous experiment. A well-informed writer in the Pantalogia states that, in the year 1773 or 1774, a great number of brood mares in his neighbourhood were covered by a very favourite blind stallion, belonging to the Honourable F. King, near Ripley, in Surrey, whose pedigree, shape, make, figure, and qualifications were so perfect, that the want of eyes scarcely seemed to constitute an objection. The result, however, was, that, about the third or fourth year, the major part of the colts got by this stallion had become as blind as their sire.

Anxious to ascertain the truth and extent of this hereditary transmission of disease, Mr. Taplin bought a grey horse, called Jerry Sneak, that had proved a tolerable runner while in the possession of Lord Spencer Hamilton, and whose eyes were just beginning to fail. This horse covered a few mares in the neighbourhood of Frimley, near Bagshot; but it was found, in the fourth year, that most of the produce were totally blind, and the remainder very likely to become so. The fact, indeed, of the transmission of constitutional defects from both sire and dam has been so fully established by frequent experiments as to require no further corroboration; nor does it apply to blindness alone, but to curbs, spavins, and every disease or disposition to disease.

On the subject of *crosses* there are various opinions. It was said by the greatest breeder in this country, Mr. Bakewell, and deduced from long and attentive experience, 'that to cross with a breed not decidedly better than the other should never be attempted; but, if a superior breed could be obtained, it was a truly desirable measure.' In these sentiments he was joined by the late Mr. Campbell, of Charlton, also an excellent judge, and who thus expresses himself in some letters on the subject addressed to Lord Egremont :—' As to the art and mystery of generation, or conception, all that I pretend to know—and that I do, by many experiments, to a certainty know—is, that ill shapes and properties of a particular breed, when introduced into others, even by a single cross, will continue to have effect, sometimes more, sometimes less, and sometimes lurking for generations, scarce perceivable, or even totally out of sight or feeling, and then break out on some individual as strongly, and with as bad effect, as if there had never been any further mixture or addition of blood on the other side. I therefore consider crosses to be a matter requiring the greatest caution, and what I should never choose to resort to, if there was one bad property in the proposed cross; and I am of opinion that the surest and best means of improving a breed, is by constantly and completely weeding the original stock and nursery, and securing the opportunity of advantage from particular extra individuals that may happen to be produced in it; and in every respect availing one's self of all the use it may afford, and carefully preserving the continuance of it as long as possible, or until a yet better comes.'

The judicious breeder will, however, observe, that this does not authorise the system of *breeding-in-and-in* so far as to weaken the original stock, which it undoubtedly will do, if long persevered in; but it only requires that it should be confined to the most perfect animals of the same *breed*, although not of the same *stock*. The advocates of that practice maintain 'that best can only procure best; and therefore, when we cannot procure a better animal than our own, we should breed from that.' Repeated trials, however, have proved that animals of all kinds so produced—that is to say, bred from a continuation of the same race—degenerate in size and vigour, and also perpetuate those defects, some of which are found in every breed; therefore, after a couple of descents from the same family, it is always advisable to cross the mares with a stallion from another stock. There has been much discussion as to the principles which regulate the breeding of animals, but space does not permit of our going into the various points further than we have already done. We may, however, conclude our remarks in this department, by quoting here the conclusions arrived at by Dr. Hitchman, the author of an able paper on 'Breeding and Form of Stock:'—

'1. That man has been endowed with the means of controlling and modifying the forms of all animals.

'2. That such modified forms can be handed down to the progeny; but, being departures from the primitive or natural type, the form can only be maintained by assiduous attention on the part of the breeder.

'3. That not only because the qualities of the male can be immediately brought to bear upon larger numbers, but also because of his own special endowments, it is best to seek for improvement of form and quality through him.

'4. That qualities both of the form and also of the character become hereditary in proportion to the frequency of the repetition in past generations, but that it is dangerous to breed from any animal with important defects, however high its pedigree.

'5. That healthful well-formed animals, without hereditary taint, even if closely related, may be safely permitted to propagate their kind, provided the practice be not continued through many generations.

'6. That young animals, for their first impregnation, should be placed to the best of their own kind, in order to avoid the reappearance of stain in any future progeny.

'7. That science has not revealed any trustworthy arrangement by which the proportion of the sexes can be determined upon and secured.'

CHAPTER III.

OF CART STALLIONS AND MARES.

IN our observations on breeding, we have already considered so largely the requisite qualifications of horses intended to propagate their respective breeds, that it only remains to particularise the points that are peculiar to our heavy draught horses of various descriptions.

The *cart stallion* should possess all the properties of vigour and constitution, strength of muscle, and just proportion of bone, which other breeds have; but there are certain points considered essential to the symmetry of one species of horse, that may be and are deemed imperfections in another. Thus, one of the most important points in a hunter, and more especially in a good hack, is, that he be high in the fore-hand, with a shoulder thrown back, so that the saddle may rest behind his fore-legs, and the weight of the rider may not impede his action. In draught horses, the shoulder can scarcely stand too upright, so that the collar may bear equally upon it, without pressing too much on the withers. A low fore-hand is here found advantageous, inasmuch as it brings the traces more upon a level with the line of draught. Thus, also, the small head, the expanded nostril, and the fiery eye, so much admired in blood horses, are indications of spirit and impatience very ill suited to an animal that is required to obey the voice of the driver, and whose steadiness is one of his greatest merits. The cart stallion should undoubtedly have a moderately large head, with a full but placid eye, a muscular neck, a broad, deep chest, and an upright shoulder. His back should be broad, and rather short, and somewhat curved upwards over the loins, that being a sure sign of strength. His barrel should be round and deep, and well ribbed up to the haunch-bones, which should never stand prominently out. His quarters and thighs should be thick, the arms sinewy and strong, the legs short, and the hoofs round, but wide at the heels, and of a dark appearance and tough substance. His colour must depend upon the breed, and although it has often been remarked that 'a good horse is never of a bad colour,' yet the darkest are generally found to be the hardiest. Blacks are proverbially steady pullers; and experience has proved that they and the greys are less subject to become blind. His size is a most material consideration, for, even in the heaviest breeds, very large bones are not always an indication of proportionate strength; 16½ hands high should be the least of his height, and yet we would have him look smaller than he is: a horse that looks his full size, or larger, is seldom symmetrically formed. Compactness is better adapted to hard work and lasting spirit, and it should be remembered that the greatest improvements in our stock of blood horses have been effected by the smaller breeds of Barbary and Arabia.

The material difference between the form of a brood mare and a stallion is, that she should be rather the longest in the body. An eminent anatomist[1] has erroneously asserted that the mare should be the largest, or at least larger than the usual proportion between them. This is contrary to what is seen in any biped or quadruped. The *cart-mare*, however, should have a long body, roomy chest, broad loins, and wide quarters, a good head well set on, and well formed and placed legs. Her constitution should be healthy and vigorous, her temper gentle and tractable, and she should be free from all hereditary defects.

A mare may be bred from at three years old, but this is scarcely wise; it is better to wait until she has attained to the age of four or even five years, as all her powers will then be more developed and more energetic, and the fœtus will consequently be better nourished and with less detriment to her own system. For a working mare, it is better to defer her going to hard work until the third or fourth year, so as not to try her strength too early. Mares that have no hard work may produce a foal

[1] The late Mr. Cline. See Communications to the Board of Agriculture, vol. iv. pp. 440–446.

every year; but once in two years is often enough for those who work.

The *period of gestation* in mares is about eleven calendar months,[1] and the time of putting them to the horse, when the progeny is destined for agricultural purposes, is usually in April or May. The former month is preferred by many persons, from an idea that the earlier the foals are dropped in the ensuing spring, the better chance they will have of thriving, in consequence of being suckled longer before it becomes necessary to wean them; but when they are dropped at this season, it is often so cold that their growth is materially stinted; nor is the herbage either sufficiently abundant or rich to afford the necessary supply of milk to the dam. It is therefore an injudicious practice, unless the mares are well supplied with succulent food in addition to their pasture, and have also the advantage of warm sheds to run into at pleasure. It is even less advisable for mares that are employed in farm labour, for if they are covered early, they will drop their foals at the busiest season of the year. The month of May is the preferable time, for they will then foal after the spring sowing, at a period when there will be grass, and, soon afterwards, winter tares for their support, with abundant time for them to rest before their services will be again needed for turnip sowing and hay harvest. The mares having dropped their foals, the best time of putting them to the horse again is about a month afterwards, when they will generally be found in season.

If the progeny is intended for hunting or racing, the mare is, if possible, covered in the early part of February or March, for as the age of the horse now legally dates from the first of January, a late-dropped foal might often be said to have entered his second, or any subsequent year, and be compelled to carry weight accordingly, when he really was two or three months short of that age.

Mares should be well but not over fed throughout the whole period of gestation, and bran-chaff and oats given them daily.

The Yorkshire farmers who breed from their working mares, generally employ them until the very time of foaling (and where the work is not too heavy this practice is advantageous rather than otherwise), after which they usually have two or three weeks' rest before they are again put to labour. The foal, while very young, is shut up in a stable during the time its dam is working;

[1] The result of the experiments made by M. Teissier on the gestation of mares is as follows:—

Of 278 mares, 23	foaled between the	322nd	and 330th	day: mean term,	326 days.
227	„	330th	„ 359th	„	$344\frac{1}{2}$ „
28	„	361st	„ 419th	„	390 „

There was, therefore, between the longest and shortest period, an interval of ninety-seven days.

but this should not be continued, for exercise, in moderation, tends to develop its frame and invigorate its constitution. It is the practice of some farmers to bathe the udder of the dam with cold water when she returns from work, and to draw some of the milk, lest, in consequence of its being heated, it should have a bad effect upon the foal. This is a good plan, so far as regards the washing of the udder, for that refreshes the dam; but the waste of the milk is objectionable, and it is better to allow the mare to stand until she is cool. Some continue to separate the foal from the dam so long as the former sucks; others, after it has acquired sufficient strength to run with the mare, allow it to accompany her at her labour on the farm, from an opinion that it is of advantage to both that the milk should be frequently drawn,[1] while the exercise that the foal is thus compelled to take contributes to its growth and strength; and in this latter opinion we coincide.

At Dishley, and some other well-managed farms in Leicestershire, and throughout the fens in Lincolnshire, the whole work is done by mares and oxen. Of the mares, all that are fit are put to the horse, of which three are reckoned upon an average to rear two foals, allowing the third for casualties.[2]

Mares should be partly placed on hard meat a few days before the weaning of the foal, and entirely so immediately after their separation, for it assists in drying off the milk, and, if again in foal, it is of service in strengthening them, and in preventing abortion—an accident which is not uncommon at that period. Care, however, should be taken to keep their bowels open during this period, for which purpose either bran mashes should be given nightly, or they should be turned into a paddock. The latter is the better practice, for the less mares in foal are kept in the stable the better, and open sheds are at all times preferable.

As we have already observed, moderate work, so far from being prejudicial to mares while they are in foal, is of service; it promotes health and vigour, and enables them to produce their young with greater ease, and it may be continued with safety until the near approach of their foaling is announced, first, by the springing of the udder, and soon afterwards by the teats becoming filled with milk.

Before concluding our remarks on the various departments of breeding of horses, as contained in this and the preceding chapter, a few notes on some other points of practical importance must be given. We have already, in the chapter on Cattle, pointed out the importance of attending to the proper selection of first-

[1] Agricultural Survey of Yorkshire, p. 275.

[2] Agricultural Survey of Leicestershire, p. 287. Agricultural Survey of Lincolnshire, 3rd edit. p. 423.

class bulls where stock of value is desired. And if important as regards the cattle, it cannot be, and is not, of less importance to be attended to in the case of horses, upon which so much depends on a farm in their quick and economical working. Although more attention is paid to the breeding of horses, both from good sires and dams than formerly, it is notwithstanding matter of great surprise to those who are closely interested in the progress of agriculture in this country, to note the extraordinary indifference there is amongst farmers as to the having a good stock of working horses. At one time any old 'screw' of a skeleton was deemed good enough to serve a mare with, even although, as sometimes happened, she was of a good or moderately good breed; and even to this day many are still content to carry on the system, which is as silly as it is a source of serious loss to them. As a writer, from whom we shall presently quote a most suggestive paragraph, remarks: 'Farmers forget that the cost of "serving" is a small item compared with the sum spent in the after rearing and training of the animals.' The difference, moreover, between the sum asked for the services of a sire with good points and a fair pedigree, and that for those of an 'old worthless screw' is so very trifling compared with the increased, or rather greater value of the superior progeny obtained by the use of the good sire, that no one but he who is enamoured of the 'penny wise and pound foolish' system would ever think of withholding the amount of the difference.

While 'pedigree' must not be overlooked or neglected as constituting an important element in estimating the value of the sire as a stock getter, so much should not be made of it as to override or put out of consideration in the mind of the breeder the necessity of attending to the 'points' of the animal; and to ascertain which the breeder must subject it to a rigid examination. It is but a common-sense proceeding to see what one is paying their money for. In fig. 55 we give a diagram showing the position, and giving the names of the 'points' of a horse as generally received—regarding which we may remark that there does not appear to be the same diversity in the nomenclature of the points in the case of the horse as in that of cattle, to which in a preceding chapter we have referred. The writer to whom we have already drawn attention, while commenting on the subject of pedigree, and contrasting it with that of the points presented by a horse to the eye of the careful breeder, remarks that it—pedigree—'can never be accepted in the room of good and useful qualities, but simply as a guarantee for the certain transmission of the many good qualities which the well-bred cart-horse must in addition possess.'

CHAPTER IV.

ON THE REARING AND TRAINING OF COLTS.

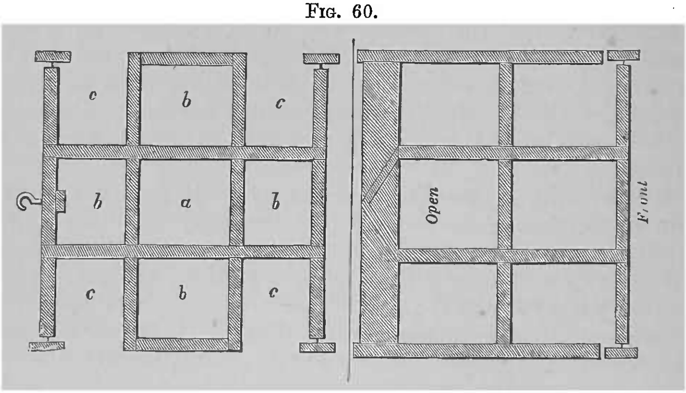
DURING the first summer the foals may be allowed to run with their dams until Michaelmas, or even longer if the weather continues open and mild. They should then be weaned and kept in fold-yards, or paddocks containing open sheds, with low racks and mangers for receiving their food, which ought, at first, to be the sweetest hay that can be procured. Where rowen or aftermath can be procured, it will furnish a succulent and invigorating article of food: hay and rowen, bran, oats, or pollard, or a moderate quantity of bean-meal—the proportions varying with circumstances—will constitute the staple food. By feeding young colts with oats, in conjunction with other food, they acquire more rapid growth, and greater strength, than when they are fed only with bran and hay; and will also be enabled to endure more severity of weather. The corn, of every kind, should be previously bruised in a mill. It may be assumed as an axiom, that there is no greater error in the breeding of animals, than the too common one of stinting them during the early part of their growth. It is at this period that they require the greatest nourishment, and if it is withheld they will be injured in their constitution, and consequently in their value, to a far greater extent than can be repaid by any possible saving in their food. To no animal does this remark apply more forcibly than to the horse.

It is a common practice, on *weaning foals*, to put them into warm stables during the following winter, from a notion that they are not, at that early age, able to support the cold of an open shed. Whether this may be judicious with regard to the more tender breeds of racing cattle, it is not our present object to enquire; but with respect to the progeny of the dray-horse, the cart-horse, or the roadster, it is unquestionably wrong. These, from the nature of their future employment, must necessarily be exposed to vicissitudes of weather; and they cannot be too early inured to a certain degree of hardship. They should, indeed, be prevented from lying out in the wet at night; but, during the day, they cannot be too much abroad; and dry sheds are far to be preferred to warm stables for their nightly shelter. It has even been found that young colts, who had shown symptoms of disease while kept with all the care usually bestowed on hunters, have recovered when removed to a paddock; and that weaned foals have thriven better when only sheltered in a rick-yard than when housed.[1]

Colts, thus treated, will have acquired sufficient strength and hardihood, before the second winter, to be enabled to brave the inclemency of the season, without any other food than hay, or any other covering than that with which nature has provided them.

The largest dray-horses are thus reared in the Lincolnshire marshes; yet, if they can be allowed the shelter of a straw-yard, with the addition of unthrashed oat-straw, or some of the succulent roots, and especially carrots, it will be of material benefit: they should, however, be daily turned out into a field, as exercise is not merely conducive to their general health and growth, but particularly requisite in strengthening their limbs, and giving firmness to their feet. This, indeed, used to be attended with additional trouble; for, in severe seasons, or when the pasture was quite bare, it became necessary to feed them in the paddock into which they were turned. This was commonly done either by throwing the food on the ground, by which means it was exposed to be trampled upon, or spoiled by the wet; or giving it in cribs, where the strongest colts often prevented the others from eating. To remedy these inconveniences, a very simple machine was used at Dishley, that is well worth imitation on farms where many colts are bred. It consists of a movable *Colt's Trough*, formed thus—

Fig. 60.



COLT'S TROUGH.

The centre (*a*), fig. 60, consists of a *cratch*, or bin, for the reception of the provender with four mangers (*b*) projecting from it; the open spaces (*c*) being so many stalls for the colts, four of which can thus eat at the two interior, and two others at the outer

[1] See Parkinson on Live Stock, vol. ii. pp. 65–67.

mangers. The master colt cannot readily drive away another without losing his own food; and being obliged to stand separately, they cannot easily kick or bite each other. The whole being roofed in, the food can be neither spoiled nor wasted; and the machine being on wheels, it can be moved as occasion may require.[1]

In the following summer the colts should be allowed the range of the best pastures, although they are too frequently turned on the worst;[2] and in the autumn they should be taken in, for the purpose of being broken to labour.

The *process of training* horses for the saddle often requires considerable skill in the breaker. For those intended for the plough, it is very simple; but, for both, the best means are gentleness and patience. The horse is an animal possessed of great intelligence. He is capable of considerable attachment and of equally strong resentment. If treated with kindness he becomes docile; but severity generally fails of its object, and renders him intractable. There is certainly much difference in the natural temper of colts, some requiring more care and time to reduce them to obedience than others; but even the most restive may be rendered manageable by kind and gentle usage.

From the moment of its being weaned, the foal should be accustomed to the halter, and wisped over and occasionally tied up, but this should be done by the person who feeds it, and never entrusted to lads, who will probably worry the animal and teach it dangerous tricks; nor to any hasty, ill-tempered man, who would be likely to ill-treat it. The colt will thus early become accustomed to be handled, and will consequently occasion much less trouble than if it had been previously neglected.

After the colt has been a day or two in the stable, a bridle should be put on; but with a small bit at first, instead of the large one usually employed by horse-breakers, and which, by the horse's champing on it with impatience, sometimes occasions the mouth to become callous. He should then be led about, and accustomed to obey the rein in turning and stopping, which he will very soon learn to do.

After a few days, he should be completely harnessed, and put into a team with some steady horses. At first he should be neither whipped nor forced to draw, but left quietly to walk with the other horses. In a very short time he will imitate them, and begin to pull. It may then be proper to let some one mount him, even if he should not be intended to be commonly ridden, as it will render him the more docile. This will be the best done while

[1] See the Agricultural Survey of Leicestershire, p. 67.
[2] See the Agricultural Survey of Yorkshire, North Riding, p. 275.

he is in the team, as the other horses will prevent him from plunging. No violence should be used; for such is his intelligence, that while he will readily learn everything that he is taught, he will also recollect many things that it might be wished he should forget: thus, if he is beaten for starting at any particular object, he will only start the more on meeting it again, for he will remember the chastisement it occasioned; and if hurt in shoeing, or on any other occasion, he will not soon forget the pain it occasioned, nor suffer a repetition of it without impatience.

The proper period of *castration* depends on the breed of the horse, and the purpose for which he is designed. On the colt destined for common agricultural purposes, it should always be performed before he is weaned—perhaps when he is six or eight months old. It is an operation then attended with little danger, provided the weather is not too hot.

If the colt, however, is intended either for heavy or for speedy draught, the operation should be delayed until the animal is a year or a year and a half old, when his fore-quarters will be tolerably developed. It should then be performed as speedily as may be convenient, lest he should become too heavy before, and perhaps a little self-willed. May or September are the best months for the performance of this operation.

Castration, being the business of the veterinary surgeon, need not therefore be described here.

CHAPTER V.

OF THE AGE, QUALIFICATIONS, AND SALE OF HORSES.

THE names by which horses and mares are distinguished while young, are—First of horses. These are called *colt foals* during the first year, and afterwards *yearlings*, *two years old* and *three years old colts*, until four years old; when they become *geldings*, if castrated, and otherwise *entire horses* or *stallions*.

Second of mares. These are called *fillies*, while sucking; then *yearlings*, *two* and *three years old fillies*, and until four, when they finally acquire the appellation of *mares*.

The *age* is calculated from the first of January. Previous to that time, a horse may be said to be *rising* four, five, or six years old; but when that is passed, he is four, five, or six years old, until after seven years, when he is termed *aged*.

The following hints, relative to the age and the essential characteristics of the horse, may not improperly form a part of the present outline:—In old horses, the eye-pits are generally deep; although this mark is considerably uncertain, as it also occurs in young horses that are descended from aged stallions. There are also a few grey hairs about the face, the lips are thin, and not perfectly closed—the withers are high—the back is sinking, and the quarters lengthening. There is, however, a great deal of uncertainty about this, and the only criterion to be depended upon is that derived from the teeth, the number of which amounts to forty; namely, twenty-four grinders, or double teeth, and sixteen others—four tushes or tusks, and twelve cutting or fore teeth; and these last are the surest guides for discovering the age of a horse. As mares usually have no tusks, their teeth are only thirty-six. A colt is generally dropped with two grinders on each side, and in seven or eight days the two central teeth above and below appear. In about six weeks the two next are seen, and, in six or seven or eight months, the two corner ones. He has now six front or incisor teeth in each jaw, and he retains them until he is two years and a half old, which makes it difficult, without considerable care, to avoid being imposed on during that interval, if the seller find it to his interest to make the colt pass for either younger or older than he really is. An inspection of the teeth, however, will prevent serious imposition.

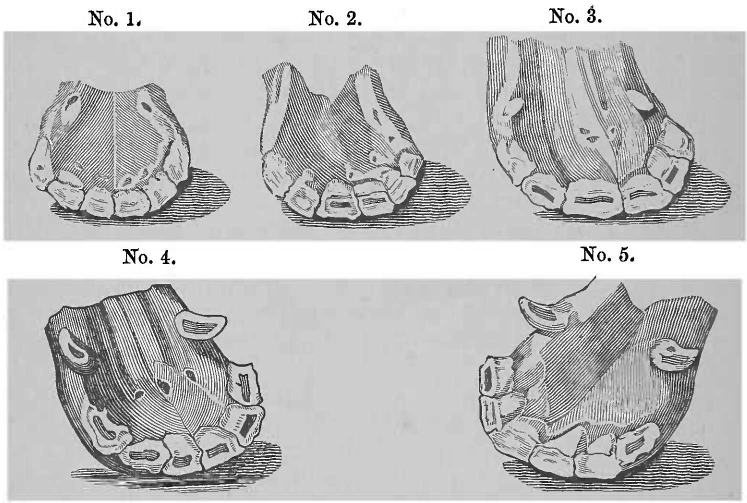
The teeth are covered by a hard and polished substance, called the enamel. It not only spreads over the upper part of the teeth, but it sinks into a little hollow on the surface below. Portions of food being deposited in this hollow, and there hardened and blackened, constitute what is called the *mark* of the tooth. This hollow is wide at the top, and contracted towards the bottom. As the edges of the front teeth are worn away in plucking the food, a portion of the blackness is rubbed off, and the mark becomes fainter, and at length quite disappears. The gradual progress of this will enable him who is at all accustomed to horses, to guess, with considerable accuracy, at the age of the animal. With some variation, depending on the food, the mark in the two central front teeth will be almost worn out. At two years it will be gone, and considerably diminished in the tooth on either side.

The frauds of the breeder or the dealer may have, ere now, possibly commenced. He has a likely two-year old colt that was dropped early in the year, and whose good qualities are considerably developed. If he could make him pass for a three-year old, he would be worth 10*l*. more. His central front teeth are extracted, the central permanent teeth rapidly grow, and the mouth of the colt is apparently that of a three-year old one.

At from two years to two years and a half old, sometimes sooner, and sometimes later, according as he has been fed, a horse begins to change his teeth. The pincers, which came the first, are also the first that fall; so that, at three years, he has four horse's and eight colt's teeth, which are easily known apart, the former being larger, flatter, and yellower than the others.

When the horse is coming four years old he loses the teeth on either side of the central ones, and four others supply their places, which follow the same rule as the central ones. He has now eight horse's teeth and four colt's.

Fig. 61.



DENTITION OF THE HORSE.

The dishonest breeder or dealer is more anxious than before to give the appearance of an additional year to the colt, and the same trickery is displayed, with regard to these teeth, as with the central ones in a preceding year.

During this year also, his four tushes, which are seldom seen in the mare, although the germs of them are present, begin to protrude; the lower ones often four months before the upper ones. The two lower tushes offer the most certain proofs that a horse is coming five years old, notwithstanding his colt's teeth may not be all gone.

No. 1 of the annexed engraving (fig. 61) of the horse's teeth represents them at two years and a half old; No 2, at three years old; No, 3, at four years; No. 4, at five years; and No. 5, at six years.

It is not an unfrequent practice of jockeys and breeders, in order to make their colts appear to be five years old when they are but four, to pull out the last colt's teeth; but if all the colt's teeth are gone, and no tushes appear, the purchaser may be certain that the trick has been played.

When a horse is coming six years old, the mark is disappearing from the two lower central front, or incisor teeth, or there remains only an inconsiderable black spot. Between six and seven the mark disappears from the two middle teeth; and between seven and eight the corner teeth follow the same course. After this it is difficult to determine with certainty the age of a horse, and he is technically said no longer to have the mark in his mouth. In this case recourse must be had to the tushes. At four and a half years old they are rounded and prominent in front, grooved on either side, and concave on the inside surface, with sharp edges. At five years old the tush has increased—the grooves are disappearing—the outer surface is more regularly convex, and the inner surface remains concave. At six years old the tush has attained its full growth, and still remains convex without and concave within. At seven the tush is rounded at the point and edges—still prominent without, and beginning to be a little so within. At eight the tush is still blunter and rounder every way. The degree of bluntness and roundness of the tush will continue to increase every year, and some rude guess may be formed of the age of the horse, although nothing certain can be determined. Horses that are kept in the stable have always the mark in the incisor teeth worn out sooner than those at grass, while it would be folly even to guess at the age of a crib-biter. Generally speaking, the mark is worn away from the central fore-teeth of the upper jaw at nine years old, the next pair at ten, and from all of them at eleven. The lower front teeth after this project forward, and at length assume almost a horizontal position, and the upper ones project over the lower ones, wearing down the outer edge, and making that, contrary to what takes place in youth, the lower of the two.

The trick called *bishoping*, made use of by dealers and jockeys to prolong the appearance of the mark in the teeth, and make an eight or nine year horse appear only six or seven, is thus performed:—They cast the horse in order to have him more at command, and with a steel graver, like what is used for ivory, hollow the middle teeth a little, and the corner ones somewhat more; then fill the holes with resin, pitch, sulphur, or some grains of wheat, to which they set fire with a piece of hot wire, of the size of the hole. This operation they repeat from time to time, until they give the hole a lasting black, in imitation of nature. Notwithstanding this fraudulent attempt, the hot iron forms a little yellowish circle round the holes similar to that which it would leave upon ivory; they have, therefore, another trick to prevent detection while the horse is under examination, and that is, to cause a quantity of foam to gather about the mouth, by rubbing a little salt, or dried crumbs of bread with salt, on the lips. This foam partially hides the circle made by the iron.

In Yorkshire and the midland counties the young stock are generally kept until rising three or four years old; but many are sold at an earlier age, particularly from the Lincolnshire fens. The method practised by the Yorkshire farmers, in making up their two-year old colts for sale, is to take them up from grass in the autumn, only a week or two before the time at which they are to be sold, in order to reduce their carcase, improve their coat, and teach them to lead. They are then disposed of, with their full tails, to the dealers, who afterwards shamefully make them up more according to art. In the hands of their new masters their teeth undergo the operations already described; they are also docked and nicked, and, after being kept on mashes made of bran, ground oats, or boiled corn, they are bought by the London dealers, who sell them as if they were five years old. They are then taken to immediate work, and in a few months many of them are completely destroyed by premature and severe labour—for nothing ruins a colt more speedily and effectually than the being prematurely put to heavy or severe work. This drawing of the teeth, however, is not a fraud practised on the London dealers, who are, on the contrary, not only aware of the deception, but require it to be done.[1]

CHAPTER VI.

THE MAINTENANCE AND LABOUR OF FARM-HORSES.

THE support of horse-teams forms so material a portion of farming expenditure, that, although not immediately connected with grazing, a few observations on the subject will not prove uninteresting or useless, especially as leading to a calculation of their value, as labouring cattle, when compared with oxen.

Nor can any precise formulæ be laid down, as so much will necessarily depend upon the kinds of food the farmer has at his disposal, and the amount of work he requires from his horses.

To feed economically and yet efficiently is the great desideratum. It is a well-known fact, that two well-fed horses will do

[1] Agricultural Survey of Yorkshire, North Riding, p. 277.

the work of three if not four that are badly kept; hence it will be evident that to keep a small number of horses, and keep them well, is more advantageous than to have a larger number, and feed them so that they are never up to *par*, or capable of doing a hard day's work. There are, no doubt, many persons who keep their teams expensively, for the mere vanity of having them in good condition; while there are others who obtain continuous service from their farm-horses under a very different regimen.

Mr. Read, in his admirable essay on the 'Management of Farm Horses,' gives the following formulæ as guides for winter feeding. No. 1 is for a moderate-sized farm-horse, and No. 2 for a larger animal, per week:—

No. 1.	*s.*	*d.*	No. 2.	*s.*	*d.*
7 pecks of oats (70 lbs.)	3	6	7 pecks of oats (70 lbs.)	3	6
8 pecks of chaff	1	0	1 peck of beans, crushed	1	6
2 pecks of bran	0	6	8 pecks of chaff	1	0
120 lbs. of hay	3	0	2 pecks of bran	0	6
7 lbs. of beans	0	6	140 lbs. of hay	3	6
	8	6		10	0[1]

In order to reduce still further the expense of horse-keeping, various trials have been made of the nutritive powers of potatoes, Swedish turnips, carrots, and other esculent roots, all of which have been found sufficient for the support of the cattle during moderate work, and when given with plenty of hay. They have even been found to answer the purpose when given with straw only; but in that case the work must have been very light, for horses should have food of a quality proportioned to their work, and, if that is considerable, some corn is absolutely necessary. In fact bulbous and esculent food is, especially when given with corn bruised, or barley-meal, better adapted for bringing horses intended for sale into condition than for maintaining them in working order. The quantity of nitrogenized food commonly given may, indeed, be diminished with the aid of roots, and straw may be substituted for hay; but, in every instance, the quality of the food must be in proportion to the required exertions, or the horse will be injured to a degree which the saving effected in his keep will not repay. Theorists adduce instances to the contrary, but every practical farmer knows that hard work can only be sustained by good feeding. This, however, may be carried to excess; and, although farmers cannot be generally accused of being too lavish of corn, yet the allowance of hay is often far too profuse. It is, indeed, a common practice to cram the rack with

[1] Veterinarian, 1849, p. 388.

an unlimited quantity of this fodder; the consequence of which is, that gross feeders stand eating half the night instead of lying down to rest. Their stomachs become unnaturally distended, and many serious disorders are generated that might have been avoided by a more regular and a more limited allowance. Nor is this the only loss this system causes the farmer; quantities of the fodder are pulled down, dropped, trampled under foot, and utterly wasted. The great secret of feeding well is to feed regularly at certain hours, and in certain and sufficient quantities, and not to allow any intermediate eating. A full meal should not be given immediately after a horse has come in from a hard day's work; let him have a little food to take off the edge of his appetite then, and the remainder an hour or two afterwards, when he is rested.

Of the esculent roots, sliced potatoes and carrots are those most commonly given; and it is a singular fact that, although the former contain the greatest proportion of nutritive matter,[1] horses thrive best on the latter. When potatoes are steamed, and thus deprived of the water of which they are in a great measure composed, and which is, with much probability, supposed to have a pernicious effect, they form a tolerably substantial food; but the trouble and expenses of the process are great objections to giving them in that way, and when raw, carrots are preferable. Horses are fonder of them; they have a visibly good effect upon the coat; they are found advantageous to the wind; and they correct the binding effect of dry food. But too many given raw are apt to produce evils of other kinds, and horses which have been fed on them for a short time often become so fond of them as to refuse other food.

In some parts of the North, the refuse oats, or any other refuse grain, or pulse, are mixed with wheat-chaff or cut hay, and boiled; and of this mess, after it has become cool, almost a pailful and a half is given to each horse once a day, generally when his work is over. This is a judicious and economical practice, as very light corn is often swallowed whole when given dry. When horses are kept partly upon straw, it is an excellent mode of preserving their bowels in good order; but when put to hard work, and fed on hay, its constant repetition would perhaps be too relaxing.

Mr. Spooner, in his Prize Essay on the 'Management of Farm Horses,' gives, from his personal knowledge, the following estimates of the cost per week of feeding farm-horses. From the middle of November to March, when the work is light, they receive:—

[1] See Book ix. chap. vi.

	s.	d.		s.	d.
Oats, $1\frac{1}{2}$ bushel .	4	6	Oats, 2 bushels	6	0
Straw, $1\frac{3}{4}$ cwt. at 2*s*. . .	3	6	Beans, $1\frac{1}{2}$ peck . . .	2	3
Swedes, 42 lbs.	0	4	Hay (not clover), 1 cwt.	4	0
	8	4		12	3

This second allowance is given as the spring work comes gradually on: when barley and turnip sowing are nearly over, and green food becomes abundant.

	s.	d.
The corn is reduced to 1 bushel . .	3	0
Green food is given *ad libitum*, and costs, say . .	5	0
Making per week .	8	0

As the wheat sowing approaches the spring feeding is again given. Thus we have for

	£	s.	d.
3 months an expense of	0	8	4
3 " " .	0	12	3
3 " " .	0	8	0
3 " "	0	12	3
	2	0	10

making the total cost average 10*s*. $2\frac{1}{2}$d. per week, or 26*l*. 10*s*. 10*d*. per annum.

On another farm the following is the feeding system adopted:

	s.	d.		s.	d.
13 weeks on oats, $1\frac{1}{2}$ bushel	4	6	13 weeks on pollard, $2\frac{1}{2}$ bushels	3	$1\frac{1}{2}$
" beans, 2 pecks	3	0	" beans, crushed, 2 pks.	3	0
" hay, $1\frac{1}{2}$ cwt . .	6	0	" hay, $1\frac{1}{2}$ cwt.	6	0
	13	6		12	$1\frac{1}{2}$
13 weeks on pollard, $2\frac{1}{2}$ bushels	3	$1\frac{1}{2}$	13 weeks on bran, 2 bushels	2	0
" beans, crushed, 2 pks.	3	0	" beans, 1 peck . .	1	6
" straw .	1	9	" cut clover, tares, and pasture	4	6
" swedes, 70 lbs.	0	8			
	8	$6\frac{1}{2}$		8	0

The following is the third system of feeding; and this one he considers as preferable to the one above given, but inferior to the first, which, though the most expensive, is that best calculated to keep horses in good working condition:—

	s.	d.		s.	d.
13 weeks on $1\frac{1}{2}$ bushel of oats	4	6	13 weeks on 1 bushel of oats	3	0
" 1 peck of beans .	1	6	" clover, vetches, &c.	5	0
" 1 cwt. of hay . .	4	0			
	10	0		8	0
13 weeks on 2 bushels of oats	6	0	13 weeks on 1 bushel of oats .	3	0
" 1 peck of beans	1	6	" clover	4	0
" 1 cwt. of hay	4	0			
	11	6		7	0 [1]

[1] Journal of the Royal Agricultural Society, vol. ix. p. 275.

So much of what has been already said on the subject of soiling cattle is applicable to the SUMMER FEEDING of horses, that but few observations are requisite. The common modes are—1st, to turn them out on pasture; 2ndly, to feed them, in the field, on artificial grasses, either cut or grazed; and 3rdly, to soil them on green food, in the stable or yard. Each method has its advocates; and the choice of either must, in great measure, depend upon the convenience, as well as the judgment of the farmer.

The *first* method is, properly enough, adopted on farms that have a large proportion of grass land, and are not within reach of a market for hay. Horses thus kept are, perhaps, more healthy than in any other way, if the herbage is abundant and good; but one great disadvantage attending it is, the time lost every morning in getting them up. To obviate this, their range should be limited, and where the enclosures are large, they should, if possible, be divided by hurdles, by which means also the grass will be less trampled, and the cattle will have the advantage of fresh pasture. As some horses will eat greedily when first turned on to fresh pastures—so greedily as to bring on indigestion, and even cause death—it is advisable gradually to accustom them to green food for some days before turning them out.

The *second* method is customary on arable farms; and, when properly conducted, is a most advantageous mode of disposing of green crops not intended for hay. The horses are, however, too commonly turned on the land to graze, and thus destroy a great deal more food than they consume. Some farmers, indeed, argue that the vegetable matter thus trodden into the soil, saturated with dung and urine, forms a complete coat of manure without the labour of spreading; but they forget the advantage that would be derived from feeding double the number of stock, and the return to the land of double the quantity of dung. It is, in fact, a slovenly and wasteful practice, that cannot be too much reprobated; and which admits of the less excuse, as it can be avoided by hurdling off the quantity intended to be used each day, and giving it cut, in cribs, or even on the ground.

The *third* method is a more economical practice, so far as regards consumption, than if the food were given cut in the field, but it is attended with the further expense of cartage to the homestead; it is far more profitable in respect to manure, for the fertilising properties of the dung and urine speedily become exhaled by the sun when dropped in detached portions upon the land, whereas if dropped on straw or litter they create a valuable manure and abundance of it. Horses also are more in readiness for their labour when kept in the farm-yard than in the field; and are cooler when under shelter, and less exposed to be teased by flies, than when abroad in hot weather. The purer air of the fields is no doubt much better for the health of all cattle, and they are found to feed better in the open air than when confined; but the superiority of the above mode, in regard to manure, is unanswerable. The only way, perhaps, in which soiling in the field can in that view bear a comparison with it, is when the land under the green crop is intended to be immediately ploughed and sown; as, for instance, when turnips follow tares, in which case, if there is sufficient stock to eat off a large quantity at once, it may be advisable to feed them on the ground, and plough the manure under, before its value is exhausted.

Cooked food is now much used by farmers, and, under proper management, with great advantage. Steamed or boiled turnips, potatoes, and carrots, are given; and the two former, and especially turnips, with great success. Boiling is preferable to steaming. About 40 lbs. of turnips is the average allowance for each horse, and this should be given warm, but not hot, and with the admixture of bran, chaff, or ground barley, and about a handful of salt. The food must be cooked as it is wanted, for if kept any time, it speedily becomes acid, and ferments, and in this state is exceedingly injurious.

Experience has also demonstrated the advantage of crushing and bruising grain, and even grinding it, and cutting or chopping fodder; these processes facilitate digestion by bringing the nutritious portions of the food more completely in contact with the stomach, and thus enabling them to pass with greater ease into the system and afford the animal more sustenance, while to the farmer they are the means of effecting a considerable saving—considerable, if we only regard the actual amount of hay, straw, &c., which is wasted when these matters are given in their natural state; considerable, if we look at the quantity of undigested grain voided in the excrements of every horse fed on whole oats or corn; and still more considerable, when we mark the difference in the condition of those horses which are fed on crushed, and chopped, and cooked food, and those which get their allowance in its natural and crude state.[1]

Of equal importance with the feeding of horses is the MANAGEMENT of them, when their daily labour is performed; but concerning the best mode of doing this a considerable difference of opinion prevails. By some it is remarked, that the keeping of horses in stables, with separate stalls for each, so that they may feed quietly and be expeditiously harnessed, is in every respect the preferable method, provided the stable be well ventilated. By ventilation we do not mean the admission of draughts of cold air from various quarters, as is too often the case in carelesslv-

[1] Veterinarian, 1849, p. 237. Journal of the Royal Agricultural Society, vol. ix. p. 250.

constructed farm stables, but that means shall be taken to facilitate the removal of the heated and impure air, as by tubes, funnels, or perforated ceilings; and where the hay-loft is over the stable, every precaution should be taken to prevent any of the foul air from permeating into the loft and saturating the food with its noxious gases. Others, on the contrary, assert that sheds, open to the front, with racks and mangers fixed below, and having a pump and cistern, as well as a small yard in which the horses may run at pleasure, are superior to the stable method; because, if well littered, they will not require any other dressing than is usually given by farmers' servants. Since, however, these animals are very susceptible of cold, it is most advisable to keep them in stables, in exposed and bleak situations; but, in mild and sheltered places, the shed-system may at times be found the most profitable. Where the practice has been followed, it has been generally found successful; and horses thus managed are by some considered not only to be more healthy than those kept in stables, but also to attain a greater age.

In stables every horse should have a stall to himself, and as roomy as possible; not less than six, or from that to eight feet in width. Thus a greater degree of supervision can be maintained; it will be instantly perceptible when an animal is off his feed, and each will get his own due share of food. There should be windows to light and air the stables when required, but these should be furnished with shutters, for many horses will not lie down to rest while the stable is light.

Carters are often very negligent—not, indeed, of feeding their horses, for they will seldom hesitate to steal corn for the purpose of pampering them—but of that care which requires labour; and masters too commonly permit their servants to manage the teams nearly as they please. The consequences of this are frequently injurious to the animals' health. It is not necessary that farm-horses should be groomed like hunters, and too free a use of the currycomb might indeed be rather prejudicial, in winter, to cattle that are constantly employed at slow work for many successive hours in all kinds of weather, for it would take from them too much of the long coat with which nature provides them as a protection against the inclemency of the season; but that argument will not hold against the necessity of cleanliness. A certain degree of grooming is highly necessary to promote health and keep in action the functions of the skin; and no dieting, no amount of ever so well chosen food, will give horses that sleek look of condition they should have, unless they are also regularly rubbed down with wisps when they come in, and well brushed, and their legs and feet cleaned, before they are shut up for the night.

The fetlocks of cart-horses are usually covered with a profuse quantity of hair, and, on flinty soils, a moderate portion of it forms a very desirable protection against injury; but if not daily cleansed from the dirt which is collected, the accumulation at length occasions that unsightly and stubborn disease 'grease.' In like manner, perspiration mats the coat, and clogs the roots of the hair with scurf, and produces eruptions on the skin that are often difficult of cure. It should, therefore, be a settled rule, that, whether the horses are kept in the stable or not, their feet should be regularly washed on their return from labour, and dried, and the legs well wisped or hand-rubbed; this friction tending to restore warmth to the extremities of the tired animal, and relieve swellings or soreness. Merely to wash off the dirt from the fetlocks and feet, and leave them to dry gradually, is even more pernicious than to let the animal remain in the state in which he comes from work.

The hoofs should be occasionally oiled and stopped. For the latter purpose cow-dung is the best application in common use. Clay hardens, and becoming dry soon, heats and otherwise injures the hoof; but the common felt stopping, now sold by all saddlers, is far neater, and quite as effectual when merely wetted. The feet require more care than is usually bestowed upon them in farm stables, and scarcely anything occasions them more injury than the reprehensible practice of letting horses stand upon soiled litter until it ferments; and the common, but very mistaken economy, of not shoeing sufficiently often.

Some persons go into the opposite extreme in the first respect, and keep their horses standing during the whole of the day upon the bare stones, the litter being thrown up under the manger; but, the pavement of stables being often laid in too slanting a direction the horses are placed in an unnatural position, that strains and injures the muscles of the legs, while the pungent effluvia of the litter ascend more readily to the eyes and to the racks, and the foundation is laid for blindness. The slope of the paving of the stall should not exceed three inches in nine feet. If litter is too scarce to allow of that part which has become saturated with urine being thrown into the farm-yard, it should at least be carried out and dried, every morning the weather will permit of it, and a little fresh straw laid for the horse to stand on.

The state of the bowels should be constantly attended to, and when hard meat is given it is an excellent practice to allow a cold bran mash every Saturday night. If, also, on that day the field labour were abridged an hour or two, and the time devoted to cleaning and oiling the harness, it would not be thrown away. The stable should be kept not only clean, but sweet, and fresh air should be constantly admitted, for the horse has a strong dislike to every offensive smell; besides this, the pungency of the vapour arising from fermented litter occasions injury to the eyes as well as general disease. Powdered gypsum strewn over the floor will absorb some portion of the ammonia arising from the litter, and save the animals much annoyance, and Mr. Richardson recommends, as a speedy and effectual disinfectant where the fumes of the ammonia are very pungent, that a shallow dish of muriatic acid be set in the stable:[1] but a more simple and equally efficacious means of absorbing, or deodorising, this pungent gas, has lately been recommended, viz. the making two small excavations, about ten or twelve inches deep, one at the centre and one at the end of the stall, and three parts filling them with powdered peat charcoal, there being such an affinity between ammoniacal gas and peat charcoal (carbon), that the former is invariably attracted and retained by the latter when near it; and the latter when saturated with the gas forms an exceedingly efficient manure, especially for flowers.[2] If sheds are used, care should be taken that the litter is dry, and that the roof effectually keeps out the rain; and, above all, it should never be forgotten that 'the eye of the master fattens the horse.'

The LABOUR performed by farm-horses is a consideration of equal importance with their food; but the subject is not so generally understood, for the power of the horse is commonly ascribed wholly to his strength, whereas it consists, at least equally, in his action. In this lies the chief superiority of the small active Suffolk punch, or the Cleveland bay, over the heavier but more slowly moving Lincoln cart-horse. The operation of ploughing is usually performed at so slow a pace that it is thought of no consequence that the cattle should be able to step more briskly. In heavy soils, where the plough works with difficulty, such reasoning may be just; but it is obvious that the quicker a horse steps, the more ground he will cover within a given time, and therefore action is material on lighter land, where the resistance is less.

Another argument used against quicker motion is, that if the horses stepped faster, the ploughman could not keep pace with them; but the fallacy of this will be apparent when it is considered that the average day's ploughing, on medium soils, and working nine hours, does not exceed a statute acre; which, also supposing a common furrow-slice of nine inches wide, will only amount to eleven miles, and allowing another mile for the turnings, a mile and one-third per hour; whereas, if the plough is not much impeded, either by the tenacity of the soil, stones, or other unusual obstacles, a good workman will find no great difficulty in following

[1] Richardson on the Breeding, Management, and Varieties of Horses.
[2] *Times*, August 7, 1851.

it at almost double that rate. It may, indeed, be doubted whether either man or horse could constantly sustain such labour; and on that ground the value of quick action might be again questioned, but the advantage of being able to perform it on pressing occasions cannot be denied; and even supposing only one acre to be ploughed, it must be admitted that both the man and the horse would be benefited by completing their task within half the usual time.

The following has been ascertained to be the quantity of land actually ploughed, and the ground gone over, by a team, in nine hours, walking at the different rates per hour, and turning the different furrow-slices, as specified:—

		At $1\frac{1}{2}$ mile per hour.			At 2 miles per hour.		
		A.	R.	P.	A.	R.	P.
Breadth of the furrow-slice	8 in.	0	3	36	1	1	7
	9	1	0	14	1	1	33
	10	1	0	35	1	2	21
	11	1	1	14	1	3	5

The distance travelled in each instance was, at the slow pace, within a fraction of twelve, and at the quicker, sixteen miles; and it thus appears that the additional quantity of land ploughed was about one-third, or in nearly equal proportion to the increase of pace. For an immense mass of 'facts and figures' connected with the horse-power of a farm, we refer the reader with full confidence to the useful work of Mr. John Chalmers Morton, entitled 'The Hand-book of Farm Labour.' Longmans: 1*s*. 6*d*.

CHAPTER VII.

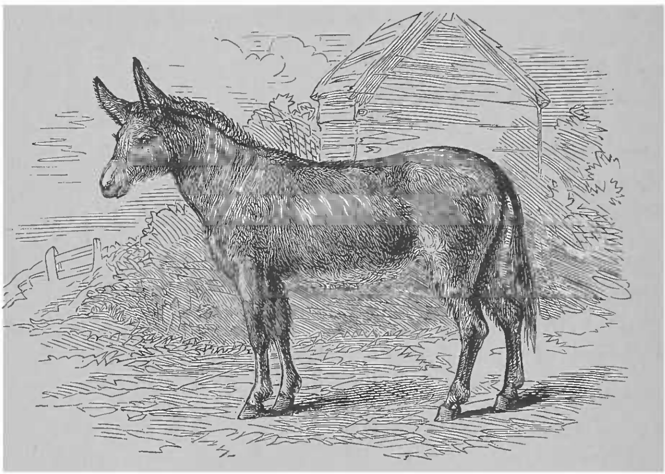
OF ASSES AND MULES.

ALTHOUGH so little employed in this country as scarcely to be enumerated among agricultural stock, yet when reared with care and properly treated, Asses and Mules may be rendered extremely serviceable, and are therefore deserving the farmer's attention, if not in this country at least in the Colonies.

I. Asses (see fig. 62), when domesticated and well used, are tractable and patient, and far more attached to their master than the horse generally is; although it cannot be denied that, under the brutal treatment to which they are too often subjected, they become slow, and stubborn, and headstrong. No animals, perhaps, are capable of supporting greater burthens or drawing heavier weights, in proportion to their size, than asses, on which account they are principally employed in conveying hucksters' goods. They have been employed, to great advantage, in drawing waggons and other carriages.

A gentleman, named Worthington, worked four asses at plough, yoked two abreast, driven in hand with reins by the ploughman, and found that they were more than masters of the work required from two common farmer's horses of a slight kind. Mr. W. esteemed an acre a good day's work; but in cross-ploughing they would do more. At such work two asses were sometimes enough,

Fig. 62.



THE ASS.

and two were also sufficient in turning the furrow at potato-planting. The soil on which these animals were employed was a loamy stone brash of middling but varying depth, and tenacious rather than light.

'In respect of consumption,' concludes Mr. Worthington, 'I can only add, that the ass is a temperate eater; and that he appears to thrive best when left at large to his bramble-leaves (which flourish almost through the whole winter), with a little corn at his breakfast, and at the close of work; and a bite of hay at noon at his gears; and he may also be safely trusted abroad with his associates, as, unless in his rutting season, he scarcely ever strays. He loves grains, and will eat them freely; and is fond, beyond any other food, of the culinary roots, and in particular of potatoes and carrots.'

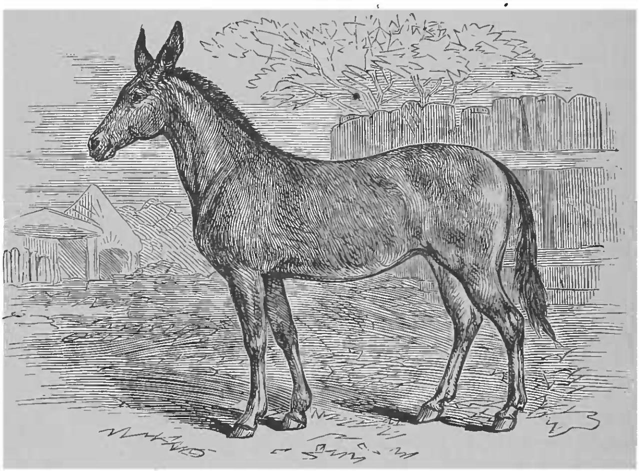
To this it may be added, that he appears to be exempt not only from most of the contagious disorders often so fatal to other cattle, but from the greater part of all ailments; that he will undergo great fatigue; and that he is very long-lived. It may, however, be doubted whether his qualifications, as a beast of draught, will often introduce him into our farmer's teams; but, as a beast of burthen, he may be rendered extremely useful, in clearing green crops from land that will not allow of carts in a wet season, and in many other things about a farm, more especially in hoeing.

There are two, almost distinct, species of the ass: the one grey; the other brown, and sometimes approaching to black. The former is the larger and the stronger, but he is also the most dull, and seems to merit much of the character for stupidity unjustly attributed to the whole race. The latter is of a light and even handsome form, and lively disposition, and is particularly suited to the saddle, for which purpose he is very generally used in Portugal and Spain, where he is bred of a very large size; but he there wears a very different appearance from that of the wretched animals often so shamefully used at our fashionable watering-places. He is first saddled with a pack, which covers the entire back from the shoulder to the loins, and is raised and peaked upwards at the pommel, to prevent the weight of the rider from pressing forward; on this a smaller cushion is laid, and secured by a kind of arm-chair with legs curving round the sides of the saddle, and having a small hanging-board instead of a stirrup, to rest both the feet—the lady sitting sidewise. The entire caparison is covered with cloth, or velvet, or morocco leather, of the gayest colours, and the breast-plate and bridle being embroidered in parti-coloured worsted, the whole, when placed upon a well-fed and well-broken-in brown male ass, forms a set-out that is very far from being contemptible.

They require very little more attention in rearing than occasionally to pare their hoofs, which are otherwise apt to grow long at the toe, and become narrow at the heel, thus rendering them liable to stumble. They are naturally very sure-footed, and if trained with gentleness they will be found exceedingly docile, their intractability being generally the effect of ill-treatment.

'Farmers,' says a writer in the 'Scottish Farmer,' 'have paid far too little attention to the ass. There are many jobs about the farm which one or a couple of donkeys could perform to the saving of a horse; and, as an ass could be bought for a tenth or a twentieth of the price of a good horse, and fed at a fourth of the expense—on the coarse herbage, indeed, which all other animals on the farm are too nice to taste—the balance in favour of keeping two, instead of an extra horse, would be something considerable.' It is gratifying, however, to know that of late much greater attention is being paid to the breeding and rearing of donkeys or asses. They are now frequently exhibited at our shows, and special exhibitions are sometimes given of them. This and the valuable prizes offered has done much, and is likely in the future to do more, to bring before farmers and others a superior breed of this highly useful, although hitherto wretchedly contemned, animal. Sir George Elliot, of Aberaman, has been exceedingly successful in the introduction into this country of the Egyptian donkey. This breed is remarkable for its beauty of form, swiftness, and the beautiful colour of its coat. One animal which Sir George brought over from Egypt, and which was presented to him by the Khedive, stands 12 hands high, and in colour

Fig. 63.



THE MULE.

is pure white. He is of larger proportions than the donkey of this country, altogether of finer build. Now that he is fairly acclimatised and in perfect health, we may expect some fine specimens of superior breeding crossed with the best of our own donkeys. Already he has been put to some fine English ponies, and the result is a remarkably fine breed of mules (see next paragraph), which have attracted great attention from their many fine qualities. Once the improvement of the breed is taken up in this hearty practical way, we shall see great improvements in the breed both of donkeys and mules.

II. The Mule (see fig. 63) is a mongrel animal, between the horse and the ass, or the ass and the mare. He is hardy, strong, and sure-footed, lives to a great age, and, being maintained at less expense than the horse, might be advantageously employed on farms. It is the only beast of burthen used in the South of Europe; and in Spain and Portugal mules are employed both for the saddle and in gentlemen's carriages. For the latter purpose they are bred of a large size, and sell at much higher prices than the horse,[1] as they not only live longer, and are less subject to disease, but are found to go through more work and to stand it better. The common load for Spanish mules, in addition to a heavy pack-saddle, is 280 lbs., or 20 stones, and with that they will travel, for several successive days, at the rate of from thirty to forty miles. Their only food is barley, or Indian corn, and straw, upon which they are kept in excellent condition, and, when not ill-treated, will continue to labour for thirty, and even forty years.

It must be evident, from this slight sketch, that these animals might be rendered very serviceable for many purposes for which horses are now employed; they are steady pullers, standing well to the collar at uphill draughts at which horses would stand still, and are more muscular, in proportion to their size; but not possessing equal weight, they have not the same power. For ploughing land that is subject to be poached by heavy cattle, for hoeing and harrowing, and all kinds of light road-work, they would probably be found a cheap and effective substitute for the expensive teams in general use. They are partially employed in some places; they have been long since introduced into Ireland, and employed there with advantage,[2] and in Leicestershire.

It is to be noted, in concluding this chapter, that considerably more attention is now paid in the breeding both of asses and mules, not merely for farm, but more especially for general purposes. It is also gratifying to state, that in the treatment of the two much more humanity is displayed than was formerly the case.

The produce of the horse and the female ass is a different kind of animal from that which we have been describing, partaking more of the appearance of the horse and less of his valuable qualities.

Mules are generally incapable of procreation, but some exceptions to this rule have occurred.

[1] In Lisbon, a pair of carriage-mules have been known to fetch as much as 250 moidores, equal to 337*l.* 10*s.*; and a good pair can seldom be obtained under 150 moidores.

[2] See Agricultural Survey of the County of Antrim, p. 336.

BOOK THE FOURTH.

ON THE BREEDING, REARING, AND FATTENING OF SHEEP.

CHAPTER I.

INTRODUCTORY AND COMPARATIVE VIEW OF THE DIFFERENT BREEDS OF BRITISH SHEEP.

AMONG the various animals given by the benevolent hand of Providence for the benefit of mankind, there is none of greater utility than the sheep, which not only supplies us with food and clothing, but affords constant employment to numerous indigent families in the various branches of the woollen manufacture, and thus contributes, in no small proportion, to the productive labour and commercial prosperity of every country in which it is largely bred.

In its wild or natural state the sheep is a lively, vigorous animal, and capable of supporting considerable fatigue. When domesticated it loses much of these properties, but amply compensates for the absence of them by the superior advantages arising from the rearing of this kind of stock. In fact, on most soils, it constitutes a material part of a farmer's profits.

As particular attention has of late years been bestowed on the improvement of the respective breeds, we shall, in the first place, present the reader with an introductory view of them, that will, we trust, convey an adequate idea of the different varieties, together with their specific characters, and the peculiar advantages they respectively possess. The general management of these animals will afterwards form a subject of consideration.

Much dispute has taken place respecting the original breed of sheep. The plains over which the flocks of the ancient patriarchs wandered still abound with these animals, and there we naturally look for the remains of the primitive sheep; but the animal that prevails in the greater part of Asia, in Palestine, and in a portion of Europe, is horned, with a large muzzle, long hanging ears, a body covered with a mixture of hair and wool, and a mass of fat on the rump. Whether or not our present breeds of sheep are descendants of these, and have become altered by difference of climate, soil, and feeding, is a question which will in all probability never be satisfactorily answered. One thing only is certain, namely, that sheep were found in a domestic state in England from the very earliest periods of which we have any record.

Several of our earliest writers testify as to the value of the wool of these original British sheep; but doubtless, at the early periods

FIG. 64.

THE BLACK-FACED SHEEP.

we refer to, only the parent stock existed, whence have gradually arisen all those different breeds which divers crosses, and the effects of care, cultivation, and locality, have handed down to us in their present valuable forms.

I. The HEATH, BLACK-FACED, LINTON, SHORT, or FOREST SHEEP (fig. 64), are names indiscriminately given to the several varieties of the same breed that are found in the north-western counties of England, and thence onward to the western highlands of Scotland.

In moorland tracts, where the pasturage consists rather of heath than of green herbage, these sheep are more valuable than others which, in more favoured situations, might be considered superior; and, although they have been superseded in some instances, they still maintain their ground on the bleak hills of the North, many of which would be wholly unproductive to the farmer with any other stock. Their flesh is juicy and highly flavoured, and, when fattened on the lowland pastures, makes excellent mutton.

The specific characters of this race are—large spiral horns, faces black or mottled, and legs also black; eyes wild, carcase short and firm, wool long, open, coarse, and shaggy, and fleece averaging three pounds and a half at four years. They are of a hardy constitution, and admirably calculated for elevated, heathy, and exposed districts. The true black-faced breed is said to be distinguished by a lock of white wool on the forehead, termed the snow-lock.

There is another moorland breed, of an unmixed character, existing on the Yorkshire wolds, that differs from the former, in having the face and legs white, with a thin flat carcase. In point of hardiness of constitution, and the characteristic distinction of large horns, it is nearly similar. Both range over the heathy mountains in the summer, without any attending shepherd; and on the approach of winter they are brought nearer to the enclosed grounds, in order that hay may be given to them during deep snows, and also that they may be prepared for the severity of the season by being salved. This operation will be hereafter more particularly described.

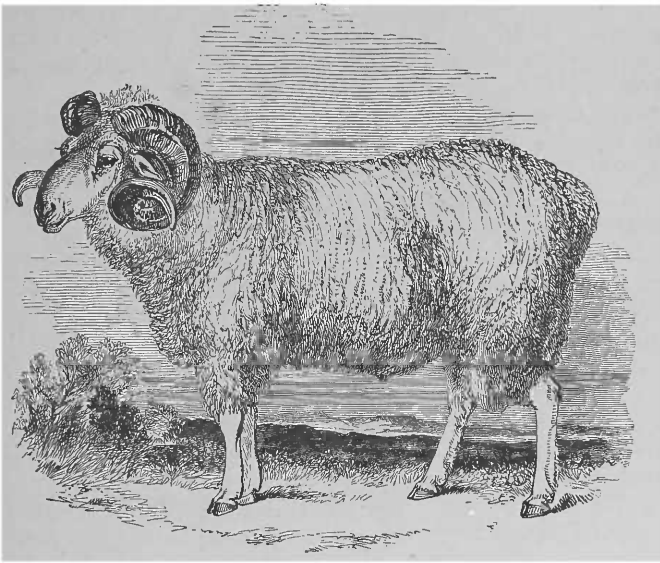
The other *horned breeds* of English sheep are—

II. The Exmoor and the Dartmoor, which derive their names from the districts in the northern and western parts of Devonshire, where they are chiefly found. They are short-woolled, with white legs and faces, and are delicately formed about the head and neck, but the carcase is narrow and flat-sided. They yield very finely-flavoured mutton, and when fatted at two and a half or three years old, arrive at 12 or 14 lbs. weight per quarter.

The country in which they are reared is generally overcharged with water after the autumnal rains; yet this breed, even in the infant state, sustain the chill of the wet ground without becoming subject to the rot, which has proved fatal to some other species that have been attempted to be introduced, and even to crosses. Their summer pasture is scanty, and their winter food consists chiefly in what they pick up while ranging over extensive tracts of pasturage, with the assistance, in the severity of extremely bad weather, of a little indifferent hay obtained from the coarse herbage of the moors; and, perhaps, occasionally with a small supply of turnips, which are sometimes cultivated, but, from the wetness of the land, often prevented from being resorted to when most wanted. From this superior hardiness of constitution, and more especially from their power of resisting wet, which is generally so injurious to sheep, nature has evidently adapted them to this soil. It is not, therefore, much to be wondered at that the attempts made to improve them by crosses with more tender breeds have not met with all the success that was expected.

The sheep of Cornwall have, however, of late years undergone a vast alteration. Crosses with the improved Leicesters, the Cotswold, and the Gloucester sheep, have materially improved both the

FIG. 65.



THE WILTSHIRE SHEEP.

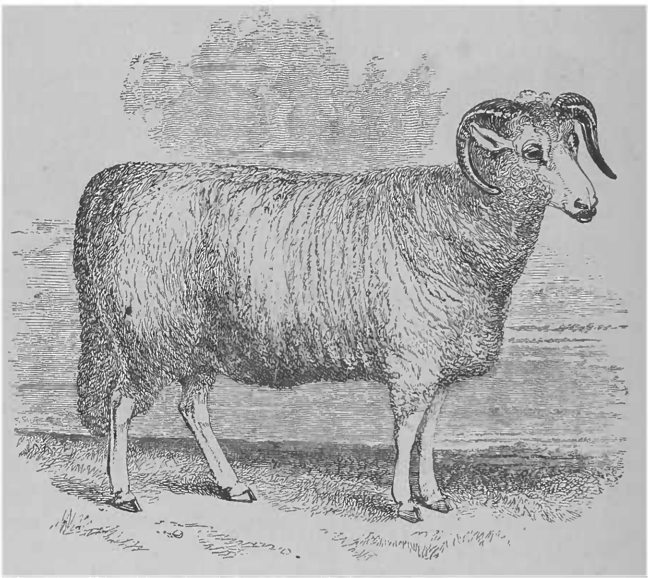
form and fleece of the Cornish flocks; but it cannot be denied that they have been thus rendered more delicate, and that the scour and foot-rot are now two diseases which commit great ravages among them.

III. The NORFOLK SHEEP were indigenous in the counties of Norfolk and Suffolk. The horns were large and spiral; the bodies long; the loins narrow, with a high back and thin chine; the legs long, black, or grey. They were of a wild, roving disposition, and not easily confined within any but strong enclosures. The wool of the original breed was short, and the fleece weighed from 2 to $2\frac{1}{2}$ lbs.

The agile form of these sheep, enabling them to move over a large space of ground with little labour, was of vast advantage to the old Norfolk farmers, many of whom were possessed of large tracts of heath-land, which they had no means of bringing into cultivation except by the assistance of the fold; they have, however, long been giving way to the South-down or Sussex-down, or Norfolk and South-down breeds, and the *old* Norfolks are a nearly extinct race.

IV. The Wiltshire Breed (fig. 65) were distinguished by large spiral horns bending downwards, close to the head. They were perfectly white in their faces and legs—had long Roman noses, with large open nostrils; were wide and heavy in their hind-quarters, and light in the fore-quarter and offal. The quality of

Fig. 66.



THE DORSET SHEEP.

the fleece was that of clothing wool of moderate fineness, averaging nearly 3 lbs. in weight; and the carcases of the wethers, when fat, usually weighed from 70 to 90 lbs.

This breed has now nearly disappeared. It was first improved by the South-downs, and it has been crossed so frequently with that breed, that it is become almost a South-down, or differs only from the true South-down in its increased size, lighter colour, and finer fleece.

V. The Dorset Breed (fig. 66) are horned. The ram has a singular long convoluted horn, and is entirely white. The chest is deep, and the loins broad. The wool of the pure breed is of an intermediate kind between long and short, and of middling fineness, weighing about 4 lbs. per fleece; and the carcase averages 18 lbs. per quarter of excellent mutton. Great numbers of South-down sheep have been introduced into this country, but in the neighbourhood of Dorchester the original breed retain their native character. They are a hardy race, being chiefly bred on open downs, and inured to the fold; but their principal value consists in the peculiar forwardness of the ewes, who take the ram at an earlier period than any other species, and are therefore much sought for, and command high prices, for the purpose of producing house-lamb for winter consumption. They will often take the ram so early as April.

There is a variety of the Dorset Breed in *Dean Forest*, and on the *Mendip Hills*. He is a small compact animal, that would thrive on the poorest soil. In both situations, however, and particularly on the Mendip Hills, the sheep are materially changed since the progress of enclosure. The Bucklands, the Leicesters, and the South-downs now occupy the greater part of these once wild tracts.

The *Polled Sheep* may be divided into two classes—the *long-* and the *short-woolled*—the peculiar merits of which have for many years formed a subject of discussion among agriculturists. Each has valuable properties, and efforts have been made to blend them by crosses, but hitherto without complete success. Nature seems to have intended them for different soils, and the short-woolled breeds, that thrive upon the bleakest hills, degenerate when removed into rich pastures, that are alone capable of maintaining the long-woolled species.

VI. The Leicester Sheep take the lead among the *long-woolled kind*, and of them there are three nearly distinct species:—

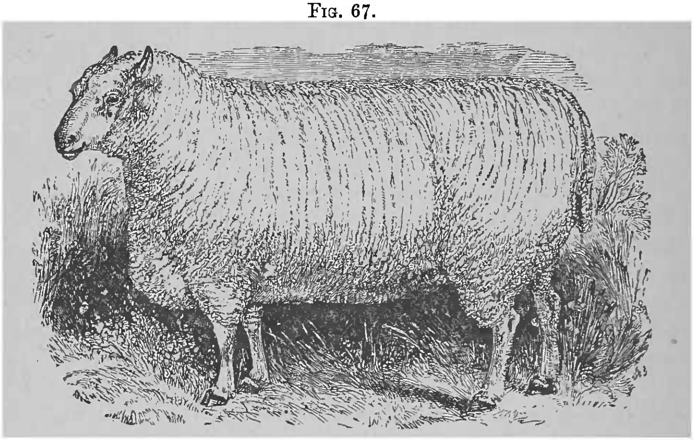
1. The *Forest Sheep*, which, though not confined to the open district of Charnwood Forest, were probably the common-field stock and original breed of the county. They are mostly polled, though some have small horns. They are generally white, but sometimes grey-faced, with legs of the same colour. They are covered with coarse combing wool, and are altogether an inferior race.

2. The *Old Leicester*, probably descended either from the still more ancient stock of Charnwood, improved by better feeding, or by crosses with rams from the rich pastures of Lincolnshire, or from a large-boned, coarse-woolled breed, common to the midland counties. They were large, heavy, flat-sided, strong in the bone, coarse in the offal and pelt, and thickly covered with wool of a coarse quality. They were well adapted for the rich deep soils, upon which weight of mutton and of wool were more material

objects for profit than fineness of quality: and, on such lands, the rams were commonly brought to weigh from 20 to 30 lbs. a quarter, with a fleece of from 8 to 14 lbs.

3. The *New Leicester*, or *Dishley Breed* (fig. 67), are an improved kind of the old species. Their forms are beautiful; and the colour white. Their heads are clean and small, the neck of a moderate length, and their breast full; the carcase round, with broad, straight backs, and the belly also straight; the legs and the whole bone fine, and particularly small in proportion to the size of the animal; the pelts thin, and the wool long and fine, and generally averaging 7 lbs. to the fleece. They are of a quiet disposition, fatten early and kindly, and are capable of being brought to a great weight on a smaller proportion of food than other breeds of the same size, the fat wethers generally weighing

FIG. 67.



NEW LEICESTER SHEEP.

(when shear-hogs) 25 lbs. per quarter, and the ewes 22 lbs. The flesh is fine-grained and well-flavoured, and a well-bred Leicester sheep carries more meat in proportion to offal than does any other breed.

The introduction and establishment of this breed is unquestionably due to the late Mr. Bakewell, but the principles by which he was guided in his selection have never been rightly understood.

This much is evident, that it was by a careful and judicious selection of such animals as excelled in symmetry of form, in propensity to fatten, in early maturity, in lightness of offal, and in fineness and length of wool, for the purpose of breeding, that, after many generations, he succeeded in producing an animal even more valuable than that which we now know as the Dishley or New Leicester Sheep. Not that the Leicester breeders of the present day are careless of their flocks: much care and attention is devoted to the selection of ewes to breed from; nevertheless many have degenerated; and although this continues to be one of our most prevalent and valuable breeds, the rage for putting Southdown, Lincoln, Cotswold, and other rams to Leicester ewes has of late introduced a great deal of cross-blood into the Leicester flocks in several parts of the kingdom, and certainly has not tended to their improvement.

VII. The LINCOLNSHIRE BREED so nearly resembles the old Leicester, that they require but little further description. They had white faces and legs, forward loose shoulders, a heavy head, with a large neck, and sinking dewlap; the bones large, and the carcase long and coarse; the back long and hollow, with flat ribs, but good loins, and a deep belly; the hind-quarter broad, and the legs standing wide apart. The pelt was particularly thick, and the fleece consisted of very long combing wool, of a rather coarse quality, weighing generally from 12 to 14 lbs. on the wethers, and from 8 to 10 lbs. on the ewes. The flesh was coarse-grained, and inferior to the mutton of the New Leicester, and particularly so to that of the small short-woolled breeds; but it frequently reached the weight of 35 lbs. per quarter; and fat wethers generally averaged 25 lbs. This description, however, applies to the old and almost extinct breed of Lincolns; in the sheep now commonly ranked under this denomination, owing to a judicious intermixture of the Dishley and other blood, many of these imperfections have been rectified, and, while they still retain the valuable properties, so essential on rich soils, of great weight of fleece and carcase, they have acquired some of the distinguishing marks of the improved breed, in the increased cleanness of the head, straightness of the back, and general symmetry.

VIII. The TEESWATER BREED, another variety of the old long-woolled species, were formerly the stock of the northern part of the Vale of York, and of Cleveland; but they have of late years undergone so great a change by crosses with Leicester rams and their descendants, which were introduced into the North by Messrs. Culley, about the year 1766, that the original race is now rarely to be met with. The modern Teeswater is simply a variety of the Leicester.

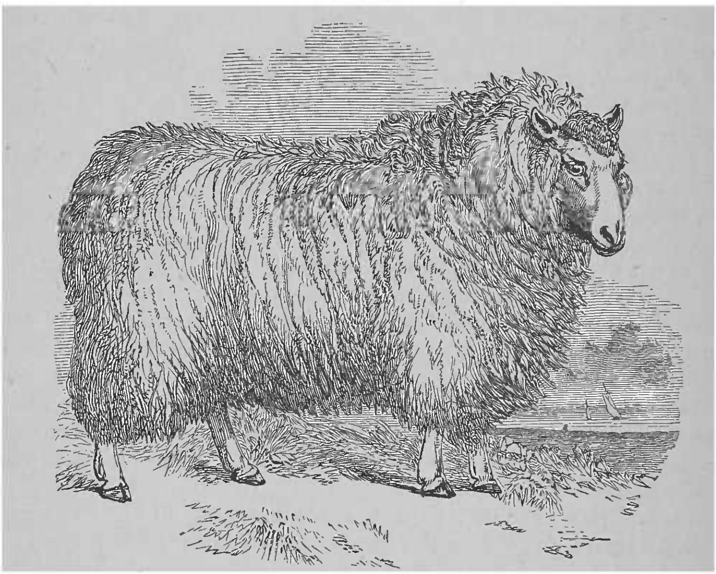
In their unimproved state they were somewhat taller than some of the long-woolled breed, and had a peculiar clumsy appearance; but they were smaller in the bone, and yielded a heavier carcase, and finer-grained meat than their general appearance would indicate. They were slow in growth, but ultimately yielded about 30 lbs. a quarter,[1] and a fleece of long coarse wool

[1] A four-shear sheep of this kind, bred by Mr. Thomas Hutchinson, of Sockburn,

weighing about 9 lbs. The ewes were singularly productive of lambs, twins being not only common, but three, and even four, being sometimes produced at a birth.

A variety of this race, which formerly occupied the lower district of Northumberland, was called *Mugs*, probably, as the surveyors of that county suggest, 'from their faces being covered with a muff of wool close to their eyes;'[1] it also grew of unusual length, and down to their feet. They rarely, however, carried a good carcase, and their wool was coarse and intermixed with hair. They have given way to the Cheviots, or the Black-faced sheep, or have been so improved by crosses as to retain very little of their original appearance.

FIG. 68.



ROMNEY MARSH SHEEP.

XI. The Romney Marsh Sheep (fig. 68) have existed immemorially on that rich tract of grazing land on the southern coast of the counties of Kent and Sussex, from which they take their name. In their original state they were distinguished by white

and killed at Darlington, in December 1777, weighed 62 pounds per quarter; and another, belonging to Mr, Dinsdale, of Newsham, weighed 54 pounds. A wether, rising three years old, bred by Mr. Powley, of Thorndon-Stavard, and killed in January 1799, weighed 59 pounds per quarter; and a lamb, five months old, bred by Mr. Henry Hutchinson, weighed 22 pounds per quarter. See Agricultural Survey of Durham, p. 248; and Agricultural Survey of Yorkshire, North Riding, p. 260.

[1] Agricultural Survey of Northumberland, by Messrs. J. Bailey and G. Culley, 3rd edit. p. 150.

faces, a considerable thickness and length of head, and a broad forehead with a tuft of wool upon it, a long and thin neck, and flat-sided carcase. They were wide on the loin, but had a sharp chine, and the breast was narrow and not deep; the belly large; the thigh full and broad, carrying the chief weight in the hind-quarter; the tail thick, long, and coarse; the legs thick, with large feet; the muscle coarse, and the bone large. The wool was of a good combing quality, and the fleece of fattening wethers weighed from 8 to 9 lbs.; the mutton was equal to that of any of the large-polled breeds, and, on account of their yielding a great quantity of loose fat, they were favourites with the butchers. The wethers, at three years old, usually averaged from 10 to 12 stones each, and the ewes from 9 to 11.[1] They were hardy, bred with little care on wet and exposed land, requiring, after the first year, when they were wintered on the uplands, no other food, in the most exposed situations, than occasionally a little hay in addition to their pasture, and were fattened entirely on grass.

The Old Romney Marsh sheep, however, are now comparatively rarely found. The Leicester breed have been introduced into Romney Marsh, and the cross has improved the form of the native sheep; but its apparent effect was to reduce the size of the animals, and make the wool lighter and closer, while, however, it gave them a better disposition to fatten. The pure Leicester breed are too tender for the cold and open pasture of the Marsh; the ewes do not produce so well, and they are not so good nurses as those of the original breed.

In consequence of this there has been considerable opposition to the introduction of the Leicesters into Kent; but, by careful and well-conducted crosses, it soon became evident that a great improvement might be and has been effected in the Marsh sheep. If they are somewhat smaller, they are more compact, and actually heavier; they do not feed so ravenously, and more of them may be stocked on the same quantity of land; the fat is placed on the carcase, instead of being loose within it; the wool, although smaller in quantity, is finer and better; and, most important of all, the wethers, that seldom reached the market until they were three years old, now find their way there at two, or even before. In consequence of this, a cross between the Leicester and the Romney Marsh—about one-third being New Leicester blood—is now the prevailing breed.

X. The Devonshire polled sheep form two distinct varieties of the same breed:

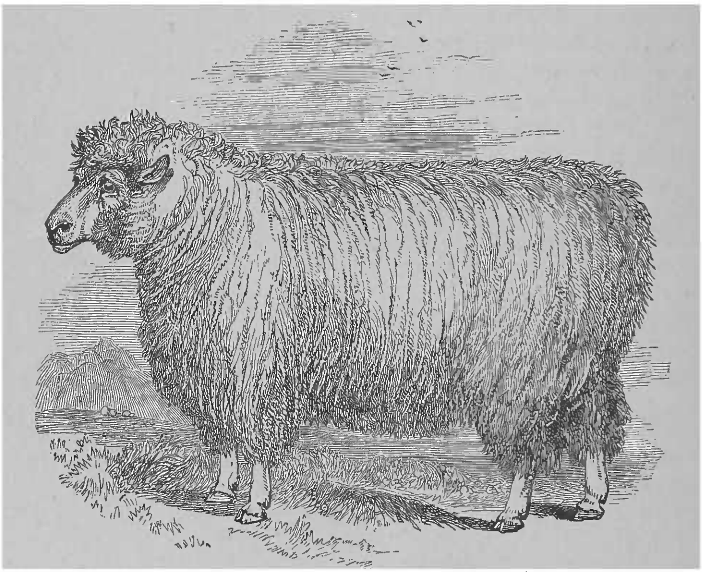
The *Devonshire Nott*, with brown face and legs, a crooked-backed, flat-sided, coarsely boned and woolled animal, carrying a

[1] Price on the Management of Sheep in Romney Marsh, 4to. chap. ii. p. 199.

fleece of 10 lbs. average weight, and the mutton averaging 22 lbs. per quarter, at thirty months old, has been crossed by the Leicester, and converted into

The *Bampton*, with white face and legs, round-chested, smaller boned, and the wethers, at twenty months old, averaging as much weight of carcase as the others at thirty. They are not, however, equally productive in weight of wool, but that wool is longer, finer, and far more valuable.

Fig. 69.



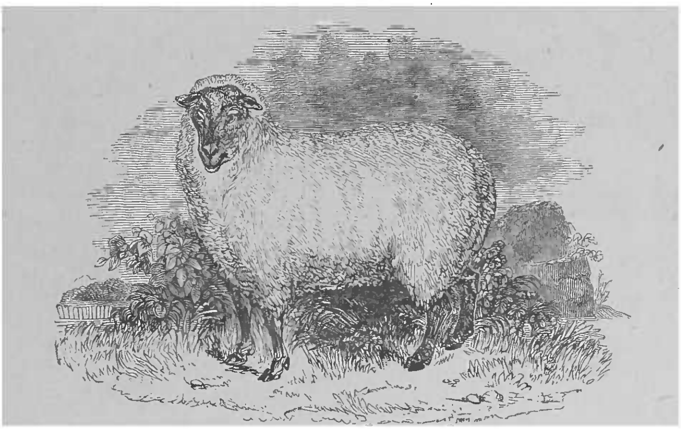
THE COTSWOLD SHEEP.

Another variety of long-woolled sheep used to be found on the *Cotswold Hills* (see fig. 69). They had lived there from time immemorial, and from the earliest periods of English history had been celebrated for the length and fineness of their fleece, for their hardiness of constitution, for their breeding qualities, and the ewes as being excellent nurses. They, too, have latterly been crossed with the Leicesters, the Lincolns, and others; the value of the cross, however, greatly depends on the situation of the farm, the selection of the individuals, and whether it will be most advantageous for the farmer to cultivate the carcase or the fleece. The cross with a Southdown and Cotswold is now in such high estimation, that there is every chance of its soon being established as a separate breed. The 'Cotswold' having been greatly improved even of late years, the breed is rising in the estimation of the agricultural public.

The chief of the *short-woolled* breeds are—

XI. The South-down Sheep (fig. 70)—according to Mr. Ellman, who was one of the best judges, as well as a most extensive breeder of them—should have the head small and hornless, the face speckled or grey, the under jaw fine and thin, and the whole space between the ears well protected with wool; the eye full and bright; the neck thin towards the head, but enlarging towards the shoulders, and there broad and high; the chest wide, deep, and projecting between the fore-legs; the shoulders level with the back, bowing outwards from the top to the breast, leaving room for a springing rib beneath; the rib coming out horizontally from the spine, and the last rib projecting more than the rest; the back

Fig. 70.



SOUTH-DOWN SHEEP.

flat from the shoulders to the tail; the loin broad and flat; the hips wide; the belly as straight as the back; the legs neither too long nor too short, fine without weakness, and of a speckled or dark colour; the belly well defended with wool, the wool coming down before and behind to the knee, and short, close, curled, fine, and free from spiry projecting fibres; the flesh fine-grained, and of excellent flavour. Fat wethers used to average about 18 lbs. per quarter; but this has been considerably increased by late attempts to improve the size of the carcase. In fig. 71 we give an illustration of a South-down ram.

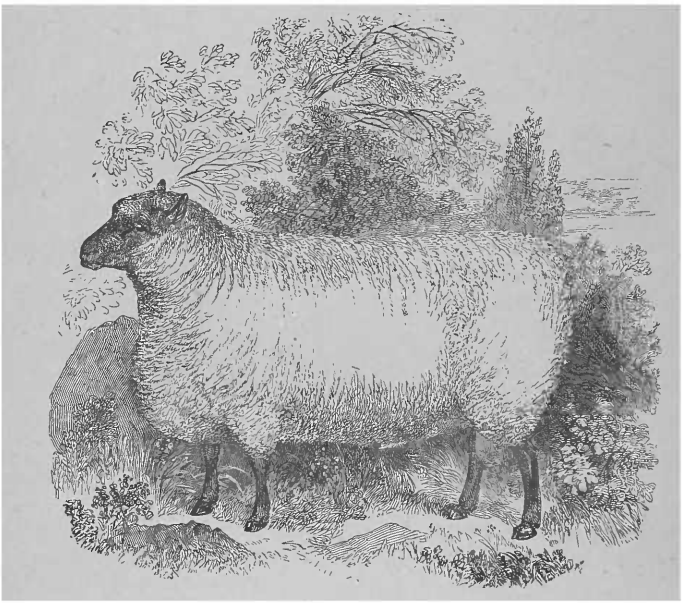
A good South-down sheep carries more meat in proportion to offal than does any other of the short-woolled varieties.

Mr. Rowlandson, in his Prize Essay on Sheep,[1] states, however, and proves by various tables and quotations from the evidence

[1] Royal Agricultural Society's Journal, vol. x. p. 427.

given before the House of Lords, that the value of South-down wool for felting purposes has deteriorated of late years; and 'that wool from a South-down sheep, crossed with a larger breed and fed on enclosed lands, having a longer staple, meets with readier sale, and is worth more money, than South-down wools of a better quality.' He advises judicious crosses with the Cotswold, and now and then with the Anglo-Merino, as a means of affecting an improvement on this point; and doubtless, so far as regards the wool, such crosses would be beneficial; but when we come to the carcase, and to the sheep themselves, we cannot advocate them,

FIG. 71.

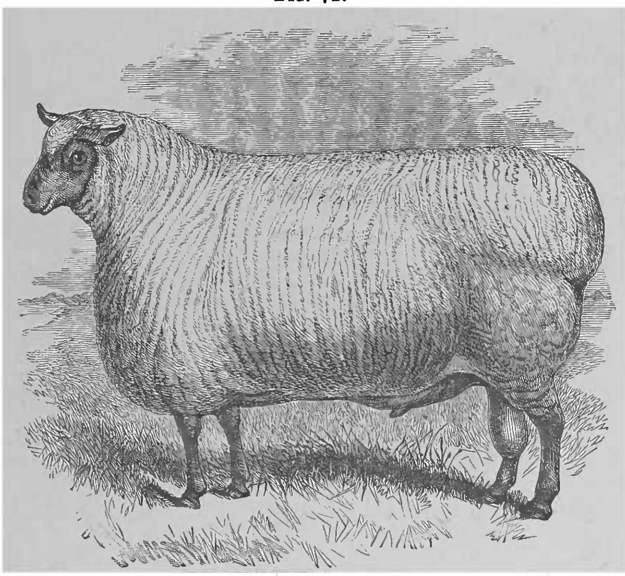


SOUTH-DOWN RAM.

unless in certain and appropriate localities; for our downs, the carefully bred South-down sheep, in their native excellence, are the best adapted and most appropriate.

These sheep have been bred for ages past on the chalky soils of the South Downs, in Sussex, and, on such short pasture and exposed situations, they are perhaps the most valuable breed in the kingdom. They were materially improved, nay, brought to their present perfection, by John Ellman, of Glynde, and are now spreading fast, not only into similar districts, but into counties better calculated for long-woolled and larger sheep. That the breed will, on those rich soils, degenerate in the superior properties of their flesh and wool, there can be little doubt; but it will still be a matter of calculation whether that disadvantage may not be more than balanced by superior weight. On their native downs, however, it will be found better to preserve them as nearly of their original size as possible; for, if rendered too large for the quality of the soil, it will be difficult, if not impossible, to maintain the increase of weight; or, if maintained, it will be most likely attended with some loss of that hardiness and activity so requisite to their thriving on the land for which they are most appropriate, or with detriment to their qualities of flesh and wool; and thus an apparent advantage may lead to serious future injury.

Fig. 72.

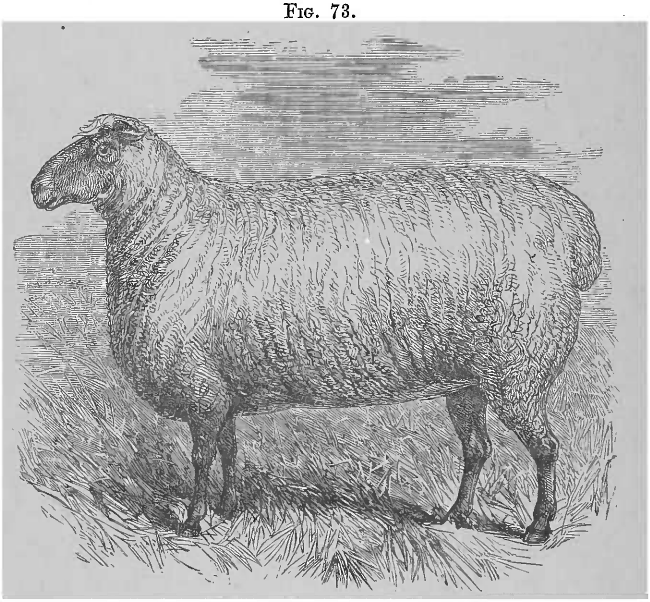


OXFORD DOWN RAM.

The South-downs are now classed as 'Hampshire' and 'Sussex Downs' and 'Oxford Downs.' The 'Hampshire Downs' are the refined type of the class, both as regards wool and carcase; the latter as compared with them, having a heavier fleece, stronger bone, and somewhat coarser and larger frame. The 'Oxford Downs,' above referred to, have during the last few years been remarkably successful in taking prizes offered for the best long-woolled sheep at several of the leading agricultural shows. This cross breed owes its introduction to Mr. Twynham, of Whitchurch, Hants, who about the year 1830 commenced to cross with a ram—itself a cross with the New Leicester and old Cotswold—and his

Hampshire Down Ewes—the object in view being to have an animal which would come to early maturity, with large carcase, good fleece, and yet which would possess the hardy characteristics of the Hampshire Downs. The late eminent agriculturist, Mr. Druce, of Eynsham, Oxfordshire, was a very successful breeder of the new cross; and at present, perhaps—we might say decidedly—the one who stands at the head of breeders of this cross is Mr. Charles Howard, of Biddenham, Bedfordshire, a brother of the members of the celebrated firm of agricultural engineers, Messrs. James and Frederick Howard. In fig. 72 we give an illustration

Fig. 73.



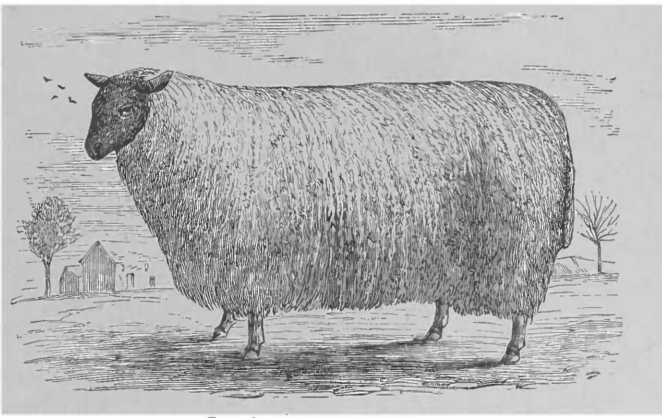
OXFORD DOWN SHEEP.

of an Oxford Down ram bred by this distinguished agriculturist; and in fig. 73 one of a sheep.

Shropshire. This is now admitted to the competition of the Royal Agricultural Society as a distinct breed. This breed resembles, in many of its characteristics, the South-down, although in fleece and in carcase it is heavier; and in constitution more robust. Fig. 74 illustrates a sheep of this breed.

In some of the counties bordering on Herefordshire, both in England and Wales, there is a breed of sheep very much resembling the Ryelands, and known as the *Shropshire morfe*. They bear wool of a fine quality, and generally have white faces and legs, although sometimes a little freckled. They are light in the bone, and have small clean limbs. There are two species, which, from inattention to the breeds, are often blended; the one polled, the other having small, light, crooked horns. A still smaller variety, bred on the mountains, is in high estimation for the table. This is generally known under the denomination of *Welsh* mutton. The Welsh sheep are classed by Professor Low into the Sheep of the Higher Mountains—that just alluded to—and the Soft-woolled Sheep of which, in fig. 75, we give an illustration. They are white-nosed as well as white-faced. The wool is very fine, being used in the manufacture of the flannel known as Welsh, distinguished by its peculiar softness and delicacy.

FIG. 74.



THE SHROPSHIRE BREED.

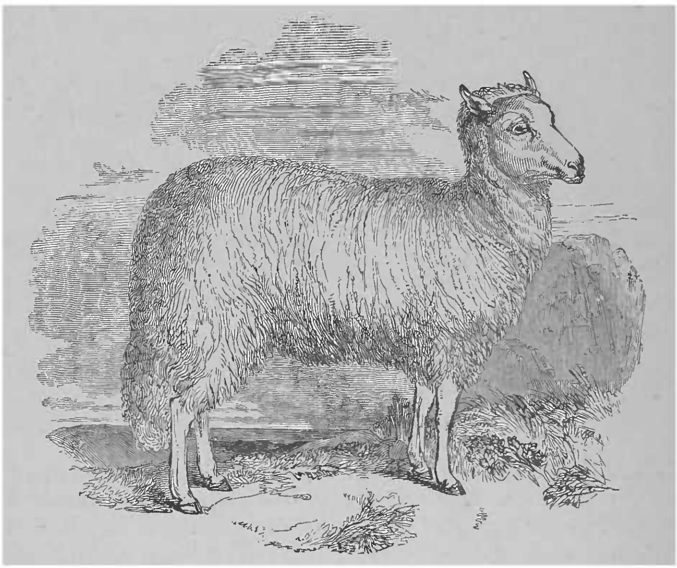
XII. The CHEVIOT SHEEP (fig. 76) were originally bred upon the hilly districts in the north-west part of Northumberland, but have since spread over many of the mountainous tracts in the neighbouring counties, and have nearly superseded the horned breed of black-faced sheep in some parts of the Highlands of Scotland.[1] They are hornless, and their faces and legs are in general white. Formerly the prevailing colour of the face was black; repeated crossings with the Leicester have, however, made both the face and legs white. The best breeds of the old Cheviots had an open countenance, with lively prominent eyes; long bodies, and fine, clean, small-boned limbs, but wanting depth in the breast and on the chine. They were seldom slaughtered until they had attained the age of three to four and a half years, when the fat wethers averaged from 16 to 22 lbs. per quarter, and, in some instances, still higher; fattening kindly, and producing mutton of excellent

[1] See the evidence of the Right Hon. Lord Napier, before the Committee of the House of Lords on the Wool Trade, 1828. Minutes, p. 15.

quality. The weight of the fleece has been increased, in some of the best flocks, from $2\frac{1}{2}$ to $3\frac{1}{2}$ lbs. to as much as from 4 to $4\frac{1}{2}$ lbs.[1]

The wool is inferior to that of most of the short-woolled polled breeds, and appears to have been injured by the attempts made to improve the carcase. It is also deteriorated in the eyes of some woolstaplers, by the practice of smearing, or *salving*, as it is termed, the flocks pastured on the most elevated hills, with a mixture of oil or butter with tar and turpentine, in order to protect them against the inclemency of winter. This custom is now very little practised in the lowlands, although many persons still

FIG. 75.



THE SOFT-WOOLLED WELSH SHEEP.

consider it to be advantageous to the fleece, as well as to the animal, by repelling external moisture, preventing cutaneous disorders, and destroying vermin.[2]

The cross with the Leicester sheep has considerably improved the Cheviot as regards making flesh, and rendered him admirably adapted for grazing purposes. He is ready for the market at two years old, and often at eighteen months, while the weight and value of the carcase is increased.

[1] See Farm Report of the County of Sutherland, published by the Society for the Diffusion of Useful Knowledge, in the 'Farmer's Series' for 1831, No. 18.

[2] 12 lbs. of butter, mixed with 4 lbs. of tar, are used for the salving of twenty-four sheep; the expense is about 6*d.* each.

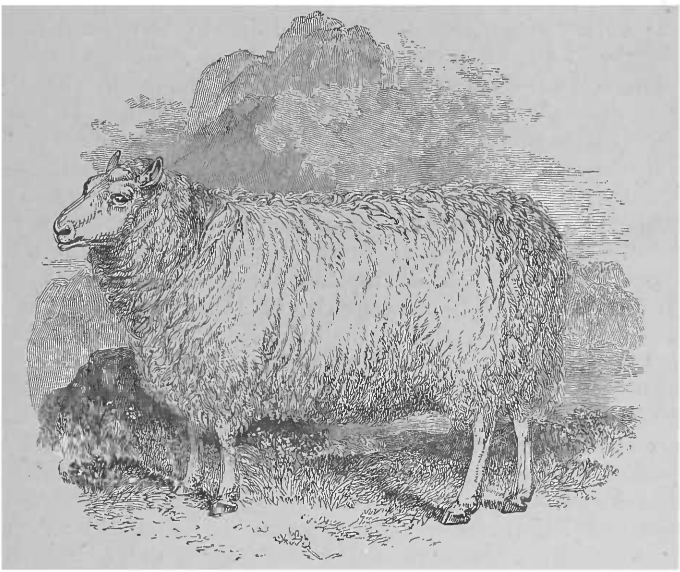
The wool is, however, altered; it is coarser and longer, and deteriorated in value: still its increased weight, and the early maturity of the animal, contribute to render the cross with the Leicester a truly valuable one.

A cross has been tried between the Cheviot and the South-down, but it did not succeed. The product was deficient in hardiness.

For mountainous districts, the pure Cheviot is one of the most valuable breeds of sheep a farmer can possess.

The sheep known as the HERDWICK BREED are smaller than the Cheviot, and principally found in the mountainous districts at the head of the Duddon and Esk Rivers, in Cumberland, and in

FIG. 76.



THE CHEVIOT SHEEP.

some parts of Westmoreland. The wethers and ewes are chiefly polled, and their faces and legs are speckled; but a great portion of white, with a few brownish black spots, are accounted marks of the purest breed. If any of them are found with horns and black faces, they are considered as descended from a cross with the common black-faced heath species. Their wool is open, and generally intermixed with *kemps*, or hairs, excepting about the neck, where it is fine.

They are a hardy breed, well adapted to seek their food among the rocks which they inhabit, which are in many places bare, and, even when they are covered, the soil is thin. The herbage is mostly green, but heath is found on the summits. They have no hay in winter, but support themselves in the deepest snows, by tearing down the herbage; and should any part be blown bare, they are sure to discover it. In storms they cluster together, in the most exposed situations, and where the snow is least likely to lodge. The lambs are well covered with wool from the time they are dropped.

The ewes are kept as long as they will breed, which is occasionally ten or even fifteen years. The wethers usually go off at about the same age as the old Cheviots. Both ewes and wethers are sold as they come from the mountains, and slaughtered without being put on any better pasture. They are usually found sufficiently fat. The wethers weigh about 10 to 12 lbs. per quarter; the ewes from 6 to 8 lbs.

The other Mountain Breeds remaining to be noticed are the 'Lonks' and the 'Penistone.'

The Lonk.—There is another breed of mountain sheep possessing great merit, being the largest of any. They are black-faced, and are called the Lonk, and were thus spoken of at the Worcester Royal Show in 1863:—'Mr. Peel's pen of Lonk shearlings was especially good. If the Lonks be as hardy as they are good, they must be the most valuable sheep for the hills that we have at present. Sheep which at fourteen months will clip 10 lbs. of wool and are full of mutton must be dangerous rivals for other breeds. The average clip of Mr. Peel's flock this year was 6 lbs., and sold at 50*s.* the tod, and the breeding ewes and shearling rams ran on the hillside pastures as they liked.'

The Penistone is a breed of sheep found on the borders of Yorkshire, Lancashire, and Derbyshire, on a heathy tract of land about twenty-six miles in length by twenty in breadth, and they are called the Penistone from the market-town of that name where they are sold. They are described by Mr. Low as having wool of a medium length, of a silky appearance, but harsh and wiry, and weighing from 4 to 5 lbs. the fleece. They have white faces and legs. The rams exceed the size of the ewes and wethers in an unusual degree—a peculiarity which is ascribed to their being taken to the lower country to be reared. The rams alone have horns, which are very large, lying close to the head, and projecting forward. A distinguishing character of this breed is an extreme coarseness of form, and especially of the extremities. The feet are large; the limbs bony; the shoulders heavy; the sides fat; but the most singular characteristic is the length and muscularity of the tail, in which respect the Penistone sheep differ from all others in this country. This enlargement of the tail is merely muscular and bony, and not at all analogous to the growth of fat which takes place in the tails of certain sheep of Eastern countries. The mutton of these sheep is highly valued for its juiciness and flavour.

The SHETLAND BREED, a nearly similar race, derive their name from the islands on the northern coast of Scotland, where these sheep are reared. The wool is fine and soft, and calculated for the most delicate manufactures. The fleece usually weighs from 1 to 3 lbs. The Shetland sheep are very hardy, and too wild to be confined.

The *Isle of Man* possesses a breed that bear much resemblance to the Welsh sheep. Some of them are horned, and others polled. Their general colour is white, but many are gray, and a few of a peculiar brown colour, provincially termed *Laughton*. This is the distinctive mark of the breed. A Laughton-coloured patch is found on the back of the neck, or it occasionally spreads over the whole of the animal.

CHAPTER II.

THE MERINO, OR SPANISH SHEEP.

THE Sheep of this foreign species have horns somewhat large in size, curved or spiral, and of which the ewes are generally destitute. The faces are white; the legs of the same colour, and rather long; a portion of loose skin depending from the neck; the bone fine; and the pelt fine and clear.[1] In fig. 77 we give an illustration of this breed.

The wool of the Merino sheep is exceedingly fine, and weighs, upon an average, $3\frac{1}{2}$ lbs. per fleece. The best Merino fleeces have a dark brown tinge on their surface, almost amounting to black, which is formed by dust adhering to the greasy, yolky properties of its pile. There is a marked contrast between it and the rich white colour within, as well as the rosy hue of the skin, which peculiarly denotes high proof. The Merinos are natives of the northern provinces of Spain, and were first introduced into this country in the year 1787; but it was not until 1792 that any effectual measures were adopted towards improving our native breeds by a Spanish cross. In the last-mentioned year his Majesty George III. received several rams of the Negretti breed; but so great was the force of prejudice, that, notwithstanding the manufacturers confessed the wool of the Anglo-Spanish cross to be of prime quality, not one individual would bid for it a price at all equal to what they paid for good Spanish wool. The experiment, however, was at length fully and

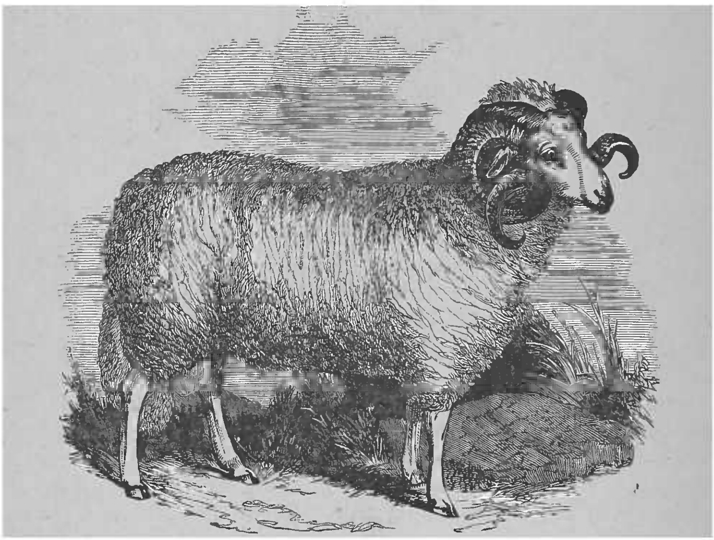
[1] Facts and Observations on British Wool, 4to. 1799, pp. 4, 5. Minutes of Evidence before the Lords' Committee on the Wool Trade, in 1828, pp. 69, 234.

satisfactorily worked out. Flocks of the pure Merino were kept by several public-spirited individuals, and the wool which they produced was equal to any that could be imported from Spain.

Various breeds of British sheep were crossed with the Merinos, and the result generally was, that, to a great extent, the wool was increased in length and weight and fineness, but the carcase diminished, or at any rate was not improved. This breed and its crosses are now entirely abandoned in England.

Did the farmer look to the fleece as his only or his chief remuneration, the Merino breed, or rather judicious crosses from it, would gradually supersede every other; but, in the language of the

Fig. 77.



MERINO SHEEP.

author of the work on 'Sheep,' in which the system of artificial feeding is carried to so great a degree of perfection—where the sheep is so early and so profitably brought to the market—that breed, however it may increase the value of the wool, can never be adopted which is deficient, as the Merinos undeniably are, in the principles of early maturity and general propensity to fatten. Mr. Ellman, a breeder who paid considerable attention to this breed, states that he gave it upon account of the difficulty which he had in selling the animals in a lean state. 'The graziers would not have them. I then tried to fatten them, but I could fatten three South-downs where I could one Merino. I treated them as I would other sheep, but I never could fatten them well.' The result of

SYNOPSIS

OF THE

DIFFERENT BREEDS OF SHEEP IN GREAT BRITAIN

				Average weight of wool per fleece	Average weight of wethers per quarter	Years old when killed
				lbs.	lbs.	
Heath	large horns	black faces and legs	coarse long wool	$3\frac{1}{2}$	14	$4\frac{1}{2}$
Exmoor	horned	white faces and legs	long wool	$4\frac{1}{2}$	15	$2\frac{1}{2}$
Norfolk	large horns	black faces and legs	fleece of middling length and quality	$3\frac{1}{2}$	18	3
Wilts	horned	white faces and legs	short and moderately fine wool	$2\frac{3}{4}$	20	3
Dorset	small horns	ditto	fleece middling length and quality	4	18	$3\frac{1}{2}$
Dean Forest and Mendip	ditto	ditto	fine short wool	2	14	$4\frac{1}{2}$
Dishley	polled	ditto	long wool	6	22	2
Lincoln	ditto	ditto	ditto	11	25	3
Dishley and Lincoln	ditto	ditto	ditto	6	23	2
Romney Marsh	ditto	ditto	ditto, good quality	7	24	$2\frac{1}{2}$
Teeswater	ditto	ditto	ditto	10	26	$2\frac{1}{2}$
Dartmoor Nott	ditto	ditto	ditto	7	22	$2\frac{1}{2}$
South-down	ditto	grey faces and legs	fine short wool	3	18	2
Cannock Heath	ditto	grey faced	ditto	3	20	3
Ryeland	ditto	white faces and legs	very fine short wool	$2\frac{1}{2}$	14	$4\frac{1}{2}$
Shropshire Morfe	polled and horned	speckled faces and legs	short fine wool	2	15	$4\frac{1}{2}$
Cheviot	polled	white faces and legs	short wool	3	16	$4\frac{1}{2}$
Improved Cheviot	ditto	ditto	ditto	$3\frac{3}{4}$	19	$3\frac{1}{2}$
Herdwick	ditto	ditto	ditto	2	10	$4\frac{1}{2}$
Shetland	ditto	colours various	fine cottony wool	$1\frac{1}{2}$	8	5
Pure Merino	horned	white faces and legs	short and very superior wool	$3\frac{1}{2}$	16	6
Half Merino	partaking of the description of the crossed breed		ditto	3 to 5		

trials made by other parties with this breed is, we believe, equally unsatisfactory; so that, practically, it is not taken cognizance of in British farming. The foreigners, however, continue to pay great attention to the breed, and the specimens exhibited by some German breeders at the Battersea Show of the Royal Agricultural Society in 1862 and the Paris Exhibition of 1867, were everything that could be desired as regards form and the quality of fleece which they bore. At the Hamburgh Show, held in July 1863, the display of Merino sheep was splendid, so far as their fleece was concerned. Continental breeders, however, ought to think more of the carcase than they have done.

CHAPTER III.

ON THE BREEDING AND MANAGEMENT OF SHEEP.

BEFORE we proceed to discuss this branch of rural economy, it will be necessary to state the names or terms by which these animals are generally known at different ages; though even these vary in different counties.

From the time of weaning to the first shearing the *males* are denominated *hogs*, *hoggets*, or hoggerels; after which they receive the appellation of *shearing*, *shearling*, *shear-hog*, or *diamond tups*, or rams. They are then called *two*, *three*, or *four shear*, according to the number of times they have been shorn.

When male sheep have been castrated, they are termed, from the period of weaning to that of shearing, *wether*, or *wedder hogs*, then *shearings*, *shearlings*, &c.; or they are afterwards denominated *two-tooth*, then *three* or *four-tooth wethers*, and finally, *full-mouthed*.

The females from the time of weaning to the first shearing are termed *ewe* or *gimmer-hogs*; they then take the name of *gimmers* or *theaves*, which continues only for one year, after which they are denominated *two*, *three*, or *four-shear ewes*; and, when old, they are termed *crones*.

Sheep, in general, renew their first two teeth from fourteen to sixteen months old, and afterwards every year, about the same time, until they are more than three years old, or *three shear*. At four years old the sheep has six teeth fully developed, and the two corner ones protruding; and at five years old all the teeth will be perfectly developed, and the animal may be said to be full-mouthed.

With respect to the selection of sheep, as an article of *live stock*, the same principle of symmetry of form, and other requisites belonging to a good breed of cattle, that have been already specified, are equally applicable. The breeder, or grazier, should also carefully examine the nature of his land; and, having attentively weighed its relative degree of fertility, and his various sources for supplying food, he may proceed to purchase that breed which, after mature consideration, he has reason to believe is best calculated for him. On this point the introductory view of breeds and varieties, already referred to, will probably afford some guidance; but there are other additional hints, to which we would call his attention.

In the first place, therefore, though he should never suffer himself to be led into needless expense, by purchasing fashionable breeds, he should be scrupulously particular in procuring the best blood of that particular breed on which he may fix.

Secondly, the nature of the land whence the sheep are to be purchased should be attentively considered; for with sheep, as with cattle, if any breed is brought from a rich to an inferior soil, it will always decrease in condition and value. Thus on down lands our larger breeds do not find food enough to keep them without taking more exercise than is natural or would be beneficial to their weight of carcase; while, on the other hand, a South-down or Cheviot sheep should not be selected for rich pastures, as, from their natural habits of exercise, they would trample over more food than they consumed.

Having thus noticed the general objects in selecting sheep, we proceed to state some particular points that will demand the breeder's attention; and, as on all cattle the male has the greatest influence, we shall specify the requisites that are essential to a good *ram*.

'His head should be fine and small; his nostrils wide and expanded; his eyes prominent, and rather bold and daring; his ears thin; his collar full from his breast and shoulders, but tapering gradually all the way to the junction of the neck and head, which should be fine and graceful, being perfectly free from any coarse leather hanging down. The shoulders should be broad and full, which must at the same time join so easy to the collar forward, and chine backward, as not to leave the least hollow in either place. The mutton upon his arm, or fore-thigh, must come quite to the knee; his legs upright with a clear fine bone, equally free from superfluous skin and coarse hairy wool, from the knee and hough downwards. The breast broad and well forward, which will keep his fore-legs at a proper wideness from each other. His girth, or chest, should be full and deep, and, instead of a hollow behind the shoulders, that part, by some called the fore-flank, should be quite full; the back and loins broad, flat, and straight, from which the ribs must rise with a fine circular arch. The belly should be straight; the quarters long and full, with the mutton quite down to the hough, which should stand neither in nor out; his *twist* (i.e. the junction of the inside of the thighs) deep, wide, and full, which, with the broad breast, will keep his fore legs open and upright; the whole body covered with a thin pelt; and that with fine, bright, soft wool.'[1]

Such is the description of the animal recommended by Mr. Colley, who observes, that the nearer any breed of sheep comes to it, the nearer it approaches to excellence of form; and there is little doubt that if the same attention was paid to the improvement of any particular breed which has been bestowed on the Dishley breed, the same beneficial consequences would be obtained.

It should, however, be remembered, that symmetry consists in that shape which is best suited to the soil on which the animal is bred, and that which would be thought perfect in a Leicester sheep may be found a deformity or an injury in a South-down or a Cheviot.

The *pelt*, or coat, should always be attentively examined, in order to ascertain whether it is not *stitchy-haired*; for in this case the fleece would be so materially damaged, in the course of two years, that the injury would not be remedied for a long period, or unless the whole flock was changed.

The fineness of wool is not the only criterion by which it should be estimated even in the short-wooled breeds. The *staple* is also of great importance; although on that material point on which the substance and wear of the cloth so much depends, it may be observed, that the now fashionable Saxon wool is far inferior to the fine Spanish growths of Leonesa and Segovia.

Ewes generally breed at the age of fifteen or eighteen months, although many experienced persons never admit the ram until they are two years old. Much, however, depends on the goodness of the food, as well as the forward or backward state of the breed. The choice of ewes, therefore, should be determined with much care and discrimination, not only as to the characteristic marks, which should be the same as those of the ram, but also with regard to the breed; for with sheep, as with other stock, no certain degree of excellence can be obtained, *unless the female possesses an equal degree of blood with the male.*

The purchaser should particularly ascertain that the sheep are *sound*; and, as an assurance of this, the teeth should be white, the gums red, the breath not fœtid, the eyes lively, the wool firm, and the feet cool.

[1] Colley on Live Stock, pp. 103, 104.

Of equal importance is the proper selection of *rams*, even of the same breed and apparent qualifications. In attending to this point, the conduct of the late Francis Duke of Bedford (whose memory every real friend to his country must revere) deserves to be imitated by all attentive breeders. Previously to drawing off the ewes for tupping, it was his constant practice to select every ram, together with the lambs produced by them in the preceding year, from the rest of the flock, and confine them in separate pens, in order that he might examine them and their issue, by the value of which he was guided in his choice.

The following hints are selected from the maxims which Mr. Smith lays down on the subject of breeding, in his prize essay on the 'Management of Sheep:'[1]—'That for the production of male animals no plan is equal to that of "breeding in a line." When using rams of the same flock, they should by no means be put together nearer than the third remove in the same line of blood. That Leicesters will improve larger breeds, but if we attempt to enlarge our mountain breeds by such means, the progeny will not prosper on the hilly pastures of their dams, nor will they ever become profitable on the richer pastures of their sires. The great object of the breeder should be to produce robust, docile, and symmetrical animals, and such as may be fed with advantage on that land which he has at his disposal.'

Ewes bring forth one, two, and sometimes three lambs,[2] after a gestation of five months or twenty weeks: hence the sheep-farmer or breeder may, by considering whether he has sufficient grass to support the ewes and their progeny in the spring, ascertain the most advantageous period for lambing, or, in the event of a failure of pasturage, whether he has a stock of turnips adequate to their maintenance until there is sufficient herbage to supply them with food.

The usual time of yeaning is towards the end of March or early in April; consequently the rams are, according to the general practice, admitted in the commencement of October. South-down ewes drop their lambs in January, and in the county of Dorset the ewes are, from a peculiarity in their constitution, capable of producing lambs about that period;[3] such is also the case in the southern and south-western districts, where large quantities of house-lamb are

[1] Journal of the Royal Agricultural Society, vol. viii. part 1.

[2] According to Mr. Teissier's experiments on gestation (already alluded to), out of 912 ewes,

140	lambed between the	146th and 150th day;	mean time	148 days.
576	,, ,,	150th and 154th day;	,,	152 ,,
96	,, ,,	154th and 161st day;	,,	157½ ,,

Giving a mean of 152 days.

[3] It is commonly, but erroneously, supposed that the Dorset ewes bring forth lambs twice a year; such instances have occurred, but they are rare.

raised for the table; and it is most profitable to adopt this plan, and so to admit the male that the lambs may be dropped quite early in the year.

The strength and beauty of sheep-stock greatly depend on the number of females that the ram is allowed to serve. While he is young, fifty or sixty should be the utmost extent; as he advances in years, the number may be gradually increased, but should seldom exceed eighty and never a hundred. Without these precautions, the lambs would not only be deficient in number, but also in point of strength.

Various expedients have been resorted to in order to make the ewes BLOSSOM; among others is the practice of worrying them with small dogs kept for that purpose, in consequence of which they become *warmed*, so that they seldom refuse the ram.

In Leicestershire a practice was introduced at Dishley of employing TEASERS, that is inferior rams, with a cloth so fitted on them as to prevent copulation, and whose duty it is to prepare the ewes for the visits of the sultan of the fold. It is, however, much better to keep the rams and ewes in different pastures, until the time when they are intended to be brought to the rut; and for about five or six weeks before that to let them have somewhat better pasture than they have been usually accustomed to, by which expedient they will be disposed sooner to take the ram. In fact it is with sheep as with other cattle, the female must be to a certain degree desirous of the male before the latter will attempt to serve her; this object can be artificially attained by increasing the richness of their food for a short time before they are required to couple. Ewes that are well kept and have had fresh pasturage will take the ram a week or ten days earlier than others which have been poorly fed.

Dating the period of gestation ewes require great attention, lest any accident should occasion them to *slip* their lambs; and if that should occur, it will be proper to separate them immediately from the rest of the flock. Where they are not pastured upon open downs or moorland, the best plan is to keep them in the same manner as cows while going with calf, namely, upon a moderate or tolerably good pasture, where there is nothing to disturb them. It is also advisable to give them turnips, or similar green food, and pea- or bean-meal with it, until within the last two or three weeks before their yeaning.

In the breeding of cattle it is a maxim, which should be steadily kept in mind, that nothing can be more prejudicial to the females than to fatten them during gestation. This rule should be more carefully observed with respect to breeding ewes than to any other animal, for if they are fed too highly while they are going with lamb, there will probably be great difficulty in yeaning. On the other hand, however, unless they are in tolerably good condition when that period arrives, they will be deficient in strength at the critical moment, and destitute of a sufficient supply of milk for the support of the lamb; and, consequently, both the dam and her progeny greatly deteriorated, if they do not actually perish from such mismanagement.

As the time of yeaning approaches, the attention and assiduity of the shepherd should proportionably increase, as it sometimes becomes necessary to render prompt assistance in cases of difficult parturition. If the yeaning takes place in the open air, it may be necessary to drive away the crows and other birds of prey, which might otherwise attack the newly-dropped lambs, and destroy their eyes, notwithstanding all the efforts of the dam to protect her young one.

As soon as the ewes are expected to begin to *yean*, they should be separated from the rest of the flock, and placed in a more sheltered paddock, and brought to the stack-yard, or to some sheltered place every night when the pastures are not too far off; where they are at a distance from the farm a spacious littered fold or shed would be a great improvement, on one side of which should be a warm cottage-hut, provided with a chimney, and a stove for warming milk, and also with a bed, on which the shepherd may lie down. Here he should sleep during the lambing season, in order that he may be ready to watch, assist, and tend any ewes that may be attempting to lamb, and, if necessary, to give aid to the young animal. Some farmers have huts of this description on four wheels, to draw about with the flock wherever they may be, and, on extensive downs, this is an excellent plan; but, in farms of a moderate size, it is preferable to have one or two well-sheltered enclosures, to which the flock may be taken without any distant driving; for, although the fold may be useful in very exposed situations and inclement seasons, yet the practice of folding ewes at lambing time is generally objectionable.

It has already been intimated that turnips are of considerable service in giving a flush of milk to ewes, unless they have been weakened by difficult parturition, in which case they may be prejudicial.

As many ewes drop their lambs at an early period of the year, it is necessary to provide a sufficient quantity of this root. If the land is wet and liable to be poached, the best mode is to draw the turnips, and cart them to a dry pasture or shed or pen, where the sheep may be supplied with them once or twice in the day, proper care being taken that they eat the whole without committing any waste. If this is duly observed, the necessary quantity can be easily ascertained, and the stock of roots will be consumed in the most beneficial and economical manner.

On dry land a different practice may with advantage be adopted, viz. hurdling off a certain quantity for the flock, and eating the crop on the land, and, as it is consumed, extending the hurdles further. By this method no considerable degree of trouble is occasioned, and it is preferable to the practice of allowing the sheep to run over the whole field, for then the roots are never eaten off so cleanly as they are when the flock is confined to a small quantity at one time.

During very wet or stormy weather, or in deep snows, it will be necessary to supply the ewes with hay. Some farmers drive them to haystacks, where they meet both with shelter and with food; but this measure, from the manner in which it is commonly practised, is by no means consistent with the economy that should exist in every department of the farming business; it might, however, be rendered less objectionable by fencing the stack round with hurdles, and distributing the hay from it daily. A square stack, when placed in the centre of a standing fold, forms an excellent defence for a small flock against bleak winds, as they have quite sufficient sagacity to seek its leeward side.

The hay is sometimes given in moveable racks, and a stated portion *per diem* is allowed. This is an excellent method while on turnips, let the weather be good or bad, for it corrects the watery quality of that food; and sheep thus fed are found to thrive better than upon either hay or turnips alone.

In some parts of the kingdom farmers give their ewes and lambs cut clover-chaff, bran, bruised oats, or oil-cake, in troughs, while they are feeding on turnips; but the expense attendant on this practice can only be repaid by a superior breed.

By the course of feeding here detailed the sheep may be successfully supported until the month of March, about which time the stock of turnips upon the land is generally consumed, so that every attention should be paid to have a proper supply of spring food. Among the many expedients resorted to may be mentioned the turning of sheep into a spot of rye sown for the purpose, or into crops of wheat, in order to feed them off; a practice which, however, is necessarily confined to arable farms, and can seldom be carried to any useful extent. Another plan is, to let the animals run over the clover and pasture of the farm, but the crops of hay and the pastures for large cattle thus receive material injury.

Some sheep-owners have a sufficient spot of land, under grass and clover, ready to take the ewes and lambs from turnips, before they are turned upon the pastures. Where this can be done it is as good a course as can be pursued, and it may be materially assisted by having a store of *Swedish turnips*, which have been removed from the ground and stacked upon layers of straw, the tops and roots having been previously cut off. The common turnip will become sticky; but Swedes, treated in this manner, will retain their nutritive quality until towards summer, and will be found essentially serviceable at this trying season. Mangold-wurzel has also been given with great success to ewes during the lambing season, and some breeders even prefer it to turnips.

Rape and burnet are highly recommended by some as food for sheep. Rape, according to the results of a very wide experience, gives per acre much more mutton than an acre of turnips. The latter has the peculiar property of maintaining its verdure throughout the winter; so that, even under deep snows, some luxuriance of vegetation may be found. In November it should be four or five inches high; and then by February the crop will gain two or three inches in the growth of the young leaves, when it will be ready for sheep.

Far preferable, however, to any of these useful articles of late spring-feed for ewes and lambs, is *rowen*, or the after-grass, especially the after-math of sainfoin or clover, kept on dry meadows and pastures when the hay-harvest is concluded. Although a field of rowen presents an unpromising aspect at a distance, being in colour not unlike very bad hay, yet when this covering is removed, a fine green herbage, from five to six inches in height, will appear; the whole of which is eaten with avidity by the ewes and their young progeny, who are thus supported until they are turned into the pasture. This being a sure resource, while others may fail, should never be neglected.[1]

With regard to the best time for *weaning* lambs, much depends upon the period or season when they were dropped, and also on the quality of the pasture. If a lamb is to be kept for breeding in a good common pasture, it is the practice in some counties to wean it at the end of about four months, in order that it may become strong, and that the ewe may acquire strength, and quickly begin to *blossom*: while in others that are more mountainous and poor, the lambs are weaned a full month earlier; but, whatever influence local customs may have in this respect, it should most certainly be performed before the expiration of July. It is of essential importance to their future growth, and, consequently to the breeder's profit, that due provision for their maintenance be previously made; and it will be proper to remove the ewes to a

[1] Mr. Marshall is said to have replied to a farmer, who was asking by what means he brought his young sheep to so desirable a condition, 'I don't know; they were lambed fat, and they have been fat ever since, and I have kept them as well as I could keep them.'

It is very properly stated that it is an easy thing to keep young sheep in good condition when they have not been neglected at first, but exceedingly difficult if they have been once *let down*, ever to make them fat again, or, indeed, scarcely worth keeping.—*Marshall's Rural Economist and Farmer's Mag.*, 1807, p. 43.

distance from the lambs in preference to disturbing the latter, if this can be effected without stinting the lambs in their food. Clover, while in blossom, is good food; sainfoin and rowen may also be successfully employed; ram lambs will thrive on green tares, but nothing is superior to a sweet bite of fresh pasture-grass. On weaning the young animals, their dams should be milked two or three times, in order to relieve their udders, which would otherwise become painful.

When lambs have been once stinted in their growth, either by disease or insufficiency of food, they become what is technically termed *sticky*; after which, although they may appear to be in health, it is beyond the power of art to fatten them. Hence it is of the utmost importance both that the ewes should have abundant food in order to produce a flow of nutritious milk while they are suckling, and that the lambs should have plenty of good pasture, or of other succulent green meat, when they are weaned.

In grazing farms, it is not only very advisable to dispose, at certain times, of such beasts as either become unprofitable, or are sufficiently fat for sale, but also to separate the stock, and class them in different pastures, according to their age and condition. In the southern counties the severing of sheep usually takes place about six, eight, or ten weeks after the shearing is finished, or about the middle of August. In making this selection, great care should be taken to choose those only that give indications of their being of the true breed; and to regulate their pastures according to their comparative strength or weakness. Hence it will be proper to place the animals that are designed for breeding or fattening by themselves: the *wedder* or *wether hogs* (i.e. males, whether castrated or not, that are of one year's growth), and *theaves*, or females that are two years old, each by themselves; the old wethers and rams by themselves; and, lastly, the lambs by themselves; otherwise the stronger animals will persecute such as are weak, and prevent them from taking a sufficient quantity of food to enable them to thrive.

When a farm is thus stocked with a proper assortment of sheep, the owner should frequently inspect them, particularly in the winter; and either remove them into better feed, or dispose of those which do not thrive upon their allotted grounds, as he sees need. Independently, too, of these examinations, the shepherd should carefully watch over his charge, as it is liable to numerous maladies.

A very frequent evil is the acute form of inflammation, which pursues its course with almost incredible rapidity in autumn and winter. In such cases, the sheep will lag behind, or separate himself from the flock, or stand with his head protruding, or beginning to breathe with difficulty. Before the affection has proceeded far the animal will evince considerable uneasiness. There will be severe constipation; then the evil will suddenly change its character, and frequently violent purging will succeed.

The sheep are often unable to defend themselves against the attacks of flies during hot seasons, and in severe weather. Docking is strongly recommended by some persons, as a means of preserving the health of the animals, keeping them free from ordure which they deposit on the fleece, and giving the animal a square handsome appearance in the hind quarters. It is not, however, very generally adopted, except in a cold climate or in exposed situations; nor do we recommend it for breeding ewes, as while suckling the tail affords considerable warmth and protection to the udder.

Throughout the whole system of sheep husbandry the greatest attention is necessary on the part of the *shepherd*; he must regularly and frequently inspect the animals committed to his

FIG. 78.

THE SCOTCH COLLIE OR SHEEP DOG.

charge, and act promptly in all cases requiring his aid. From the nature of his employment, which is usually exercised at a distance from his master's eye, he is under little control; thus, as the property in his care is generally valuable, and always requires the closest attention, great circumspection should be exercised in choosing an experienced and trustworthy person for the office; and, when such an one is found, his services should not be grudgingly remunerated. In Saxony the shepherds have no fixed wages, but are allowed a profit on the produce of the flock. From the adoption of this arrangement the sheep-masters derive great advantage, for the shepherds have no inducement to deceive them, but are themselves interested in taking due care of the animals committed to their charge. This practice has also been adopted, and with success, by some flock masters in Scotland. It is certainly worthy of consideration, if not of trial.

The *Shepherd's Dog* (fig. 78) performs so important a part in the management of sheep, that some notice of his qualities cannot be deemed irrelevant to the subject. The species delineated occurs chiefly in the extensive sheepwalks in the northern parts of this island, where the purity of its breed appears to be preserved in the greatest perfection. His docility and sagacity surpass those of every other variety of the canine race. Obedient to the voice, looks, and gestures of his master, he immediately understands his commands, and almost his wishes, and instantly and cheerfully executes them. A well-trained dog of this kind is an invaluable acquisition to a shepherd.

CHAPTER IV.

THE TREATMENT AND REARING OF HOUSE-LAMBS.

IN the preceding chapter the treatment of sheep intended to yield lambs to be kept for stock has been chiefly regarded; but, as the price given in the winter, in the metropolis, and in other places where there is a demand for young lambs, is often considerable, we shall at present confine our attention to the rearing of those which are denominated *house-lambs*.

Two circumstances are to be carefully regarded: 1. To bring the rams and ewes together at such a time that the lambs may fall at the proper season—an object that may be easily effected by any skilful shepherd; and, 2. That appropriate places be provided for their reception. Where the suckling of house-lambs is intended to be regularly followed, it will be necessary to divide the building in pens in order that each lamb may be conveniently suckled; but, when this is not a primary object, any airy building may be made to answer the purpose. Care must, however, be taken not to crowd too many into one house at the same time; or the increased degree of heat, and the accumulation of impure air thus occasioned, will render the place unwholesome.

The breed of ewes best calculated for producing house-lambs are the early Dorset, which are put to the ram at such time as will ensure their dropping their lambs about Michaelmas; and from this source the demands of the luxurious in the metropolis are chiefly supplied. The dams are fed with turnips, hay, cabbage, cole-seed, bruised corn, oil-cake, or any other nutritious or succulent food which the farmer may have at his disposal; and this is given in an enclosure adjoining the shed or pen where the young lambs are confined. They are taken to the lambs about thrice in the day for the purpose of suckling, and then returned to their enclosures.

Where the system of suckling is carried on to a considerable extent, it will be advisable to mark the ewes, in order to ascertain which has been longest suckling the strange lambs. There is often much difficulty in compelling the ewes to suckle strange lambs; but when they have lost their own by accident, they may be deceived by stripping the skin from the dead lamb, and stitching it round the body of a living one for a few hours.

In the intervals of suckling, some wheat straw or good clover may be given to the lambs in racks, with bruised wheat, peas, or beans in troughs, together with chalk for them to lick; but as the ewe's milk is the chief support of her young, especial care must be taken to supply her with turnips. In case these or other roots cannot be procured, besides turning her into a warm pasture, she should be fed with brewer's grains, to which may be added a little hay, oats, or bran; the last-mentioned articles, however, are greatly inferior to turnips, or any of the succulent roots, in producing a flow of milk.

The ewes should be brought to the lambs three or four times in the day; and if any one has more than an ordinary flow of milk, she may be held a little time while a second lamb draws the udder. During the whole of the treatment, the strictest attention should be paid to *cleanliness*, to promote which the pens should be well littered with fresh straw; the temperature kept as equal as possible, and a free circulation of air without draughts or chills provided for. Thus treated the animals will, *if kept free from disturbance*, speedily fatten, and their flesh become delicate and white.

CHAPTER V.

THE FEEDING ON PASTURES, THE FOLDING, AND SHELTERING OF SHEEP.

THE successful feeding of sheep, on the first of these methods, must greatly depend on the quality of the pasture intended for their reception, and the sources which the farmer has for supplying them with food during the trying winter months. It will always be necessary to suit them to the pasture, and on no account to procure sheep from grounds of a superior quality to those which are destined for their support. The larger breeds are calculated only for good and luxuriant pasture, while the smaller kinds are best adapted for the less fertile tracts, and for a shorter bite.

In the grazing of sheep it is impossible to lay down any rules that are of universal application. Some farmers purchase *hoggets* early in May, which, for several weeks, are indifferently kept until all the grass has been mown, when they are turned into the rowen, and are afterwards *forced* or fattened off on turnips, hay, and oil-cake, during the winter months, so as to be fit for sale at the commencement of March. This practice is profitable if conducted with care. Others purchase pregnant ewes towards the close of summer, or early in autumn, and keep them on inferior grass land, or fallow, until the beginning of the following year. They have better food as the lambing season draws near, and the lambs will then be ready for sale. Another profitable practice on good soil is, to buy lambs of forward breeds about the end of August, or in the beginning of the following month. These animals are kept in somewhat inferior condition until the following spring, when they are turned into rich pasture, and fattened so as to be ready for sale before Christmas, at which time the whole stock is cleared off the land. Others purchase their sheep in good condition, and then force them on with the best keep that can be procured, disposing of them as quickly as possible. Each of these plans has its advocates, and the advantage of either can only be determined by consideration of the soil and situation, and the quantity and the nature of the food at disposal.

A great improvement has been made within the last half century in the preparation of sheep for the market. They used to be kept until they were three years old before the farmer dreamed of offering them for sale; while now, and especially since the introduction of Swedish turnips, they may be sent to the butcher at sixteen or eighteen months. This is of great advantage to the farmer, not only as enabling him to increase the number of his sheep, but better to prepare his fields for the growth of corn. Some caution, however, is requisite, in order not to make more haste than good speed. Where the process of fattening is quickened, it must not be urged on too eagerly at first, or the lamb, unaccustomed to it, may die from undue accumulation of blood.

In grazing sheep, the fine grasses produced on the downs are, certainly, the best and most congenial food for these animals, and, on such soils, both the finest wool and the best mutton are produced; but, in order to bring sheep forward at an earlier period than would be practicable on such herbage, and for the larger breeds reared on lowlands, richer and more luxuriant pasture is necessary.

Great attention is necessary that sheep be kept from all grass that is grown in marshy places, otherwise they will become affected with the ROT. Soft boggy grass is very apt to give them foot-rot. Perhaps the best preventive is pasturing them in such positions that they will have some hard-surfaced parts to go upon.

Tufts of long rank grass that usually spring up where horse-dung has been voided are injurious, unless the pasture has been exposed to a few nights' frost, after which the sheep may be turned in with safety. It is also improper to suffer sheep to browse upon fallows that are wet and unsound, as they frequently pull up unwholesome herbs by the roots, and devour them with the dirt adhering to them. It is observable that the sheep on salt marshes are exempt from this malady; and therefore it has been conjectured that salt acts as a preventive to rot, but its effects have not been sufficiently tested.

Before turning sheep into pastures, particularly water-meadows, and also into those places that are subject to the rot, it will be necessary to give them hay or cut straw; and after the dew has been evaporated by the rays of the sun, to drive them gently round the field two or three times before they are suffered to feed. When any kind of dry food is given, they should be supplied with plenty of water, particularly during the intense heat that usually prevails in the middle of the summer, and often renders the grass as dry as stubble. Clear running water is always to be preferred where it can be obtained. Generally speaking, however, sheep will do well without water except at this time of the year; and in the winter, they may be kept a long time on food the greater part of which is dry without appearing to suffer from thirst. While ewes are suckling, they should have access to water, otherwise their milk will be diminished in quantity or injured in quality, or they will become covered with a mangy eruption. Some caution is required when sheep have been long kept from water how they again have access to it.

The best time for turning sheep into summer pasture is in May, when every attention should be paid to proportion the number according to the luxuriance of the grass; and, as these animals are with difficulty restored to good condition when injured by want of sufficient food, it will be advisable rather to understock than to overburthen the land. The sheep will not then be driven to feed on herbage that is injurious to them, and which they would not touch unless urged by hunger. It is likewise worthy of notice, that by pursuing a system of as *close feeding* as is fairly practicable, the plants will be prevented from running to seed, and the grasses that are naturally coarse and unprofitable will be kept down, and rendered sweet and valuable.

From the number to be allotted to an acre depending on the weight of the stock, the richness of the soil, and the forwardness of the pasture, it must be evident that no general rule can be applicable to this portion of management. It must be wholly regulated by circumstances. A certain number of store cattle should be suffered to run with the sheep, otherwise all the finer bottom grasses will be eaten up, and the long and coarse ones remain untouched.

Of late years, it has become a frequent practice to soil sheep during summer with the various artificial grasses, and to supply them with barley, as well as green food, during winter. In this view, barley meal, when abundant and cheap, may be advantageously combined with green meat, and will speedily fatten wethers. Pulverized oil-cake has also been given, but has been objected to by some persons, as apt to impart a peculiar flavour to the mutton. The cattle compounds, used by Mr. Warnes, and given in chap xii. b. 1, of this work, have been recommended for fattening sheep. Pea haulm is much relished by sheep; and potatoes, particularly if steamed, would rapidly contribute to fatten them, were not the operation attended with too much trouble.

Sheep, when soiled, not only retain their health as well as when they are allowed to pasture at large, but acquire a greater aptitude to fatten, and consequently attain a greater weight. The first year, however, should have nearly passed before this mode of treatment is adopted. Some authorities appear to think that it is to be lamented that the soiling system is not pursued to a far greater extent. The prevention of all waste in the food—the perfect saving of the manure—the absence of poaching and treading down the crop—and the power of giving to the animals just what kind and quantity of food we please—are most important things, and intimately connected with the interest of the farmer. An excellent paper, by Mr. A. S. Ruston, was read in 1860 before the Central Farmers' Club, in which some valuable remarks will be found, on the breeding of sheep as producers of manure.

Cole-seed, cut cabbage, and burnet supply an excellent food for sheep during the winter, particularly towards the close of that season; but in most situations turnips form the farmer's chief dependence for the winter-keep of his sheep-stock.

There are various methods in use, by which turnips may be given to sheep. Some farmers turn the sheep promiscuously into a field and allow them to eat the roots at pleasure. Others divide their land by hurdles, and enclose the sheep in such a space that they can clear in one day, advancing progressively through the field until it is cleared; but in either way, care should be taken not to turn them in until the dew is off in the morning, lest by eating the wet leaves they may possibly become hoven. Another method is, to raise such a quantity of turnips as will be consumed in a few days, and cart them off the land to the sheep pastures; and, in wet weather, or when it is not an object to feed off the turnips on the ground on which they are grown, this is an advisable method.

Each of these methods has its advantages; but a more profitable plan than either is to eat off the crop by two successive flocks of fattening and store sheep. By allowing the first the range of the field they will scoop out such turnips as they prefer, and thus satisfy their appetites better than where the turnips are dug up. This is a material point in fattening all kinds of cattle. They should be indulged with the food which they like best. The store sheep may then follow, and the roots and pieces left by the former taken up for their use. One man with a common picker will, in a few hours, turn out and break as many as will serve a large flock; and his hire will be more than compensated by their being entirely eaten; while, if that were done by the fatting flock, it would check rather than forward their improvement. When the turnips are hurdled off to be eaten on the land they should always be taken up, for otberwise, in so small a space, they would be trodden under and spoilt.

Another method of winter-feeding sheep on turnips is to have these roots consumed by the animals in sheds near the farm or homestead. A writer in the Journal of the Royal Agricultural Society for 1850, strongly advocates the feeding of all sheep immediately destined for the butcher thus. He says, 'They are no way retarded by the weather, are constantly dry and healthy, fatten more quickly, and consume less food in proportion to their progress; besides the manure is much richer, and far more efficacious, from being applied to the land just previous to the sowing, instead of lying there exposed to wind and rain to evaporate.' He advises that the sheds should be about fifteen feet in width, and divided into pens measuring six feet wide and about eight feet long, and that a space or passage of about three feet should be left in the middle; the troughs are to be placed in the pens on the sides next to the passage, for the convenience of feeding. The flooring is to consist of wooden gratings about three quarters of an inch apart, and having beneath it a tank or pit of brick-work about three feet deep for the reception of the manure. This pit may be three parts filled with marl. He considers that this shed would also do for the ewes at lambing season, and that under this system sheep would fatten in about twelve weeks.

Turnips given in enclosures or sheds should be chopped, as also should cabbage; pea- or bean-meal may occasionally be mixed with them. Cut clover-chaff and hay may also be used with advantage. The sheep-cribs and racks in common use are too well known to require description. Considerable benefit may be derived from their adoption for the purpose of feeding sheep. It effects a material reduction in the consumption and expense of provender, which is thus prevented from being trodden under foot or soiled with dung. Whatever system of management may be adopted by the farmer, whether at home or in the field, he ought on no account to withhold SALT from his sheep; for not only does a moderate continual use of that article contribute to the digestion of succulent vegetables, and, of course, preserve the animals in constant health, but it is also said to improve both the quantity and the quality of the wool. It ought particularly to be used in those situations that are liable to produce the rot, of which malady it is both a preventive and a cure.

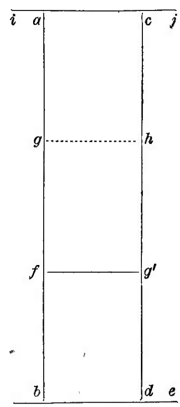
The preceding statements have been chiefly given with reference to the fattening of sheep for the market; but it should not be forgotten that the growth of the wool is liable to be materially affected by the system of feeding pursued. *It is essential to the evenness and strength of the staple, that the feeding of the animal should be uniform, and without any sudden interruption or transition.* Where this is suffered to take place, the natural progress of the wool is for a while injuriously interfered with. It continues to grow, but the new fibre is unhealthy, and becomes so weak as to yield under the operations of the manufacturer. This state of the wool is easily discoverable by the assistance of a lens, and in the majority of cases can be readily detected by the naked eye. The unhealthy portion is, not unaptly, called a breach in the wool, and lessening the value of the wool, it diminishes its price to a very considerable extent. Much wool is injured by the change between summer and winter keep; hence any sudden transition from rich to poor, or from poor to rich keep, should carefully be avoided.

We shall conclude this chapter by a few supplementary notes on pasturing, folding, and the shelter of sheep.

In 'pasturing' sheep it is a good plan, as with all other stock indeed, to change the 'bite,' that is, to shift them from one field to another; the difference in the grasses, &c., giving that change which is found beneficial to all stock. When the 'bite' is poor, that is, the grass short, which is of course usually the case in autumn and winter, the feed is supplemented by turnips, oil cake, hay, &c. &c. The turnips are carted on to the field and spread as uniformly as possible over the surface of a certain part or strip so that the sheep will manure the land as evenly as can be effected. The turnips are generally cut or sliced into 'fingers' by a hand barrow turnip-slicer, or by a slicer attached to the cart. The hay is placed in racks—the best kind are on wheels—and the oil-cake and other foods in receptacles, made either in these racks or in specially constructed appliances.

When sheep are folded upon turnip-land (swedes); that is, where the turnips have not been taken up, the great purpose of the system is to manure the soil, and also in the case of light lands, for which it is specially adapted, to tread down and consolidate it for succeeding crops, as wheat, which requires a firm seed-bed. In carrying those two objects out, care should of course be taken to arrange the feeding off of the turnips in such a way that the manuring and consolidation of the soil be effected as uniformly as possible. This is done by staking or dividing off, by means of wood or iron hurdles, a certain breadth of the field containing as much space as will feed the sheep for a certain time, usually a week. The strip, if it may be so called, which is divided from the rest of the field by the two rows of hurdles (one now is only needed when the sides next the fences are being eaten off) should run in the direction of the length of the field or the line of furrows, so that the plough can turn in the manure or dung of the animals as fast as each piece or strip of land is fairly eaten off. If the field is long, or the usual or average length, one end only, as *b f g′ d*, of the strip is staked or hurdled off, say the south fence, as *b d e*. When that part is eaten off, the stakes crossing the strip as *f g′*, are moved further up, say to *g h*, and the sheep eat off the fresh turnips on the space of *f g′ h g*. When that part is eaten off, the hurdles *g h* are removed, and the part *g a, c h* left to be eaten off. In this rough type diagram (fig. 79), *a b, c d* are the hurdles—*b d e* the south, and *i j* the north fence of the field. In all movements of the cross land hurdles, as *f g′, h g*, the back pieces technically termed the back feeds, as *b f, g′ d*, are kept on to the new pieces, as *f g h g′*—so that the sheep at the first removal of the fence *f g′* have got the whole piece *b g h d* to feed off. This is done, as many of the turnips on the back piece, as *b f g′ d*, have not been fully or properly fed off at first, and the sheep may return to them to feed them up; to facilitate this, the soil or earth-fast roots are dug up by a labourer, and left on the surface. What is finally left along with the manure is ploughed in as soon as the whole strip *b a c d* is eaten off.

FIG. 79.



Had the subject of sheep shelter-sheds on fields been discussed in agricultural circles but a few years ago comparatively; there is little doubt but that he who had proposed it, would have been looked upon as one more remarkable for his utopian or impracticable, than for his practical views. Yet although we find, as yet, but few examples of such structures in our farms, the wise policy of having them is by many considered to be the right thing;

and so marked is the advance which agricultural opinion has taken during the last few years, that we shall not be surprised to see almost every farm in which sheep are kept, being supplied with sheds by which shelter can be afforded them in the fields. No doubt sheep, unlike the other animals of the farm, are provided with heavy fleeces, through which the cold and frost cannot penetrate; but still there is the fact, as shown by the recent teachings of science, that cold has an effect even upon sheep, and that while it reduces the benefit done the animals by abundance of food, it influences also in a prejudicial form their health, through the action of the atmosphere charged often with damp as well as cold, the body acting through the lungs irrespective of the skin, covered as that is often in this case by a long fleece. We say often, for with the exigences of modern farming it is not only the long-fleeced sheep which are folded out, but those breeds which are not so well provided, and are, moreover, through and under the influence of a long-continued system of peculiar breeding and rearing, not so well calculated to resist the action of the cold and damp, as other breeds better adapted to folding are. But taking even the most favourable view as to the capability of sheep—even of breeds provided by nature with the best protection against cold—it is somewhat difficult to see how, if the indications of modern science be correct as to the influence of cold upon all live stock, a sheep can escape more than other animals its prejudicial effects. If other animals of the farm lose much of the benefits of the food they get by exposure to cold and wet, it is difficult to understand how sheep wholly escape this loss. Indeed much argument is not required to prove that, although the percentage of loss may be less—as we believe it is—than in the case of other animals, still that percentage is quite high enough to make a perceptible difference in the balance of profit and loss if that balance should be struck.

But apart from the argument which has been brought forward for the providing of sheep with shelter sheds in winter, when of course they are alone folded on turnips, on the above ground, there is another which can scarcely be refuted on any ground. And this is the injury done to the fleece of the animals, by exposing them to all weathers. Alternations of damp and dry, of rain, frost, and snow, must have a bad effect upon the staple of the wool. This, we believe, is admitted by all who have considered the subject. But there is another source of deterioration of the fleece, the practice of folding on turnip fields, and that is from the fleece coming in contact with the wet soil upon which the animals lie. This also is a cause of loss which it is not easy to gainsay.

We are by no means desirous to take a one-sided, prejudiced view of the point. We can have but one interest to serve, and that is the interest of our readers; and in point of fact we are more fully detailing the opinions of others than we are giving weight to our own. And seeing that there is diversity of opinion upon this as there is upon all other farming questions; and that doubt therefore is sure to arise in the minds of those who come fresh to the consideration of the subject, as to which opinion is right; we would conclude what we have said on the subject so far, by suggesting that it will be the wisest plan to take the benefit of the doubt, and provide shelter sheds.

One great point is that their provision does not involve large expenditure, either of time, trouble, or cost. The roughest possible structure will suffice—so rough that the name of structure is too dignified almost to give to them. They require to be rough, at least it would be folly to make them otherwise, seeing they are to be taken down so shortly after being put up. But while 'rough'—using the term to indicate inexpensive erections—they must be strong, in order to resist the high winds to which they will be subjected at times; and they must be moderately warm. Shelter against winds may be largely and effectually provided by taking judicious positions as regards fences, &c. A high, old-fashioned fence may indeed form the side or part of the shelter-shed by rearing timbers up against it, and interweaving straw between them. A system of shed construction may be carried out which would be available at any part of the farm, and could be easily and quickly put up and taken down by any labourer.

In previous editions of this work the system of *house* feeding of sheep was adverted to and condemned, much on the same grounds as, we have now shown, some condemn the occasional shelter of these animals. But agriculture is a progressive science, and the practice of yesterday may be shown to be wrong by the experience of to day. And so it is in the present instance; at least a very large amount of the experience of late goes in favour of sheep feeding houses forming part at least of every mixed husbandry or other farm where sheep are kept. And one strong point in favour of the system is that the experience comes from those who practise sheep husbandry on the very largest scale, that is, our Colonial farmers. We also find its adoption becoming almost universal on the Continent; the most advanced agriculturists there being in favour of it. Nor are those in this country wanting who advocate and practise the system, and whose opinions are worthy of all consideration from the high position they occupy as practical and scientific farmers.

It is advanced against the system now, as it was in previous editions of this work, that sheep are from their roving, restless habits unfitted for it, as well as from the fact that they are provided by nature against the effects of cold. There is at first sight a good deal of force in these arguments; but as regards the latter we have shown that there are other views which may be taken of it—and it certainly is a strong point that the new system is found to be the most successful, in climates even better than our own. And as regards the other objection that sheep are restless, so may it be said that cattle are so also—and yet we find they thrive well under the systems of stall and box feeding, the very antipodes of pasturage, with its full liberty of roving at will. It is, however, surprising how rapidly the original habits can be and have been altered and modified by man and his various systems of managing. One sheep-breeder mentions the case of a lot of sheep, of rather a restless habit, having been housed; and after a very short time, when allowed to go out, they showed little or no desire to go, but to keep in their more confined quarters.

Be all this as it may, the fact remains for consideration that the system of housing sheep is on the increase; that it is largely adopted in our own Colonies, in America, and on the Continent; and that many amongst us, who although opposed to it, but having tried it, have come to the conclusion that sheep fed under it, not only fatten much more quickly, but consume much less food than when pastured or folded; and that the manure made by them under the system is of very superior quality, that is, if they are littered on straw. On this point we shall have more to say presently. We leave the points we have put before the reader for his consideration and decision, we wish to take no one-sided partizan views of them; as before stated, we have only one interest to serve, and it is that of our readers.

In housing sheep, then, one of two plans may be adopted, the details of which will be found explained in the Chapter on Farm Buildings. The first is that in which the sheep lie upon sparred floors, the second that in which they are littered or bedded with straw. Each of those methods has its advocates, but if we are to take Nature as a guide, the hard floor is better than the soft one made with straw or litter. Sheep, if they have a choice between a hard and a soft place to lie upon, will always prefer the hard, and a hard surface is better for their feet than a soft one.

CHAPTER VI.

THE SHEARING OF SHEEP.

THE shearing of sheep is an object of very considerable importance in rural economy. The most proper time should be regulated according to the temperature of the weather, in the different parts of the island, and in different years. If it is hot, the month of June may be fixed upon, though some breeders defer it until the middle of July, under the impression that an additional half-pound of wool in every fleece may be obtained in consequence of the heat of the weather, and the increased perspiration of the sheep. An early shearing, however, is preferable, where the weather and other circumstances will admit of it. The new wool will have more time to *get ahead* before the next winter approaches, and the animal, being more thoroughly covered, will be better secured from the attacks of the fly. Nature, however, herself points out the proper time for sheep-shearing, viz., when the old wool is separating, or has evidently separated from the skin, and the new fleece is beginning to grow. The choice of time should not, therefore, depend entirely on the weather, but the farmer should ascertain the loosening of the old coat, and the preparation of the new one. This will usually happen some time in June.

Previous to the shearing, the sheep must be washed, in order to remove the dust and other nuisance which they may have contracted. This operation is usually performed in some neighbouring stream, or even in a pond, by men standing in the water, who often take cold and occasionally have become seriously indisposed in consequence of the immersion. To remedy this inconvenience, and also the abuses resulting from the careless manner in which the washers frequently do their work, it has been humanely proposed to form a kind of passage through the water between a double rail. The sheep are to walk into this by means of a slope cut in the bank at one end, and come out by means of another at the other end, with a depth sufficient for them to swim at one part. The breadth need not be more than 6 or 7 feet. At opposite sides of this passage, where the depth is just sufficient for the water to flow over the sheep's back, may be placed two casks, either fixed or loaded, and a man may stand dry in each of them. The sheep being in the water between them, as it swims through the deep part, is seized first by one and then by the other, and thoroughly washed. It thus escapes up the other slope and finds a clean pen, or a dry pasture, or rick-yard, where it remains for a few days, until it is thoroughly dry, and fit for the shearers. There are now regularly constructed sheep-washing tanks, &c., used on many farms.

The lambs are first separated from the other sheep, and confined in distinct pens. A few planks will form a bridge to the tubs, and there should be a pen at the first mouth of the water, where the sheep may be soaking a few minutes before he is driven to the washers. There is, however, generally speaking, no necessity for all this preparation. The sheep is caught by a man on shore, and thrown into the arms of the first washer, who performs his part, and then hands the animal over to another, from whom, the cleansing being deemed completed, the animal escapes and eagerly swims ashore. The washers then comparatively seldom get much harm, for they are sufficiently fortified within to resist all cold from without.

In *washing the sheep*, the use of water containing chalk should be avoided; for this substance decomposes the *yolk* of the wool, which is an animal soap, and the natural defence of the fleece. Wool, often washed in calcareous water, becomes rough and brittle. The yolk is exceedingly useful to the sheep in cold and wet seasons by the resistance which its oily nature opposes to the rain, while it nourishes the growth of the wool, and also imparts to it a greater degree of softness. Ponds are generally considered preferable to rivers for sheep-washing.

The *clipping*, or *shearing* of sheep, is performed in two ways, and a barn, or a small shady paddock, is chosen as the scene of operation. The first and most ancient way is longitudinally from head to tail; but this mode of operating is attended with considerable difficulty, and is not always well executed. The second, and improved method consists in cutting circularly round the body of the animal, the beauty of which is by this means supposed to be increased, while the work is more uniformly and closely executed. The shearer holds the animal under him, either with his knee or left arm, and clips the wool with a spring-shear, which, being without handles, he is enabled to manage with one hand, and thus perform the operation without assistance, unless the sheep are unusually strong and restive. The entire fleece is removed, without any separation of the different parts of it, and rolled up together, and the different qualities afterwards sorted by the wool-stapler; but previously to the sheep being handed over to the shearer it is a good practice to clip off all coarse and *kempy* wool from the hips, legs, poll, and forehead, and keep it apart from the rest of the wool, in a bag or basket. This is particularly necessary to be observed in the shearing of lambs; for, in lambs' wool, if the coarse parts and kemps are suffered to mix with the fine, they never can be sorted out, and must spoil any fabric to which the wood may subsequently be applied, because the kemps will not take any dye. Great care should be taken, in shearing, not to give the wool a second cut, which would materially injure and waste the fleece.

During the whole process of shearing, the operator should anxiously avoid wounding or pricking the animal with the edge or point of the shears; otherwise the flies, abounding in the sultry heats of summer, will instantly attack the sheep, and often sting them almost to madness.

In these the days of mechanical progress, when mechanism is applied to such an infinitely wide variety of purposes that it is difficult to name one to which it is not, or at least proposed to be, applied, we need not wonder at the fact that it has actually been applied to the shearing of sheep. The machine for this purpose, the invention of Captain Turquand, has been so recently introduced that we have not data enough to enable us to judge as to its chances of success. There are certain difficulties in the way of this being secured without the expenditure of much time and money. But these may be, as we hope they will be, overcome. It appears to us, at present, that a large proportion of the animal may be thus sheared, but that some portion it will be very difficult to deal with. One advantage it is hoped it may possess, viz. that the cutting-edges may be so guarded that the animal will be secured from wounds. The horse-clipping machine has been successful; the sheep-shearing one, we may hope, will also prove so, although the difficulties are greater than in the case of the former.

When shorn, the fleece should be carefully folded and rolled, beginning at the hinder part, and folding in the side, or belly-wool, as the rolling proceeds. When arrived at the shoulders, the wool of the fore part should be rolled back to meet the other, instead of having the binder twisted thence in the usual manner, and the whole secured by a pack-cord in the common way in which parcels are tied. Thus the fleece is kept much tighter together, and unfolds itself with more regularity under the hand of the sorter, who is otherwise much inconvenienced by the confusion or breaking of those parts of the fleece which, in the common method, are twisted together for the band.

In the preceding details we have spoken of an annual shearing; but experiments have been made by some enterprising breeders, in order to discover whether, in certain cases, long-wooled sheep might not be *shorn twice* in the year. The trial, however, has not been attended with any advantage; for, although a trifling additional quantity of wool may be thus obtained, it would not be sufficient to pay for the additional trouble and expense. The quality, also, would be inferior in length of staple, and late shearing exposes the sheep to injury from cold. To meet this latter objection it has been proposed to clothe the sheep in flannel jackets, as practised by the breeders of the new Leicester rams; but, although this may answer the purpose of tup-masters, who find it to their interest in supporting a peculiar breed of delicate sheep, it could not be generally adopted, even if it were advantageous to the animal, of which many strong doubts may be entertained. The external air and sun are necessary to the health of the sheep. It is also exceedingly probable that the system of clothing sheep is prejudicial to the growth of the wool both in strength and staple.

Lambs have been usually clipped a short time after the rest of the flock: but a custom has been lately introduced of not shearing them until the second year. The wool of the *hoggets* thus acquires a great length of staple, or, *a longer nip*. It is chiefly used in the manufacture of shawls; commands a higher price than the other qualities, and is of great importance to the proprietors of short-wooled flocks. After sheep have been clipped, it is usual to *mark* them with ochre, ruddle, or other colouring matter; but, as it is sometimes difficult to wash the stains of these substances out of the wool, a composition of finely-pulverized charcoal, or lampblack, and tallow mixed together over a moderate fire, with a small portion of tar to give it a proper consistence, will answer the purpose better. Wool that has been marked with this mixture may easily be cleansed by washing in strong soapsuds.

It is essential that a distinctive mark should be given to the ewe and wedder lambs, which is easily done by notching one ear of either of them. The same method may be employed, with some variation, to class them at the future stages of their growth. Where a pure as well as a mixed breed of sheep is reared on the same farm, it will become necessary, in order to avoid mistakes, to distinguish those of the first breed with a different mark from that employed for the sheep of the second. This system might be carried still further, and each sheep branded on the cheek with a separate number; a judicious breeder would then find it conducive to his interest to keep a register, in which the number of each sheep might be marked, and where also such observations as relate to the coupling and crossing of the breeds, and the experiments he may wish to try upon the animals, should be carefully entered. A careful breeder, who is solicitous to improve his flocks, will, in such register, notice the defects or other qualities of his sheep, their respective states of health or disease, the nature of their wool, the profit they yield, &c. It will thus be easy to ascertain what individuals it is proper to dispose of each year, as well as those from which it will be advantageous to breed; and at length the object proposed will be obtained, namely, the improvement of the different breeds, and the deriving from them the greatest profit.

CHAPTER VII.

ON WOOL.

THE importance of the woollen manufacture, both to the commercial and labouring classes of this country, has long been felt; yet it is only within the last fifty years that the subject has been scientifically considered, or any efficient measures taken in order to improve the quantity or quality of British wool.

The growth of wool is generally completed in one year, at the expiration of which it spontaneously decays and falls. In this respect, indeed, the covering of sheep bears a close resemblance to the hair of most other animals, although it differs widely in the following particulars. Wool is considerably finer than hair, and grows more uniformly, each filament springing at equal distances, and separating at nearly the same period from the skin, and, if not shorn in time, naturally falling off, and being succeeded annually by a short coat of young wool.

Another peculiarity in wool is, the different degrees of thickness which prevail in various parts of the same sheep, and also the great difference in the diameter of the same fibre, according to the health of the animal, or the temperature of the weather at the time at which that portion of the fibre was protruding through the skin. The extremity of the fibre is always thicker than any other part, because it grew immediately after shearing, when a covering for the denuded skin was required, and the want of length of wool was made up by the largeness of the fibre. The portion that grows during the winter is of a much finer quality than that produced in the summer, for the pores of the skin are contracted by the cold, and permit only hair of much tenuity to escape.

The names given to wool are various, according to its state or relative degree of fineness. When first shorn, it is termed a *fleece*; and every fleece is usually divided into three kinds, viz. the *prime* or *mother-wool*, which is separated from the neck and back; the *seconds*, or that obtained from the tail and legs; and the *thirds*, which are taken from the breast and beneath the belly.

We shall now proceed to state some of the principal requisites that are indispensably necessary to constitute good wool. These are:—1. The *length of the staple.*—This regulates the different purposes to which the fleece is destined. There are various fabrics that can only be constructed from wool of a certain length, and from the improvement in the working of wools they can now be used from nine or ten inches to less than three inches in length. All the long wools have materially improved—they have become finer, and truer, and stronger. Their felting property is small—the curves are not numerous—all kinds of worsted and hosiery goods are made from them, and each requires a wool of a different length and character. 2. In clothing or carding wool, a disposition to assume a *crumpled or spring-like shape*, is an object of great importance. In the fine short wools every fibre is twisted into numerous minute ringlets or curves. The object of the curder is to break the wool in pieces at these curves, and the body of the cloth is formed by these several curves joined to each other, as they are beaten and driven about. The fineness of the cloth will depend in a great measure on the smallness of the fibre, and still more on the minuteness of the curves. This curling quality, Mr. Luccock states,[1] cannot prevail in too high a degree, in making cloths that require a close and smooth surface: but for cloths where a long and even nap is required, too large a proportion of this curling property would be detrimental. 3. *Pliability* of wool is another important quality to which the attention of the grower should be directed, as, without this property, it will be unfit for the purposes of manufacture. 4. The peculiar property termed the *felting quality*, is of equal importance with either of the preceding; and, though not evident to the eye, is, in fact, indispensably requisite in all wools that are wrought up into such cloths as are submitted to the action of the fulling mill. Mr. Luccock describes it as 'a tendency in the pile, when submitted to a moderate heat, combined with moisture, to cohere together, and form a compact and pliable substance.' The Cheviot, Morf, and Ryeland fleeces possess this quality in the greatest perfection.

The explanation of this felting property is very simple, and there no longer remains the slightest doubt about its truth. The woolly fibre consists of a stem or stalk, from the edges of which proceed certain serrations, resembling leaves. They are more numerous in some wools than in others, and also stronger and more decidedly projecting, and they all take the same direction, from the root to the extremity of the fibre. Almost all the wools have been examined as to this construction of the fibre, and in all of them these serrations have been discovered. They are more numerous and more decidedly projecting in proportion to the felting property of the wool. In the Leicester there were a certain number of them, but the projections were not bold. In the South-down they were more numerous and decided in their formation; and in the Merino they were still further multiplied, and the projections more strongly marked.

Does not the reader at once perceive a simple, but unanswer-

[1] In his valuable treatise on *The Nature and Properties of Wool*, p. 147.

able explanation of the *felting* property of wool? In the carding machine, these little curves are blown and beaten about and entangled with each other—*they are entangled by the curves, and prevented from being disentangled by the serrations.* They are then sent to the fulling-mill, and there beaten into a connected cloth. In proportion to the fineness of the fibres they penetrate in every direction, and the serrations prevent the possibility of retraction. Nothing can be clearer than this. The agriculturist and the manufacturer will, at some future time, properly appreciate this discovery, for he will have that by which he may test every kind of wool, and he can select for breeding those animals that are best adapted for every possible manufacture.

5. A *soft pile* is also an essential requisite to constitute a good fleece. This, doubtless, also depends on the structure of the fibre, and probably on the number of these joints, or their peculiar structure; but there is another, and perhaps more powerful agent, *the yolk*, the substance especially destined by Nature to give its chief softness and pliability to the wool. In this, as well as in other properties already enumerated, the Saxon and the New South Wales wools peculiarly excel; and among the British fleeces those of the Ryeland and the Shetland sheep stand unrivalled in this respect.

6. The *specific gravity*, or relative weight of the pile, is a quality to which the attention of wool-growers has not yet been directed so particularly as the subject requires. It is an important one, for some kinds of wool will produce far more cloth from the same weight than others will; and this is in precise proportion to the lightness of the wool. The farmer is anxious to increase the weight of his fleece without ascertaining whether he is increasing the number of the fibres, or adding to the density of each. In the one case he is benefiting, and in the other materially injuring the manufacturer. In order to ascertain the comparative weight of different samples, Mr. Luccock directs each of them to be brought as nearly as possible to the same degree of purity; to expel all the moisture which wool obstinately retains, and to extract all the air contained in the interstices of the staple.[1]

7. The *smell* of the wool is not a property to which much weight can attach. Pure, perfect, and well-washed wool has no smell; but, before it is thoroughly cleansed, there is a peculiar odour in most wools, that enables the woolstapler to guess at the district whence they come. He who is in the slightest degree master of his trade would, by the smell, select a lamb's fleece from that of either the wether or the ewe.

8. In *colour*, it is essential that wool should, as far as possible, be perfectly white.

[1] Treatise on Wool, p. 173.

9. Another property to which the attention of the growers of wool should be directed, is trueness of hair, or a uniform *regularity of pile*, in which no coarse shaggy hairs are perceptible, for the latter, by reason of their brittle nature, would very materially affect the progress of the manufacturer. Such coarse hairs, as well as *kemps* or *stichel hairs* (which are generally short, brittle, pointed, opaque, and of a gray or brownish cast), are found principally in neglected breeds.

10. Another property, and the last that shall be here mentioned, is that of *soundness*, or uniformly healthy structure of the fibre, in opposition to the withered portions or *breaches* which are to be found in those parts of the wool that protruded from the skin when the animal was labouring under any disease of the integument, or, in fact, serious disease of any part, or when he was exposed to undue cold, or unnecessarily stinted in his food. The examination of a few fibres by the eye, or the drawing them through the fingers, will detect these breaches. In very old, and in poverty-stricken sheep, the greater part, or the whole of the wool, will have a shrivelled appearance, that can generally be detected by the eye, or the finger.

Since the art of combining the properties of the parent sheep in their offspring has been generally known, the expert grower of wool has been enabled to produce great alterations in the relative weight and fineness of the fleece. In countries where wool is the chief object in the breeding and management of sheep, every other consideration is sacrificed to its improvement; but in England, the carcase is generally of greater importance than the fleece, and weight of mutton has of late years been more attended to than fineness of wool. In this, the farmer has doubtless found his account. These are objects that cannot be combined with equal advantage to both, and the consequence has been, that while the size of the principal breeds of our short-wooled sheep, and the weight of the fleece, have been gradually increased, a proportionate change has taken place in the quality of the wool. This fact has been denied by many breeders; but evidence of its truth, and that of a most conclusive nature, was produced before the Committee of the House of Lords.

BOOK THE FIFTH.

ON THE BREEDING, REARING, AND FATTENING OF SWINE.

CHAPTER I.

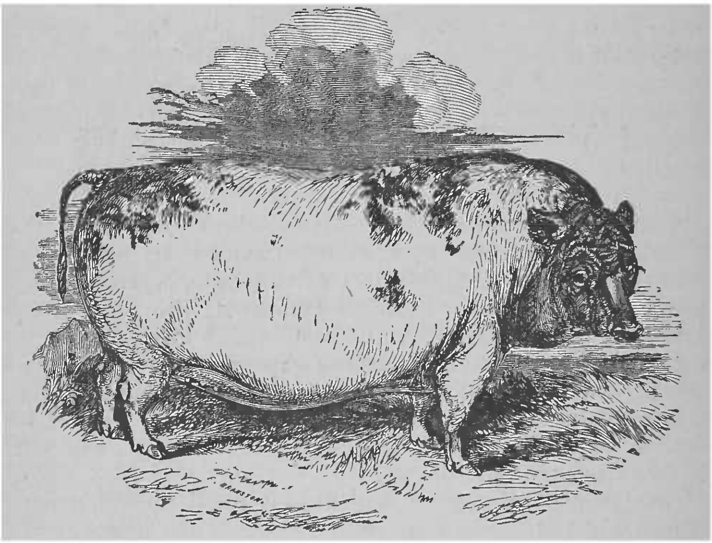
AN INTRODUCTORY AND COMPARATIVE VIEW OF THE DIFFERENT BREEDS OF SWINE.

AMONG the various articles of live stock, few are more profitable to the breeder than swine, provided the number kept is proportionate to the resources of the farm, especially as the attendance they require is, when compared with that of other animals, exceedingly trifling, and the benefit arising from their dung more than counterbalances the expense of such attendance. It is, however, only of late years that farmers have begun to perceive this, and that eminent agriculturists have devoted their attention to the improvement of our breeds of pigs, and consequently of our pork and bacon.

The 'points' of a good hog are—a small muzzle, a narrow forehead, but the cheeks large; the eye quick and bright; the ear short and thin; the neck, from the ears to the shoulders, almost as thick and as broad as the chine, and that continued of an equal breadth nearly to the tail; the belly almost touching the ground from the hind legs to the fore, and thus continued almost to the muzzle; the thighs large both inward and outward, and the division between them large; the legs small and short; the feet firm and sound, the bones small, and the joints fine; the hair long and thin; few bristles, and the skin loose and mellow. On account of the numerous crosses which have taken place of late years, and the variety of appellations bestowed by different breeders on their own peculiar stock of pigs, it is scarcely possible to do more than point out which were the original breeds, and what are and were their distinguishing characteristics.

I. The Chinese Breed (fig. 80) was originally obtained, as its name imports, from China. The cut below given is taken from the portrait of a sow sent from China to William Ogilvy, Esq., Honorary Secretary to the Zoological Society. There are two distinct varieties of the breed, the *white* and the *black*. Both of them are small; and, although of an extraordinary disposition to fatten, will seldom arrive at a greater weight than 28 or 30 stones of 8 lbs., at two years. The former are better shaped than the latter; but they are less hardy and less prolific. They are both very small limbed; round in the carcase; thin skinned; finely bristled; and the head so bedded in the neck that, when

Fig. 80.



CHINESE HOG.

quite fat, little more than the end of the snout is peceptible. They are tender, susceptible of cold, and difficult to rear, and the sows are bad nurses; yet, from their early aptitude to fatten, they are in great esteem with those who rear only young porkers. If fed on farinaceous food, their flesh is very delicate, but it becomes coarse and oleaginous where offal and animal substances are given; it is not adapted for bacon; it is also deficient in lean meat; and their hind quarters being small in proportion to the body they cut up to disadvantage when intended for hams: however, they possess the valuable property of fattening on a comparatively small quantity of food.

There is a *mixed breed* of this kind, arising from some cross; white, yet variously spotted with black; these have erect ears, like the true breed, which they otherwise resemble in form; another variety, having the ears round at the ends, and hanging down, is also occasionally met with. The latter are in every respect coarser than the former; but they are remarkably prolific; good nurses, and will, with proper care, bring up two litters within the year. They are, however, only valuable as breeding sows and roasters, being indifferent store pigs, rarely attaining any great weight, and fattening less kindly than the original stock.

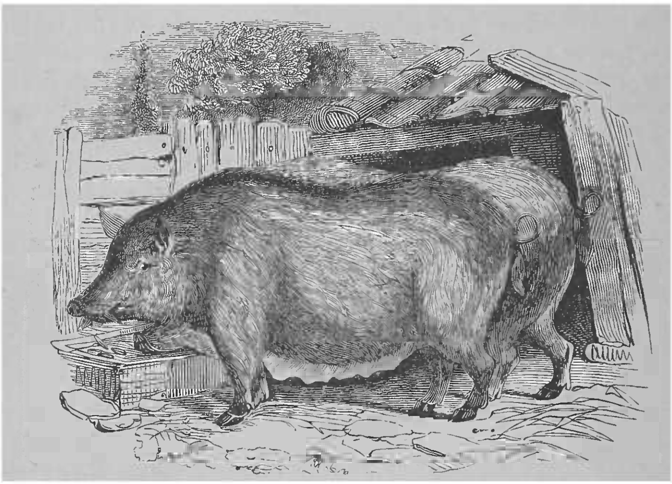
There are several other varieties of the Chinese breed, and numerous crosses of them with our native swine. Most of the varieties have a great aptitude to fatten, and it is on this account that they have spread over a considerable part of the kingdom. Perhaps this disposition to accumulate fat is, to a certain degree, objectionable. They can rarely be used for the purpose of bacon, and they are occasionally too much loaded with fat even for common purposes. Mr. Parkinson, a most valuable writer on live stock, describes a pig of this breed that obtained the prize at one of the Christmas shows, as being 'a perfect bladder filled with hog's lard, and nearly of the same kind and quality. A pork-butcher pronounced him to be the worst pig he ever saw; and that the judges were deceived in supposing it to have little offal, for it was all offal; and, although the bones were small, yet when the fat was cut off, there would be little left but bone.'

Many of the crosses of this pig are, however, truly valuable, especially that between the Berkshire and the Chinese; and there are few of our small breeds that are not, to a greater or less degree, indebted to them for greater compactness of form, and earlier and more decided aptitude to fatten; but they also entail upon their descendants delicacy of constitution, and diminution of number in the farrows.

The Neapolitan Breed has been largely imported into England for the purpose of crossing and improving our original stock. This variety is in itself too delicate to admit of its being extensively kept. It is black, shorter in the body than the Chinese, though much resembling the black Chinese pig; it is better made, more symmetrical, and its snout is more pointed. It has, perhaps, smaller bones in proportion to its size, than any other breed. It fattens quickly and kindly, and the sows are tolerable breeders, but not good mothers. Its value as a means of remedying the defects of our native breeds is too well known to require specification, but, like all other crosses, it must be used judiciously and sparingly.

II. The animals from which the underneath figures (fig. 81) were drawn were bred by the late Sir William Curtis, and exhibited at Lord Somerville's cattle show, in 1807, where they attracted almost universal admiration. They were of the BERKSHIRE BREED, the specific characters of which are a sandy or white colour, with brown or black spots; the sides broad; the body thick, close, and well formed; the legs short; the head well placed; the ears large, and sometimes pendent over the eyes. Another distinctive mark of this breed is, that the best of them are without bristles; and the hair long and curly, and curiously feathered about the ears. The skin is remarkably thin, the flesh well flavoured, and the bacon of a superior quality. The hogs

FIG. 81.



BERKSHIRE BLACK AND WHITE SWINE.

sometimes arrive at a large size, and have been reared to the weight of 113 stones of 8 lbs.[1]

The cut (fig. 82) illustrates a Berkshire black breeding sow.

Although generally termed the Berkshire breed, and having probably been originally reared in that county, these pigs are now dispersed over the whole kingdom. Some of the best are bred in the neighbourhood of Tamworth, in Staffordshire, from the progeny of an animal well known to pig-breeders by the name of the *Tamworth boar*.

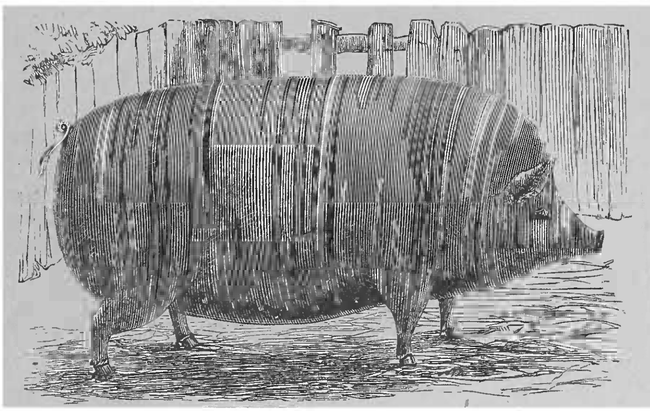
The crosses from this breed are too numerous to be detailed: that with the Chinese and Neapolitan breeds has been generally considered to be most successful where it has not been carried too

[1] See the Agricultural Survey of Sussex, in which two similar instances are recorded, p. 383; and Parkinson on Live Stock, vol. ii. p. 239.

far, so as to produce delicacy of frame. Once in five or six generations will usually be found quite often enough if we would have improvement without accompanying degeneration in hardiness and breeding qualities.

III. The Essex Breed—of a pig of which kind the following is a portrait (fig. 83)—are apparently descended from the Berkshire stock, and may be reckoned among the finest breeds in this country. They are black and white, short-haired, fine-skinned, with smaller heads and ears than the Berkshire, broad and deep in the belly, full in the hind-quarters, and light in the bone and offal. The sows are good breeders, and have litters of from eight to twelve: but they have the character of being bad nurses.

Fig. 82.



BERKSHIRE BLACK BREEDING SOW.

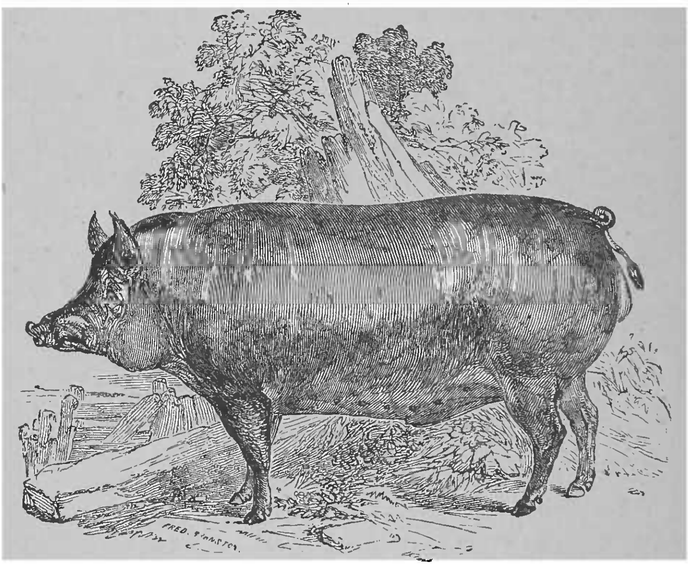
Lord Western describes them as feeding remarkably quick, growing fast, and being of an excellent quality of meat. He considered them as equal to any other breed, upon a fair comparison of age, food, and weight.

The old Essex breed had long and sharp heads; they were roach-backed, high on the leg, and with fat and long carcases. They were quick and greedy feeders. They were far inferior to the variety just described, which has doubtless been produced by judicious crosses with the Berkshire and Neapolitan breeds, and chiefly the latter.

The Sussex Breed are probably a variety of Lord Western's Essex, but some assert that they are the original stock. They are black and white, but sheeted; black at one extremity, and white at the other. These pigs are clean and well-shaped, but their bone is somewhat too large. They are quick feeders, and come early to maturity; but are smaller than the Berkshire, and, when full grown, seldom exceed 18 or 20 stones of 14 lbs.

The SUFFOLK BREED are in great repute with some breeders; some are black and some white. Mr. Stearn, a well-known breeder, says of this breed: 'There is a pig called the improved black Suffolk, which many persons prefer to white, thinking they are more hardy, but I have fairly tested the thing of late (which I suppose most present have been eye-witness to), and proved that the white will exceed the black as far as early maturity is concerned, and of course early maturity is where the profit is gained; and I find the better the quality of breed, the more lucrative it

FIG. 83.



AN ESSEX PIG.

becomes, much less food being required. Now for our white Suffolk breed. In choosing the sow and boar, the chief points are a smallish head, with short snout, wide chaps, the ears rather small and thin, ends sharp, pendulous, and pointing a little forward, broad and deep chest, round ribs, long in the body and short in the leg, the haunch or thigh dropped almost to the hock, back broad, straight or slightly curved, shoulders and hams thick, and the neck to rise well behind the ears, small bones in proportion to the flesh, the hair to be long, thin, and silky, tail small and curled.'

The LEICESTER or DISHLEY BREED, that were at one time as celebrated as any of Mr. Bakewell's stock, are remarkably fine-boned and delicate, and are supposed to be partly descended from crosses of the Berkshire and Chinese. They were certainly carried to great perfection, and possessed considerable weight in a small compass. They were broad over the back, deep on the sides, thick in the shoulders, round in the ribs, full in the hams, and capable of fattening with far less food than the generality of the old breeds. They answered well for pork and small hams.[1]

IV. The WOBURN BREED were a new variety introduced by the Duke of Bedford. They were of various colours, well-formed, hardy, prolific, disposed to fatten, and had attained to nearly twice the weight of other hogs within a given period of time.

In addition to these are the improved *Hampshire*, the specific characters of which are—colour, chiefly white, but some of them spotted; neck and carcase long, and the body longer and flatter than in the Berkshire pigs; fattening kindly to a considerable size and weight, and making excellent bacon.

These have been latterly considerably improved by crosses with the small breeds; the characteristics of the original breed are fast passing away, and a hardy useful animal, which fattens early, and is easily kept in good condition, has been obtained.

The old larger variety, or 'Hampshire Hog,' bred for bacon, occasionally weighed from 600 to 800 lbs., but it required more than usual good feeding in order to bring it to its full growth and weight. Very few of them are now to be met with.

The OLD NORTHAMPTONS were white, with short legs, ears enormously large, often sweeping the ground, the body large, with coarse bone and hair, and many bristles. They fattened to a great size, but not very kindly. The present breed are of a smaller kind, and answer well, particularly in the dairies.

The SHROPSHIRE, which appear to be a variety of the Northampton race, to whose characteristics they bear a great resemblance, fatten to a large size, but are not so kindly disposed as the Berkshire. They are both favourites with the distillers, who seem to require a coarse heavy pig in order to consume their wash and grains with advantage. The breed has been much improved of late years by crosses with the Berkshire, and also with the Chinese, and is now a more compact, better made animal, and fattens at an early age.

The OLD YORKSHIRE are similar in colour to the Berkshire but

[1] See the Agricultural Survey of Leicestershire, p. 295. The measurement of two pigs of this breed was as follows:—

A Boar used for stock.			A Hog not quite fat, but estimated at thirty-one stones.		
Length from nose to rump	5 ft.	4 in.	Length from nose to rump .	5 ft.	0 in.
Girth round the shoulders	5	4	Girth round the belly .	6	9
Thickness at do . .	1	8			

with longer ears and coarser hair. They have long legs, flat sides, and are coarse in the bone. They are also slow feeders; but for the reasons already assigned, they, as well as the Northampton and Shropshire, are in esteem with the distillers; besides, they are quicker feeders than many other breeds.

In the improved breeds of this county we find all the coarser and more ungainly points have disappeared, and a smaller-boned, finer-eared, thinner-skinned animal is produced, which fattens quickly and kindly. Those universal regenerators of the porcine breeds, viz. the Chinese and Neapolitan varieties, have been used here, and so has the Berkshire, and Lord Western's improved Essex.

The LINCOLNSHIRE have well-formed heads and ears of a medium size, which point forwards, and are curled at the tips. They are long and straight from head to tail, of sufficient breadth in the loins, round in the carcase, and deep in the sides; the skin and hair are thin.. The true-bred pigs of this race are white, and disposed to be tender; they reach to fifty stones of imperial weight, and in point of profit may be ranked next to the Berkshire. This breed is also known (with some occasional variation) as belonging to the *Norfolk and Suffolk*.

The CHESHIRE are of various colours, but chiefly marked with broad patches of black, or blue and white. They have large heads, with long pendent ears. These animals are very long in the body, and much too narrow in the loins; curved in the back, and flat-sided; large-boned, and long-legged, with much loose skin, and altogether ill-formed; but they grow to an extraordinary weight, and are one of the largest kinds in the kingdom.

Mr. Culley gives an extraordinary account of one of these pigs. It measured, from the nose to the end of the tail, 3 yards and 8 inches, and was in height 4 feet 5½ inches. It weighed, when alive, 12 cwt. 2 qrs. 10 lbs., and, when killed and dressed, 10 cwt. 3 qrs. 1 lb., or 86 st. 1 lb., and, at the price of 8*d*. per pound, was worth 40*l*. 3*s*. 4*d*.

A smaller and improved breed has latterly been introduced, which is free from all the salient deformities of the old stock, and, although smaller, is a hardy thriving animal; its good qualities have been derived from judicious crosses of the old breed with the Chinese and Berkshire.

It is usual, when enumerating the various breeds of swine, to include the *Rudgwick*, so called from a village in Sussex, in the neighbourhood of Slinfold. They were one of the largest and oldest breeds that the kingdom contained, and yielded a great quantity of excellent meat, but they were slow in fattening. They are now, however, scarcely known, even in the village whence they derived their name.

The pig was much undervalued in *Scotland* until within the last half-century, and is now far from being a profitable animal in many of the lowland districts. He was originally of a dirty white colour, the carcase light and narrow, and the legs much too long; but he has been considerably improved by crosses with the Chinese and Berkshire breeds; not that the Chinese cross answers if repeated often, as it renders the animal too delicate. Dr. Walker mentions a native breed in the Hebrides, small, dark, and wild, grazing on the hills like sheep all the year round, unsheltered, and without any food but roots and herbage. They are in the best condition in the autumn. Being killed in their wild state, they afford a considerable quantity of good meat; or being driven into the lower parts of the country, they grow to a considerable size and fatten quickly. Almost every variety of our English breeds of pigs are, however, now to be found in Scotland, and numbers bred in England are fattened there every year.

The WELSH hog is a large animal, big-boned, with coarse bristles and long flopping ears. They fatten well, but not quickly, and they consume an immense quantity of food, so much, indeed, as to render them very unprofitable as stock. There is a variety arising from a cross with the Berkshire which comes earlier to maturity, attains to as large a size, and fattens with less difficulty. but many think the flesh not so firm or well flavoured, and it certainly is not so lean as that of the old variety.

The IRISH pig was formerly a very inferior and unprofitable animal, long-legged and thin-sided, with little disposition to fatten; the colour a dirty white, or spotted black and white, and with long slouching ears covering the sides of the face. It has, however, been very much improved of late years by admixture with the Berkshire and Chinese breeds; and a considerable quantity of pork and bacon, some of it, however, still coarse and not well cured, is annually exported.

Each of the breeds we have mentioned has its advocates; but, as their respective value does not depend on soil or situation, these differences of opinion can only be ascribed to the want of sufficient comparative experiments, or to prejudice. A very competent, and apparently a very candid, judge of the merits of the principal kinds, gives it as his decided opinion that the Berkshire rough-haired, feather-eared, curled pigs, are superior in form and flesh to all others.[1]

His opinion of the relative merits of the Berkshire and Chinese pigs must have been based on fair experiments and due consideration of their respective value; for he mentions having fattened a Chinese sow to the weight of 40 stones of 14 lbs., at

[1] Mr. R. Parkinson, Treatise on Live Stock, vol. ii. p. 263.

three-and-a-half years old;[1] and the quality of the bacon, of each kind, fatted and cured, was decided by a party of gentlemen at Lord Conyngham's table, in favour of the Berkshire. In this we unhesitatingly coincide; but we are inclined to think that the improved Essex breed may fairly compete with either, for it can be brought earlier to maturity by three or four months, it makes finer and more delicate pork, especially for pickling, good bacon and hams, and the sows are good breeders.

CHAPTER II.

ON THE BREEDING AND REARING OF PIGS.

SWINE are capable of propagation at the age of eight or nine months; but the boar should be at least twelve months old before he is admitted to the sow, which would also farrow a stronger and better litter if she were kept to the same age. The period of gestation is from seventeen to twenty weeks,[2] when from five to ten or more pigs are produced. One boar should on no account be allowed to serve more than ten sows; and those sows are reckoned the best for breeding strong pigs that have at least ten or twelve teats.

Where swine are kept solely for the purpose of *breeding*, it is necessary to pay the same attention to the principle of selection as in other articles of live stock. Hence, whatever sort may be required, the boar and sow should be chosen as perfect in symmetry and in all other requisites as may be practicable. The value of the progeny will mainly depend on the qualities of the sire and dam, and stock can never be raised with so much profit from inferior as from superior animals. They should also be well kept; but, as with other cattle, care must be taken that the sows, when expected to be placed with the boar, are not too fat, experience having shown that, if they are in very high condition, they will seldom produce a considerable litter of pigs.

[1] The height of this pig was 2 ft. 3 in.

	ft.	in.
Length	4	11
Breadth across the loins	2	0
Girth	9	10

[2] According to M. Teissier's observations on the gestation of animals, already alluded to in our preceding remarks on the other kinds, the extreme periods of gestation in 25 sows were 109 and 143 days.

From the whole of his observations, M. Teissier infers that the period of gestation is extremely variable in every species; and that its prolongation does not seem to depend either upon the age or constitution of the female, or upon the diet, breed, or season, or, in short, upon any known cause.

As most sows will produce two litters in the year, the breeder will find it beneficial so to arrange each time of farrowing that it may take place about the latter end of March or early in April, and towards the beginning or end of August; he will thus be enabled to rear his pigs at less cost, and certainly with less probability of losing them from cold, than if the second lot had been produced later in autumn. While the sows are in pig, they will require to be kept on nutritious food, in order that they may be got in good heart at the time of farrowing; but they should by no means be allowed to get fat, and, after they have littered, it is absolutely necessary that they be regularly and liberally fed. If the young pigs are deprived of their proper nourishment while suckling, they will never reach the weight they would otherwise attain. They should also be kept well littered and clean. Too much litter should not be allowed at the time of pigging, lest the sows should overlay their young, during the first week.[1] At the end of a week or ten days after having farrowed, the little pigs may be let out of their styes into their yard, for three or four hours during the middle of the day, and the sow should, before this, be allowed, if possible, exercise and fresh air for an hour or two each day. This will be far preferable to total confinement.

It sometimes happens, at the first farrowing, that young sows devour their progeny. In order to prevent this, they should not only be narrowly watched, but also well supplied with food for two or three days before the expected time arrives. Some persons are accustomed to wash the backs of newly-farrowed pigs with a sponge dipped in a lukewarm infusion of aloes and water, in order to prevent the sow from destroying her young ones. We have not much faith in this, and should not be disposed to run the risk of disgusting the mother with her offspring. If several sows farrow at the same time, they should be confined in separate pens or styes, otherwise they will be liable to lie upon, and so destroy, the young. The sows should be supplied with plenty of water at this time, which will render them better satisfied and quiet, and less disposed to do mischief. While the sow is suckling she should have extra food.

The best time for killing *sucking pigs* is when they are about eighteen or twenty days old. By this time the others will be able to follow the sow. The males may then be castrated, and the spaying of the females deferred for another week.

When it is proposed to wean the pigs (the proper age for which purpose is two months), they should not be taken from the mother suddenly, but gradually separated from her an increasing number

[1] In order to prevent such accidents, an open frame is sometimes placed on each side of the sow, under which the young pigs can run, and thus escape the danger. A strong rail, elevated a few inches from the ground, will answer the same purpose.

of hours each day, and thus starved into eating. They may be put into styes, purposely prepared for them, and having a small yard in which they may run; and both the yard and the stye must be kept perfectly clean and well littered.

Their food should be good, and they should have as much as they will eat. Boiled potatoes for a fortnight, and then raw food, will prove useful, with one feed of bruised oats every day, for a month; and, afterwards, pea or bean, barley or oat meal; unless there is a dairy, in which case skim-milk or whey may be substituted until the clover-field is ready for them, which will be in the beginning of May. If the pigs are three months old, they will thrive well on that food. Lettuce and cabbage, especially if boiled, have also been found very serviceable, the former not only on account of the succulence of the plant, but from its promoting an inclination to sleep, which is of considerable importance to the growth of young animals.

In the rearing of pigs, no kind of food can bear comparison with milk, or butter-milk. During the weaning, especial care should be taken to supply them with plenty of sweet straw, and to keep the pigs in as clean a state as possible. This is a circumstance of so much consequence, that the want of it cannot be compensated by the most plentiful allowance of food.

In the management of swine, of whatever breed or variety they may be, it will be proper to have them *well ringed*, in order to prevent them from breaking into the corn-fields during harvest; and that operation should be performed as early as possible. Mr. Tubb advises, instead of ringing, the shaving or paring off, with a razor or sharp knife, the gristles on the top of the noses of the young pigs. The wound soon heals over, and they are thus rendered incapable of that destructive rooting, or turning up of the ground, which farmers find so detrimental to sward land.

Sows may be allowed to breed until they are six years old; and they will breed even longer, but it is better that they should not; and the boar may be used until he has passed his fourth year, but not longer, or his flesh acquires a rank unpalatable flavour. After that time, the former may be spayed and put up to fatten, and the latter castrated. Although they are no longer fit for breeding, their flesh will make excellent bacon.

In *buying and selling swine*, both in a *fat* and *lean* state, it has been calculated that every 20 lbs. of live weight will, when killed, produce from 12 to 14, the advantage being in favour of large hogs; so that, if a farmer or breeder weighs the animals while alive, he will be enabled to calculate the net profitable weight when dead. By weighing the hogs every week, he may also judge of the best time for disposing of them to advantage; for, as soon as an animal ceases to acquire that daily increase which makes it beneficial to feed him, the best step that can be taken is to sell or slaughter him without further delay.

With regard to the buying of hogs in a *lean* state, as open markets seldom afford the means of weighing, and the purchaser is compelled to rely on the accuracy of his eye, he should have been in the frequent habit of weighing live pigs of various sizes at home. This will enable him to decide in the market with some precision, and, consequently, to offer a proper price.

CHAPTER III.

ON THE FEEDING AND FATTENING OF SWINE.

WHEN permitted to wander unrestrained, swine devour in marshy and miry grounds, fern, frogs, sedge, &c.; but, in drier spots, they feed on slows, crabs, hips, haws, chestnuts, acorns, beech-mast, and similar wild fruit. In the domestic management of these animals, however, the quality and supply of their food is regulated by their age and other circumstances, and particularly whether they are sows in pig, store pigs, or fatting hogs.

1. With regard to *sows in pig*, it is obvious that they should be better fed than either of the two following classes, in order that they may be enabled to supply their young ones with the necessary quantity of milk; but while care is thus taken to keep them in good condition, equal caution is necessary that they do not become too fat. For those that litter in the spring, tares and cabbages, combined with the butter-milk and wash of the house and dairy, may be employed with advantage; or, if the supply from the dairy is not adequate to the demand, a wash may be prepared with oat, barley, or pea meal. For those who litter in autumn, lettuces have been found wholesome and nutritive, in addition to the wash; and in the winter season, potatoes, Swedish turnips, parsnips, and other roots, previously prepared by boiling, should be added.

2. The *young pigs*, after being weaned, may be fed in the same manner as the sows; but the addition of pea-soup, made by boiling a bushel and a half of peas in about 60 gallons of water until they are thoroughly broken and dissolved, and either given alone or mixed with the butter-milk or whey, will very materially improve their condition. No species of food has been found more fattening than barleymeal, especially when combined with skimmed milk. It is also an excellent addition to steamed potatoes. Whatever may be the food, young pigs should be kept

warm, for they never grow or thrive well when exposed to cold. An intelligent farmer in North Britain, who keeps from five to seven breeding swine, disposes of most of his produce when from six weeks to three months old, considering this system fully as profitable as fattening them for sale. At these ages he generally has a good demand for them, as many persons, such as tradesmen, villagers, &c., wish to fatten a pig, who could not conveniently keep a breeding sow. Having this advantage, there is scarcely a *cottager* or *weaver's* FAMILY in the neighbourhood, which has not its fat pig, weighing, after being fed on the refuse of the potatoes and the offal of the kitchen, from 8 to 12 stones.[1] In the vicinity of large towns, and particularly where there is the advantage of a dairy, it will be found more profitable to keep them until about four months old, and then to sell them fat as porkers, unless they have been farrowed so early in the spring that they become fit for the butcher in the heat of summer, at which time pork is not usually saleable.

3. *Store pigs* are those that have attained nearly half their growth, and should be separated from others some time in May, when they may be turned out upon the artificial grasses. Here they are to continue till Michaelmas; but, in order that this system of management may be attended with due effect, it is necessary that all the fences be in excellent repair, and that there be a pond in the field to supply the animals with water. A large number of swine may be thus kept, and they generally pay a fair price for their food; but, with all the advantages of this system, that of soiling swine in the yards will usually be found most profitable, notwithstanding the expense is greatly increased, and some portion of food will be necessarily wasted. By being kept quiet and prevented from rambling, they thrive faster than in the field, and the manure is more valuable. The proper vegetable crops for this purpose are lucerne, chicory, clover,[2] tares, and other green meat. In order to carry on this system with effect, an ample supply of litter, together with sand and peat, or earth, should always be laid on the ground for the purpose of absorbing the urine.

For the winter keep of store-swine various roots are useful, such as turnips and potatoes, which require to be boiled; but Swedish turnips, cabbages, carrots, mangel-wurtzel, and parsnips may be given in a raw state. Potatoes, when given alone, should be *steamed*; but it has been found more advantageous to give them in conjunction with turnips, in which case the latter are *boiled*. The liquor from potatoes should never be given.

[1] Sir John Sinclair's System of Husbandry pursued in Scotland, vol. i. p. 149.

[2] Where *cottagers* have gardens and keep pigs, it would be profitable if they had a small spot of clover in their gardens to cut for them.

It may be scarcely necessary to add, that the Swedish turnip is preferable to the white, whether boiled or raw.

With regard to the soiling of pigs, Sir John Sinclair has noticed a discovery of considerable moment, viz., that they may be soiled on *cut green beans* with great profit, and are ravenously fond of them. The Windsor sort is preferred, and the beans should be planted at three different times for the sake of regular succession. The feeding may commence in the beginning of July, and terminate about the end of September. When pork is worth $7\frac{1}{4}d.$ per lb., the profit, besides a quantity of most valuable manure, is calculated at $10l.$ per acre.[1]

4. The business of *fattening hogs* is generally performed in February or March, or in the month of October. For *pork*, they are usually fattened from six to nine months old; for *bacon*, from nine months to a year and a half; and store-swine to the same period, or very rarely beyond two years: the latter, however, is the preferable age for substantial bacon for farmer's use, and for which purpose the hog should be made perfectly fat. For porkers, butter-milk, whey, and barley-meal are preferable; for bacon hogs, equal parts of fresh pollard and pea-meal have been recommended. White peas are much better calculated than beans either for feeding or fattening swine. These animals not only fatten more kindly when fed with peas, but their flesh *plumps* in boiling, and has a good flavour; while that of swine fattened on beans will shrink in the pot, the fat will boil away, and the flavour of the meat will be injured.

The proportion of peas requisite to fatten a hog varies according to size, breed, and kindliness of disposition to fatten; but, generally speaking, a hog in good condition when put up, and intended to be fattened to twenty score, will consume six or seven Winchester bushels of peas. They are generally given raw; but some experiments tend to show that they might be more advantageously used for porkers when boiled to the consistence of thick soup.

Indian-corn ground, barley, oat and pea meal, Swedes, parsnips, mangel-wurtzel, carrots and kohl rabi, flax-seed, green tares and clover, beans and maize, are some of the best and most nutritious matters which can be used in fattening swine. Roots and vegetables should be given cooked, as numerous experiments tend to prove that they are more nutritious and digestible so than when given raw. Indeed, pigs fatten better and thrive quicker on cooked food of all kinds than they do on raw. The refuse wash and grains of breweries and distilleries likewise furnish a wholesome and useful article in the feeding and fattening of swine; and refuse of starch manufactories may be also employed with great

[1] Sir John Sinclair on Scottish Husbandry, vol. ii. p. 18.

advantage for the same purpose. For the general stock of hogs, during the month of October and part of November, cabbages are of considerable use. Swine are often very cheap at that period; and in such case it is of material consequence that the farmer be amply supplied with an article of food by means of which he can keep his stock for a better market. In point of fact, without a provision of cabbages or roots, it will be impossible to keep large stocks of store swine to the best advantage.

The time which is requisite for fattening may, upon an average, be computed at from five or six weeks to two or three months. The latter period will, in most cases, be found fully adequate for the purpose, though the length of time is necessarily regulated by their kindliness of disposition to take on fat, the relative goodness of their condition when first put up to fatten, and the quality of the food. On the latter subject more experiments have been tried on pigs than on any other animal, from an idea that, in consequence of their extraordinary voracity, they will fatten on anything. It is true that they will grow with any kind of garbage that fills their stomachs, and that they will even put on a certain quantity of flesh when fed solely on potatoes; but good firm bacon is only to be made by means of sound corn and pulse, and in exact proportion to the nutritive quality of the food will be the weight and value of the meat.

Whatever system of fattening swine may be adopted, it is of essential consequence that they be kept warm and clean, especially in cold and damp weather, and that they also be supplied with plenty of litter, the cost of which will be amply repaid by the increased proportion of excellent dung thereby obtained. It has been frequently asserted that swine thrive better while fattening, if they are allowed to wallow at home in their own filth, or abroad in mud and wet. Because these are their ordinary habits, it is assumed that they must promote their condition. Such an assumption, however, is the offspring of theory, and not the result of experience.

In addition to some remarks that will be subsequently offered on the structure and situation of the piggery, it may here be stated, particularly in connection with the fattening of swine, that a hog-stye should be built, if such a situation can be commanded, with the advantage of running water, so as to admit sufficient for the swine to drink, and the floor or ground should always be laid upon a gentle declivity to carry off their urine to the dung-heap.

Not only, however, should these animals be kept warm and dry while fattening, but they should also be confined, if possible, by themselves; or, at all events, there should be as small a number in the same stye, and as much out of the hearing of the cry or grunt of other hogs, as practicable. By these means they will be enabled to take more frequent and uninterrupted repose, which greatly contributes to promote their fattening. In addition to which, those inconveniences will be effectually obviated which often occur from hogs worrying each other, and from the weaker being deprived by the stronger of their fair proportion of food.

Regularity of feeding should likewise be especially regarded, as it has great influence in facilitating or retarding the fattening of swine; hence it will be proper to give them a full allowance of food three or four times, or at certain other stated intervals in the day, as convenience or other circumstances may allow. If any animal should have surfeited itself by eating too large a proportion of food, it will be advisable to administer half an ounce of flour of sulphur in some wash once or twice in the course of the day, and on two or three successive days. By this simple remedy their palled appetite will be restored more effectually than by administering antimony, or any other drug, the use of which has been recommended in fattening swine.

A practice has been introduced in the county of Essex, though yet not generally followed, of fattening pigs in separate stalls. These are so constructed as to admit only one pig each, and just allowing room for him to lie down, but not to turn. They are built with the bottoms on a sloping direction to carry off the filth; and some persons do not allow any litter, from a foolish idea that their masticating it might be prejudicial to their thriving.

The food given is usually barley and pea meal, and water or whey, and they are said to fatten far better in these styes than in the common ones: this is attributed to their being more quiet, and having only to eat and to sleep. Instances have occurred in which a hog half fat, when put into one of these cages, has gained fifteen pounds a week in flesh.[1]

This experiment was also tried with success by Lord Egremont, in Sussex. A hog was confined, on March 4th, in a cage made of planks, of which one side was contrived to move with pegs, so as exactly to fit the animal, with small holes at the bottom for the water to drain, and a door behind to remove the dung. The cage stood about one foot from the ground, and was made to confine the animal so closely, that he could only stand up to feed and lie down upon his belly. The sliding partition was extended accordingly as he increased in size.

This hog, when put up, weighed 11 stones 2 lbs. (8 lbs. to the stone), and was killed on April 13th following, when he weighed 18 stones 3 lbs., having gained 7 stones 2 lbs., live

[1] Young's Agricultural Survey of Essex, vol. ii. p. 343.

weight, in five weeks and five days. His food consisted of 2 bushels of barley-meal and about 8 bushels of potatoes. He was sulky during the first two days, and would not eat. The most interesting part of this experiment, however, is, that seven other hogs of the same breed were put up in the common mode, and killed at the same time, and, though better fed, were not in equal condition.[1]

Mr. Stearn, a well-known and most successful breeder of pigs, read a paper before the 'Framlingham Farmers' Club,' in which there is much that is valuable; the following is upon the feeding of the pigs: 'I begin to feed the young pigs at five or six days old, with warm milk mixed with a little very fine sharps, and a small quantity of whole maize, out of troughs like some I will show you presently. For the first few weeks after being weaned I have the boy feed them very often, but give them a very little food at a time, so they will clear the troughs out. In the winter I feed all with warm food, but not in the summer. I give them a great variety of meal, such as wheat, maize, barley, oats, and whatever is most convenient to mix together. I just wet it with cold water, and then scald it with boiling water, and sprinkle it with salt; between meals I give them whole maize, and mangel-wurzel or swedes cut small; and once or twice a day a little coal, but not too much, as it will be likely to do them harm. I allow them plenty of clean water; and there is one thing I am very particular about, not to give them any more food than they will clear up at a time. When pigs are put up fatting, it will be found very beneficial to wash them, at least once a week; this is quickly done by experienced hands, and will amply repay any-one for the trouble. I also like to have them very often brushed. If you will only try the experiment between this and the common mode of treatment you will be surprised at the difference. Store pigs ought to have their liberty as far as convenient—such as to range in large yards in winter, and the run of a piece of pasture in the summer. They should also be fed two or three times a-day. Good-bred and well-fed store pigs will always consume the refuse from the farm and dairy, when a bad-bred one will refuse. I have never known mine refuse anything in the way of pig food yet that was offered them, not even the prize animals. In my opinion the generality of pig-troughs are very badly constructed, so as to waste a great deal of the food, and soil it, by allowing the pigs to get their forefeet in. I have tried a great many different sorts, and find those I have brought here to-night to be the best kind I have seen, to prevent both spoiling and soiling; they are called the light iron Norfolk troughs. They cannot be

[1] Agricultural Survey of Sussex, p. 386.

too flat, according to the size of the pigs, to prevent their getting deformed. Their shape is very often injured through not using a suitable trough. I have a great many different sizes, and use them to suit the animal.'

CHAPTER IV.

ON CURING PORK AND BACON.

HAVING thus given a few directions that will assist the breeder in forming an estimate of the progress made by his hogs in fattening, and the most proper time to dispose of them with benefit, we shall conclude this Book with some remarks on the best modes of converting their flesh into *bacon* and *pork*.

In Hampshire, Berkshire, and some of the adjoining counties, after a hog is killed, the first process is to *swale* him, or singe off the hairs by kindling a fire of wheat or rye straw round the dead animal, taking care that there is an equal layer of the straw, and that one part shall not burn longer or more fiercely than the others. This done, the process of scraping commences, and the carcase is doused with lukewarm water to cleanse it from dirt, hair, &c. The animal is then cut up, and the pieces are laid in a tub or trough, containing a strong solution of salt and saltpetre, where they continue from three weeks to a month, in proportion to their size, and are frequently turned and well rubbed with salt during that period. Thence they are taken out, and either suspended in the chimney, over a wood or turf fire, or in regular curing-houses constructed for the purpose, until they are perfectly dried. In the county of Kent they are dried before a slack fire, which operation requires a similar period of time with that employed in salting; and in each of the respective counties they are hung up, or deposited on racks, until they are needed for domestic consumption.

Somersetshire or *Wiltshire bacon*, which is the most esteemed in the whole of England, used to be prepared and cured in the following manner:—When a hog is killed, the sides are laid in large wooden troughs, sprinkled over with bay salt, and left unmoved for four-and-twenty hours, in order to drain off the blood and superfluous juices. After this they are taken out, wiped thoroughly dry, and some fresh bay salt, previously heated on an iron pan, rubbed into the flesh until it has absorbed a sufficient quantity. This rubbing is continued during four successive days, the sides, or *flitches*, as they are usually called, being turned every second day. Where large hogs are killed, it becomes necessary to keep the flitches in brine for three weeks, and in the interval to turn them on the alternate days, after which period they are taken out, and dried in the common way.

In Yorkshire, and particularly in those parts whence the York bacon comes, the following is the practice adopted:—After the pig has been killed it is hung up for four-and-twenty hours; it is then cut up, and a mixture, composed of about a pound of saltpetre and two stones of common salt, well rubbed into the flitches and hams, which are then laid in a pickling tub. Here they remain a fortnight, and are then turned, and about half a stone more salt well rubbed in. They are again left for another fortnight, after the expiration of which time they are taken out, and hung up in the kitchen to dry, a process which takes about two months. When dry, the inner side is washed over with quick-lime to preserve the meat from being injured by the fly, and they are stored up for use in a dry cool chamber.[1]

The *hams* of hogs are likewise converted into a favourite article of food. In the county of Westmoreland, which also is celebrated for the flavour of its hams, the following method used to prevail:—First, they were thoroughly rubbed, usually with bay salt alone; after which they were, by some curers, covered closely up, while others left them on a stone bench for the purpose of draining off the brine. At the expiration of three or four days this friction was repeated with equal diligence, but the bay salt was then combined with somewhat more than an ounce of saltpetre to each ham. Saltpetre requires to be used very sparingly; its chief use being to give the red colour to the ham; but too much of it makes the flesh hard and dry, and does away with the tender, juicy parts. We have almost wholly discarded its use; and the hams we cure will stand comparison with many. They were next suffered to lie for about a week, either in hogsheads among the brine, or on stone benches; after which they were hung up in the chimney to dry. In this last part of the process there is a difference of practice. By some they are so suspended that they will be dried solely by the heat arising from the fire below, and without being exposed to the smoke; by others they are hung up in the middle of the smoke, whether this arises from coals or peat. If not previously sold, they are suffered to continue there until the weather becomes warm, when they are packed up with straw or oat chaff, and sent to the respective places of sale.[2] In Spain and Portugal, and now in many parts of this country—where the practice is happily on the increase—where the hams are remarkably

[1] Youatt on the Pig, p. 150.
[2] Report of the Agriculture of Westmoreland, 8vo. edit.

fine-flavoured, a large quantity of sugar is used with the saltpetre in curing them. This materially assists in the preservation of the flesh, and renders it peculiarly mellow. Sugar is there also very generally put into the water in which they are boiled, and is found to make them more tender. The smoked flavour, which many consider an improvement, may be imparted by rubbing the meat with *pyroligneous acid*, which is also a great preservation from putrefaction. A still more decided 'smack' of the smoke flavour can be and is said to be given by some curers, by the use of a preparation of creasote or oil of tar. But it need scarcely be said that both of these applications require to be used with judgment. Some hams are almost uneatable from the high flavour they have of one or other of them. As a rule they are better dispensed with than adopted.

Another mode of curing or preserving the flesh of swine is, by salting it down for *pork*. The tedious and common process by which such pork is cured being sufficiently known, we shall state the following simple method, which has been employed on the Continent with much success, and which is the more valuable as it may be advantageously applied to *mutton* and *beef*. First, let 2 ozs. of saltpetre, $1\frac{1}{2}$ lbs. of refined sugar, and 4 lbs. of common salt, be boiled over a gentle fire, in 2 gallons of pure spring water, and the impurities that may rise to the surface be carefully skimmed off. When the brine is cold, it should be poured over the meat, so as to cover every part. For *young pork* this immersion should continue three or four days: older pork will require one, two or three days more, according to its age. That which is intended to be dried for hams, should remain in it a fortnight before it is suspended in the chimney. At the expiration of that time, the hams must be rubbed with bran, and covered with tea bags, to prevent them from being fly-blown. It should be observed, that in warm weather the blood must be drained from the meat, and the meat then well rubbed with finely-powdered salt and saltpetre, previously to pouring the liquid over it; and, although the preparation of such brine may, at first sight, appear more expensive than what is prepared in the common way, yet it deserves a preference, as it may be used a second time with advantage, if it is boiled and a proportionate addition made of water and other ingredients.

BOOK THE SIXTH.

ON THE DISEASES OF CATTLE.

CHAPTER I.

THE DISEASES INCIDENT TO CATTLE.

THE brute creation are, in general, liable to fewer maladies or complaints than human beings, and, as their diseases are less complicated, they are more easily relieved; yet, among the various phenomena in the history of man, it is not the least singular, that the treatment of sick cattle was, until lately, confided to ignorant and illiterate persons, equally unacquainted with the structure of the animal, and the real powers of different medicines. Hence many thousands of valuable animals have perished for want of that assistance which attentive observation, aided by veterinary skill, might have afforded.

The maladies to which cattle are liable are various; and although constant and careful attention to diet, ventilation, cleanliness, and general management will greatly contribute to the prevention of disease, it frequently happens that, either from the effects of our variable climate, or from causes which all the vigilance of the farmer cannot possibly control, they rapidly sicken and die. It would greatly swell the limits of the present work, were we to enumerate every malady incident to CATTLE; we shall, therefore, confine our attention to a few of those that are of most common occurrence, and for the rest we can with confidence refer the farmer to the later editions of Clater's useful work on the Diseases of Cattle[1]—the result of forty years' experience and practice. It cannot, however, be sufficiently impressed upon the owner of cattle, that in all sudden and serious cases, he will best consult his real interests by promptly

[1] Clater's Every Man his own Cattle Doctor, 10th ed. revised by Mr. Mayhew, V.S., and the previous editions by the late W. Youatt and by Mr. W. Spooner, V. S.

summoning the aid of some experienced veterinary practitioner. The advice conveyed in the proverb is worth remembering by the grazier, that 'he who is his own lawyer has a fool for his client.' Medical experiments and surgical operations are, so to say, sharp-edged tools, dangerous to play with. The attention which is now paid, at all the different colleges, to the diseases of every kind of domesticated animal, will place properly qualified ordinary veterinary surgeons within his reach on whom he may confidently depend.

Colds are of frequent occurrence in the rearing of numerous animals, and are too well known to require any minute description. In these affections, as in every other malady, prevention is better than cure; it will, therefore, be advisable to preserve the cattle from undue exposure to sudden blasts of wind, particularly from the north-east, and not to suffer them to lie in wet pastures, especially in those seasons when fogs are prevalent. By chilling the surface of the body, an undue determination of blood to some internal organ is caused, which not unfrequently terminates in acute inflammation. We have elsewhere pointed out that the way in which some expose their live stock to the most inclement weather is not only cruel but it is costly. One half of the diseases of farm stock have their origin in exposure of this kind, and through neglect in feeding with good food, plenty of it, and given at regular intervals. By attending to these points, and looking after the quality of the water they drink—a most vital point—the cleanly condition of their coats, and of the vessels they get their food in; together with occasional doses of simple aperients to 'keep their bowels right,' few animals would be taken ill in the farm.

The lungs and bowels are more liable to suffer from cold and wet than any other parts of the body, and hence it is that diseases of these organs so frequently occur. When the cold becomes confirmed, or settles on some internal part of the body, the affected cattle may be easily discovered by the hollowness of their flanks, the roughness of their coats, the running or weeping of their eyes, and the heat of the muzzle and breath. Colds chiefly prevail among the brute creation, as among mankind, in those springs that follow mild winters; and as they become contagious if long neglected, the diseased animals should, as early as possible, be separated from the rest of the herd. If there is considerable coughing and much fever, the animal should be placed in some comfortable, yet well-ventilated stable or cow-house. The warmth will be grateful and useful; but there must be no accumulation of vitiated and poisonous air.

A warm mash or two, or some gruel, together with a gentle laxative consisting of a pound of Epsom salts,[1] and a drachm of

[1] The Epsom will always be preferable to the Glauber's salts. They are more to be depended on, and they will dissolve in a considerably less quantity of water.

ginger, dissolved in three pints of gruel, will, in the early stage of disease, generally set all right.

Should, however, symptoms of fever remain, or considerable cough or heaving of the flanks, or heat of the roots of the horns, blood should be withdrawn. The quantity should generally vary from two to three quarts—the physic, if apparently needful, being afterwards repeated. If the first dose has not discharged its duty, a second but milder one—half of the former ingredients—should be given. Should the fever increase, and the disease evidently progress, febrifuge medicines should be administered. Those on which most dependence can be placed are, digitalis (foxglove), emetic tartar, and nitre, which should be given in doses of one drachm of the first, two of the second, and three of the third, morning and night in gruel.

There is one circumstance with regard to the administration of drenches, that cannot be too earnestly pressed on the attention of him who has to do with cattle. The medicine, according to the manner in which it is administered, will either fall into the first stomach, or the paunch; or, like the food that has been ruminated and reduced to a pulp, pass into the fourth or true digestive stomach. If it is poured down all at once, it will by its weight, and the force it has acquired in its descent, force asunder the closed entrance into the paunch, and fall into that stomach, and there it will remain and be lost as to any useful purpose. If it is administered gradually, and scarcely acts upon this closed entrance into the paunch by its natural weight, or its acquired momentum, it will flow on into the true stomach, and thence into the intestines, and do its duty.

If the animal does not speedily amend, *inflammation of the lungs* is at no great distance, or perhaps has commenced. The head is projected forward, or it unnaturally droops. The cough is frequent, the ears and feet are cold, and the animal will not lie down. If there still remains much fever, bleeding must be renewed, and until the pulse falters; but where the patient is already very weak, to bleed him will be still further to debilitate him. The Epsom salts (with ginger) must be repeated if the animal is not decidedly purging, and setons must be inserted in the dewlap.

Perhaps *pleurisy*, inflammation of the membrane covering the lungs, has succeeded instead of pneumonia. This would generally be shown by some very peculiar symptoms, viz. a tenderness of the sides, a peculiar twitching of the skin covering them, a trembling of the shoulders and the upper part of the chest, and a low, short, painful cough. The treatment would not materially differ from that in inflammation of the lungs, except that perhaps an equal quantity of the common liquid turpentine might be substituted for the nitre as a stronger diuretic, and more likely to prevent that accumulation of water in the chest which accompanies pleurisy.

Neglected cough has too often a most fatal termination. Long-continued or neglected catarrh is followed by—

Pleuro-pneumonia, and it is scarcely credible how many oxen, and more particularly dairy cows, are the victims of this disease. The loud cough has gone, but soon afterwards a short husky one succeeds, which gradually increases in frequency; at first, few symptoms of disease are apparent, but gradually the appetite fails, the respiration becomes quick and uneven, the pulse rises, the animal temperature diminishes, rumination is suspended, and the secretions are diminished.

Bleeding and purgatives and tonics may be administered by the grazier, but we should strongly recommend him to send at once for the 'Vet.,' as the Veterinary Surgeon seems to be everywhere designated, for bleeding. A simple purgative is never out of place, and this, with attention to diet, and keeping the animal warm, is all that should be done till the 'Vet.' arrives.

Colic.—Cattle are exposed to two varieties of this disease. The first is *flatulent colic.* The animal is continually lying down and getting up, moaning, and striking at his belly. There is also an occasional discharge of gas from the mouth and from the anus. A drench composed of two drachms of powdered ginger and caraways, with two quarts of warm gruel, will generally give relief. The animal should be walked about, but not cruelly worried by dogs. A second dose should, if necessary, be given in the course of an hour; and if no relief is then obtained, an ounce of aloes, dissolved in warm water, and to which half a drachm of the essence of peppermint is added, should be administered. Cold water should be carefully avoided, and warm mashes and gruel placed before the animal. In desperate cases the paunch may be punctured at the left flank. In *spasmodic colic* there is the same lying down and getting up, and moaning, and striking at the belly; but there is not so great a discharge of gas, and there is some intermission between the spasms. The only difference of treatment should be that bleeding should be practised in every obstinate case.

Foul in the foot.—This disease affects the feet of cattle chiefly in consequence of hard driving, or where they travel through much dirt. It is generally caused by gravel, or some other hard substance, getting between the claws. The part affected must be well washed, in order to get rid of the offending substance; after which it should be dressed with a mild digestive ointment, and kept perfectly clean from all filth or extraneous matter.

If there is much inflammation, the animal should be bled in the foot, and absolute rest enjoined. Where the injury seems to be confined to some particular spot, at which the heat or tenderness is greatest, the horn should be pared away, and the matter suffered to escape. After this, and more especially if there is ulceration, the surface of the wound, or ulcer, should be lightly touched with butyr of antimony, and a pledget of soft tow bound tightly on the part. During treatment, the animal should stand on a perfectly dry floor.

Foot and Mouth Disease.—This, although not a fatal disease or complaint, reduces greatly the condition of the animals, and causes them so much suffering, and from being apparently—for the point is much disputed—highly contagious, if not infectious; next to the cattle plague and pleuro-pnuemonia, there is none which is more dreaded by the farmer. It has been greatly on the increase during the last few years, so much so, that special means have been obliged to be taken to stop, as far as possible, its ravages. As its name indicates, the seats of the disease are the feet and mouth. There is great inflammation in both, which precedes the suppuration and formation of sores. There seems but little doubt that the matter exuded from these, as well as the slaver from the mouth—even before suppuration actually begins—is highly dangerous, as being the media for conveying the disease to healthy animals. By the orders in Privy Council notice has to be given at once to the Veterinary Inspector of the district, who attends immediately on receipt of it. It is needless, here, therefore, to enter into any detailed description of the remedies to be employed. But the animals should at once be isolated from all others, and considerable relief—if not speedy cure as maintained by some—will be obtained by cleaning the wounds, etc., and washing the parts with a preparation of carbolic acid, a preparation so useful for other purposes and other diseases that the grazier should never be without it.

Hoven.—No disease is of more frequent occurrence among cattle than tympanites, or the *blown*, or *hoven*, as it is usually denominated by farmers. It is induced by sudden alteration of diet, and in the spring may arise from the animals being turned on to a rich pasture, which they greedily devour; or in autumn, by their eating too eagerly of turnips. The food is imperfectly masticated, the stomach becomes loaded, the process of rumination is prevented, decomposition take place, gas is generated, and the animal becomes swollen with confined air, that distends the paunch and intestines. Various remedies have been recommended and tried for this malady, which, if not soon discovered and speedily attacked, too frequently proves fatal. The best means of affording relief is, to make a puncture with a trocar, in the flank on the *left* side, two or three inches below the spinal column, and midway between the haunch bone and the last rib. The paunch lies immediately below this place, and will necessarily be punctured, and the air will escape through the aperture. When the trocar has been inserted, the stilet may be immediately withdrawn, and the canula suffered to remain as long as the operator pleases, and, in imminent cases, such fluids injected through this pipe as will best tend to neutralise the offending gas. If, from absence of proper means, a knife has been used, a quill, or any small hollow tube, may be introduced into the puncture. There is no danger attending this operation if a trocar and canula is used.

During the continuance of the hoove, medicine is almost out of the question, except, indeed, the chloride of lime, three drachms of which may be administered in a small quantity of water. The gas is carburetted or sulphuretted hydrogen. The chlorine quits the lime, and unites with the hydrogen, and forms a substance—muriatic acid, with which the new uncombined lime unites, and the result is a harmless substance—muriate of lime.

Should a second attack of hoove occur in the course of a few days or weeks, the beast should be fattened and sold as quickly as possible, for it will always be more or less subject to this complaint. Hoove is also caused, if not extreme danger otherwise to the animal brought about, by obstructions in the gullet, caused by pieces of turnip, etc., being arrested from some cause or another on their way to the stomach, and preventing the passage of its gases upwards. These obstructions should be removed without loss of time, otherwise the results may be fatal. This removal is easily effected by the employment of the instrument known as the Probang—that made by Read of London—almost universally used, and can be had at any ironmonger's. No farmer should be without this. Directions for its use are sold along with the instrument.

Looseness or *scouring* assumes two very different characters, and requires different treatment. The essential difference is, whether mucus is discharged with the fæcal matter. If there is no mucus, it is *diarrhœa*—if there is mucus, there is *dysentery*. The first is often easily subdued—the second is too frequently fatal. In the former, the fæces may be discharged with some force, but in the latter, they are actually shot from the animal. In the former, the fæces, when fallen, have a smooth appearance—in the latter, they are covered with bubbles, which continue on the surface for a considerable time.

Diarrhœa results from change of food, from too great abundance or deficiency of it, or from its watery or otherwise unwholesome nature; sometimes from the animals being overworked, and at other times from atmospheric influences In general it may be easily treated. A dose of physic should be administered, in order to carry off any cause of irritation, and then recourse should be had to astringents. The best astringents for cattle are opium, ginger, catechu, and chalk, in the proportions of one drachm of the first, two of the second, four of the third, and eight of the fourth—given in thick gruel, and repeated morning and night. In some cases, however, it is with difficulty got rid of, or there is an occasional return of it. The animal will then lose its condition, and gradually waste away, and die if not relieved. Occasional purgatives will now be necessary, but they must be of the mildest nature, as linseed or castor oil, to which small doses (10 grains) of opium may be added. The chalk powder just mentioned should also be tried again and again. Alum whey occasionally has some astringent power. The pasture should be as dry as possible, or the animals should be kept up and fed with hay.

Dysentery is a far more fearful and destructive malady, arising from various causes, or, oftener than otherwise, from no assignable cause. It is generally fatal when it allies itself with any other disease. It is essentially an inflammatory disease—first of the mucous coat of the intestines, and at length of the whole of them. The only successful treatment must be founded on the description of its nature just given. The inflammation must be subdued. The animal must be bled. In spite of his purging, mild aperients must be administered, and continued until either a bloody discharge supervenes, which shows that the intestines can no longer bear them, and that the death of the animal is not far distant, or until the mucus ceases to be discharged, showing that health is returning. Emollient glysters are always serviceable.

The fever being a little subdued, opium should be had recourse to, but in minute doses. No succulent food is admissible, but good hay, good gruel, and bran mashes. The fæces having somewhat changed their character—the mucus having disappeared, or the discharge of it being diminished—astringents may be ventured upon, and particularly the chalk powder already described. To these follow tonics, as gentian and ginger. After the disease is quite subdued, much care is necessary to prevent its return.

Poisons.—While grazing abroad cattle are subject to a variety of casualties, such as eating the leaves of yew, various species of crowfoot, and other acid plants, and to bites from rabid dogs and venomous reptiles. The 'Vet.' should be called in when cattle are poisoned. The treatment is beyond the knowledge of unqualified practitioners.

Red Water, or *Bloody Urine.*—The name of this malady renders a specific description of it unnecessary. The animal is making frequent but fruitless attempts to discharge urine, which, when it is passed, comes only in small quantities, and tinged with blood. This disease often follows long continuance of dry weather; sudden change of pasturage will occasionally produce it; also musty or coarse food, or stagnant water, or the herbage growing in particular localities, or on swampy land, or the miasma of crowded ill-ventilated stables. As soon as an animal is observed to void blood it should be conducted to a warm, dry shelter, and bled. Purgatives should then follow—the Epsom salts in the usual dose at first, and this succeeded by smaller or ½ lb. doses, morning and night, until purging commences; the animal being allowed nothing but mashes and gruel at the same time.

Such is the nature and treatment of *acute red water*; but there is another and more frequent appearance of it, termed *chronic red water*. The animal separates himself from the herd, and ceases to ruminate, and refuses his food. The urine is of a brown colour. It becomes darker, almost black, or a red hue begins to mingle with it. There is considerable diarrhœa; if that ceases, and obstinate constipation follows, the animal is in danger. If the animal is in the slightest degree feverish, he should be bled. He should also be bled if he is in high condition. He should then be well purged, and the purging kept up by smaller doses of the medicine. To this should follow the giving of succulent food, as young grass, or tares, or carrots, and the administration of vegetable tonics, as gentian and ginger. Under this treatment the animal will usually recover.

The *Staggers—Apoplexy.*—The first name is given to this disease from the manner in which the animal staggers about. This species of the disease arises often from the 'overfeeding' or fattening process. Bleeding to a great extent is the only remedy, and if the animal recovers, he should as soon as possible be sent to the butcher.

The *mad staggers* are sufficiently indicated by the name. If the animal can be approached with safety, bleeding and physic, and low diet, will afford the only chance of saving him.

A species of staggers is frequently caused by an overloaded stomach, and is then called *stomach staggers*, *grain-sick*, or *maw-bound*. The distension of this organ is sometimes so great, that its powers are completely destroyed. The practitioner should be careful that he does not confound this with HOOVE; for there will be some distension, and the same loss of consciousness. The hardness of the flank will, however, be a sufficient distinction.

Wounds must be treated in cattle as they would be in the human being, or in any other animal: the main object should be to obtain a union of the parts by the first intention, and to prevent or remove dangerous inflammation.

Cattle are frequently tormented when at pasture by the ox-fly, breeze, or gad-fly, as it is variously termed (the *Œstrus bovis* of Linnæus), which has spotted wings, and a yellow breast. As these insect pests are most active during the heat of the day, the animals should be taken up and housed for the period. A shelter shed should be provided in the fields to which the poor persecuted animals can retire. Their enemies will not follow them into the shade. More injury is done to cattle by insects than most people will admit—especially to dairy cows; so that while affording them one means of protection from these pests—which so affect the cattle that they sometimes run about half-distracted—the claims of the purse are attended to as well as those of humanity.

Rheumatism or *Garget* of the limbs is a disease very common in marshy or exposed districts, and in old and neglected cattle. It is, in fact, the consequence of cruel and indefensible neglect. The cure, if cure can be effected, lies in making the animal more comfortable—placing him in a well-sheltered place—giving a dose of gentle physic, with plenty of ginger, and using embrocations of hartshorn and turpentine, with a little laudanum.

Fardel-bound consists of an accumulation and hardening of food in the fourth stomach or *faik* or *fardel bag*. It attends almost every inflammatory disease, but is sometimes confined to this stomach alone. It is readily produced by a sudden change from green to hard food. Its symptoms are a dry muzzle and hot mouth, unwillingness to move, and costiveness, or the voiding of small quantities of hardened dung mixed with blood. Bleeding and purging are imperative, and the *slowly* horning down of plenty of warm thin gruel, or, what perhaps would be better, tepid water with a small portion of Epsom salts dissolved in it. Nothing but liquid food should be allowed.

The *Milk* or *Puerperal Fever* is a dangerous and often fatal complaint, attacking cows shortly after their calving, and sometimes just as they are about to calve. The animal suddenly drops, her hind limbs appear paralysed, she often lies as if dead, and the pulse is oppressed and slow. Some notice of the attack is, however, generally given by symptoms of restlessness, shivering, and fever, and partial or total loss of milk. The 'Vet.' should be sent for without delay in such cases. An excellent preventive is the use of a daily allowance of the best oil-cake during the last two or three weeks of her being in calf. Milk fever almost always arises from the bad condition of the bowels. Hence the value of the oil-cake—given, say, to the weight of 4 lbs. to 5 lbs. daily—in regulating them during the most critical period of the cow's existence.

Affections of the Udder.—The udders of cows, and especially young ones, or that are in high condition, are sometimes greatly swollen and inflamed a few days *before* they calve, in which case it will be proper to milk them repeatedly, and to anoint the distended udders with cooling ointment or olive oil. If swelling, and a hard and knotty feeling comes on, or continues *after* the parturition, the suckling of the calf, and *his knocking about of the udder* will afford the most likely means of cure. Should the inflammation continue, and the cow becomes feverish and off her food, she should be bled and physicked. It will also be necessary to attend to the seat of disease. The 'Vet.' should be called in for the treatment of this serious complaint; but the milk should be drawn off from the affected teat or teats twice every day, after which some emollient ointment should be gently but well rubbed in.

CHAPTER II.

ON THE DISEASES OF CALVES.

SCOURING, or *Looseness*, is generally the first malady that attacks calves. It is frequently occasioned by the inattention of the persons to whose care the sucklings are committed, and who often put them too soon to suck, and allow them to remain longer at the teat than is proper. Too frequent change of milk will likewise produce this disease. A slight degree of looseness should not be meddled with. It may be a salutary process of nature; but if it continues, and the animal begins to droop, the same medicines should be administered, and the same mode of treatment adopted, as recommended for diarrhœa in adult cattle.

The *Shoote*, or *Dysentery*, in calves, should also be treated in the same manner as in cattle, except that there will be the opportunity of mixing a little ground rice or eggs with the milk.

There is, however, a disease which wears the appearance of purging, but which is of an utterly contrary description, viz. constipation, and is exceedingly fatal. The milk when received into the stomach of the calf is always coagulated there, and afterwards again dissolved by the gastric juice; but when, from some fault in the milk, or weakness of the stomach of the young one, the after-dissolution does not take place, the stomach becomes filled with a firm coagulum. The animal seems to purge, from the quantity of whey that is discharged, while, on the contrary, the stomach is becoming loaded. This is a very deceptive disease, and many a calf is lost from its not being well understood. The symptoms that would lead to a suspicion of the real nature of the case are these:—after the calf and its mother have been apparently well, all at once the calf exhibits evident symptoms of distress, will not move, heaves at the flanks, and a whey-coloured fluid begins to be discharged. It is usually a bad case, and will generally end fatally. Drachm doses of carbonate of magnesia in whey should be administered every two hours, until four doses have been taken. Two drachms of Epsom salts should afterwards be given, with half a drachm of ginger.

We cannot better conclude this chapter than by giving some hints from the valuable Prize Essay of that talented veterinary surgeon, Mr. Karkeek, of Truro,[1] on the 'Disease of Live Stock occasioned by Mismanagement.' At the head of the predisposing causes he places—'*Insufficiency of Food.*' He terms food 'insufficient when it is incapable of producing healthy nutritious chyle in a growing animal. The object of good feeding is not to fatten a young animal, but to give strength and tone to the vital force, to make the vital powers predominate, and prepare the animal to withstand those external agencies which tend to alter the structure and composition of the tissues, and predispose to disease.' '*Insufficient Shelter and Exposure to Cold and Rain*' stand next; Catarrh, diarrhœa, and dysentery are thus induced, and the animal predisposed for other disease. '*Insufficient Drainage of the Soil*' he regards as the subtle agent in many epizootics, and infectious disorders, and fevers. '*Inattention to Contagious Disorders*,' he says, 'is the occasion of much mischief and loss of property;' and when such are about, he advises the grazier 'to establish a rigid quarantine, and admit no new animals into stock until several weeks have established their freedom from unhealthy symptoms.'

'*Carelessness on the part of Shepherds and Feeders*' comes now; and under this head he includes attention to cleanliness, to regularity of feeding, to ventilation, and to the temperature of stables, stalls, or sheds, as well as to the quality and quantity of the food, and the goodness of the water (to which we may add kindliness and gentleness of treatment, with thorough rubbing down, and frequently, and also curry-combing).

'*Inattention to First Symptoms of Disorders*' concludes the list. 'Veterinary surgeons,' he says, 'know that the majority of fatal cases which occur in their practice arise from not attending to the premonitory signs of disease. These are, in cattle, loathing of food; rumination suspended, or lazily performed; the muzzle dry, instead of being bedewed; respiration increased; hair pitched, and not licked. When any of these make their appearance, the herdsman, or the master, may be assured that disease is approaching; and it becomes his duty to act without delay, as by so doing the disease may be mitigated or arrested.'

[1] Journal of the Royal Agricultural Society, vol. xi. p. 541.

CHAPTER III.

ON THE DISEASES OF HORSES.

OF all domestic animals the horse is the most liable to disease. This is not to be wondered at when we consider the toil he is frequently forced to undergo, the brutality with which he is often treated, the tender age at which he is generally compelled to work, and the improper treatment he commonly meets with, even from those who, although desirous of using him well, err through ignorance. As in all cases of disease, we should recommend early application to a skilful veterinary surgeon; it is not our intention to go into any very lengthened detail of the maladies of horses generally, but merely to give a summary account of the symptoms and treatment of the most common maladies to which these useful animals are subject, in order that the farmer may, *on any sudden emergency*, be enabled to detect the nature of the complaint with which he has to contend, and to administer those medicines that are most conducive to its removal.

Botts are the *larvæ* of a species of gad-fly, named the *Œstrus equi*. This fly deposits its eggs on the fore-arm and side of the horse. In a few days they are ready to be hatched, and the warmth and moisture of the tongue of the horse being applied to them as he licks himself, they burst; the worm adheres to the tongue of the animal, and thence finds its way to the stomach, to which it clings by means of its firm and strong tentaculæ, and lives and grows, until the approach of the following summer, when it quits its hold, and is carried through the intestines, and discharged with the fæces. Sometimes it crawls out of the anus, and is seen adhering to it under the tail of the animal. It often irritates the horse, and that very much, while it hangs there, and, if observed, it should be removed; but, beyond this, neither during its long residence in the stomach, nor in its passage through the intestines, is it productive of either inconvenience or mischief. Other worms are occasionally productive of mischief. The *long white worm* (*Lumbricus teres*) inhabits the small intestines, and, when existing in considerable numbers, is injurious, probably from the quantity of chyle which it devours, and from the irritation which its presence and movements occasion. If many of them are seen in the dung, and the horse is getting a little *tucked up* and out of condition, two drachms of calomel should be administered over-night in a small ball, with a good dose of physic in the morning.[1] The Ascarides are small thread-like worms inhabiting the rectum and cæcum. They sometimes occasion a troublesome itching around the anus, but beyond this they do not appear to do harm. An injection consisting of linseed oil, or a solution of aloes, will generally destroy them.

Colic is frequently produced by overloading the stomach with green food, or allowing a horse to drink cold water, or hard well water, or feeding him largely on new oats or green meat while he is hot. When first the horse is seized, a drink composed of from two to three ounces each of spirit of nitrous ether and laudanum, given in half a pint of warm ale, will often produce almost instantaneous relief. Should not this, however, be the case, the horse should be walked about, his belly should be thoroughly wisped, and, if possible, dry heat applied to it, and, in the course of half an hour, the drink should be repeated. If the spasms still continue, it becomes a serious affair. The horse should be bled, and a strong aloetic drench (an ounce of Barbadoes aloes dissolved in warm water, with an ounce and a half of rectified spirits in it) administered, and the animal backraked. Should the spasms yet remain, inflammation of the bowels is near at hand, or has commenced.

The symptoms of colic are as follows:—the horse appears restless and uneasy; frequently paws his litter; looks round at his flanks; endeavours to strike his belly; falls down, rolls on his back; gets up suddenly, and after a short time falls again, with other demonstrations of extreme pain. The mode of distinguishing an attack of colic from inflammation of the bowels will be seen by referring to the symptoms of the latter complaint, under the head 'Inflammation.'

Cold or *Catarrh.*—This disorder is generally induced by exposing a horse to cold or wet, while in a state of perspiration. Its symptoms are dulness and watering of the eyes, cough, discharge from the nostrils, some quickness of breathing, and somewhat accelerated pulse. (*A healthy horse's pulse beats from thirty-two to forty strokes in a minute.*) A little additional warmth, a few mashes, and a few doses of the powder recommended for 'Colds in Cattle,' will usually effect a cure; but if the cough is obstinate, and the mouth gets hot and the throat sore, the matter becomes somewhat more serious. And at this stage the regular practitioner should be without hesitation called in.

Grease.—This disorder consists in a discharge of stinking

[1] The best and almost the only certain purgative for the horse is aloes, and the Barbadoes aloes should always be preferred. It may be given in doses of one or two drachms, made into a ball, as an alterative, and of five, six, or seven drachms as a purgative.

matter from the heels. It usually commences with redness and heat in the heel of the foot; to this cracks succeed; then considerable swelling, occupying the whole of the pasterns, which are exceedingly tender, and smoke as the horse stands in the stable. At length a fungus begins to spring from the heels and soon extends to the fetlock. On the first appearance of grease the horse should have a dose of physic. To this should succeed alterative and diuretic balls, either alternated or given together, and to these tonics should be added, if the horse is in poor condition, or is evidently getting weak.

If these balls are combined, the combination must be regulated by the state of the disease and the horse. When there is simple redness and heat of the heels, the white lead ointment will cool and supple them. It is best made by rubbing down one drachm of white lead with seven of lard. When cracks have commenced, the same ointment may be used in the first instance, in order to abate inflammation, but it must not be continued above a day or two. A weak solution of blue vitriol (a quarter of an ounce in a pint of water) should follow. If, instead of healing, the cracks should deepen and become inflamed, they must be poulticed with linseed meal, or mashed turnips or carrots. The inflammation being subdued, the common Turner's cerate spread on tow will often prove an excellent dressing; the cracks being still slightly washed with blue vitriol lotion, once every day. Should much swelling come on, and the heels smoke, the poultice should be applied, particularly that made with carrots. To this, astringent lotions should follow, consisting either of a solution of alum (half an ounce to the pint), or a decoction of oak bark, or both combined. When grapes begin to appear, the case is in a manner hopeless, and a skilful veterinary surgeon alone must decide on the course to be pursued.

Inflammation.—Under this head may be classed fever or general inflammatory action, and the determination of that action to particular parts.

Fever is general increased circulatory action, without determination to any part. This is of frequent occurrence. We find a horse with quickened pulse, laborious breathing, staring coat, and shivering. There is no expression of local pain—no cough. This lasts one, two, or three days, and then he either gradually recovers, or some considerable and dangerous inflammation ensues. A horse in this state should always be bled; the increased circulation requires it. He should be very gently purged; and should take some doses of the fever medicine, and be put on low diet, and warmly clothed. In the course of a very few days this increased action of the circulatory system will subside, or some manifest local inflammation will appear. We will consider those of most frequent occurrence. But we would here again repeat the caution, that in all cases requiring prompt treatment, and in which symptoms supervene—and with great rapidity—which baffle the ordinary observer, the services of the veterinary surgeon should not be grudged. So rapid, indeed, in their effects, so accompanied with peculiarly prevailing circumstances are all inflammatory diseases, and so frequently are exceedingly valuable animals carried off by them, that we have our doubts as to the propriety of here giving anything more than a description of the symptoms, lest by giving instructions as to treatment some of our readers may be tempted to carry them out too far and be ultimately the losers. A '*little* learning (in surgery or medicine) is a dangerous thing.'

Inflammation of the Brain—Mad Staggers.—This is usually preceded by a sleepy comatose state, from which the horse suddenly rouses. His flanks heave, his nostrils dilate, and he soon abandons himself to the wildest delirium. There is but one chance of saving him — immediate and profuse bleeding, and from both jugulars, until he drops. To this should follow, and before there is time for him sufficiently to recover and recommence his furious struggles, an ounce, at least, of aloes in solution with ten or fifteen drops of croton oil; two drachms of aloes being repeated every six hours until purging commences. If the horse lives at the expiration of twenty-four hours, an ounce of the fever powder should be given in a drink morning, noon, and night, and the head should be blistered. The inhalation of the fumes of ether and chloroform has been found of great benefit in subduing staggers.

Inflammation of the Eye.—The common inflammation from cold or accident may be abated by cooling applications to the eye, general bleeding, physic, and restricted diet; but the periodical ophthalmia, which returns every second or third month, and shifts from eye to eye, must terminate in blindness.

Inflammation of the Lungs.—To this disease, on account of the sudden changes from heat to cold, and the cruel exactions of speed and strength to which he is exposed, and the occasional transfer of almost every inflammation to the lungs, the horse is peculiarly liable. It is occasionally most sudden in its attack. Many horses die in less than twenty-four hours from the first appearance of the disease. This is often confounded with various other maladies of the respiratory system, wherein a somewhat different method of treatment should be adopted; yet there are several peculiar symptoms that ought not to be mistaken. The nostril is unusually open, the head protruded, the membrane of the nose intensely red, while the extremities are cold as ice, and the pulse is oppressed. The eyes have a strange wild expression, and the pupils are dilated. The heaving of the flanks is precipitate and expressive of great pain; the horse gazes mournfully at them; he is with difficulty induced to move, and he obstinately retains his standing posture until he recovers or dies.

Here, also, the treatment must be of the most decisive nature. If the pulse is hard and heaving, he must be bled until he seems ready to fall; but if it is scarcely perceptible, the bleeding had better be deferred. He should be blistered on the brisket and sides; and powerful stimulants used to rouse the natural energies to action, and friction applied to the extremities. The digitalis and nitre should be frequently given, in full doses, and the bowels should be opened by some mild aperient, as a drachm of aloes, every third or fourth hour; *but the animal must not be purged.* He should be warmly clothed, but his box should be open to all the winds of heaven. The great point to be aimed at is the restoration of the circulation and vital energies. Food should not be thought of beyond a cold mash or a little gruel.

Pleurisy—Inflammation of the Pleura, or covering of the Lungs.—Although this is a disease of a part so near to the lungs, the symptoms and the treatment are exceedingly different. The membrane of the nose is scarcely tinged with red, and sometimes pallid; the extremities are of their natural temperature, but the pulse is hard and bounding. There is pain on pressure on the side, and the skin is continually in motion. *There are little waves rapidly succeeding to each other.* Bleeding, blisters, and sedatives will be in immediate requisition, and to them may be added that valuable auxiliary, purging. But for cases such as this the 'Vet.' must be called in.

Catarrhal Fever, or *subacute Inflammation of the Respiratory Passages.*—This, under the name of influenza, or distemper, or epidemic catarrh, is very prevalent and destructive at certain seasons of the year. It is readily distinguished from either pneumonia or pleurisy by the following symptoms:—It commences with shivering; the eyes are redder than in either of the other diseases; the membrane of the nose has a peculiar livid hue; there is great discharge from the nose; there is considerable soreness of the throat, so that the horse is sometimes totally unable to swallow. There is evident weakness even from the beginning, and a peculiar staggering gait referable to the hind quarters. The cause of this disease is generally attributable to some atmospheric influence. It is clearly epidemic, and as clearly infectious. Bleeding should be practised at the commencement of the disease, the faltering of the pulse alone limiting the quantity to be taken. Small doses of aloes should be given morning and night until the bowels are gently opened. The sedative medicines already recommended should be repeated until the fever has evidently subsided, after which, and especially if the weakness is not disappearing, two drachms of the spirit of nitrous ether should be added to each dose, and, by degrees, some vegetable tonic following. Blisters or stimulating applications should be applied to the enlarged glands. Mild, but nutritious food should be given, and, if they can be obtained, grass, tares, or carrots; thus, while the insidious but dangerous fever is subdued, the strength of the animal will gradually return, and nothing will be requisite but caution, as to his ordinary food and work, to effect a restoration to perfect health.

Inflammation of the Liver.—Careful observation has proved that this is a far more frequent disease in the horse than it was once imagined to be. Its indications are those of common fever, attended by a peculiar yellowness of the skin, and particularly of the eyes. Bleeding, gentle purgatives, and alterative medicines are indicated. The disease will, however, often continue to progress; the substance of the liver will become broken down; and the peritoneal covering of it, weakened, until at length it will give way, a stream of blood, large or small, according to the fissure, will pour into the abdomen, and the animal will be lost.

Inflammation of the Bowels.—There are two varieties of this; the one more particularly attacking the outer coverings of the bowels, and known by the name of *red colic*, is attended with dreadful pain, during which the poor animal is up and down, and rolling about. Hence this disease has been confounded with actual colic, but is distinguished from it by the coldness of the ears and legs, tenderness of the belly, and pain without remission.

Here, also, the lancet should be promptly used, and an aloetic purgative with opium given. Hot water or a stimulating liniment should be applied to the belly, he should be raked, and enemas perseveringly thrown up. Chloroform has been used in obstinate severe cases with almost miraculous effect. Green meat and gruel must be the only food.

Inflammation of the mucous Coat of the Bowels is usually the result of the administration of improper and too violent physic. It is sometimes produced by sudden change of food, as from dry to succulent. In this, as distinguished from the former, the ears and legs are always warm. From whatever cause produced, it must not be too suddenly arrested. Gruel and starch should be given in considerable quantities. They will sometimes arrest the discharge. If they fail, astringents, as catechu and opium, and chalk as an anti-acid, may be added; these must, however, be discontinued as soon as the purging begins to cease.

Inflammation of the Kidneys will proceed from exposure to cold, sprain, too powerful diuretic or unwholesome food, and is always sufficiently plainly indicated by the straddling walk, and the heat and tenderness of the loins; it demands prompt and decisive treatment. The lancet, purgatives, hot local fomentations, and mustard poultices, must be had recourse to. We need not add that no kind of diuretic should be administered in such a disease.

Inflammation of the Bladder.—The symptoms have considerable resemblance to those of the kidney, except that there is no heat and tenderness of the loins, or pain on pressure. The mucous coat is affected from the presence of a calculus, or of some irritating drug, as cantharides. Bleeding and physic will be the first steps, and then may be given plenty of thin gruel, and small doses of opium. When the neck of the bladder is affected, there will be, as also in the last case, frequent voiding of small quantities of urine, terminating in total suppression of it. The distension of the bladder from the accumulated quantity will likewise be felt if the hand is introduced into the rectum. The neck of the bladder is inflamed, and thence results spasmodic closure of it. This spasm will generally be got rid of by decisive bleedings, and the administration of opium.

Inflammation of the Feet.—With this we conclude our list of inflammations, although many more might be added. This disease is also known under the term *founder*. It means inflammation of the sensitive and elastic substance interposed between the horn and the bones of the feet. When it is considered how severely these parts are taxed in rapid and long-continued action, to what dreadful concussions the foot is exposed, and how frequently it is confined and injured in unskilful shoeing, it is not to be wondered at that it should become subject to most painful inflammation—so great, even, that sometimes the animal succumbs. There is no inflammation under which the horse suffers more pain, or in which his moanings are so dreadful, and by the continual application of his muzzle to his hot and tender feet, he prevents the possibility of error with regard to the seat of disease.

There can be no hesitation with regard to the treatment. The shoe must be removed, the tightly-pressing horn be thinned, particularly at the sole and the quarters, that it may yield a little to the outward pressure of the turgid vessels within. Blood must be taken from the toe, and as nearly as possible to the seat of inflammation. The foot must be surrounded with a soft poultice of linseed meal, which must be frequently renewed and a dose of physic must be administered. If persons could be kept constantly employed about it, the fomentation of the part with hot water would be more effectual. More blood may be abstracted on the following day, and a blister applied round the coronet on the third day if relief has not been obtained; the patient being all this while kept on mash diet. Nothing more can be done if the horse should recover, he must be spared from work as long as possible.

Broken Knees.—The dirt and gravel should be carefully and perfectly removed, and the part thoroughly washed with warm water. If it should then appear that the joint is not opened, the wound may be treated in the usual way. If the joint is opened, firing should be resorted to in order to close it; poulticing the wounds afterwards. The iron should pass in every direction, but not penetrate too deeply. If the synovia continues to flow, the iron must be applied a second or even a third time.

Galls.—When a horse is galled by the saddle or harness, the following lotion will be found serviceable:—

Sulphate of zinc	1 ounce.
Super-acetate of lead . . .	1 ounce.
Water	1 quart.

If this does not at once succeed, the friar's balsam or tincture of myrrh should be used.

Strains.—The best method of relieving the inflammation attendant upon a strain is, to bleed and wrap the injured part in a large poultice. The horse should then be physicked and kept on a low diet. Some persons, instead of poultices, employ cold applications; as

Super-acetate of lead .	1 ounce.
Vinegar .	4 ounces.
Water . .	1 pint.

Their effect is the same as the poultice; each tending to reduce inflammation. Blistering and, in some cases, firing may be re-resorted to. Sprain of the back sinews is one of the most serious to which the horse is liable. The parts should be well fomented with hot water, and then poulticed. The poultice should be taken off, and the fomentation renewed three or four times every day. The inflammation having in some measure subsided, a flannel bandage should be applied, and with considerable tightness, and kept wet with an evaporating lotion composed of three parts of water and one of spirit. The bandage should be drawn tighter every day. If at the expiration of a fortnight or three weeks there is not the least lameness, heat, or tenderness, the horse may be put to gentle work; but if the slightest lameness remains, the leg must be blistered. In aggravated cases, it will be prudent to fire. When the cautery lesions are healed, the horse should be turned out for as long a time as he can be spared.

Strangles.—This is a disease to which the horse is subject between his third and fifth year. It consists of a tumour in the interposed cellular tissue between the branches of the lower jaw. The horse will not do well except this tumour runs its course, and a considerable quantity of matter is formed and discharged: the principle of the treatment of strangles is to hasten the ripening of the tumour. This may be effected by blisters or poultices—the former are better than the latter. Little medicine will be required except a few doses of the fever powder. A mild dose of physic may be administered with advantage, and should the horse continue very weak, tonic medicines may be occasionally given.

Lampas.—This is a swelling of the bars of the palate, when the horse is cutting his grinding teeth. It may also be produced by some general inflammatory tendency about him. It is a common practice with farriers to burn the swollen part with a hot iron—a cruel and unnecessary operation, arising from ignorance of the causes producing the complaint. A few incisions across the bars may, by the loss of blood, relieve both the local and the general inflammatory tendency. The instrument, however, must not pierce too deeply, lest the palatine artery should be wounded.

The following prescriptions will be found useful on many occasions:—

DIURETIC BALL.

Powdered yellow resin .	4 drachms.
Powdered nitre .	3 drachms.
Powdered ginger . .	1 drachm.

Palm oil sufficient to form a ball.

DIURETIC POWDER.

Powdered resin	4 drachms.
Nitre .	3 drachms.

TONIC BALL.

Powdered gentian .	3 drachms.
Powdered ginger . .	3 drachms.
Powdered cantharides	5 grains.
Powdered aniseed	2 drachms.

Palm oil sufficient to form a ball.

BLISTERING LINIMENT.

Olive oil	4 ounces.
Oil of turpentine . .	1 ounce.
Fresh powdered Spanish flies	1 ounce.

ALTERATIVE BALL.

Levigated sulphuret of antimony .	1 drachm.
Powdered nitre	3 drachms.
Flour of sulphur .	4 drachms.

Palm oil sufficient to make a ball.

ASTRINGENT BALL.

Powdered catechu . .	2 drachms.
Powdered opium . . .	½ drachm.
Powdered ginger . .	1 drachm.
Prepared chalk .	4 drachms.

Palm oil sufficient to make a ball.

FRIAR'S BALSAM.

Benzoin	1½ ounce.
Balsam of storax .	1 ounce.
Balsam of tolu . .	½ ounce.
Aloes . .	2 drachms.
Rectified spirit	1 pint.

LIQUID BLISTER.

Powdered Spanish flies.	1 ounce.
Boiling water . .	½ pint.

After allowing the mixture to stand during a day and a night, add

Rectified spirit of wine	4 ounces.
Oil of origanum	1 ounce.

SHEEP AND CALVES' CORDIAL.

Prepared chalk .	1 ounce.
Powdered catechu . .	½ ounce.
Powdered ginger . .	2 drachms.
Powdered opium .	½ drachm.
Peppermint water . .	½ pint.

Shake it well before using; the dose, one or two tablespoonfuls.

CHAPTER IV.

ON THE DISEASES OF SHEEP.

SHEEP are subject to various disorders, and unfortunately these have been, until of very late years, too much neglected by scientific as well as practical men. Our limits will only admit of our noticing those which are most serious and of most frequent occurrence. It may be easily ascertained when sheep are in health by the careless quicknesss of their motion; the clearness of their eyes; the cool moisture of the muzzle; the absence of purulent discharge from the nostril; the sweetness of their breath; the coolness of their feet; the regularity of their respiration; the fine pink colour of their skin; the soundness and firmness of their teeth; and the uniform, unbroken texture of their wool.

Blindness.—The eye of the sheep is subject to many more diseases than is generally supposed. In scab the edges of the lids get sore, and the eyelashes fall off. A weak mercurial ointment would be of service. There is quite as frequent inflammation of the conjunctiva in the sheep as in the horse, and more than in the ox, and it too often runs on to blindness. The lids occasionally adhere to the ball of the eye in consequence of this inflammation. Cataract is a disease prevailing among sheep to an extent that would scarcely be thought credible. The Ettrick Shepherd says that at least one in ten in flocks in cold and exposed situations have cataract in one eye; and he adds that 'there are many more *blind* sheep than a stranger would imagine, for a friend generally attaches itself to the sufferer and prevents it from going astray.'

Blood-striking, or *apoplexy*, is a very frequent disease among sheep. It arises from feeding on too luxuriant pasture, by which every artery and vein becomes surcharged with blood, and the vessels of the brain are the first to be ruptured.

The description given by some writers of this blood-striking is most fearful. 'Suppose a flock of sheep grazing on a pasture somewhat too luxuriant; they have been lately turned upon it, and the weather is hot. Suddenly one of them stands still—he seems to be fixed to the spot; his pupils are dilated, but they are motionless — his eyes are fixed — he is blind. The sheep-dog barks; he hears it not, he is deaf: presently he begins to stagger —he falls—he struggles—he dies—and all this takes place in less than a quarter of an hour.' This is a faithful picture, and it should make its due impression. It is apoplexy, caused by overfeeding. The most effectual remedy, if there should fortunately be time for it, is bleeding; after which the animal should be turned into a dry pasture, and a good dose of Epsom salts be administered.

Dunt.—This disease is variously known by the names of *staggers*, *giddy*, *vertigo*, *turn*, *sturdy*, and *hydatid in the brain*. The last name is the appropriate one. It is an hydatid, and sometimes more than one, between the pia mater and the brain, which growing swells and presses on the brain. The origin of hydatids is a disputed point; but wherever they come from, the air or elsewhere, they cause the animal to lose its accustomed spirits; it begins to stagger as if its senses were confused; it seems to have strange delusions, and turns round and round; it daily loses flesh and strength, and at length falls and dies.

Can we prevent the existence of this hydatid? In some measure we can. It is confined to, or oftenest found in, damp marshy ground. Let such pasturages be shunned as much as possible. It is found in sickly sheep to a great extent. Let the general health of the flock be better attended to, and particularly let them have access to salt. All attempts to kill the hydatid are simply exercises of extreme cruelty to the sheep. The only course to be pursued is to destroy the sturdied sheep as soon as the peculiar symptoms announcing the presence of the hydatid appear—to fatten and dispose of as many of that year's sheep as can conveniently be effected—to take more care of the mothers—and to avoid everything likely to have a tendency to produce debility in the flock.

The *Flux* is a diarrhœa, or looseness, which attacks sheep that are suddenly placed on full feed after having been stinted. It is also sometimes occasioned by their eating unwholesome food of various kinds. In general it is not attended with any dangerous consequence, and in dry weather usually disappears in the course of a few days. Should it, however, continue, the sheep must be removed from that pasture, and fed on good sweet hay, and the medicine administered which has already been recommended for colts and calves. Diarrhœa should be got rid of as quickly as possible when the fly commences its attacks.

The Fly.—This disorder is most troublesome to sheep that are continually exposed in hot seasons, particularly in enclosed woody districts. A peculiar fly, the *Œstrus ovis*, lays its eggs among the wool. The larvæ immediately burrow under the skin and annoy the sheep to a degree that would scarcely be thought possible. The head is a favourite place, and, in a country subject to the ravages of the fly, it is often defended from their attack by a plaster of pitch, to which a little bees'-wax has been added in order to render it more adhesive; this proceeding is called *capping*. The maggot must be carefully removed from every part that has been attacked by it, and a little of the coarsest fish oil, thickened with brimstone, and in very bad cases mixed with a small quantity of spirit of tar, applied to the wounds. The same may also be smeared over the whole of the sheep when the fly is unusually troublesome.

Foot-halt.—At the front of the foot of the sheep, and immediately above the division between the pasterns, is an orifice leading to a canal belonging to each portion of the foot, and within which is secreted an unctuous fluid, designed probably to supple and give freedom of motion to the pasterns. Occasionally, from some cause or other, this orifice becomes closed and the secretion within continuing, the canal becomes distended with the secretion, and considerable inflammation, producing lameness, comes on.

Ignorant people imagine that these tubes are enormous worms, and talk of pulling or cutting them out. The proper mode of cure is to bathe the feet well with warm water, in order to remove the dirt or sand that may have insinuated itself into the orifice of the canals, and then, if there is much swelling, to apply a poultice. Should there be much ulceration, the chloride of lime, or the friar's balsam, or each alternately, may be used. In very bad cases, and where there is much disease in these canals, a small seton may be passed through one or both of them.

Foot-rot is an altogether different disease. It is inflammation and ulceration of the foot, and separation of the horny covering. It is a disease appertaining to or arising from soft or marshy ground, and is most prevalent in wet seasons. Nature never designed the feet of sheep for such soils as tend to soften and relax them. They were originally inhabitants of the mountains, or of extensive and arid plains. The horn, and particularly the edge of the crust, was designed to resist the wear and tear to which the foot in such situations would be exposed. If the sheep is turned on to soft and marshy ground, there is little or no friction to wear down the foot; the horn therefore grows, it overlaps the sole, it is unequally pressed upon, it breaks, and openings are made between the claws, and extend to other parts of the foot. Dirt and gravel enter by means of them, and inflammation and ulceration are the result.

As soon as a sheep begins to halt he should be caught, his foot carefully examined, and every particle of loose horn cut away with a sharp curved-pointed knife to the very bottom of the diseased part. If the ulceration has proceeded to any considerable extent, and there is a discharge of fœtid matter, the foot should be well washed with the solution of the chloride of lime already described, after which butyr of antimony should be, with not too much freedom, applied over the whole of the ulcerated or exposed surface. Some clean tow should then be bound round the foot, and the animal placed in a perfectly dry situation, and a dose of opening medicine given. On the following day the foot should be again examined, every separated portion removed, and the caustic once more applied. Where there is not too much previous disorganization of the foot, a cure will soon be effected. The removal of the horn, and the daily application of the caustic—not too severe after the first time—are the grand secrets of the treatment of foot-rot.

There is one circumstance, however, that should never be forgotten. The discharge from the diseased foot is contagious, and other sheep cannot be turned with impunity on the pastures on which these have trodden.

It has been properly suggested that sheep turned on to those rich pastures which are likely to give the rot should be examined every spring and fall, and the feet well pared out. If there is the slightest appearance of unsoundness in any one, that sheep should be separated from its companions and put into a well-littered shed or yard. Some have recommended that such sheep should be driven a very little along the road every day.

The *Scour*, or diarrhœa, is a too prevalent and fatal disease among sheep. It is very common in hot sultry weather, and, if long neglected, will assuredly destroy the animal. The first step is to remove the sheep that are purging much, to a shorter and drier pasture, or to a fold, and give them hay. The 'sheep or calves' cordial' will be very useful here.

If the discharge becomes thinner, green, and slimy, and is mixed with blood, and the animal begins to get rapidly thin, there is considerable danger. In the earlier stages, should there be fever, bleeding will be beneficial; a purgative should also be administered, and a little opium with it; the animal must be kept warm; gruel is the best thing for it until the disease abates and symptoms of appetite are manifested. After the purgative the sheep's cordial should again be resorted to with a scruple of gentian added to it. This must be given thrice in the day, not only until the purging ceases, but, in smaller doses, for at least two days afterwards.

Diarrhœa and Dysentery are peculiarly fatal to lambs, and especially at weaning time, when so different a kind of food begins to be given. The treatment should be nearly the same as with full-grown sheep—a mild dose of physic first, as castor-oil, and then the calves' cordial, warmth and nursing.

Pinding is a consequence of diarrhœa, and particularly of dysentery. It is the accumulation of dung about the tail and haunches, gluing them together, and forming a mechanical obstruction to the passage of the fæces. This is oftenest seen in the sucking lamb; but sheep are occasionally subject to it. The obstruction must be removed, or the animal will die.

Hoven, or *Blown*.—See the first chapter of this Book.

Pelt-rot.—In this disorder the wool or hair falls off spontaneously from the sheep. Scanty keep, exposure to much wet, or, sometimes, a sudden change from poor to full feeding, will produce the pelt-rot, which is likewise occasioned by the *scab*. In the last case, the removal of that disease will of course effect a cure; but in the former one, as soon as a sheep is discovered to be affected, it should be separated from the flock, and driven into a detached yard, where the diseased part should be cleansed, and the animal anointed with a mixture of tar and lard or other grease, in such proportion as to form a salve: a piece of cloth being sewed on the animal to keep it from the cold. It should be supplied with the best food; an attentive regard to the regular distribution of which, especially in winter, would probably have prevented this malady.

The Resp.—This malady is believed to originate from sheep feeding too freely on turnips, clover, or other rich and succulent vegetables. Frequently driving them about, and the use of common salt, are said to be successful remedies; and it is affirmed that the disease may be *prevented* by giving the animals dry provender in the course of the night, after they have been feeding on the vegetables above mentioned. The use of parsley in this malady is likewise said to be beneficial.

This disease commonly makes its appearance about the beginning or end of winter, and first affects the breast and belly, although at times it spreads itself over other parts of the body. It consists in an inflammation of the skin, that raises it into blisters, which contain a thin, reddish, and watery fluid. These continue for a short time, and then break and discharge their matter, and are followed by a scab.

There is every reason to believe that this is the mild form of that malady, the sheep-pox, which in 1861 committed such ravages amongst the sheep of this country, especially in Wiltshire and Berkshire. The reader interested in the account of this remarkable outbreak, the opinions and remedies called forth by it, will find a detailed account in 'The Year-Book of Agricultural Facts, and Annual Record of Farming Progress,' for 1862. Blackwood & Sons.

Sheep-Pox.—This malady, like the small-pox in the human being, has two forms—the mild and the malignant, and it only attacks the animal once. It consists in a cutaneous inflammation, followed by the eruption of numerous pustules or pocks, which in milder cases dry up into scabs, but in more virulent attacks become confluent, and render the whole surface of the body one mass of humour. It is a highly contagious disease, and cannot be too much guarded against, for the progress of infection is subtle and rapid, to a degree. It suffices to drive sheep through the same line of country where a diseased flock has passed, or even to send among them a dog which has been used in driving a diseased flock, and the healthy ones will inevitably become infected.

The early symptoms are dullness, loss of appetite, a feeble staggering gait, fever, heat of the skin, and acceleration of the pulse. In the course of a few days the eruption developes itself, the eyes are inflamed, the mouth burning, the breathing laborious, and considerable thirst is manifested.

The sick animals must be comfortably littered in a dry well-ventilated shed or yard, and supplied with plenty of good water. Medicines are of little use, excepting gentle purgatives where there is much fever and some costiveness; castor oil, in gentle doses, given once or twice a day in warm gruel, as the exigencies of the case seem to require, will be the best. The food should be succulent and nutritious, and given at intervals and in regular quantities; and where the appetite fails, they must be fed with gruel.

Some eminent writers[1] recommend inoculation as a preventative; they advise that this operation should be performed late in the spring or early in the autumn, with sound fresh matter inserted between the cuticle and the true skin with the point of a needle or a lancet. The best places for inoculation they state to be at the root of the tail, on the inner side of the flap of the ear, on the inside of the thigh or fore-arm, or under the belly.

But as 'prevention is better than cure,' it behoves all farmers carefully to separate their flocks, not only from all suspected ones, but from all places where they have the least reason to believe that sheep affected with this disease have been, and to guard them against all things which may be the medium of bearing the contagion from one place to another; to avoid mixing foreign sheep with their flocks, at any rate until the animals have undergone sufficient quarantine to prove that no disease lurks about them; to avoid crowding their flocks, or putting them in ill-ventilated sheds, where there is danger of engendering miasma; to be careful in the selection of their food, and the water they drink; to avoid damp marshy localities, especially when the weather is warm enough to engender miasma; carefully to isolate the flock from any animal that shows the least symptom of this

[1] See Journal of the Royal Agricultural Society, vol. viii. p. 490; Veterinarian, vol. xx. p. 624.

disease; to have *immediate* recourse to skilful advice, and to burn or bury deep in the ground the whole carcase, wool and all, of any sheep that dies of sheep-pox.

Red-Water is a disease that chiefly appears, in this country, when sheep are eating turnips off the land: it is seldom fatal. In cases where the disease is violent, a little blood should be taken. Salt is here also useful, both as a preventative and a cure. In the former case rock-salt should be placed where the sheep can lick it when they feel inclined; and in the latter common salt should be given in ounce doses, dissolved in water, and with or without the addition of turpentine.

Mr. Benjamin Holditch directs a drachm and a half of pearl-ash to be dissolved in a pint of water, and given to each sheep every second morning while the disease lasts.

The Scab.—This is another cutaneous disease, bearing much resemblance to, or identical with, the mange in other animals. Minute insects of the same genus, but differing in different animals, burrow into the skin, and there form their habitation, and produce their young; and it is the inflammation which they set up that produces the pustules that characterise the disease, and the intolerable itching that drives the animal half mad. Various circumstances tend to favour the attack of this insect. Where the sheep is diseased and half-starved, it seems to be a law of nature that there should be plenty of vermin to begin to eat him up, almost before his time. Whatever weakens or endangers the life of the animal seems to increase the ravages of these parasites. The grand cause, however, is contagion. If one scabbed sheep gets into the fold, the disease spreads like wildfire, partly by actual contact, but more by means of the *rubbing places*, the gates, trees, posts, &c., which the pasture contains.

The cure of a disease like this is brought to a very simple point—the destruction of the animalculæ; and that can only be effected by the application of a direct poison to them—a poison sufficiently energetic in its quality to destroy them without endangering the life of the sheep. This is applied in the form of infusion or solution, into which the animal is dipped, or of an unguent well rubbed into the skin. Tobacco, or arsenic, are the substances used in solution. The first is seldom sufficiently powerful, and therefore rarely resorted to. Arsenic, dissolved in hot water, and in the proportion of an ounce to a gallon and a half of water, is more efficacious. The sheep is plunged into the liquid, and rubbed all over for a couple of minutes, in order that the solution may penetrate to the skin in every part. As much of the fluid as possible is then wrung from him, and he is suffered to make his escape. The living insects are thus all destroyed, and the young ones are poisoned as fast as they are hatched, by the arsenic that hangs about the wool.

The unguent is the common mercurial or blue ointment rubbed down with five times its weight of lard, or, in bad cases, only with four times its weight. The wool is to be parted in a straight line from the head to the tail, so that the skin may be exposed. Some of the ointment should then be taken on the finger, and rubbed into the skin. Another parting or division is then made on either side of the first, and another beyond that, and, in fact, all over the sheep, where the application is required.

The whole quantity should vary with the size of the sheep. It should never be less than half an ounce, and may be increased to two or three ounces. The sheep, when well rubbed with the hand all over, may be dismissed. A week or ten days afterwards, if the itching continues, a second dressing should take place, with half the quantity of ointment. If this does not check the disease all the wool must be shorn, which is an immediate remedy. There are other skin-affections, and very troublesome ones. We have only room to mention one—the *Rubbers*, so called from that dreadful itching which causes the sheep to be incessantly rubbing against whatever he can approach. It is occasioned by the attacks of a small insect. Ticks are larger insects, of a brown colour, and flat, which attack sheep. They bury their heads deep in the skin, and it is almost impossible to detach them without breaking. They appear to adhere obstinately to the spot on which they had first fixed themselves. Scarcely any washes will detach them, but a little of the mercurial ointment rubbed on and about them will generally succeed in destroying them. The sheep sometimes swarms with lice. They are found together with, as well as distinct from, the scab. The mercurial ointment will most readily destroy them.

The Rot.—This is the most mysterious and destructive of all the maladies to which the sheep is subject. A sheep may be in perfect health. He is turned into a pasture where the ground is wet. It has been overflowed; but the flood has receded, and much of the herbage has been weakened or destroyed by the moisture. He is left there probably only a few hours, and then returns to his former or to some other pasture. He begins to thrive much more rapidly than he did before. He becomes ready for the butcher a considerable time before his companions. Something occurs, and he is not sold. Many weeks do not pass before he becomes dull—the red veins of health disappear from his eyes, a yellow tinge steals over his skin, he gets thin—his breath smells offensively—the wool begins to fall off—the belly enlarges—he is dropsical. In less than three months he is wasted to a skeleton, and dies. He is examined—the belly is found to be filled with water—the liver is inflamed and enlarged, and it and all the biliary ducts are filled with flukes.

What is the cause of all this? The sheep inhaled an infectious vapour, or miasma, from the decomposing vegetables of the field into which he was turned. These peculiar miasmata always exert their deleterious agency on some abdominal viscus, and here it has been on the liver.

The rot does not depend on starvation or on plethora, or on exposure to cold or deficient ventilation, but is simply connected with the soil and the pasture. In every district there are fields on which no sheep can graze, or on to which they cannot be turned even for a few hours, without having the rot. There are others that never give the rot except when an ardent sun succeeds to a continuance of drenching rains. Like the miasmata from fens, so fatal to the human being by producing incurable disease of some abdominal viscus, so the gases now evolved or discharged exert all their deleterious influence on the liver of the sheep, and produce the malady too well known by the name of 'The Rot.' The prevention of this disease is plainly and palpably, to a certain extent, within the grazier's power. He has but to keep his sheep from rotting ground, and by some contrivance, and by a careful arrangement of his live stock, he may generally manage to do this; or he may drain the rotting pastures, which will serve the same purpose.

The grazier is often disgracefully negligent with regard to these things, and will not believe that *this is the simple cause of rot.* There is no contagion in the matter, and hereditary predisposition is out of the question.

What shall be said as to the cure? If the sheep is in fair condition he should be sent to the butcher. The flesh may be pale, and will not tempt every purchaser, but some epicures will say that it has a peculiar tenderness and a not unpleasant flavour. Should, however, the breed be particularly valuable, the farmer may possibly be warranted in attempting to preserve it, although it will be rarely indeed that he will succeed. The first step is to remove the animal to a sound and dry pasture, or, perhaps, to the straw-yard. He should then be bled moderately and also purged, and given nothing but hay or chaff.

As to medicine, there is but one that can be in the slightest degree depended upon, and that will too often fail—salt. The virtues of salt are not sufficiently appreciated in the common feeding and management of cattle and sheep. Sheep pastured on salt marshes never have the rot. Nature has made all of them fond of it, for it has an admirable influence on all the digestive and secreting organs during health, and it is of the greatest utility in many of the diseases of these animals. And most of all is it valuable in the rot; if there is any medicine that really has power in the cure of this disease, it is the common culinary salt. The dose will vary with the size of the sheep and the virulence of the attack: it should be from a quarter of an ounce to an ounce and a quarter, given morning and night, dissolved in about a pint of water, and in aggravated cases that quantity may even be increased. To this may be added a vegetable tonic, and there are none comparable to gentian and ginger in doses of a drachm each.

If the case is not going on favourably, a couple of grains of calomel and opium may be given with each dose of the salt; beyond this there is nothing to be done but to sell the animal as soon as it can be got into fair condition.

Affections of the Udder in Ewes.—The treatment of these differs little from similar diseases in cattle. *Garget*, however, is more frequent in the sheep than in the cow. If there is the slightest reluctance in the sheep to permit the lamb to suck, it should be caught and examined. It should at all events be confined to a pen, and a dose of Epsom salts should be administered; but, unless there are decided kernels in the udder, nothing more is requisite than to foment the part well with warm water.

If, however, the udder should still continue to be sore, the ointment recommended in garget of the cow should be used, and the teats carefully examined every day. As soon as any of the kernels soften, and seem to contain matter, they should be opened, for the progress of disorganization will be far more rapid in the sheep than in the cow.

There is one circumstance attending this state of inflammation which the farmer should bear in mind. He examines the udder of the sheep and he detects the formation of matter; but it is deeply seated, and he thinks that in a day or two it will be much nearer to the surface. In that day or two, the heat and tenderness and deep-seated matter will have disappeared, and he congratulates himself that he did not lance the part. Many weeks, however, do not pass away before the ewe begins to droop—she gets worse and worse—dropsy comes on, and she dies. The matter has been reabsorbed, and has acted as an animal poison.

After the udder has spontaneously ulcerated, or has been opened with the knife, the chloride of lime, and the tincture of aloes or friar's balsam, should be used, as recommended for the cow. If, in the course of treatment, one of the teats should be lost, or even if, after a severe case, the udder should be perfectly healed, it will always be prudent to fatten and sell the ewe, for the disease is too apt to return.

CHAPTER V.

THE DISEASES OF LAMBS.

THE most frequent and the most fatal of these is *Diarrhœa*, and which cannot be better treated than in the way recommended for calves in book vi. ch. ii.

That discharge of whey-coloured fluid which too often indicates the distension of the true stomach with coagulated milk, should be treated as already described in book vi. ch. ii. It is what is called the *white skit* by some writers, and for the cure of which the most ridiculous things have been proposed.

The *green skit* of the same authors is the common diarrhœa; it occurs when the animal first begins to feed upon grass while it sucks, or when, at weaning time, young and succulent grass becomes its only food. A mild aperient, given in gruel first, and then astringents, will afford the best chance of cure.

Costiveness, referable to an obstructed state of the bowels, is also a not unfrequent disease of the lamb, when its pasture is dried by the heat of summer, or it is suddenly changed from succulent to green food. Some care will here be necessary in order to ascertain the real state of the bowels. A lamb is often said to be constipated when, in fact, there would be a too plentiful discharge of liquid fæces, were not the tail glued to the rump. That frequent discharge of fæces in small quantities with great straining, and which is the most decisive characteristic of dysentery, is also confounded with constipation. True constipation in the lamb, except when connected with considerable fever, is seldom dangerous to the animal. A quarter of an ounce of Epsom salts with a small portion of ginger, administered every eight hours, will generally overcome it.

Fever.—A thriving lamb, and far too richly fed, will occasionally be often attacked with inflammatory fever. Bleeding, physic, and restricted diet will give the best chance of cure.

Apoplexy.—Occasionally, but not so frequently as in the full-grown animal, a forcing system, too decidedly pursued, will produce a sudden determination to the head—*the blood*, as it is commonly and absurdly called. Here, again, bleeding, physic, and restricted diet will be the only means of cure.

CHAPTER VI.

ON THE DISEASES INCIDENT TO SWINE.

IN the management of swine, too much attention cannot be paid to regularity of feeding, to supplying them with proper food, and to keeping their styes clean and well drained and ventilated: much illness will thus be saved—and pigs are at the best awkward patients; and the animals will thrive twice as well.

Garget.—To a slighter degree than in cattle or sheep, the teats of swine are subject to inflammation and ulceration, and especially if the sow was in too high condition at the time of farrowing. The same means as those recommended for cattle and sheep must be adopted, with this difference only, that the curative measures must be very diligently pursued, on account of the natural tendency to inflammation in the swine.

Garget of the Maw is another term for indigestion. It is in young pigs the coagulation of milk in the stomach, and in others the overloading of the stomach with any kind of food. A dose or two of Epsom salts—a half or quarter of an ounce, according to the size and age of the patient—will usually settle this business.

Rising of the Lights is a common term for *inflammation of the lungs*, a disease to which pigs are very subject, and one that is too often fatal. It is palpably an error to deem this disease hereditary, for it evidently arises from atmospheric influence, or some mismanagement in feeding, cleaning, or ventilation; and generally, when it does make its appearance, runs through the whole piggery. The grand remedy is bleeding. The hog is most readily bled from the palate. To this must follow purgatives, promptly administered, and consisting, according to the size of the patient, of from two to four drachms of Epsom salts, and the same quantity of flour of sulphur. If the animal feeds tolerably, he will take the Epsom salts in his wash, and the sulphur may be omitted.

The principal symptoms of inflammation of the lungs are heaving at the flanks, a cough more or less painful, and loss of appetite. Attention and promptitude are requisite, as this disease runs its course very rapidly.

The *Mange*, like the scab in sheep, is a cutaneous eruption, arising from the presence of minute insects called *Acari*, and occasioned, in the majority of cases, by inattention to cleanliness. It appears in the form of blotchy sores on different parts of the body, and is accompanied by a dreadful state of itchiness. The best local application is the sulphur ointment, consisting of sublimed sulphur three ounces, and prepared lard eight ounces. If this should not be sufficiently powerful, a drachm of the common mercurial ointment may be added to every ounce of the former. Internally, from two to four drachms of the alterative powder should be given daily.

The Measles.—This is a disease to which pigs are exceedingly subject, and which sadly injures the quality of the meat. It consists of tubercles scattered everywhere through the cellular and adipose tissue between the skin and the muscles. It is by many considered to be a species of leprosy. Sulphur is one of the best things that can be given for it.

Leprosy is a more virulent kind of mange, principally attacking the cuticle or outer portion of the skin, attended by a puckering of the skin, and separation of the cuticle in the form of flakes of greater or less size. The only cure will be the long and constant administration of 'the alterative powder' in the wash, and the application, every second day, of the mercurial mange ointment, in quantities not exceeding one or two drachms.

Quinsy. — An enlargement of the glands of the throat will often occur in fattened hogs, and sometimes in those which are only in store condition. A swelling occurs under the jaws and about the throat, which either presses upon, or so much affects, the upper respiratory organs, that the animal seems to be almost in danger of suffocation. Bleeding and purging should be first effected, to which should be added puncture of, or setons in, the glands wherever there is the least suspicion of the formation of pus; and in serious cases counter-irritants may be had recourse to.

Apoplexy.—This not unfrequently attends the too hasty fattening of the hog. It will be recognised by the staggering, lethargy, and semi-unconsciousness of the animal. Bleeding and purgatives, and a diminished quantity of food, will be the proper means of cure. No time should be lost in attacking this disease, for it is very rapid in its course, and animals recovered from it must be very carefully dieted for some time, if we would avoid its recurrence.

Diarrhœa frequently occurs, whether the animal is too well or too poorly kept. Farinaceous food, given dry, will often stop it, or if not, a little prepared chalk mixed with milk. If these do not succeed, recourse must be had to the astringent powder.

Colic.—This disease is very frequent among swine that are ill-fed and housed. The symptoms are, rolling about the stye, and terrible squeaking. Warm milk with two drachms of the calves' cordial, and that, perhaps, repeated twice or thrice, will usually give relief.

Sore Ears.—The sulphate of zinc ointment will be the best application.

Vermin.—Pigs out of condition will often be sadly infested with lice. They should first be washed thoroughly with warm soap and water, and then the mercurial mange ointment, to the extent of one or two drachms, should be well rubbed in every second or third day, as long as may be necessary. The styes, too, must be completely cleansed, and fresh litter laid down.

CHAPTER VII.

ON THE BREEDING AND REARING OF DOMESTIC FOWLS, THE GUINEA FOWL, THE TURKEY, AND PIGEONS.

THE grazier on a large scale, and far in the country, seldom concerns himself with the rearing of poultry beyond the consumption of his immediate household. Much trouble and little profit would attend the devotion of his time or capital to this pursuit; while the other and more immediate objects that have been considered in this treatise promise greater and more certain remuneration. The farmer on a small scale can, however, easily and advantageously occupy himself in this minor pursuit; and the cottager may frequently contrive to add not a little to his savings, or his comforts, by the rearing of chickens, or the sale of eggs. In the neighbourhood of large towns, and where the sale is ready and extensive, the rearing and fattening of poultry for the market should become a regular business, and be as scientifically conducted as any portion of the employment of a grazier. For poultry, if properly managed, not only repay the trouble and expense of their keep, but afford a very considerable profit to the rearer and dealer. Yet how few persons seem aware of this, or at any rate how few there are who pay that attention to this branch of farm stock of which it is so well worthy.

The origin of the domestic fowl has never been determined. The 'crowing of the cock,' and 'the hen gathering her chickens under her wings,' are alluded to in the sacred volume at the time of the mission of our Saviour.

Pliny, in the first century after Christ, gives an accurate description of these birds, and we have records of their existence, and in considerable numbers, in our country so early as the reign of the first Edward. One hundred hens, at one penny each, formed part of the weekly fare of the monks of St. Edmondsbury at that period. A variety of our domestic fowl is cultivated in every part of the East, and abounds in the islands of the Asiatic seas. Like the ox and the sheep, but in a far inferior degree, being useful to man, it is found wherever the human foot has trodden.

Among the breeds in most common request are the *Game-fowls* reared for one of the most abominable species of gambling. From a very early period the game-fowl has been cultivated in the East, and it has disgraced almost every country of the West. 'There still exists in India an original variety of game-cock very similar to our own, but inferior in point of size. We know nothing certain as to the date of their introduction into the British Isles, but there is every reason to believe that it was at the time of the invasion of Julius Cæsar, as the Romans were very fond of the sport of cock-fighting.'[1] The most tyrannical and imbecile of our princes have been its patrons. It has had its day, and being illegal is now fast getting into disrepute.

The game breed is somewhat smaller than the others, but light and elegant in form, and the flesh is particularly white and well-flavoured; but, although the hens are excellent layers, it is impossible to rear them for domestic purposes, on account of that innate propensity for fighting which either nature, or the habits of more than a thousand years, have rendered an inseparable part and portion of them. Nothing is so common as for whole broods to be blinded or destroyed by their interminable quarrels. It is almost impossible, on any large scale, to get even a cross from this breed, on account of the hereditary predisposition to fight.

The common *English dunghill* or *barn-door* fowl, is considerably larger than the game-fowl, and although some affect to despise him on account of his mottled coat, and the white feather in his tail, he has not yet been put out of the field by any English or foreign variety. For the number of eggs which it produces, the successful incubation of them, and the excellence of the meat for table, this breed will yield supremacy to no other.

The *Dorking* breed, so named from the town where it was first and is still chiefly reared, comes even before the old English fowl in excellence, and equals, if not excels, it in the number of eggs the hens will lay; the flesh is beautifully white and most delicately flavoured. Most of the capons which are sent to the London markets are of this breed. These fowls are often mottled, but the finest and purest bred are white.

The *Horsham* or *Sussex* fowls differ from the Dorking ones in the absence of a fifth claw, by which the Surrey poultry are distinguished, and which, probably, was only an accidental variety, afterwards diligently cultivated.

[1] Richardson on the Domestic Fowl.

The *Poland* fowls, as they are called, but which were originally from Holland, are kept on account of their beauty—being usually of a glossy black, with white top-knots—and also for the multitude of eggs which they lay. On account of this latter quality they are sometimes called *everlasting layers*. There is often, however much difficulty in getting them to sit, and other hens are occasionally employed to hatch their eggs.

There formerly used to be a larger kind of fowl, called for some now forgotten reason, the *Shack-bag*. Some of the pullets have weighed ten pounds. The flesh was peculiarly white and finely flavoured. It was crossed by the Malay hen, but with much disadvantage, and in consequence of this cross it became undervalued, and the true *Shack-bag* disappeared.

The *Malay*, as may be supposed from what has just been stated, is a large fowl. It produces many eggs of a large size that used to be prized, both on account of their size and quality; but the flesh not being delicate, and the hens being bad sitters, they have lost much of the reputation which they once possessed. A cross between the Malay and the common fowl, if made with proper attention to both cock and hen, is productive of a very fine breed partaking of the best qualities of both sides.

The *Cochin-China* is a fine breed of fowls, handsome in appearance, large in size, and well-flavoured. The hens will often lay two or even three eggs each day. This breed has been very successfully crossed with the *Dorking*, and also with the common fowl.

Another fine breed is the *Spanish*; these, when pure, are almost invariably of a bright glossy black. The hens lay well. The flesh is white and well-flavoured, and they fatten rapidly.

To these must be added the diminutive but showy *Bantam*, originally from the East. It is kept on account of its beauty, its puppyism, its great produce of eggs and chickens, and the peculiar delicacy of its flesh.

As soon as it is determined to have a poultry-yard, the breed or breeds should be determined on—for some must be chosen for sitters, and others in order to supply the nests and the table with eggs: great care should be taken in the selection of the fowls, for on their healthiness or freedom from disease success will chiefly depend. The signs of health are as evident and as certain in the feathered biped as in the quadruped. The glossiness and smoothness of the feathers—the brightness of the eye—the cleanness of the nostrils—the florid redness of the comb—the soundness of the legs—and the shortness of the claws—will be sufficient pledges of health. The male should be large of his kind, and bold and active. The hen should be gentle and tame, and by no means above the middle size. A small comb on the hen may be pardoned, but should not be chosen. A large comb on her head is a frequent pledge of her unquietness, and rarely belongs to a good sitter, or a careful nurse. Yellow legs are to be avoided, because there is a prejudice against them, and not altogether without cause. They are often connected with a tender constitution, and with coarse and tasteless flesh. The fowls should be of a middle age—from eighteen months to two years. Before that period the eggs will not have attained their full size, and the young broods will be proportionally small. The first inhabitants of the fowl-yard, and who will give to it its future character, should not be bought from a stranger, but there should be a certainty that the hens are good and early layers, and that they begin to lay again as soon as their brood is disposed of. The best period for commencing the business of the poultry-yard is the latter part of the winter or the beginning of spring.

Where a considerable number of fowls are kept, a poultry-house, however small and simple it may be, should be devoted to their use. In a farm establishment this is particularly necessary, otherwise the owner will suffer materially, as they will often wander away and be liable to be killed by foxes or other vermin, and the eggs will be laid in all kinds of places. This building, although well ventilated, should be warm and comfortable, and so contrived as to receive the sun's rays during the greater part of the day. Few animals suffer more from cold than our domestic fowls. The roosting-places should be easy of access to the poultry, but sufficiently high to be out of the reach of vermin, and they should consist of one or more long level ranges. The boxes for laying and sitting should be convenient and warm, apart from each other, and sufficiently numerous. If there is sufficient space, a yard should be fenced or walled in, communicating with the poultry-house, and in which the whole stock may be occasionally confined. It should contain a stream or pond, or troughs of water, and be divided into compartments, so that the different broods may not become intermingled. At all events, if the poultry wander about the yard, or the barn door, or other parts of the premises during the day, their roosting, and laying, and sitting-place should be comfortable, and closed at night, and there they should always be fed.

The poultry-yard should be dry. There should be sheds for refuge in wet weather, and these should not be allowed to get damp. It should be sheltered from the north and east winds; and sand and gravel, chalk and bricklayer's rubbish should be strewed in different parts of it, in which they may roll themselves at their pleasure. This is more conducive to the health of the fowl than is generally imagined; not only cleaning the feathers, and getting rid of eruptions and vermin, and favouring that most important of all functions, cutaneous perspiration, but sand and chalk assist in forming the shell of the egg, and we often see hens, deprived of these useful adjuncts, lay a considerable number of soft eggs.

The hens will usually begin to lay in January, or the beginning of February, and this period may be somewhat hastened by a small portion of buck-wheat, or hemp-seed, or barley, being given with the usual food. This object, however, being accomplished, all stimulating food should be removed; for a laying hen must not be too liberally fed. Too plentiful, as well as too little food, will almost equally lessen the number of eggs.

Towards the beginning of March, many of the hens will show a disposition to sit. Fresh nests should be prepared composed internally of short and soft materials in a frame of wood, and level with the ground, or, which is better, about three or four inches from the ground, and the ascent to them very gentle. The hen or hens that are intended to sit should be carefully selected. The eggs that are to be placed under the hens should have the date of their being laid marked upon them; and varying with the size of the hen and the eggs, a proper number should be selected that were laid within a day or two of each other. A small hen, and the eggs belonging to a small breed, will cover from eight to ten eggs. A large hen may manage twelve or fourteen. These should all be marked, and advantage taken of the occasional absence of the hen to see whether any others have been added. If there are more than the proper number, the unmarked ones must be removed.

Proper and sufficient food should be placed near to the hens, that they may not be too long absent from their charge. Hunger alone will induce them to leave it for a moment.

No interference should be permitted during the whole of this time, unless, at the close of it, the chicken should not be able to free himself from the glutinous substance that lines the inside of the egg; nor should any of the chickens be taken away as they are hatched, for this will only disturb the hen and the others. She should be left quite alone until she comes chuckling from her nest with all her little ones about her.

The proprietor may not wish to have too many broods of chickens running about at the same time. If there is not more than a day or two difference in their age, he can select the last that hatched her chickens, or he can take the most careful or the best mother, and give her the whole of the broods. If the other hens are then placed at a distance, they will give over clucking in the course of a day or two, and begin to lay eggs again.

The best food for newly hatched chickens is shelled oats, boiled for a minute or two; to this may be added a little hard-boiled egg, or crumbs of bread. The mother will provide them with plenty of insects and other food. There is one kind of food with which, in the course of a week or two, they may be indulged without danger, and almost without restraint. Everyone who has much to do with poultry will have a brood-basket, in which he can carry the hen and her chickens to different parts of the yard or farm. In the months of June or July, and when the turnip crop is attacked by the fly, or is threatened to be so attacked, this basket may be carried into the field. The wickerwork will allow the chickens to go out, and they will pursue and pick up all the larvæ or insects, and all other creatures destructive to the young crop. When one space is cleared the basket may be moved, until the greater part of the field is gone over. If there are different baskets, and different broods, they must be placed at such distances as not to be able to intermix.

After about a week the hen may be suffered to run abroad with her brood. She will need this indulgence, and her health will be improved by it. She will also teach them the most suitable kinds of food, and by her habit of scratching will procure them much that would otherwise be lost.

For chickens that are intended to be fattened, the grain during the first week, or, perhaps, for a considerable part of the time, should be steeped in water, or boiled for a few minutes. The hot liquor may be thickened with oat- or barley-meal to a firm or almost solid state. Pea-meal or boiled potatoes, given warm, and light corn, or almost any food of this kind, which is most convenient to the owner, and which does not excite purging, may be substituted. In the course of ten or twelve weeks the chickens will have become sufficiently grown to send to the market.

It will be, however, necessary to bring a certain portion of them to a higher state of condition and fatness than can be accomplished by these means. The *barn-door fed* fowl is in great requisition. He is suffered to run about the different yards, picking up the waste corn, and food of various kinds that comes in his way—diligently attending the barn-door when the corn is threshed out, and occasionally coming in for more from the hand, when it is thought that his crop may not be sufficiently full. With all this nutriment, and the digestive organs being kept in full energy by the exercise which he takes, he acquires a peculiar state of condition that renders his flesh highly palatable in the estimation of epicures. He is plump, and covered with healthy and well-tasted flesh; and there is not much fat mingling with it to disgust those who are fanciful on these subjects.

This method of preparing the fowl is not always sufficiently rapid for the purpose of the feeder, and then the creature is cooped up, and not only has as much food before him as he is disposed to take, but is crammed with more. The process continues, perhaps, seven or eight days, and the bird certainly increases rapidly in weight. He has accumulated an additional quantity of fat, but the fleshy part, the most wholesome, and the most pleasant to the taste, is considerably diminished. The appearance of the fowl on the table is improved, but he is far less valuable in the estimation of the connoisseur.

This leads to the subject of *Capons*. The large short-bodied male fowls are castrated, and that invariably gives a disposition to accumulate fat and unwholesome flesh. The fine large fowls that are seen in the poulterers' shops have undergone this process. They are shut up in some dark place, enclosed in coops, and crammed with barley or other meal, formed into a paste by means of hot liquor; and this operation is repeated several times in the day. The consequence of this over-loaded crop is that the bird becomes indisposed to move, and is rendered sleepy, and is soon thickly covered with unwholesome fat. The capon-feeders are much belied if they do not go farther than this. They mix ardent spirit with the paste by which the birds are crammed, and that, and the darkened place in which they are confined, disposes them to be stupid and half asleep, and to become literally bloated with fat. This process, however, cannot be long continued, for fever or apoplexy will carry off the bird, or the whole of the carcase will be reddened and spoiled by redundancy of blood.

THE GUINEA FOWL.

This bird is a native of Africa, on the western coast of which it may be seen in large flocks. The male and the female can scarcely be distinguished from each other; the principal or almost only difference being in the wattles, which in the cock are tinged with blue, while those of the hen are more inclined to red. They lay a great number of eggs, but they appear as if they were only half reclaimed among us. They rarely enter a building to roost, like our domestic poultry; but, if they have the opportunity, they betake themselves to the trees, mounting to the very top in fine weather, and in wet weather seeking for shelter in the lower branches. The flesh approaches to that of the pheasant in flavour, and is ready for the table when the season for game is coming to a conclusion.

Their nests are formed in the most secret places that they can select, and oftenest among weeds, or nettles, or the bottoms of hedges. The eggs are usually hatched by the common hens, and the young ones are as easily reared as other chickens. The time of incubation is a month; but the hen, not calculating the progress of time, but judging of her duty by what she hears of the little prisoners within the eggs, patiently continues to sit until her task is accomplished. If the guinea-fowl sits on her own nest, she is easily disturbed, and too often induced to forsake it in consequence of very slight annoyance.

The young ones will follow the hen, and should be treated like other chickens, except that they are more tender than our native breeds. Their earliest food is usually boiled or steeped rice, or sopped wheaten bread. They may be fed and fattened like other fowls. Considering the price that they will yield, and the delicacy of their eggs, it would seem unaccountable that the breeding of them is so much neglected, did we not know that it is almost impossible to rear them with other fowls, on account of their worrying propensities, and had we not heard the harsh discordant noises they make.

THE TURKEY.

The native country of the wild turkey extends from the north-western territory of the American United States to the Isthmus of Panama. About the beginning of October they assemble in flocks, and direct their course to the rich pasture lands: the males by themselves in parties of from ten to a hundred, and the females in separate troops, with their young ones about two-thirds grown. At the middle of November they arrive at the place of their destination, where they remain during the winter, all ages and sexes being now intermingled. This is the time for destroying them, and the inhabitants have a rich harvest. About March they begin to pair. In April the female prepares her nest in the most secure recesses of the prairie, and as soon as the young ones are strong enough for the journey, the whole troop return to their summer abodes.

The European turkey, although a different account is given by some of our naturalists, is of American origin. It was first sent from Mexico to Spain; from Spain it reached England in 1524, and soon, on account of its valuable properties, was reared and multiplied in every part of the kingdom.

The turkey is a comparatively stupid bird and a bad mother, never taking trouble to procure food for her young, and often carelessly trampling them to death; yet where it can be bred with convenience, no fowl is more valuable. There are various breeds, the best and most hardy of which, and the least difficult to rear, are the large black Norfolks. The varieties of a copper colour never attain to the size of the Norfolks. The white turkeys have the character, and truly so, of not being sufficiently hardy.

As soon as the laying season commences, the males may with advantage be separated from the females; for, contrary to what takes place in our other domestic fowls, all her eggs are impregnated before she begins to lay. Naturally stupid, and still somewhat wild, she will perhaps endeavour to build her nest in some inconvenient place, and with improper materials; it will, therefore, be proper to watch her, and to remedy this. She will generally lay more eggs than she can cover. About a dozen is a proper number for her. Each turkey hen ought to rear at least ten at the first hatching, and about half a dozen at every subsequent time. The period of incubation is twenty-eight days, or sometimes one or two more.

Until she has hatched her young ones she is a good mother, and will half-starve herself on her nest; therefore she should always have food, and water, and sand within her reach.

The young birds are very tender, and should be left under the mother until the whole hatching is completed. The practice of dipping them into cold water as soon as they are hatched, for the purpose of hardening them, is absurd: no one knows with whom it originated, but he who practises it deserves to have a good ducking himself.

During the first month the young turkeys require a great deal of nursing, and should be preserved from any inclemency of weather. Their food should be nutritious and varied: oat- and barley-meal moistened and beaten into a mass, bread sopped in water, well-boiled eggs, malt, meal, &c. These articles should be alternated or mixed together; the principle is, that there shall be a frequent change of food. After the first three weeks the food should be a little more stimulating, and bruised peppercorns may be added, or caraway seeds. The first should be given in preference, and the two will, for general purposes, supersede every other kind of spicy food. The state of the brood should be often inspected, and if any of the young ones are drooping or refuse to feed, or are pen-feathered, a few additional peppercorns may be given, with pills composed of garlic and rue, which must be forced upon them. Small bits of lean meat, well boiled, may also be thrown to them. They may have free access to water, but the food that is given to them should be beaten together into as solid a form as possible.

When two or three weeks are passed, if the brood is doing well, the food on which they will be afterwards kept may be given in small quantities, as buck-wheat and other kinds of grain, and vegetables, &c., the mixed meals being still continued. They may now wander farther from their coops, or be placed under the care of the mother, if she is prevented from taking them too far from home. By degrees, however, they will wander farther, until they have become independent of the hen. They will then, perhaps, be rarely seen at home, except in the morning and the evening, in order to receive their regular food. The danger of losing these birds is chiefly during the first month.

When the bird is nearly full grown, there will be little trouble in getting him into a fair condition by the use of plain and wholesome food, and the flesh will then possess the best flavour. If there is a necessity for haste in this process, or it is wished to accumulate more fat upon them, the spices that have been already referred to may be given in the food, with the occasional addition of an onion, of which the bird seems to be naturally fond, and which, if given in moderate quantities, can rarely do harm. If there is a decided objection to anything as a frequent or constant food it is to milk, which has a strange tendency to become quickly sour in the pouch of the turkey.

Of the cramming system enough, if not too much, has already been said, when describing the method of fattening the capon.

A very profitable kind of food is the corn which is left in the stubbles. The constant exercise which these birds take in search of their food promotes their health and flesh; and, in fact, the union of air and exercise, and corn, disposes them to accumulate fat with a rapidity that would scarcely be credited. They only require afterwards to be confined for a week or two, when they are fit to send to the market.

PIGEONS.

There are two distinct questions here: the policy of building a pigeon-house on a farm, and the management of that pigeon-house when built. There is no doubt that a well-stocked pigeon-house is a great advantage in the family of the farmer. For nearly ten months out of the twelve he may draw upon it occasionally, as circumstances may require, and some few dozens may probably be sent to the market. There can likewise be no question that the pigeons are useful in destroying the grubs in ploughed lands and the seeds of many a weed. The dung from a large pigeon-house is considerable in quantity, and exceedingly valuable. On the other hand, however, it cannot be denied that they are sad destroyers of the new-sown corn, and scratch up, or trample or destroy, more than they devour; and also, when the corn is getting ripe, their ravages are almost beyond computation. During the sowing, and previous to the reaping season, each of them will devour his full weight of corn.

On the whole, it must be admitted that they are sadly injurious to the farmer, and the proof of this is, that pigeon-houses are rapidly decreasing everywhere. In Norfolk particularly, and in Kent, the number of pigeons is much fewer than it used to be; and many of the houses have altogether ceased to be inhabited, on account of the injuries that may be too clearly laid to the charge of these birds.

Where, however, the farmer persists in having a few pigeons, there is often no part of his establishment so badly conducted as this. It may be said, with perfect truth, that 'the principle of managing them consists in regular feeding, sufficient space for breeding, and a strict attention to cleanliness;' but there are many minor details intimately connected with the profit of a dove-cot.

The kind of pigeon which is kept is a circumstance of no little consideration. The dark blue or gray pigeon may be the most hardy, but some of the mixed breeds, which are less inclined to wander, or may be almost always seen about the dove-cot, are more profitable, on account of their greater frequency of breeding.

The *runt* pigeon, being of the largest size, and breeding early, may likewise be selected; but he knows little of the economical management of the pigeon-house who suffers a single *fancy* bird within his premises. The pigeon-house, if it is not a circular building, should, if possible, have a southern aspect. The principles of it are—roominess, cleanliness, and warmth.

The house having been stocked in the way most agreeable to the owner's fancy, the young pigeons will usually begin to breed in about six or seven months from the time of their being hatched: some intimation of this will be afforded by the deep tone of the cooing of the male, and the endearments of the female. The eggs are generally but two, and the labour of incubation is equally shared between the pair, the male occupying the nest through the greater part of the day, and the female during the whole of the night. The period of incubation is about twenty days. The care of feeding is also shared between both, but in a most singular way. We here quote from Dickson's 'Practical Guide':—'The crop of the pigeon, at the time of having young, has the power of preparing a fine soft kind of highly-nourishing fluid, of a milky appearance, which serves the purpose of feeding them. This the old birds throw up at pleasure, and force it, as often as necessary, into the mouths of their young, which are readily opened for the purpose of being thus fed. After this sort of feeding has continued about a week, and the young pigeons get more strength, some harder sort of food is collected, and being mixed with that which was at first given, is put into the mouths of the young ones, soon after which the newly-hatched pigeons become capable of feeding themselves, and the old ones prepare to breed again.' The young pigeons are generally taken from the nests and sold at this early stage, unless they are intended to be kept for breeding.

CHAPTER VIII.

THE PALMIPEDES, OR WEB-FOOTED BIRDS.

OF these the only two that it will be requisite to notice are the duck and the goose.

THE DUCK.

The WILD DUCK (*Anas boschas*) is the original of our common duck. The wild duck is diffused over almost every part of the globe, and differs little in his plumage or his habits, wherever he may be found. In our own country he pairs about the end of February or beginning of March, and each company lives apart amidst the sedges in which the future brood is to be reared. The incubation lasts 28 or 30 days. Whenever the female leaves her nest in search of food she covers it carefully up, while the male keeps anxious watch. Nothing can be more affectionate than they are to their young, which are generally three months before they can fly, and three more ere their plumage is complete.

There are several varieties of the tame duck—the common white, the Aylesbury white, the speckled brown and white, the common brown and the dark roan. There have been many crosses between these, but that between the Aylesbury white and the Rouen or French duck is most valued; the former of these is an early breeder, and the latter yields the most delicately-tasted flesh.

The habits of all these breeds are very similar. The orderly manner in which they start for their day's excursion and return at night has been observed a thousand times. After having their morning meal, they sally forth in search of frog or insect, slug, snail, or worm, and almost every kind of weed or vegetable which the marsh, the pond, the river, or the garden produces.

In this portion of the poultry establishment it is usual to have one male to every four or five females. They should be carefully selected, with regard to their being prolific, attentive to their young, little addicted to wandering, fattening kindly, and their flesh being of good flavour. Different breeds should not be mixed together. The breed should be well considered and then adhered to.

When they are of an early kind and well taken care of, they begin to lay about the middle or end of January, and previous to this they should be more than usually well fed. Some attention should be paid to their nests, for they are apt to be careless at the beginning of their laying. The eggs should be regularly collected and marked with the day on which they were dropped. When there is more than one duck anxious to sit, the eggs should be selected according to the time when they were produced. A brood-duck will generally manage about a dozen eggs. They should always have food and water by them, that they may not be taken away too far or kept too long from their nest.

The ducklings should remain with the mother a few days or a week, being kept on nearly the same food as the young chickens, with plenty of water in shallow pans or troughs. To this should be added as many slugs, or snails, or worms as can be collected. In a few days, if the weather is warm, the coop under which the mother has been confined from the beginning, may be moved to some sheltered, sunny spot, where there is plenty of grass, and be shifted every day. In the course of a fortnight or somewhat less, the ducklings may be permitted to go with the mother to one of the ponds, and the smallest is the best; but the day should be fine and the weather warm, and they should be suffered to remain out only a little while at first, lest they should be cramped, or violently scoured, which the long application of cold water to them at this early period is apt to produce.

The practice of raising ducks under hens is a cruel and unprofitable one. The foster-mother is anxious to keep her brood from the water, and they, distracted between the instinctive desire for it and her incessant calling, do not gather half the food which the water contains. It is an unnatural practice, and rarely comes to good.

In six weeks or two months, the ducklings will have grown considerably, and the owner will be thinking of turning some of them to a profitable account. He increases both the morning and the evening meal—he gives them more corn—perhaps he indulges them with grains, always a favourite food—or some culinary vegetables. He varies the kind of food continually. This is a golden rule, that should never be forgotten. He mixes up the meal or the grains with any waste animal fluid, &c. The ducklings are thus kept in a state of unnatural fatness. This is dangerous, but it is necessary; for otherwise they would not attain the condition that is indispensable to their sale, nor that peculiar flavour in which the epicure delights.

The fattening of the full-grown duck is another business. He is taken from the corn-field and the pond, and subjected, like every over-fed fowl, to a species of imprisonment. It is not so bad as the coop of the capon or the turkey; but it is enclosed, and it is somewhat darkened. He has no longer to seek for any portion of his food. It is placed immediately before him, and he has nothing to do but to eat and to sleep; and, under the combined influence of these processes, he rapidly gets fat. The greater part of the food is the same as before. Some linseed meal is added to it, and some wholesome vegetables from the garden. The birds are kept clean, and their food is good, and in process of time they yield an ample profit to their feeder.

Some breeders are not content to follow this honest and wholesome plan, but they get every kind of garbage for their fattening ducks. They give them the refuse of the butcher's shop and of the slaughterhouse. There is danger of inflammation here; but where that is escaped, the prisoners fatten as rapidly as could be wished, and the flesh acquires the colour and the flavour of the wild duck. The profit on the fattening of the duck is greater, where there are proper conveniences, than on the fowl.

With the wild-duck decoys the grazier will usually have little to do.

THE GOOSE.

The Wild Goose (*Anas anser*), like the duck, is found in every latitude and in every country. He shifts his habitation with the seasons, and there is no portion of the world that is not occasionally visited by him.

The Domesticated Goose is a descendant from the wild one; but accident, or the fancy of the owner, has established various breeds. The male of the common goose is generally white—the female is gray. The large Embden goose, and the smaller Spanish, are white. The best geese, like the best turkeys, are found in Norfolk, Suffolk, and Berkshire. The goose is a more intellectual—if this term may be used—and affectionate bird than the duck, and likewise yields more profit to the breeder. The proper proportion is a gander to four or five geese; but some breeders will not allow more than two geese to one gander. The goose is said to live to the age of eighty years or more. A mixture of different breeds is far from unusual or improper in the rearing of geese. The large white gander and dark gray goose will best suit. An important object with the breeder of geese is to have, if possible, two broods in the same season. In order to effect this, he feeds his breeding stock well towards the close of the winter months, and particularly as the laying season approaches. He will know when that is at hand, by the goose beginning to carry straw in her mouth. He must immediately provide her with a nest in the hatching-house, or some other convenient place, and she will then begin to lay her eggs. Ten or twelve eggs will be as much as she will manage to cover, and the rest should be removed. No sooner has she taken her place on the nest than the gander assumes the office of guard at the door. He will suffer no vermin to approach, he will contend even with the dog, if he attempts to intrude; he leaves his station as seldom as she does hers, and when she goes for her food or water, he takes her place at the nest. Her time of incubation is thirty days, during which she should be fed chiefly on oats, and a little boiled potato rubbed fine, given to her every three or four days.

The goslings should remain with the goose—the entrance of vermin of every kind being prevented—and should be supplied with the kind of food already recommended for the ducklings and other young fowls. Fresh water, sand, and a clod of grass, or turf are among the indispensable things. Having become a little stronger, and not so liable to be attacked with cramp, &c., which will be the case in about a week or less, they may be turned with the goose into a plot of ground or short grass covered. She must be confined by four hurdles, forming a square, and raised from the ground, that the goslings may run in and out at their pleasure. In the evening they should return to their old shelter. On the following morning the hurdles should be placed on another portion of the ground. Three or four different breeds may occupy the same paddock, and there will be little or no danger, for each gosling will recognise his own portion and the old goose within it. This may be continued until they are strong enough to be turned out with the other geese.

By these means also the goslings will be prevented from going too early into the water; for although they are afterwards to spend much of their time on the water, nothing is so destructive to them when young as wet, on account of the cramp, and diarrhœa, and apparent colic which it produces.

The after history of the gosling and the goose varies but little from that of the duckling and the duck; the same full allowance of food is required, and the same week or fortnight's extra feeding before they are sent to market. Boiled potatoes and oats, given warm, will tend to fatten geese into fair condition. The principal difference between them is, that the fattening of the goose is generally more profitable to the farmer than that of any other poultry.

CHAPTER IX.

THE DISEASES OF FOWLS.

THEY are numerous and fatal. First in the list stands—The *Roup.*—This is a species of catarrh to which fowls of all kinds are exceedingly subject, especially if they are ill-fed, and confined in close places. There is swelling around the eyes, and discharge from the nostrils, and drivelling from the mouth, at first limpid, and afterwards becoming purulent and fœtid. The crop is unnaturally hard—the digestive organs sympathise with the respiratory ones. Common salt is often given in this case, with good effect. It usually acts as an emetic. The dose for an ordinary-sized fowl is half a teaspoonful of the saturated solution. Next to this is cleanliness. The eyes and head should be frequently bathed with warm water. Warmth is indispensable. It is the secret of treating almost every morbid affection of the respiratory passages of our domestic animals. It must not, however, be the warmth of a close and ill-ventilated place. The James's powder is very useful, in doses of a grain, made into a pill with bread. After this should follow a very common, but a very useful remedy—garlic and rue, beaten into a mass, with a little butter, and pills of it forced down the throat of the fowl. These act as mild stimulants, and are well suited to a disease so apt to assume the typhoid form.

Ducks are very subject to this complaint, and it carries them off almost without warning. In geese it is recognised under the name of *Gargle.* It frequently attacks the pigeon, and whole dove-cots are depopulated by it. In fowls of almost every kind there is the same defluxion from the eyes, the nose, and the mouth, the same disinclination or inability to feed, the same moping appearance and gradual weakness. Garlic and rue, with warmth and cleanliness, are the grand means of cure. Little pills of the horse-cordial ball have often been given with considerable effect.

The Pip.—This name has sometimes been given to a disease of the glands of the rump; but it more probably belongs to the head, and especially the respiratory passages. The bird refuses all food, or he makes ineffectual attempts to get it into his mouth. On examination, there will be found a white hard gathering about the tongue, and the back part of the mouth, and the opening from the nose into the mouth. The eye, that was bright yesterday, is now perfectly white. The bird has become all at once blind. On closer examination, it will be found that this is a white cheesy matter that has covered the eye, and surrounded the tongue, and stopped the passages of the mouth. With some trouble it can be picked to pieces, and almost entirely removed, and the sight and the faculty of swallowing are restored; and this must be done without delay. The parts must then be washed with a weak solution of white vitriol, and a piece of garlic about the size of a corking-pin's head, or a couple of grains of black pepper, given twice or thrice a day; but, in the majority of cases, this cheesy substance is formed again and again, and the bird is choked or dies of exhaustion.

The Turn, or *Giddiness*.—This is another fatal disease. A bird is apparently well; he has scarcely moved before he falls from his perch in a fit, and, if neglected, quickly dies. The veins of the palate should be immediately opened, and a few drops of a mixture composed of six parts of the sweet spirit of nitre and one of ammonia poured down the throat. The grand cause of this is overfeeding and want of exercise.

The Scour.—Diarrhœa, or dysentery, in birds is produced by sudden alterations of food, or it is often the effect of atmospheric influence. A few drops of the syrup of white poppies, mixed with a little castor oil, will be useful, if anything will.

Affections of the Skin.—Birds are often covered with a minute insect, that teases them without mercy. Gurlt states that the greater part of these insects do not touch the skin or suck the blood, but live on the feathers, and irritate the birds by their rapid and incessant motion. But he adds that there is a mite, the *Dermanyssus avium*, which only comes on the birds at night, and which does suck the blood. This mite is particularly troublesome to pigeons and domestic fowls; if horses are kept near where the fowls roost, it will pass to them and produce a disease similar to mange.[1] Pimples and ulcers break out in various parts, and the feathers cease to grow or are plucked out. All this arises from the same cause. One part of hydrocyanic acid should be mixed with twenty of water, and this lotion should be daily applied, and well rubbed into the parts where the itching appears to be most intense. Not more, however, than a drachm of the lotion should be used at one time. Should this fail, one part of the strong mercurial ointment must be mixed with twelve parts of lard, and a little of it well rubbed in daily.

Stoppage of the Crop.—From greediness, or from debility, the crop will occasionally be distended with food, almost to bursting. This is frequently the case with pigeons fed on peas. It should be opened with a sharp penknife, the contents taken out, and the wound sewed up with fine thread and closely-placed stitches. From one to two grains of calomel should then be given in a pill of the horse-cordial ball.

Inflammation of the Lungs.—This, characterised by great heaving, mopishness, a peculiar gaping and loss of appetite, requires bleeding from the palate, and from a grain to two grains each of calomel and James's powder.

Convulsions.—These attack ducks oftener than fowls, and carry them off in a very short space of time. Tincture of rhubarb and Cayenne pepper are the best remedies in these cases. From three to four drops of the former, and the same number of grains of the

[1] Magazin für die Thierheilkunde, 1849.

latter, may be given, and repeated after an interval of twelve hours if the bird still looks heavy and moping.

Asthma.—This is a very common disease. The bird sits in a corner, breathing short, and with the mouth open as if to gasp for more air. This principally arises from too stimulating food and too confined air. Aperients will be the best remedies, consisting of equal parts of calomel and antimonial powder, in grain doses daily.

Wasting.—It is strange how much this disease prevails among poultry, and especially hens that have been too much put upon, by being made to hatch and to nurse several successive broods. There is no cure for it but good air, plenty of sand and rubbish, and the frequent administration of the garlic and rue pill. Connected with this atrophy is—

Disease of the Liver.—The liver is enlarged, and altered in structure, and filled with tubercles. The spleen, the kidneys, and even the heart, sometimes contain them. The bird is wasted to a perfect skeleton. The colour of the skin and the eyes will usually betray the character of the disease. There is no cure; the poor hen has been too much put upon, and is exhausted.

Obstruction of the Rump-gland.—This gland secretes an oil to anoint the feathers, contribute to their growth, and make them water-tight. The action of a bird before a shower of rain will sufficiently prove the intention of this gland. It occasionally takes on inflammation and indurates, or matter forms in it. It should be punctured with a sharp lancet, and the evil will usually be terminated at once.

Bad Feet.—This is a frequent and troublesome disease. The feet should be well cleansed. Any loose scales should be removed. The friar's balsam should be applied to any wounds, and camphorated oil rubbed daily into any enlargement. Canker in the feet, or the loosening and rotting away of any of the toes, can only be conquered by removing the gangrened or affected toe at the joint above.

Moulting.—This is a trying season with all birds, and a great many are lost in the process. The wild and uncaged birds escape comparatively harmless. The principal inconvenience to them is, that they can take no long flights on account of their loss of feathers, and that they lose condition to a certain degree, because it requires much expenditure of nutriment and animal power to reproduce their plumage. They, therefore, frequent those more cultivated places where their food—seeds and insects—may be readily obtained. The domestic bird, at the time of moulting, requires to be well supplied with food, and of a somewhat stimulating nature. In addition to the common food, a little canary seed, or hemp seed, will be all that will be required for some, and a few meal worms and ants' eggs for others.

Pairing Fever.—This is a disease which seems to be consequent on the domestication of some birds, especially pets. To a certain degree they get reconciled to their imprisonment, and eat and sing, and are cheerful; but by-and-by comes the pairing season, and they then feel a natural and strong impulse to fulfil the grand law of nature. They cease to sing—they flutter for a while against their cages, they mope in the corners of them, their feathers become ruffled, they pine away to a skeleton, and die. A little aperient medicine—a grain or two of calomel every second day—may be given; but the grand and only secret of cure is change of scene, so far as it can be obtained, or some approach to old scenes and habits. The bird should be placed in the window, or hung out of doors. The effect of this will be almost magical; for the prisoner will generally, in a few days, resume all his liveliness and sing as merrily as ever. There is nothing so infectious as this disease of the mind; it resembles, and it equals in intensity, the occasional and half-insane longing of the Swiss peasant to revisit his native country. If the cages of the males are separated from those of the females at this period, the spell will frequently be broken at once. These latter observations apply chiefly to cage birds, and will not, we trust, be deemed intrusive here.

BOOK THE SEVENTH.

ON FARM OFFICES AND IMPLEMENTS OF HUSBANDRY.

CHAPTER I.

THE FARM HOUSE.

FROM the manner in which husbandmen usually acquire the possession of farms, it rarely happens that they have it in their power to erect a building in such a situation, and with such offices, as convenience and good management may require. Where, however, the agriculturist has, either by descent or purchase, a farm at command, or the old house is so much dilapidated that a new dwelling is preferable to any repairs, a few hints on the most advisable plan of building may not be quite useless. Although it need scarcely be named here, it forms no part of the plan of this work to go further than the giving of those hints, and to enter into long and detailed statements of the principles upon which the various buildings and the machinery of the farm are based; and to illustrate all the methods and forms which they assume in practice. This is the work of other treatises, the scope and scheme of which embrace these departments either specially or partially.

Every prudent man will endeavour to apportion his expenditure to his means, as well as to his wants; first, therefore, it will be necessary to consider the expense of the improvements proposed. This will materially differ in proportion to the value or rental of the farm. In cases where the annual rent is from 300*l.* to 400*l.*, it has been estimated that one year's rent will, upon an average, be nearly sufficient for the dwelling-house. In farms of greater extent, 500*l.* or 600*l.* are allowed for this purpose, and from 1,000*l.* to 1,500*l.* for the requisite offices; but these calculations are of a general nature, and must necessarily vary materially according to existing circumstances.

In erecting farm-houses, the first objects necessary to be attended to are *convenience* and *a salubrious situation.* These are points of the greatest importance, as materially affecting the health and comfort of the individuals of the family as well as the stock.

Independently of the general salubrity of the place where farmhouses are proposed to be built, the nature of the *air* and *water* require particular notice. The former should be pure and temperate, the latter wholesome and easily obtained. The most healthy spot, therefore, should be selected for building the house; which, where choice of situation can be commanded, should have a southern aspect, and be as nearly in the *centre of the farm* as circumstances will permit. Where a farm-house is unavoidably built in the vicinity of marshes, it will, perhaps, be better to select a northern aspect, for fewer noxious vapours will arise while that wind blows. On all sites at all marshy or damp, thorough drainage is the first thing to be attended to. Many parts of our fertile island abound with rivulets and streams, which, however, are rarely regarded, although this point is of much importance, as placing that valuable auxiliary 'water power' at the farmer's command. A gentle elevation greatly conduces to the advantage of the farm-house, as well as to convenience of carriage; and where a quick-flowing stream has a clean channel and dry banks, it adds considerably to the beauty and salubrity, as well as the value, of the place.

A somewhat elevated situation is not only more healthy for the farmer, his family, and servants, but the manure from a farm-yard so situated will be conveyed to the fields in the cheapest and most expeditious manner; and, what is of yet greater importance, the farmer, whose eye should pervade every place and every thing, will be enabled to superintend with greater ease that which is going on around him. Yet we do not advise that the farm-buildings should be situated on the summit of an elevation, for they should always be sheltered either by higher ground or in some natural manner.

There are few points so much neglected in the construction of farm-houses as the *convenience* of the inhabitants. The facility and the pleasure of carrying on many of the operations of husbandry depend on a judicious arrangement of the abode of the farmer.

Where circumstances will admit, it will be best to erect the house at a moderate distance from the respective offices, and so to arrange the rooms commonly occupied for sitting or working as to command a view of the business being carried on both in the house and abroad. The house and the offices should be of a size and on a scale adapted to the produce of the farm. In planning the house, both the comfort and pecuniary interest of the master require that the *kitchen* shall not be a thoroughfare; nor should any house-door open directly into it, with the exception of the *mistress's store-room*, which should adjoin it and be connected with it. This will save her many a step in the course of every day. The ground floor should contain a good parlour and kitchen, with a back kitchen attached to it, which may serve the occasional purpose of a bakehouse and brewhouse. A pantry, and some place that can be used as a cellar, must not be forgotten. It is essential for the ground to be raised a foot or eighteen inches above the usual level, which will contribute much both to cleanliness and to health. The best way to secure this is to raise the timbers of the ground floor above the ground level by having the house approached by two steps; three will be better, however, than two. This adds very much to the dryness of a house, than which scarcely anything conduces more to the health of its occupants. The windows of the common *keeping* or *sitting-room*, and of the master's and mistress's bed-room, should command a full view of the farm-yard. The farmer should have a separate store-room for sacks, small tools, nails, &c., and the party-walls should be raised above the roofs of the offices, in order *to prevent the communication of fire*, especially where the farm-offices are *thatched*.

On farms consisting of from two to three hundred acres, these apartments on the ground floor, with four bed-rooms above, and a sleeping-room, with a separate staircase, for men-servants, either in the garret or over the offices, will be found sufficient. On those of a larger size, a house of superior dimensions and accommodation will of course be thought requisite.

THE FARM-YARD AND ITS OFFICES, OR THE ARRANGEMENT AND CONSTRUCTION OF THE FARM STEADING, 'FARMERY,' OR 'HOMESTALL.'

No object of rural economy is of greater importance than the judicious arrangement of the offices or outbuildings necessary to the successful management of a farm. It must be evident to the most superficial observer that the size of the various outhouses should be regulated by the extent of the farm to which they belong, and also by that branch of husbandry which is more particularly carried on. In a grazing or dairy farm, fewer offices are requisite than in other departments of farming; but it is nevertheless highly necessary to have distinct buildings for the various kinds of cattle, and that the whole of these should be so distributed as to facilitate the labour and convenience of the servants; that no distances be needlessly traversed; no time lost in going from one apartment which is wrongly placed with reference to another.

This general principle as to the relative arrangement of the different parts of the farm offices or 'farmery,' or by whatever one of the many names—indicated in the heading to this section—they may be called, is of the most vital importance. A farm steading viewed as a whole may seem if on the large scale to be a complicated arrangement of a number of buildings more or less isolated from each other, and of apartments more or less numerous; thrown together apparently without any fixed rule or guiding principle of arrangement. That this is but too literal a description of many farmeries designed and in—fortunately—a fewer number of cases actually erected, is, we regret to say, the case in various districts of the country; but analysing a well-designed farmery, arranged by one conversant with the work to be done in it, and the practical requirements which it is designed to meet, a leading principle, or, perhaps, we should say, leading principles, will be found which dictate what the arrangement of its component parts ought to be. What these are we propose briefly here to state.

To one of them we have already in a general way referred, the importance of so arranging the relative position of the various apartments which go to make up the farmery in such a way that the work of the farm of all kinds shall be carried on in the most convenient way. Numerous and diverse as regards the purposes which they are erected to serve, as are the apartments which make up a farmery, they may be grouped into three classes. 1. Those connected with the produce of the farm and its preparation for market and for the feeding of stock. 2. Those connected with the housing of the live stock of the farm; and 3. The various structures which may be called miscellaneous; and which are used for a variety of purposes aiding the work of the two other groups, as, for example, store houses for food, for implements, workshops, and manure pits, and sheds of different kinds.

Now it is obvious that there are at the command of the designer of the farmery as a whole, more than one way of combining or arranging these various groups. They may be arranged in that rough and ready way which sets at defiance all attempts to classify them, and to arrange in proper sequence the work done in them, or they may, on the contrary, be so arranged that the work of the one will aid that of the other. This latter it needs not to be said is the true principle. When followed out, the various groups of apartments above-named fall at once into their proper places; those connected with stock occupying one part, those for produce another.

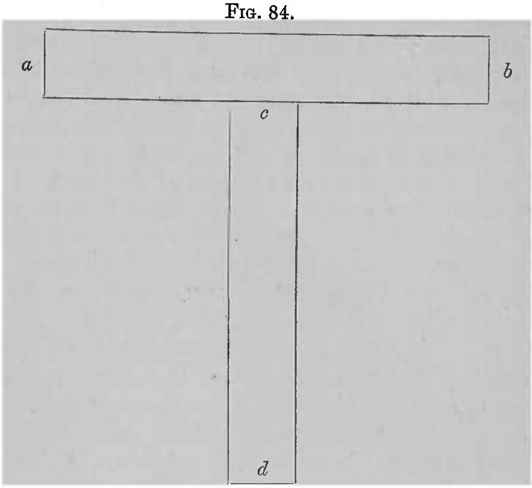
But it is obvious that this principle of arrangement must be carried further. For it is not enough that the stock apartments, for example, shall occupy a certain position in the general plan; but it is necessary that, as there are varieties of stock, so also there must be a secondary grouping, so to call it, of the apartments they use, so that each separate one shall occupy the place best suited to have its work done in the readiest and easiest way. Thus, for example, the apartments, &c., for those varieties of stock which require the largest supplies of straw should be placed in the nearest contiguity to the barn in which the straw is stored; while on the other hand ready access to the manure pit or dung-sluice or shed should be secured, as well as to the turnip or root store. Take again the case of dairy cows; they not only require large quantities of straw for bedding, &c., but other foods, either those grown on the farm, or supplied from external sources. The stores for these will require, therefore, to be near the cow-house or byre; and this again as before near the manure pit, and also have a certain definite relationship to the apartments in which the milk is made either into butter or cheese, or into both. Then, like the produce department, the straw barn should be near the thrashing barn, where the grain is separated from it, this again near to the machinery by which the thrashing machine is worked, whether this be a steam-engine, the more antiquated, but still efficient and largely used, waterwheel, or the still more ancient and—excepting on small farms—the nearly disused horse-mill or works, while the whole must be in close contiguity to the rick-yard in which the grain to be thrashed is stacked. Next to the thrashing barn is the corn barn in which are placed the machines and appliances used to prepare the corn, &c., for market, while near the engine or other motive power is the general machine room, in which materials or produce, home or foreign, are prepared as food for stock. It will thus be seen that there exists what may be called a cycle or circle of operations to be done, beginning with the stacking of the grain and ending with the manure pit or shed, and for the due carrying out of which there are various apartments and courts all of which should be placed in that proper relationship to one another which will best and most economically seeure the carrying out of the work to be done in them.

But there is still another point or principle necessary to be attended to, and which is very frequently forgotten or overlooked by some designers of farms, or with which—not being practically conversant with the necessities and requirements of modern farming—they are not acquainted, and this point is, that the farmery should only have those apartments which are absolutely necessary for the carrying out of the requirements of the farm to which they are attached. This is such an obvious common-sense principle that the wonder is, that it is ever overlooked. It is no use —nay it is worse than useless—to give, for example, accommodation for dairy work, in a farmery where dairy cows are not kept, or if kept only to the extent of two or three, or perhaps only two or even one, and that only to supply the farmer's family wants. The breach of this common-sense principle arises from, as already hinted at, ignorance on the part of designers of farmeries, who do not know what farming is—who fancy that, to put it in the 'Argument absurd' style, 'farming is simply farming,' and that there is, therefore, only one kind in place of, as there are many and very diverse styles in modes of, farming practised throughout the country, each and all influenced and regulated in their peculiarities by the exigencies of soil, climate, locality, and position, such as pastoral farming, grazing farming, partly pastoral, partly arable, dairy farming, town or suburban farming, and the like.

It is obvious, however, from the nature of our work that we cannot even glance at, far less fully describe in detail, all the peculiarities of the various classes of farmeries suited to the requirements of the different modes of farming. We must content ourselves—and indeed the aim and object we have in view will be fully met by it—with selecting what may be called here, two 'representative plans' by analysing which we shall obtain subjects to illustrate and describe, which will exhaust notices of all the various apartments and structures necessary for our readers to be acquainted with. These are: (1) a mixed husbandry farm; (2) a dairy farm. The mixed husbandry mode of farming is admirably calculated to afford a representative plan, inasmuch as—indeed its name indicates—it embraces nearly every kind of farming peculiarity practised in the kingdom, and the titles of some of which we have given above. Taking, then, this as the representative plan the following is a rapid *résumé* of the apartments required for it, and the relationship which they bear one to another.

To the north of the building is placed the stack-yard; parallel to and along the southern side of this is a long range of buildings, and of course running east and west, as *a b* in the annexed rough type diagram. In the centre and most safely and conveniently outside of the wall of this are placed (1) the 'fuel house,' and (2) the boiler house; at this point there is a long range of buildings, *c d* (see fig. 84), at right angles to the range *a b* named above as running east, and this second range *c d* running from north to south. The first apartment in this is (3) the engine-room. Next to this is (4) the corn barn, next to which is (5) the straw barn. At the end of this is (6) a root store, having a door leading to (7) the boiling or cooking house, next to which is (8) the food store for oil-cake, grain, and artificial foods; and this north and south range

FIG. 84.

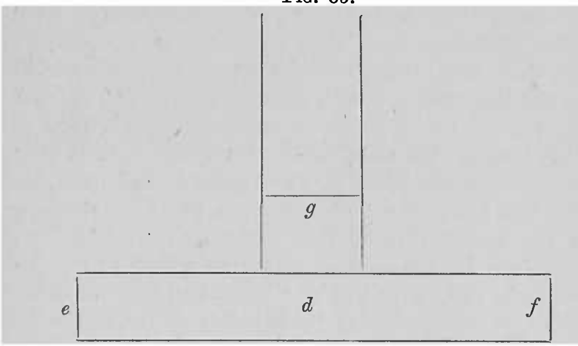


STACK-YARD.

is finished off with (9) a second root store. Here we have two ranges formed like the letter T, the leg of which *c d* is north and south, the arms *a c*, *c b*, east and west. Returning to the east and west range and taking the parts of it to the left of the leg of the T, as *c b* in the diagram, we have first (10) the work-horse stable, next (11) the hay house, next (12) the farmer's nag stable, next (13) the food and store room, in which may be placed, if worked by hand, the oat-crushing machines, &c., next (14) the boiling house for preparing mashes, and this end of the range is furnished with (15) a poultry house. Taking now the other half of *c b* of range *a b* (see diagram), we have (16) the machine room (next the engine house) for preparing the food for dairy cows, &c.; (17) the mash or boiling house being next, (18) the hay-house, then (19) the dairy cow-house; (20) the dairy rooms, comprising wash-house, milk-room with churning and cheese room finishing off the range. This back or north range is two-storied, the second story above the point *c* being (21) the apartment to which the grain is carried up—by a gangway—from the stack-yard behind, and supplied to the thrashing machine, and where, also, the grinding mills, &c., are placed. The remainder of the second story towards *a* from *c* is taken up by (22) the granary, and the extreme end may be furnished by apartments partitioned off from (23) the granary, and appropriated, one end, say at *a*, to a cheese store-room (24), approached by a stair from the cheese-making and churning-room below, and at the other end of the range by (25) a store room. The north and south range *c d* (see diagram) is also two-storied; but the straw barn is not provided with a second flooring, being open from floor to roof, but the extreme end *d* may be floored, and a wool store-room or a poultry house (26) may be made there.

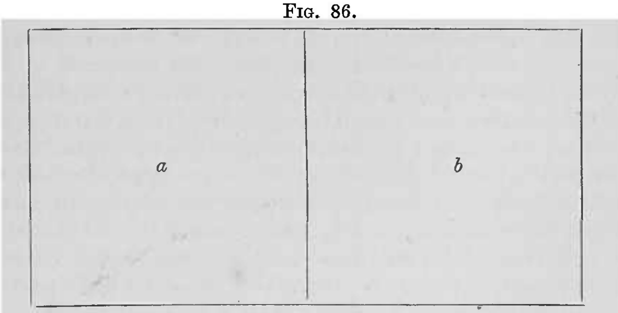
The south range (see fig. 85) at *e d f* is taken up wholly by a range (27) of cattle-feeding boxes on both sides. The

Fig. 85.



west side is occupied by a range of buildings which run parallel to the centre range *c d* in the first diagram, the first apartment (nearest to the point *a*) of which is taken up or occupied as (28) a calf-house, next to which is (29) a turnip store, next (30) an infirmary for sick animals, (31) bull boxes, and cattle feeding boxes, and (32) the piggery. The east side at end *b* of north range (see first diagram) has another range of buildings, parallel to those on the west side; the first apartment of which is occupied by (33) the gig or coach-house of the farm, next (34) the cart shed, next (35) the workshop for wood-work, (36) the implement stores, (37) the smith shop, and (38) the manure and guano stores.

Fig. 86.



We have now ranges which make a complete quadrangular building, divided into two by a central range, as *c d* in the first diagram; and thus giving two large open spaces *a* and *b*; on each side of this, as in fig. 86 annexed. The spaces *a* and *b* are filled on the inside *a* with (39) hammels for the feeding and shelter of young stock, and if advanced farming be carried on, sheep shelter-sheds—the space *b* by (40) open cattle-yards and shelter-sheds.

The arrangement here of course is not presented to the reader as a 'model' one, as we are not of those who believe in 'model farms' or 'model cottages,' circumstances of locality, soil, climate, &c., bringing into play various modifications; but it is one which, upon the whole, will be found to facilitate the economical and regular working of a farmery. Thus the straw being a very bulky material will therefore require much labour to carry it from point to point; but being placed centrally it can be distributed to the stock houses which are placed right and left of it, and as near to it as possible; and it is also near to the long range of cattle-boxes on the south side of the range, and to the hammel and the cattle-courts in the central space in *a* in the third diagram. Then again, the stable on the one side, and the cow-house on the other are in close contiguity to the hay-house, milk-house, and food stores; while the dairy-rooms are near the cow-house; the implement-stores, and cart-shed near the workshops; while turnip-stores are placed at convenient points to the places in which the stock are housed which use them; and finally, by placing the manure-pits and tanks at the ends near the outside of the east and west ranges, the dung, &c., from the stable and cow and calf-houses can be led to them at once. A more convenient place for these, if space could be obtained, would be points near to the hammels and the cattle-courts in the spaces *a b* in the third diagram; they would then serve there as well the stables and cow with calf-houses, as also the southern range of cattle-boxes.

Of the apartments of the Farmery or Homestead which may either form an integral part of the main building, or be completely isolated from them, the dairy apartments are the most important. As to these we now offer a few remarks; premising that they will also be applicable to the special or representative plan of a dairy-farm which we shall presently give. The dairy-apartments of a farmery, whether that be on the mixed husbandry system now under consideration, or on the special dairy-farmery hereinafter described, require to be constructed and fitted up with the most scrupulous care; for of all the substances or materials with which the farm has to deal there is none which is so liable to 'go wrong'—as the expressive phrase is—as milk; and no produce of the farm has to be treated with such cleanliness and purity as the butter and the cheese made from it. The great pride of the dairyman ought to be to take with these articles the 'top price' of the market; and this he cannot do unless he has every department of the dairy arranged to aid the making of them in the highest style of production. The dairy apartments proper are those connected first with the storing of the milk for the production of cream for churning purposes. Second, the room for churning and cheese-making; third, the room for the ripening and the storing of the cheese; and fourth, the washing-house in which the water is boiled and used for cleansing the various vessels and utensils. Let us glance briefly at the essentials to be considered in the construction and fittings of the *milk-room*. As regards aspect the only one for the windows admissible is due north; or if any deviation be permissible it is in the direction of north-east: dairy milk-rooms, therefore, in which windows are placed all round the room, are clearly wrong. The next point as regards the windows is that they be all double-framed, so as to have a space left between the two. The outer frame should be guarded or shielded outside with a framework filled in with fine wire gauze, in order to keep out the flies and insects, and also to let in the fresh air; this framework should of course be moveable along with the outer window-frame, which should be hung door fashion, so that the two halves shall open right and left; and the fresh air thrown in accordingly. The inner window should be double hung, the upper leaf hinged at its lower edge, so that it can be placed and set at any angle, by pulling chain and weights or by quadrant and thumb-screw—to throw the air up towards the ceiling; while the lower leaf should be made into two and being like the outside window-door fashion throwing the air right and left. The walls should be built double or with a cavity or hollow in the centre; and the roof should also be double, the ceiling being coved or higher in the centre than at the sides. These structural arrangements have all in view the keeping of the air in the interior of the milk-room as uniform in temperature as possible throughout the year, an object of paramount importance. To remove the used air, or to keep a current in action, ventilating shafts should be provided in the ceiling, and these have valves easily worked by cords and pulleys to regulate the velocity of the currents. In winter the best means of keeping up the temperature is to have hot-water pipes. The next object to be secured in the milk-house is its perfect freedom from damp, than which nothing scarcely is so prejudicial to the milk. The site or soil of the house should therefore be as dry as possible, and in order to put the matter beyond the possibility of a doubt, the site for some distance round the milk-house should be well drained and deeply. The floor should be dug out for a depth of at least two feet, and filled in with dry cinders, or smithy clinkers, and above this a layer of cement, in which, if a tile-floor be used, the tiles forming it should be carefully embedded. The best tiles are the Staffordshire. The great point as regards the floor is to have its surface impervious to damp, and all the joints waterproof, and quite flush with the general surface of floor, so that no hollows can be formed in which water, &c. can lodge. Some prefer cellar milk-rooms as giving a more uniform temperature, but there are two difficulties connected with these: first, the time lost in ascending and descending the steps, in taking down and lifting up the milk; and secondly, the keeping of the rooms dry. The first difficulty can be got over by having an inclined gangway down which the milk-cans can be shot, and a 'lift' by which they can be raised to the churning-room; the second, by careful construction—but, upon the whole, we believe the best plan is to have the milk-room on the same level as the other apartments. We are inclined to recommend, in addition to the milk-room, a second room next to it, in which the cream is put up to sour and thicken. The shelves in both rooms will be best and most easily kept clean if of cast iron perforated, so that the air will have free access to the milk vessels. Some recommend open shallow galvanised iron troughs in place of shelves, so that cold water in summer and hot water in winter can be made to flow along them; this surrounding the milk vessels placed in the troughs keeps those at the proper temperature.

The churning-room and cheese press-room should have at one end near and under the window a marble slab upon which to work the butter. This should be hollowed out at one end to the depth say of two or three inches, and slope up to the other end 'to nothing,' as the technical phrase is. A tap to supply cold water should be placed near this. An excellent and highly useful addition to the dairy apartments, will be a small ice-room for the storing up of the butter in hot weather, and for use occasionally in the milk-room to reduce its temperature; and in the churning-room when making and working up the butter. The ice-room should be next the churning-room, and separated by an open passage from the washing-room. This latter apartment must be provided with a copper or boiler to keep up a supply of hot water, and an arrangement could be made to have the hot-water pipes supplied to keep up the temperature of the milk-room in winter. To avoid the excessive heat caused by the furnace, &c. in summer time, the boiler might be built in a small outhouse, entering to the washing-house, the hot water being brought in by pipes. The washing or scalding tubs may either be portable or fixed; if the latter, hot and cold water pipes should be connected to them. Every means should be taken to have the wash-room well ventilated, so as to carry off at once all vapours and bad smells, and to prevent them having access to the other apartments. The vessels when cleaned should be placed outside, and to protect them a verandah should be erected outside the building. If this be carried round the house, it will tend to keep the interior temperature uniform.

The other and remaining apartments, &c., of the farmery, which may, like the dairy ones, be either isolated from, or form part of the main building, are two in number, and form what many large farmers will scarce dignify with the title of farming apartments, or allow them a claim to be constructed: those are the poultry- and pigeon-houses.

Of the poultry-house we have already, in the chapter on poultry, in the preceding book of this work, given a few details. To these we may add the following:—All poultry-houses, to be healthy and profitable, should not only be free from damp, but have their interior in the winter time well warmed, and at the same time be supplied with fresh air in abundance. Some advocate a soft floor, so that the poultry can peck at it and form dust-baths or holes in its surface—but all the pecking should be done out of doors, and the dust-baths be formed in the small yard attached to the house. We consider cleanliness the first point to be aimed at in the house, as the only way of keeping down the vermin; and this can best be obtained and maintained by a floor capable of being washed and quickly dried. Damp in a poultry-house is a prolific cause of disease, and should be carefully guarded against in floor, walls, and fittings. Warmth, as already stated, also is essential to poultry, and if the house can be placed near the engine-house or other apartment where there is a source of heat, so much the better for the house and the poultry. While warmth is essential, so also is fresh air. To secure these two essentials, perhaps the best plan would be to have the house fitted up with an ordinary fireplace, or better still one of the new (and cheap) forms of warming and ventilating stoves. Some may be disposed to smile at this proposal—be it so—but where adopted we do not hesitate to say that it will pay. As to the fittings, or the roosting-poles, much again has been written—perhaps the simplest are the best, namely, rough battens or branches of young trees split up the middle, and placed like a sloping gallery, so that all the droppings shall fall to the floor directly from the roosting-poles. Some prefer the surface of the floor to be covered with sand or ashes—if covered at all, the first is perhaps the best material. In some cases the poultry-house is placed on the second floor or granary floor; in which case a part of the granary near the end is partitioned off. There is no doubt that a house so placed will be dry and warm, compared with one on the ground floor. As to the 'pigeon-house' this is usually a separate structure, well known from its peculiar and anything but graceful architectural style, if that term can be applied to a building in which no style at all is observable. Yet there is nothing to prevent, but everything calculated to promote the desire to have this so designed as to form a really ornamental feature in the farming buildings. If the desire does not exist, or, if existing, expense stands in the way, then the pigeon-house may be made very comfortably at the side of the poultry-house, if that be, as named above, placed on the granary floor.

We now come to consider the case of a *Dairy Farm*, the second 'representative plan' we have decided to illustrate.

The large increase in the population of our towns, especially those in the manufacturing and coal and iron districts; and what may be called the larger proportional increase in the wages which they now receive, have not only added to the consumers of farm produce, but to the price which the farmers obtain for it. For milk, butter, and cheese the demand is enormous and the prices high, far above what our ancestors dreamed of. There is, therefore, great inducement to have means by which this demand can be supplied, and advantage taken of the high prices obtained for the produce. Dairies on a large scale are now therefore becoming very common, and what may be and is called the manufacturing process is carried out in connection with them. It will be well, therefore, to glance briefly at some of the leading points connected with these arrangements and constructions.

The dairy buildings proper are those in which the milk is stored up, prepared, and fitted for the after or final processes, such as butter and cheese making; and being quite distinct from the buildings in which the milk is produced, may either be connected with or detached from those. But as the two departments are so intimately connected; and as the processes of the one cannot be carried on without the products of the other, it will be well to glance, as briefly as may be, at what constitutes the apartments of a first-class dairy farmery.

The main or principal part is of course the cow-house or byre in which the cows are kept. This is fitted up with stalls, either single or double, and the rows of stalls arranged so as to give the largest amount of working space within the minimum extent of roof surface, the great object in this being to have the roof as cheap as possible. If the dairy farmer breeds his own stock and does not buy them in, accommodation will have to be provided for the breeding and rearing department. This will comprise a bull-house, and accommodation for the young cows from which the breeds are to be taken. This accommodation may be given either in the form of stalls, boxes, or hammels—although stalls will be the best, as they can be used when the heifers are in calf and being fed; and also when they calve, for which boxes or hammels would not be suitable. In the work on 'Farm Buildings,' hereafter more particularly noticed—the joint product of the late eminent agricultural authority, Mr. Henry Stephens, the author of 'The Book of the Farm,' and the editor of the present and also the last edition of this work—a curious and suggestive statement is made as to the space occupied by, or given to an ox fed *first* in a 'box' $115\frac{3}{4}$ sq. feet, *second* in a 'hammel' $191\frac{1}{2}$, and *third* in the 'stall of a byre' $106\frac{1}{2}$ sq. feet. A 'calf house' will also be required, fitted up with pens as elsewhere described; and in the sequence of rearing operations connected with stock, yearling-houses or hammels for young stock. Should the dairy farmer not breed and rear his own stock the accommodation named above will not be required, save and except the cow-house or byre. But we should strongly recommend such accommodation to be given to all dairy farmeries; because although one tenant may not breed and rear his own stock another might. And indeed we would as strongly recommend the dairyman not to buy his stock from the open market or from chance dealers, but to breed and rear his own; as this plan will yield him the highest satisfaction and the largest profits.

The next accommodation required in a dairy farmery is 'the piggery.' This is essential in the majority of farms, as the pigs will consume the skim-milk and butter-milk which there is sometimes a difficulty in otherwise getting rid of—although as a rule where the dairy farm is near a manufacturing town there is no difficulty in selling any quantity of either the one or the other of these dairy products. It is, however, a point open for discussion whether the highest profits are not to be obtained by giving the skimmed and butter-milk to pigs; we are inclined to think that they will; and that therefore the dairy farmers should always keep pigs. At all events a 'piggery' should be put down; and in connection with or close to it a food store, and boiling house for the preparation of mashes, &c., for the use of the pigs and brood swine. There should be a dung-pit not far off from, but not quite in connection with the piggery. The poultry-house should be near the engine-house, as it will thus be kept dry and warm.

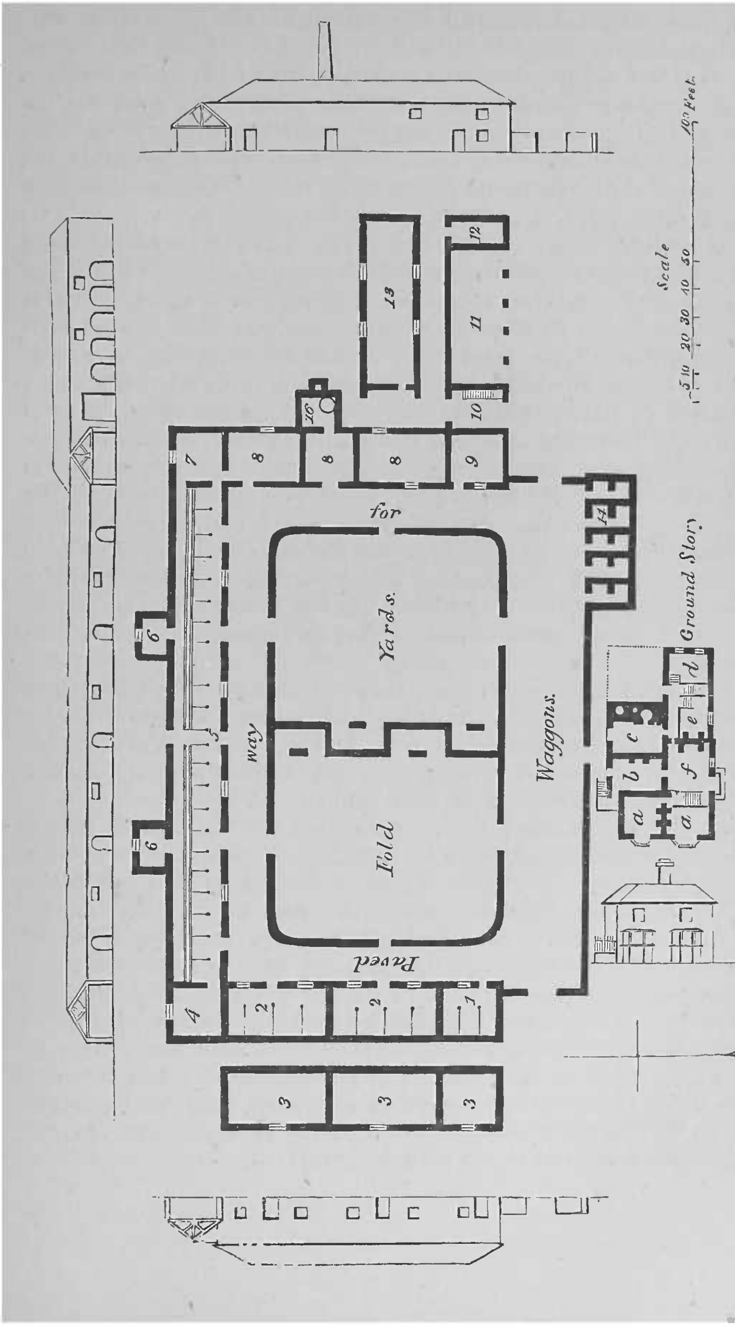
Such is the accommodation—with the addition of an extra house for the purposes of an 'infirmary,' and if one for calving be given as another extra, it will at times be found very useful—on what may be called the dairy part of a farmery. We have now to point out that which will be necessary for the arable culture connected with the dairy farm. Little, however, need be said upon this, inasmuch as it is both in extent and character very much the same as that already described in connection with mixed husbandry, with this exception, that accommodation for fattening stock forms no part of it. There is the engine-house—to begin with the source of power—and boiler-house, placed close to and in connection with the thrashing-barn, next to which is the straw-barn. The machine-room will be near the engine-room, so that power may be taken off at once to cut the roots, grind the corn into meal, &c., and to do the varied work of the food department for the horses and colts, and also for the cows. Next or near this will be the food-stores, one of which will be devoted to roots, the other to more valuable food. The hay-house will be next to the cart-horse stable, near to which will be the cart and implement shed and store, the carpenter's shop, and general store; and outside of all the central or principal covered manure pit, with its attached liquid-manure tank.

These will make up the two great departments of the dairy farm accommodations, but it will be observed that no space has been given to the apartments required for the making of butter and cheese, or the 'dairy apartments' proper. This has not been done because, according to the plan decided upon, these may either form part of the general plan of farmery, or be placed in an isolated range of buildings. Each method has its advocates, and there is, as usual in such cases, a great deal to be said on both sides of the question. The great argument in favour of having the dairy-rooms isolated from the general farmery is that the milk is removed from the cow-house or byre, and thus chances of its becoming tainted are greatly lessened. The importance of this we have already fully entered upon and discussed in its appropriate place. On the other hand, by having the dairy-room isolated from the general farmery, there is considerable loss of time incurred and other inconveniences brought into action, which will be obvious on consideration. Taking, however, all the points involved, we should be inclined to say that the balance of opinion as to the scientific treatment of the milk, &c., &c., is in favour of having the dairy-rooms quite isolated from the general farm apartments in which work is continually going on, which gives rise to taints and smells, dust, &c., &c., which cannot but be prejudicial more or less to the dairy products. A very slight consideration of the subject will show that there is something in the general farm apartments, as the cow-house or byre, quite antagonistic to the work of the dairy proper. The points connected with the apartments which are generally known as the 'dairy,' such as the milk-room, we have already discussed in a preceding paragraph under the head of the 'Mixed Husbandry Farmery,' to which, therefore, we refer our readers.

Having now given the two representative plans embracing all or nearly all the various apartments required in farmeries to suit the necessities of different styles of farming, we have now to consider the general points connected with all farmeries, such as the site, position, &c. &c.

And first as to the *position* of the farm. Much discussion has been given to the point as to what part of the farm the build-

Fig. 87.



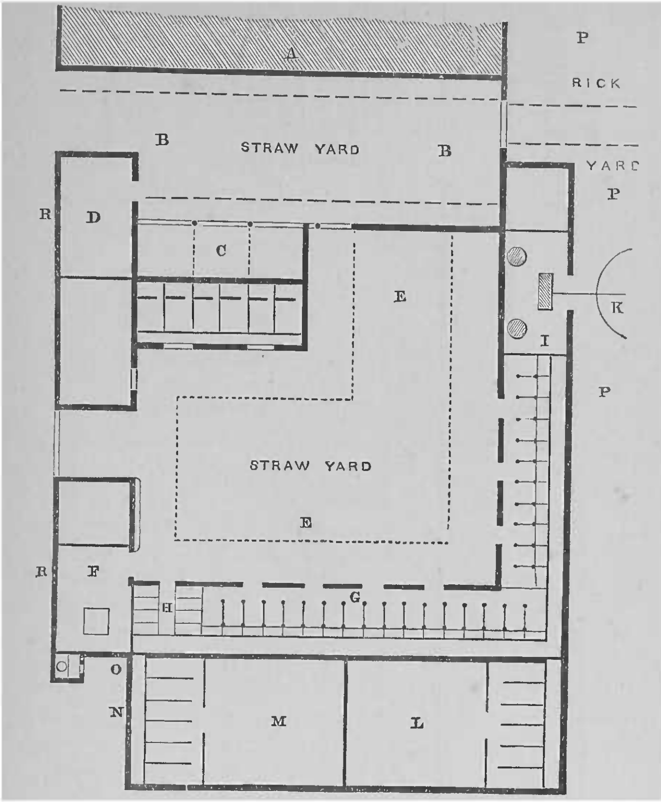
PLAN AND ELEVATION OF THE 'TEARN FARM' BUILDINGS.

ings should be placed upon. The most central point seems to be the most convenient, as all the carting to the fields of manure, and from them of produce, will be equalised from the various parts of the farm. But even this rule may have to be modified by circumstances, such as the proximity to the main road, and the points at which the supply of the best *water* can be obtained. This latter is, indeed, the point which will decide, or should decide, the position of the buildings on the farm, for water both of good quality and in abundance is essential; for other points, as roads, may be easily modified or diverted, but this cannot, so that to put buildings down where this essential cannot be secured is simply absurd. The first thing to be done, therefore, is to ascertain where water is best to be had. As there is carting to as well as from the buildings, a comparatively level position is better than one on a hill-side; but care should be taken to secure a site which will give a good fall or declivity to the various drains. Sites near marshy lands, and indeed near rivers, should be avoided, as dampness is bad at any time for the stock. The *aspect* of the building is also of great importance, as greatly influencing the health of the animals occupying it. The south-east is the best, as this gives a greater amount of sun-light during the greatest number of days in the year than any other. The beneficial influence of light upon all animals has only within the last few years been recognised and acted upon—not, however, so extensively as could be wished.

We shall usefully conclude this section by giving a few plans of farm-steadings. The first is that erected on the farm of Tearn, of which the extent is 1,160 acres. The soil is almost wholly that adopted for barley and turnips, to which is added a small proportion of water or irrigated meadow land (fig. 87).

In fig. 88 we give the ground plan of Mr. Timms' farm-steading erected on his farm at Framley, Surrey, near the Farnborough Station. The farm is remarkable for its poor soil, being in fact part of the extensive sandy and dreary tract of land known as Bagshot Heath. Yet by high farming, the liberal use of manure—by the exercise of the greatest care in cultivation, and by keeping a large stock of animals—to the 250 acres, 60 oxen, 350 sheep, 70 hogs, and 20 horses—which yield large supplies of dung—Mr. Timms succeeded in raising his poor sandy farm to the highest degree of fertility; it yielding double and in some cases treble the amount of crops as compared with other farms in the same neighbourhood. The following is a reference to the apartments indicated in the plan by letters:—

FIG. 88.

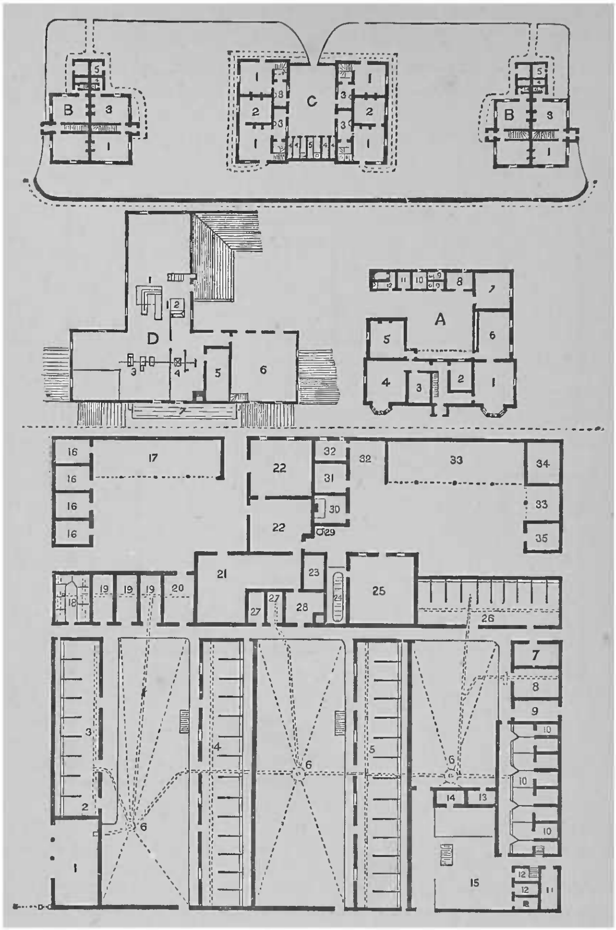


GROUND PLAN OF MR. TIMMS' STEADING.

A is the thrashing barn, with straw and hay barn and granary adjoining. B, a straw yard. C, open stalls for stock. D, cart house and nag stables. E, straw yard, with paved causeway round it. F, the food cooking house, with steam boiler and steaming apparatus. G, a range of buildings divided into stalls for bullocks, with a gangway at the head for feeding the animals. H, calf pen. I, a building containing the chaff machine, bean mill, oat crusher, &c., worked from the horse gear at K. L, hammels and small yard for sick and other stock. M, hammels for two bulls. N, liquid-manure tank and pump. O, labourers' closet. P, stack yard. R, road.

A dairy-farm steading which has long been looked up to as a 'model one' is that of Liscard, Cheshire, the property of Mr. H. Littledale, a Liverpool merchant of high position, who devotes his spare time to agricultural pursuits. Of this we give, in fig. 89, an illustration, and of which the following is a reference :—

FIG. 89.



STEADING AT LISCARD, CHESHIRE.

Reference to Numbers on Fig. 89.

1, compost house. 2, bull house, 3, shippon for 16 cows. 4, shippon for 28 cows. 5, shippon for 32 cows. 6, manure tanks. 7, gear house. 8, milk-horse stable. 9, pigs' food. 10, piggeries. 11, ducks. 12, turkeys, geese, &c. 13, shed for pigs. 14, shed for poultry. 15, poultry yard. 16, potato stores. 17, implement and root shed. 18, calf house. 19, loose boxes. 20, grains. 21, straw house. 22, barn. 23, engine house. 24, boiler house. 25, granary. 26, stable for 10 horses. 27, cut chaff. 28, steaming house for roots. 29, well. 30, smithy. 31, carpenter's shop. 32, churn house. 33, cart shed. 34, drill house. 35, slaughter house. 36, stack yard.

Reference A.

1, parlour. 2, stores. 3, office. 4, living room. 5, scullery. 6, dairy. 7, curing house. 8, smoking house. 9, privies. 10, ashes. 11, tubs, &c. 12, oven and boiler.

Reference B.

1, living room. 2, pantry and stairs. 3, kitchen. 4, ashes. 5, coals.

Reference C.

1, kitchen. 2, parlour. 3, scullery. 4, coals. 5, ashes.

Upper Floor of Barn D.

1, thrashing machine. 2, separator. 3, hay cutters. 4, linseed crusher. 5 drying kiln. 6, granary. 7, tank.

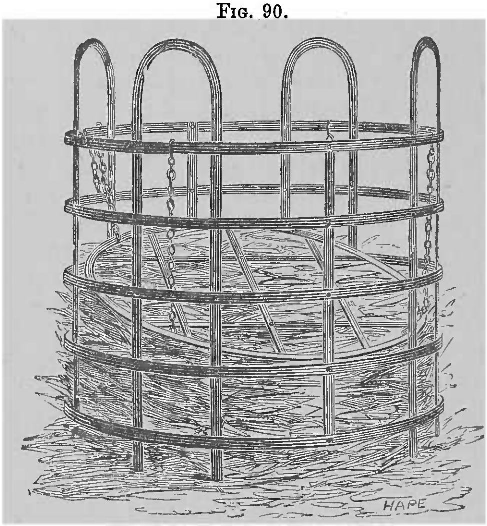
Covered Farm Steading.—The plan of having the whole, not merely the cattle-yards, of the farmery covered in with roofing has of late attracted much attention. Lord Kinnaird was the first to give prominent attention to the subject. In a communication to the Royal Agricultural Society of England, in which he gave plans of the buildings erected on his own estate on this principle, he says that he has derived great advantage by adopting it, so far as economically working the farm is concerned. 'Detached buildings,' he says, 'with large and small courts—outer and inner courts, extending over a considerable area of ground—expensive in original construction and entailing a daily waste of labour, farm produce, and time consumed in traversing from one yard to another, are faults which I have found in most farm-buildings I have visited.' Opinion, however, is divided as to the value of the system, some of the most eminent authorities holding the opinion that no advantage is obtained, commensurate with the expense, by having the whole of the farmery covered in.

DETAILED DESCRIPTION OF THE DIFFERENT APARTMENTS OF A FARM-STEADING.

Feeding Yards. Having now detailed the principles of arrangement of the farmery as a whole, we proceed briefly to give remarks on the various parts of which it is composed. As regards the preparation of the bottom of the feeding-yards, the following remarks will be useful.

Where chalk can be obtained, the surface or bottom of the yard should be bedded or coated with it, or with some other material impenetrable to water, in order that the filtration of urine or moisture may be effectually prevented, and the animal manure carefully preserved. The construction of the yard should be nearly concave, or shelving towards the centre, in order to collect the drainage from the stables and cattle-sheds; and it should have a pipe or drain communicating with the cesspool, or, at all events, with the dung-stance or pit. In order to avoid expense, many farmers bottom their yards with earth, or rubbish, in order, by absorbing the drainage, thus to form a compost in the yard itself. The saving thus obtained is, by experienced persons, regarded as trifling, when compared with the injury supposed to be done to the store cattle by thus retaining the moisture beneath them; dryness of situation being considered of the most essential consequence to their health, and indispensable to their thriving. The driest bottoming is furze; but stubble, potato-haulm, or any other loose refuse, will answer the purpose, over which the yard should be bedded deep in straw. Earth, though very valuable in a compost, should never be used within the yard.

Fig. 90.



STRAW-RACK FOR CATTLE-COURTS.

The farm or straw yard should always be sheltered on the north and east by open sheds or hovels, in order that in winter or cold weather the cattle may be protected from severe weather. The feeding-yards and sheds should be provided with turnip and water troughs. Figure 90 illustrates a good form of yard-rack for hay. It is manufactured by Messrs. Musgrave of Belfast.

I. *Cattle-Stalls.* The structure of these buildings is very simple. Each stall should not only be provided with a crib for the food, but there should also be in each a vessel, or trough, for the reception of water, that may be conducted into it by means of cast-iron tubes leading from the cistern or pump. The *size* of the house or number of the stalls or boxes must depend upon the manner in which the farm is occupied; but it should never be forgotten that the cattle must have *ample accommodation.*

In order to erect feeding-houses to advantage, great attention should be bestowed on their situation. They should neither be too much exposed to the sun or to cold winds. The floors should be in a gently sloping direction, with proper drains for carrying off the urine, and also for the easy removal of dung and other muck. These floors may be variously paved.

Some have recommended that the pavement should be of pitched stone; others advise the use of concrete; but the least expensive method is to lay the floor with Dutch bricks, or *clinkers*, usually employed for flooring or paving stables. The pavement should by no means have too great a declination; for, if too much of the weight be thrown on the hind legs, the animals will become uneasy and suffer pain, and be subject to cramp and rheumatism, and consequently will rarely feed well.

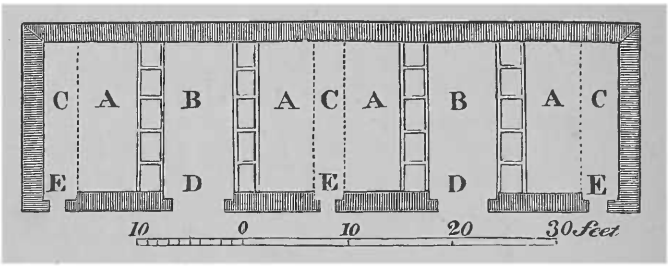
The doors should open outward, as by that means a waste of space will be prevented, and the sheds rendered more secure against intruders.

The *width* of the stall is various. For two fair-sized oxen, from *nine* to *ten* feet are considered sufficient. Cows, though in general smaller than oxen, require equal, if not greater space, in order to allow for the conveniency of milking them, as well as of suckling their calves; indeed, it is always best to place them in single stalls. Stalls should not, however, be made too wide, otherwise the cattle will turn round in them, and the stronger beasts have an opportunity of injuring their weaker companions.

Where the system of stall-feeding is adopted on a large scale, it will be necessary that a *regular temperature* and a good system of ventilation should be maintained; and especially that apertures be left for the escape of the poisonous gases generated by the breath and evacuations of the animals. There is not a more fruitful source of disease than these gases when confined. If a loft be built over the stalls for the reception of provender, several funnels should be passed through it from the ceiling of the feeding-house to the roof, in order to allow of the escape of the foul air; and great care should be taken to render these funnels, and also the ceiling, air-tight, or the provender will become impregnated with the gases, and rendered unwholesome. In addition to the windows, latticed or not, that are on the side of the house, there should be three or four open gratings near the floor, from which the wind cannot blow directly upon any of the cattle, but by means of which a constant circulation of air may be maintained throughout the shed. A slide should be contrived to close some of them, in order that, when the wind blows violently from that quarter, they may be shut; but this should be always under the direction of the master. The regular windows should be opened or closed as the season of the year or the temperature of the weather may indicate. Where it is practicable, these openings should be towards the north or east, in order that the cattle may derive some benefit from the genial rays of the morning sun, and from the cooler air of the day in summer. In addition to this, the large front doors may sometimes be set open for the purpose of further ventilation. It is most desirable that the cattle-houses, as well as the stables for the cart-horses, should not have any loft over them.

The following plan, fig. 91, of a beast-house, much used in the county of Roxburgh, may not be considered out of place here.

FIG. 91.

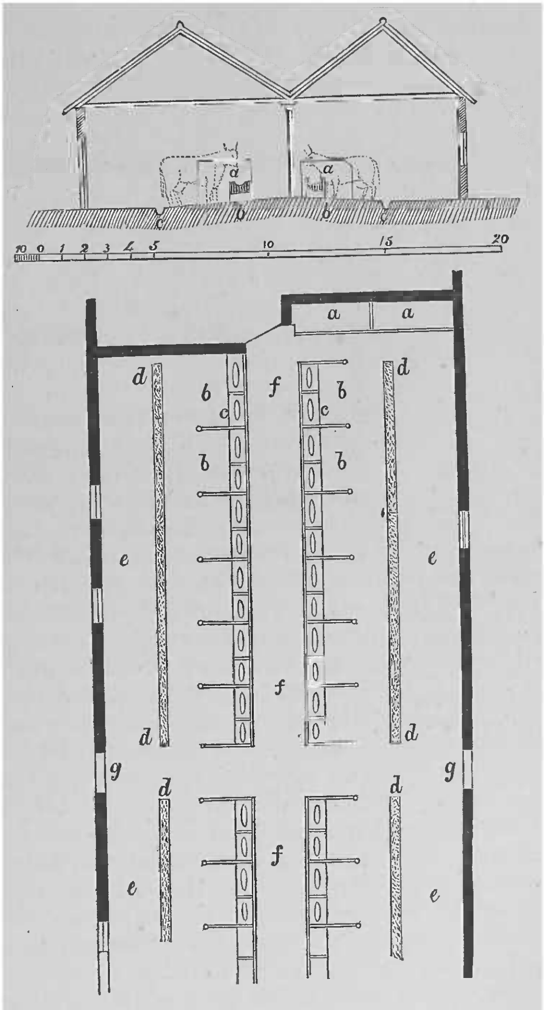


CATTLE OR BEAST-HOUSE ON THE ROXBURGH PLAN.

The feeding-house here delineated is 60 feet in length, by 18 in width, and is capable of containing twenty cattle standing in a direction across the house, with their hinder parts towards each other; while a sufficient interval is left for storing up turnips or other winter food. A A A A represent four spaces for the cattle, five being allotted to each, which may be fitted up either with cribs or with stone troughs. B B designate two spaces for receiving roots, each interval being 8 feet wide. They are separated from the troughs, or cribs, by means of strong wooden partitions, for which a thin party-wall is sometimes substituted, from 3 to 3½ feet in height. D D, the doors, are sufficiently wide to admit a cart, to be backed in, and turned up. Over this low partition the turnips, or other *roots*, are thrown to the beasts. C C C are passages 4 feet in breadth, behind the animals, for the purpose of removing the dung and filth by means of the doors that are respectively marked E E E. Should the peculiarities of the situation require, or render it convenient, the large doors just noticed may be disposed in the back of the feeding-byre, or ox-house.

The advantages of the above plan are, a more commodious division of the cattle than when they are ranged in lines along the house, instead of across it; it also admits of the feeding of store and fatting stock at the same time, for, if five feeding-cattle are placed on one side, and a similar number of young beasts or milch kine are arranged on the opposite one, the green tops of turnips or the spare leaves of cabbages may be thrown on one side to the young animals, while the roots are given to the fattening or to the working cattle.

FIG. 92.



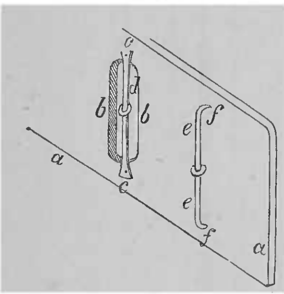
PLAN AND SECTION OF COW-HOUSE.

a a, root and straw bins. *b b*, double stalls. *c c*, mangers. *d d*, gutters. *e e*, dunging- *f f*, feeding-passages. *g g*, windows. In the section *a a* are the travises or stall divisions; *b b*, the mangers; *c c* the gutters.

In fig. 92 we give the plan and section of the cow-house or byre adopted by Mr. Harvey at his celebrated farm near Glasgow, and illustrated in a 'Report of the General Board of Health,' from which we take the drawing.

Various modes are employed to secure cattle in their stalls, of which the simplest are the following:—To the partitions of the stalls are fixed vertical rods or bars of iron, on each of which runs an iron ring, and that ring is attached to the chain that passes round the neck of the animal. The illustration shows two modes of attaching the rod to the bars of the stall (fig. 93). When the common method of tying-up is insufficient for the security of vicious beasts, another must be found to answer the purpose. A fixed iron chain, by way of a halter, should be fastened to a *standard,* mortised into the front side of the manger and the joist above. It is composed of two parts: one of which has sixteen links, and is two feet in length, measuring from the staple; the other, which contains twenty-six links, measures about thirty-nine inches, and serves as a collar. At one end of this *collar-chain* there is a ring, about an inch in diameter, and, at the opposite extremity, a key three or four inches in length, and having a hole at its centre, by which it is joined to, and freely plays in, the last link. The first chain, which by one end is fixed to the manger, is by the other connected with a middle link of the collar-chain, and thus forms two arms, which, being thrown round the neck of the beast, and the key being thrust through the ring, and placed on a bar across it, makes a very secure fastening. In box-feeding the animals are not fastened up at all, but let loose, in order that by tramping about they may compact and amalgamate the manure.

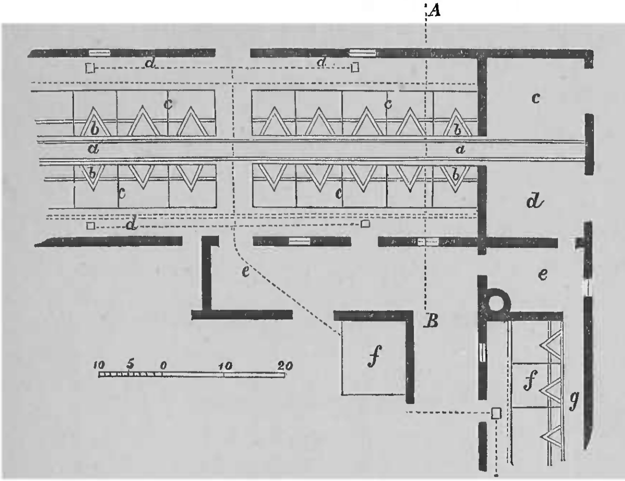
Fig. 93.



a a, the travis or stall division. *b b*, an aperture cut in the same, in centre of which an iron bar, *c c*, is secured; up and down which the cattle chain-ring, *d*, slides. In the other plan the bar *e e* has bent ends, *ff*, so that it projects from surface of travis *a a*, the cattle chain-ring sliding up and down the bar *e e*.

Cattle Boxes. As box-feeding with various compounds is now pretty generally admitted to be one of the best modes of deriving profit from cattle, we must not, in our enumeration of farm-buildings, omit the requisite compartments for carrying it on successfully. The boxes should be about nine or ten feet square, and six feet in height, and divided from one another by a brick wall to the height of two feet, and above by strong rails about eighteen inches apart; at the back should be a movable trough or receptacle for the food; the flooring, or bottom, should be of solid clay or concrete, and should be from 18 to 24 inches below the level of the outer ground, in order, with the surrounding brickwork already mentioned, to form a bed for the accumulation

FIG. 94.

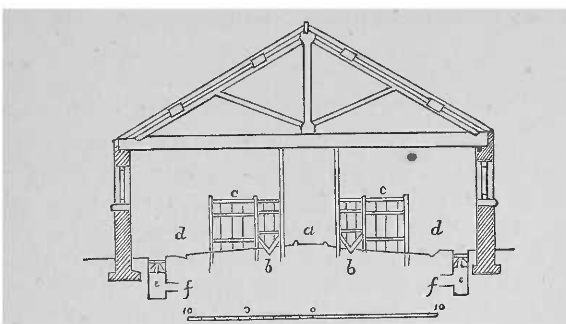


CATTLE BOXES AND COOKING HOUSE.

of manure; the roof may be slated or thatched—the latter is considered coolest—and the whole enclosed by a strong door.

A Cooking-House forms a necessary appendage to stall- and box-feeding, and should be situated as convenient to the stalls or

FIG. 95.

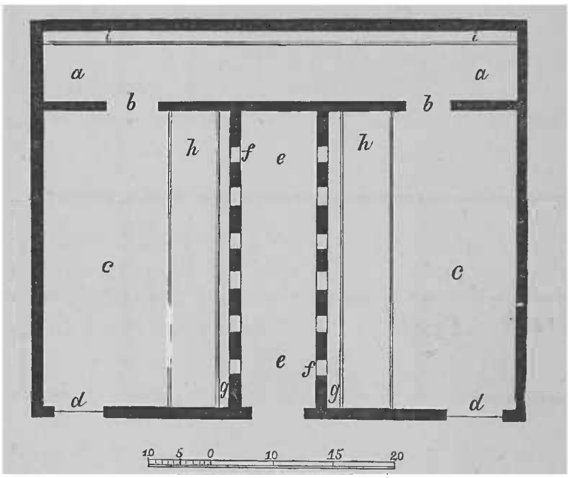


SECTION OF FIG. 94.

boxes as possible. This must contain boilers of a size proportionate to the requirements of the stock. The illustration in fig. 94 shows the arrangement of cattle-box-range, and cooking-house adapted to the plan. Fig. 95 is a section of the boxes on the line A B in fig. 94.

The plan and section here given are taken from the 'Essay on Farm Buildings,' by Thomas Sturgess, surveyor, Bedale, given in the eleventh volume of the Royal Agricultural Society. In fig. 94, *a a* is the tramway along which the trucks run which convey the food to the cattle in the boxes, *b b*, *c c*; *d d*, line of drain reaching into drain *e*, which conveys the urine to the liquid manure tank, *f*; the turnip-house is shown at *c*; hay-house at *d*; boiling-house at *e*, and other cattle-boxes at *f* and *g*. In fig. 95, the section, *a* is the central passage and tramway between the boxes, *c c*; *b b*, the feeding-troughs; *d d*, draining or side passages; *e e*, trapped cesspools, from which the liquid is conveyed to the tank by drains, *f f*.

FIG. 96.



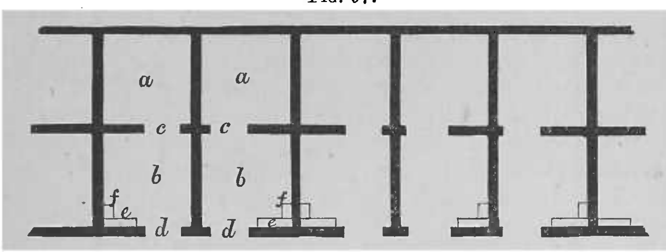
CATTLE COURTS, OR CURTAINS, WITH TURNIP STORE.

II. Besides the regular feeding-houses, it will be advantageous to have *open sheds* for the use of store cattle, into which they can withdraw from the straw-yard and obtain shelter in bad weather. In each of these yards there should be troughs for the food; where that is of a succulent nature, there will be no occasion for water. A good supply of water will, however, be requisite when dry meat is employed. They should be well littered; and, when necessary, the beasts may be respectively separated in the same manner as in the cow-houses, a similar interval being allowed for each, and the floor being also laid on a gentle descent, not only for the convenient removal of the urine and excrement, the accumulation of which would be highly prejudicial to the health of the cattle, but also for their comfort, by keeping them dry. Such sheds are easily constructed by allowing the roofs of barns, or other lofty buildings, to project forward to such a length as to afford sufficient shelter, the extremities being supported by strong wooden posts, or pillars, and the height at the open side not being more than seven or eight feet.

Fig. 96 illustrates an arrangement of open cattle-yards and feeding-sheds, or 'curtains' as they are sometimes called, used in the North of England. *a a*, the shed, entered by the doors *b b*, from the cattle-yards, *c c*, of which *d d*, are the dunging gates, *e e* the turnip-store or house, from which the troughs *g g*, in the side sheds *h h*, are supplied by flinging the turnips through the port-holes *f f*. Feeding in what are called 'hammels' is an exceedingly favourite mode with many first-rate farmers. The 'hammel' system consists of a series of small sheltered sheds, *a a*, fig. 97, entered by the door *c*, from the yard *b*; *d* the dunging-gate; *e* turnip, *f* water trough.

III. The observations we have already made on the situation and ventilation of cattle-houses are equally applicable to *cart-*

FIG. 97.



'HAMMELS.'

horse stables. The walls should, however, be always supplied with casements, not only for the admission of air, but of more light than is requisite for the cattle-houses; and shutters should, at the same time, be added for the purpose of excluding the light, if necessary, during the daytime. The door should be as near as convenient to the entrance of the farm-yard, or, if consistent with security, outside of it, in order that the horses may not have to pass through the store cattle in the yard; and it will always be of advantage that it should face the south-east. No henroost or piggery should be in close proximity to the stable. Fowls are particularly objectionable, for there have been numerous instances in which the apparent mange of the horse has been traced to the insect that inhabits the skin of the feathered biped.

Cart-horses are often put into a loose stable, without any divisions between them. There may be economy of space in this but frequent accidents result in consequence of vicious animals kicking each other, and the strongest generally get the largest proportion of the provender. Horses also feed too eagerly for the due mastication of their food, when tied up together; the expense of dividing their stables into stalls would, therefore, be well repaid by the advantages of security and quiet feeding. The *width* of the stalls should be five feet and a half at the least, in order to enable them to lie down or turn round without inconvenience. It will also be proper to elevate the divisions near the head, in order that strange horses may neither see nor molest each other. Loose boxes or rooms are an improvement on stalled stables.

Few objects are less attended to in building stables than the arrangement and formation of the mangers and racks. These, according to the common practice, are needlessly extended across the upper end of the stall: much provender, by being drawn and trodden under foot, is frequently wasted, and, as they project forward, the seeds of the hay sometimes fall into the eyes of the horse, and occasion injury. Even in loose stables separate upright hay cribs are preferable; and the manger should always have divisions high enough to prevent the horses from interfering with each other while feeding. In a great proportion of these stables the racks are much too large, especially as servants will fill them with hay, whatever may be their size. Many horses devour it ravenously, or waste a great portion of it. It would be a great convenience and protection if the mangers could be moveable. They could then be occasionally cleansed from the saliva which accumulates about them, and the spread of infectious diseases would often be prevented. Every manger should have a sparred or perforated bottom for holding the tares and clover, while they permit all the hay-seeds to escape, and a close one for the corn and mashes, or any steamed food that may be occasionally employed. The stable for the saddle-horses should be at a small distance, or at least separate from that appropriated to the cart-horses. The construction of these stables, however, scarcely comes within the plan of this work. In whatever way the corn-bin may be constructed, it should have a secure lock, for if the carter does not steal corn for himself, he will occasionally do so for his horses. A small space or room should always be partitioned off, and fitted with shelves and pegs for the reception of spare harness and various stable utensils, and small articles not in constant use, and which may be kept there in readiness, but always under lock and key.

Equally useful and economical, with reference to the food, are the racks of the stables. The following engravings will explain their construction :—

Fig. 98 is the elevation, and fig. 99 represents a transverse section of the stall. The upright *slats* prevent the horses from wasting the hay, as well as from blowing on it, and they cannot thrust their heads over the whole trough, but must feed fairly on the portion before them.

FIG. 98.

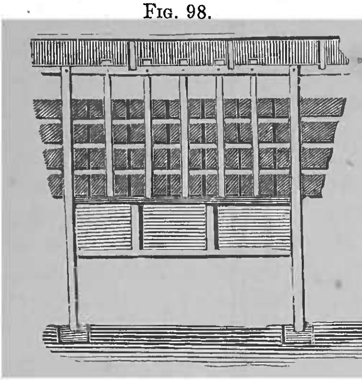
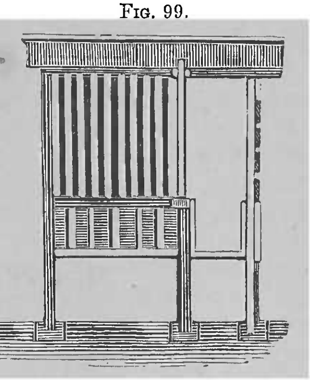


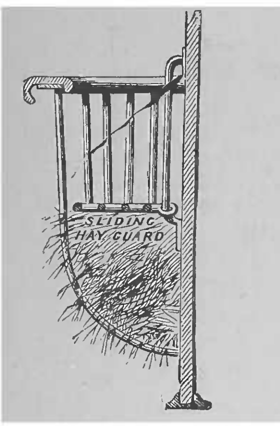
FIG. 99.



STABLE HAY WOODEN RACKS.

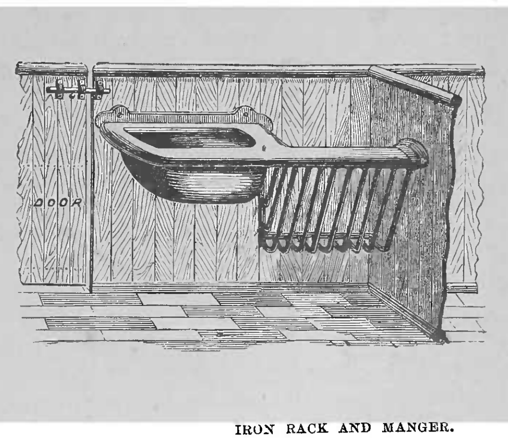
Excellent forms of stable fittings are now used; in fig. 100 we illustrate the form of hay-rack, in which the hay is kept in by the sliding guard, and the horse prevented from pulling it out and scattering it about; in fig. 101 a form of rack and manger in one;

FIG. 100.



IMPROVED HAY RACK.

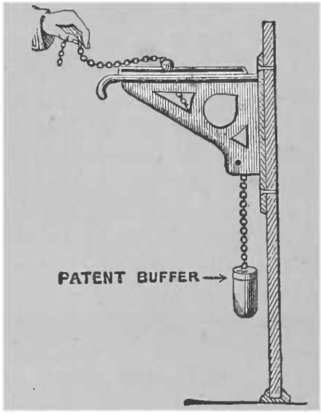
FIG. 101.



IRON RACK AND MANGER.

and in fig. 102 a 'tie' for securing the horse to the stall. All these are manufactured by Messrs. Musgrave and Co., Limited, of Belfast. In fig. 103 we illustrate the form of 'travis' or stall division made by the same firm; this is provided with the patent 'barrier sheath,' into which the barrier rod slides; by pulling this out, the stall can at once be transferred into a loose box.

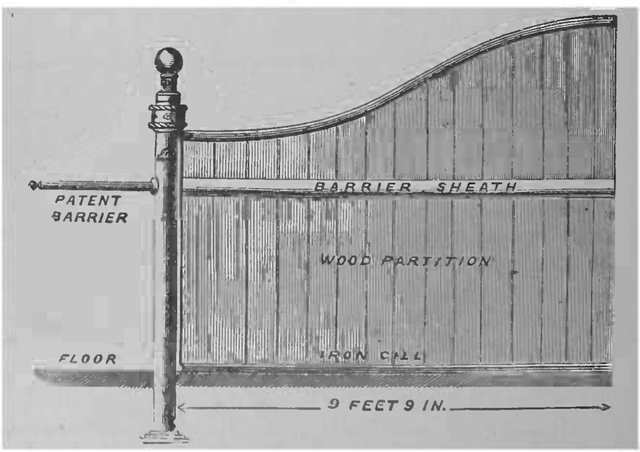
Fig. 102.



HORSE TIE WITH BUFFER

The *pavement* of almost all stables is laid in too slanting a direction. This is done for the purpose of draining off the urine more quickly and completely; but it often places the horse in a

Fig. 103.

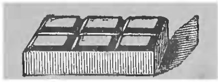


STABLE TRAVIS OR STALL DIVISION.

painful position, and the purpose may be fully answered by grooves or channels lined with some non-retentive substance.

Fig. 104 illustrates a grooved flooring brick well adapted for stables, &c.

FIG. 104.



STABLE FLOOR BRICK.

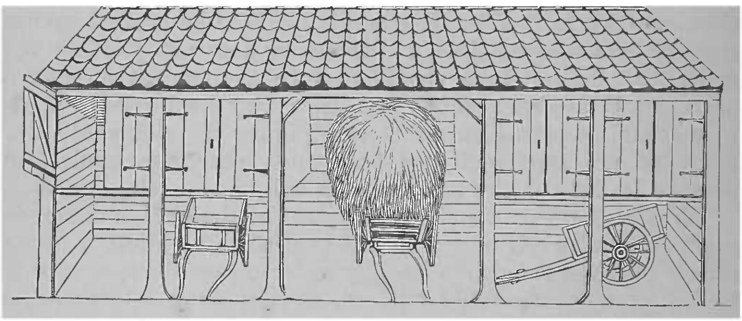
IV. Even in the farms where corn husbandry is chiefly practised, large *barns* have ceased to be considered essential; and where dairying or cattle-grazing chiefly prevails, they are of still less moment, since it is now well known that grain, properly stacked in the sheaf, will keep as well, if not better, in the yard. Wherever it is necessary to erect new barns care should be taken to make the floors dry and firm, for which purpose oaken planks are preferable to any other material, especially if thrashing machines are not in use, for the grain is liable to be bruised upon a stone or hard compost floor, and the straw does not yield so well under the flail. There should also be a sufficient number of apertures, through which hay and straw may be housed, and the barn should be placed immediately adjoining the rick-yard; thus many of the inconveniences that must otherwise result from drawing loaded vehicles into the barn will be avoided.

V. The *Granary* should be adjacent to the barn, and may be constructed with advantage in the roof of that building, immediately over the thrashing-floor, by which means the corn may be hoisted up when ready to be stored, and let down into a waggon drawn underneath when wanted for use, without the labour of carrying out. It is also more secure from depredation. The most usual mode in some districts, however, is to erect the granary upon pillars in the stack-yard, and this renders it safer from the attacks of vermin. As windows may be opened in either side, it can always be kept well ventilated. These openings should either be latticed or wired, so as to admit a frequent current of air. It should also be provided with bins for the separation of the different kinds of grain, as well as with conveniences for the storage of sacks, sieves, and measures, and, above all, with good fastenings. The girders, the joists, and the floor should be close, and firm, and strong. The inside should be lined with deal or oak planks, closely united together; the outside encased with strong weather boarding, well covered with pitch or tar varnish, and that every now and then repeated, and the roof well tiled. A little money expended in the perfect construction of this building will not be thrown away.

When grain has been stored for any great length of time, particularly if in large quantities or in warm weather, it is much exposed to that destructive insect the weevil. It is also liable to heat, and to acquire a musty smell. The only preventive is to keep it well aired, and frequently turned, and screened. For this purpose, constant ventilation must be secured, and the floor of the granary be capacious, clean, and smooth. If carefully kept, corn improves in quality with age; but it shrinks very materially in bulk.

VI. Among the smaller farm-buildings, which are worthy of more notice than is usually bestowed upon them, is the *cart* and *tool-house* (fig. 105), for the reception of the waggons and implements, which, when not actually employed, are often heedlessly left on the spot where they were last used. It consists chiefly of woodwork. The building allotted for this purpose should be

Fig. 105.



TOOL HOUSE OR IMPLEMENT SHED.

so contrived as to afford a secure shelter from rain, while the implements are exposed to a thorough ventilation. Hence an open spot, free to every wind, should be selected. The roof should be supported on pillars, high enough to admit a loaded waggon, and containing lofts for the care of light implements, sacks, or other spare articles, somewhat in the way represented by the above cut.

As the only object, however, of these houses is to preserve the carts and tools from exposure to wet, this can be attained by mere sheds, the most economical mode of erecting which is to project a roof from the back of a barn or stable, and, if possible, immediately fronting the road into the yard.

VII. *Calf-pens.*—In many parts of the country it is the practice to appropriate a portion of the cow-house to the reception of the calves: a measure which cannot fail of producing uneasiness among the cows, who, when not sucked, often withhold their milk in consequence of the bleating of the young animals. Hence, unless for the purpose of suckling from the dam, it is obviously preferable to have the pens at such a distance from the feeding-house that the cows cannot hear the noise of the calves.

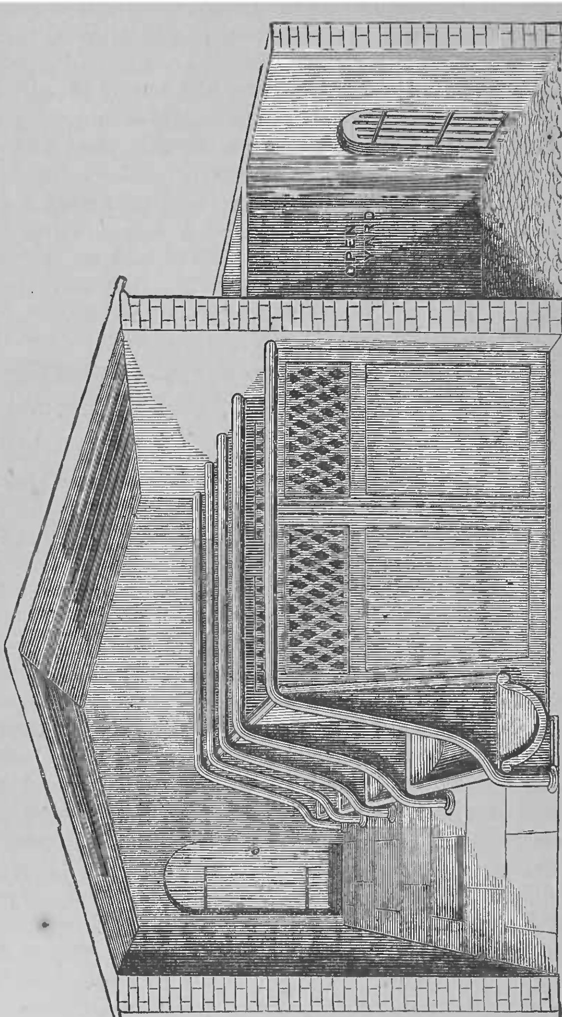
The construction of these buildings is so simple and so well known, that a particular description is deemed unnecessary. They should be latticed, so as to ensure ventilation and admit fresh air, as a moderate and rather cool temperature should at all times prevail in the calf-pens containing the animals that are to be reared. Those that are destined for the butcher should be kept warmer. Light, too, should be particularly excluded from the latter, as darkness inclines all animals to rest, and the quieter calves are kept the better they will thrive. The strictest cleanliness should also be observed, and every attention paid to keep them dry and sweet; the floors should be boarded and perforated, so that the urine and excrement may pass into a reservoir beneath; and, if possible, the pens should open either into the stack-yard, or the orchard, or some small and quiet enclosure, in order to afford an opportunity of occasionally turning out calves that are intended to be reared. Each calf, whether destined for rearing or slaughter, should have a separate pen (see fig. 101 for its fittings).

VIII. When the profit arising from the rearing of swine is duly considered, and there is an opportunity of carrying on this branch of rural economy to any considerable extent, it will be admitted that the establishment of a *Piggery* demands nearly as much attention as a dairy.

The piggery should be constructed with due regard to warmth and dryness, and divided into various partitions for the reception of the swine, according to their age and breed. Each division should be six or seven feet in width, of such a height that the largest pigs can conveniently enter, and provided with a small yard or area sufficiently capacious to hold the feeding troughs, so that the swine may be conveniently fed without the attendant unnecessarily going in among them. The piggery of a small grazing farm, however, may consist of a certain number of little sheds, opening to small yards, and disposed of in any part of the range of buildings that may be most convenient. Two things, however, should not be forgotten, namely, that every sty should have a *rubbing-post*, as few things contribute so much to the cleanliness and thriving of the pigs, and from every sty a drain should communicate with the manure pit or tank. Convenient troughs should be so arranged that offal, milk, &c., may be conveyed into them from the milk-house, or scalding-house, by means of pipes; and as these animals often thrust their feet into the troughs, and thus waste a considerable portion of food, this may be avoided by fixing some sticks in a frame over the troughs, not nnlike a rack; or a thin piece of plank may he nailed on the back part of the troughs, and so project as to allow their heads only to enter.

This object may also be attained when swine are put up to fatten on dry food, by fixing a conical hopper (a hopper holding

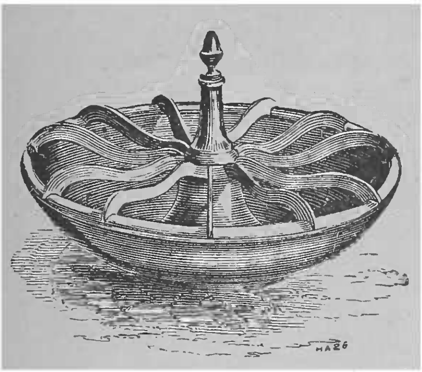
Fig. 106.



MUSGRAVE'S BRICK AND IRON PIGGERY.

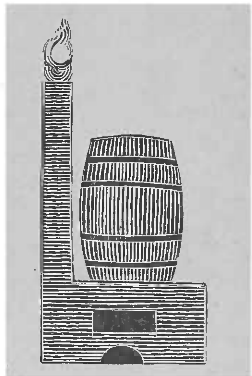
any given quantity) in the trough, with the broad end upwards, and covered with a strong lid. At the lower end should be an aperture for giving out the meat into the trough, where the animal may eat it as it falls, without being able to spoil or waste any portion of it. By adopting this expedient, the farther advantage will be derived in fattening swine, that, by feeding more leisurely than in the usual mode, their food will probably be more thoroughly masticated. This will contribute to their larger and quicker growth, and likewise to the good quality of the meat. Fig. 106 illustrates Musgrove and Co.'s, Limited, of Belfast, mode of erecting and fitting-up of piggeries. Fig. 107 illustrates a form of circular pig trough, manufactured by Messrs. Ransomes, Sims, and Head, Ipswich. This will be found very useful in pig-courts; the divisions prevent the pigs from disturbing each other when feeding.

FIG. 107.



PIG TROUGH.

FIG. 108.

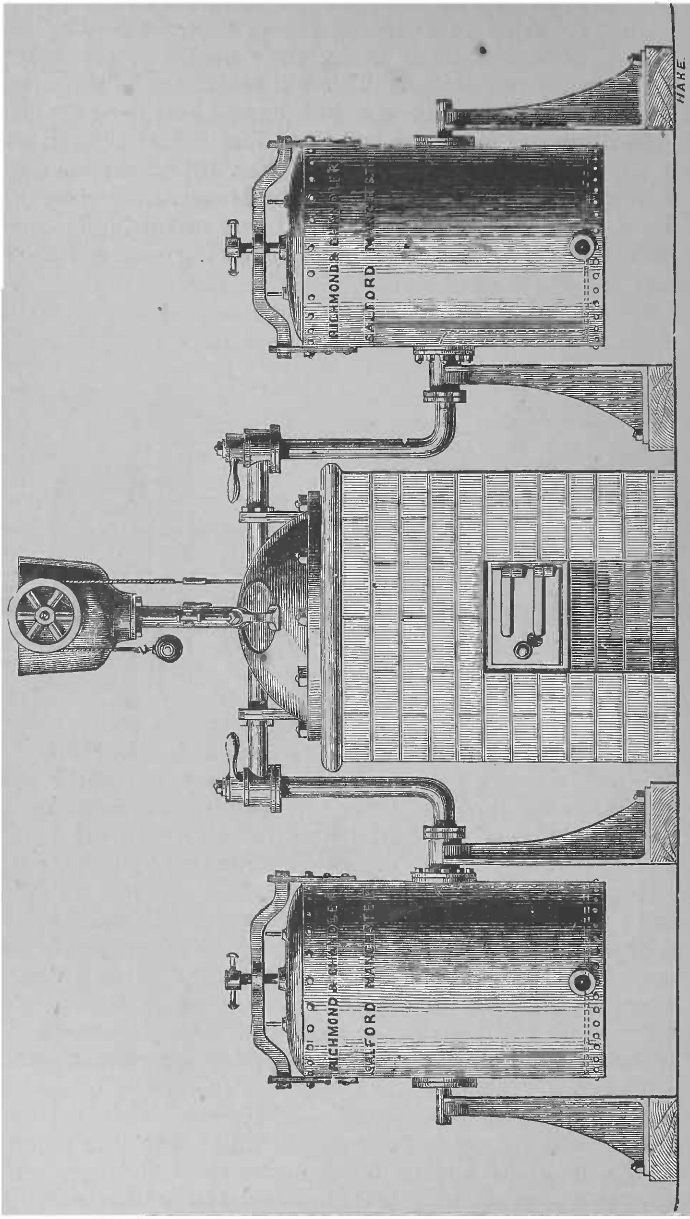


BARREL STEAMING APPARATUS FOR COOKING ROOTS, &c.

IX. *Root Houses* are absolutely necessary where the cattle are fed much on the productions of winter, as turnips, mangel wurtzel, carrots, potatoes, &c. These roots may be piled up in order to be near at hand for daily use. The root-house should be kept clean and sweet, for these vegetables are apt to rot or ferment; and if there is the slightest unpleasant smell or taste about them, the animals may be disgusted and refuse to feed. The root-house should adjoin the feeding and cooking houses, or be incorporated with the latter. A steamer is indispensably necessary on all farms where the feeding of cattle is conducted to any extent, for the purpose of preparing or cooking the vegetables for the use of the cattle.

The apparatus here delineated (fig. 108) consists of a brick or stone stove, about three feet in every direction, in which is fixed a pot or kettle, half a foot or eight inches deep and eighteen or twenty inches in diameter. Over this boiler (when about half full of water) a hogshead or cask is placed, the bottom of which is perforated with numerous holes, about an inch in diameter, so that the

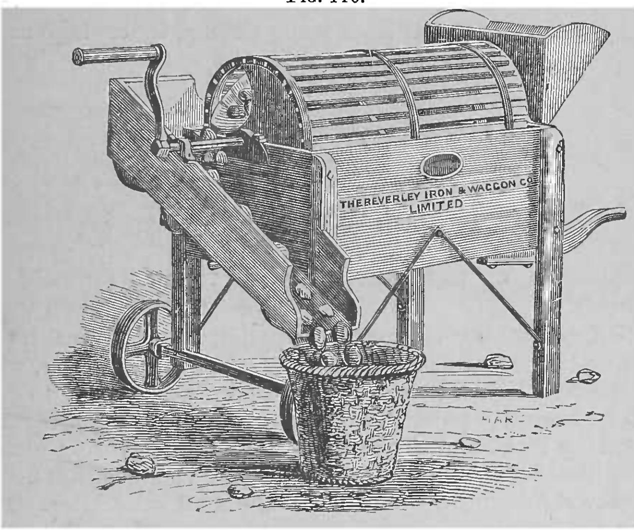
Fig. 109.



IMPROVED BOILER, STEAMING AND COOKING APPARATUS.

steam may freely pass through the roots. In America, whence this contrivance was introduced into England, the top of the cask is usually left open, but it will be more advantageous to cover it with a thick coarse cloth, or with a head fastened down to confine the steam, and in which a small valve may be inserted for the purpose of allowing the surplus steam to escape. The cask may either be removed by a rope and pulley suspended from the ceiling, or it may be turned over when the roots are sufficiently steamed. In small farm-houses, however, the family copper may be advantageously employed, by suspending over it a tub, the bottom of which is perforated with holes, which tub may be lowered or elevated by a rope or pulley fastened to the ceiling. It may be of such a size as to admit of a few inches of it going into the copper; and, to prevent it from sinking deeper, the part may be confined

FIG. 110.



ROOT-WASHING MACHINE.

by a large hoop. Thus, also, when it may be proper to steam one part of the food, and to boil the other, as, for instance, in the preparation of potatoes and turnips, the two operations may be effected by one fire and at the same time.

These are the most simple contrivances of the kind; but when larger and more complete steamers are required, an apparatus such as that manufactured by Messrs. Richmond and Chandler, of Salford, and illustrated in fig. 109, will give every satisfaction.

The washing of potatoes or roots may also be commodiously effected by means of the following machine, illustrated in fig. 110, which consists of a cylinder composed of open laths, placed in a trough filled with water, and turned by a winch; a small opening being placed in the centre for their admission. The roots are delivered at one end as they are washed, and roll down the spout to the vessel placed to receive them.

X. *Pounds* are found in almost every village, for the reception of strayed or trespassing cattle; but they are capable of being applied to more useful purposes, and may be so arranged as to serve four or five adjoining farms. In case of accidents to neat cattle, or when they have to undergo any examination, pounds will be found very advantageous, as much loss of time may frequently be prevented by their use.

Besides the various buildings thus specified, it will also be proper to have loose boxes or separate apartments for the reception of sick or diseased cattle, which should be erected in some quiet spot contiguous to the farm offices, but at such a distance as to prevent the healthy beasts from being affected by contagion.

CHAPTER II.

ON THE CONSTRUCTION OF PONDS.

THERE is nothing of greater importance to the health of all domesticated animals than a constant supply of water, which, being the only liquid horses and cattle are accustomed to drink, should be perfectly pure. Good water has been supposed to be indicated by its clearness, and by continuing transparent notwithstanding the application of alkalies or other chemical tests. It is not, however, the purest water that is the most wholesome. There are few things which so soon, and very frequently so thoroughly, produce temporary, and sometimes, permanent, derangement of health in the horse as the hard, although beautifully transparent, water of some wells.

Well water is necessary for domestic use. If it has been filtered through beds of gravel it is the more wholesome. A brook running through the farm is a great acquisition, for it is usually free from those saline admixtures that diminish the wholesomeness of the well water; but it is not every farm that possesses one, nor is the access to it always easy or safe. The farmer must depend principally on ponds for the supply of his different stock; and if they are not apt to vary too much in the quantity of water which they contain at different periods of the year, and the access to them is over a gravelly or stony descent, and they are not surrounded by any marshy ground, there will not be any danger with regard to them.

The farmer will usually find one or two ponds in his grounds; but if he has to make fresh ones, he will, if he can, select the bottom of a gentle declivity, or a corner where two or more fields meet together, by which means a regular supply of water will not only be procured after rain has fallen, but also the cattle can be watered with less waste of time and of ground.

He should contrive to have the descent to them covered by gravel or stones; or, if the descent is necessarily over clay, should take especial care that there is no vegetation within two or three yards of the water. Such ponds will never give his sheep the rot; but where the pond is surrounded by marshy ground, or the vegetation grows to the very brink of the water, or almost or quite on a level with the pasture, he must rarely, or not at all, let any sheep graze on that ground.

Clayey soils are mostly selected for the ponds, and, generally speaking, they will answer tolerably well; indeed, the stagnant water of a pond, in order to be wholesome, should stand on a clay or chalk bottom. These reservoirs, however, are apt to crack and become leaky after a hot summer, and then the farmer may be compelled to make an artificial pond.

In doing this, the pit should first be dug to a convenient depth. For one of forty feet in diameter, five feet is a sufficient depth, or it may be enlarged to seven if the pond is sixty feet in diameter. If the situation will allow it, a reservoir may be constructed for the reception of the waste water. That portion of the water which is intended for the use of cattle will thus be preserved in a state of greater purity, while the sediment that will from time to time be collected in such reservoirs may be easily drawn thence, and converted into an excellent manure. The sides of the ponds should be carefully sloped to an angle of about forty or forty-five degrees. One main point in the economical construction of ponds is to render them *perfectly retentive of water.*

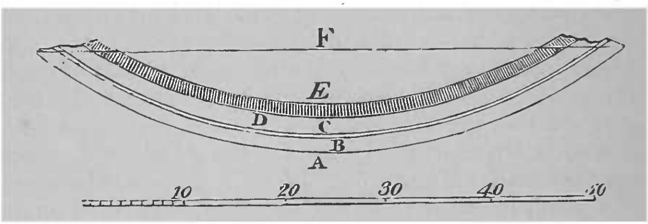
This will be best accomplished by lining the pond a foot thick with concrete or a kind of compost formed of three parts of clay and one part of quicklime, well incorporated together. This must be well and thoroughly beaten into every part of the bottom of the pond.

A coating of very cheap oil is then to be applied, on which a stratum of gravel, about an inch in thickness, should be laid before the pond is filled with water. Thus the coating will become firm and solid, and require no repair, so long as the pond is kept full. It may then be filled with water.

It will be of great importance that a regular supply of water should be conveyed to the different yards attached to the farm-house. Where there is a running stream this may be easily effected, otherwise there must be a reservoir in the highest part of the homestead.

In the annexed engraving (fig. 111) the outline of a pond for soils where there is a scarcity of water is given, of which description there were many in the county of York, before these ponds were introduced about half a century ago. We introduce it on account of its ingenuity, and the perfect success that has attended it, and because it may supply a valuable hint to those needing ponds.

FIG. 111.



SECTION OF A WATERING POND.

The line A represents an excavation made in the ground, of such dimensions as circumstances may require. On this a stratum of clay, B, is carefully beaten and trodden until it becomes a solid compact mass, from four to six inches in depth. The line C describes a layer of quicklime, about an inch or an inch and a half in thickness, which is also uniformly spread over the whole. D is a second stratum, or bed of clay, which is likewise from four to six inches in depth, and beaten and trodden down as before. The letter E designates stones or gravel, either of which are to be spread on the second bed of clay, to such a thickness as will prevent the pond from being *poached* or injured by the feet of cattle, and consequently save the water from being discharged though the pores of the earth. F delineates the line of level both of the ground and of the water; and, when thus finished, the pond will be about five feet deep, and forty-five in diameter. The expense of constructing ponds of that size is stated to have been from 4*l.* to 6*l.* sterling, according to the distance whence the clay has to be carted. We suspect, however, that these sums would be nearly trebled at the present day. Reservoirs thus formed will remain unimpaired for many years, as the lime prevents worms from striking either upwards or downwards, and, of course, from damaging the clay.

CHAPTER III.

ON FARM-COTTAGES.

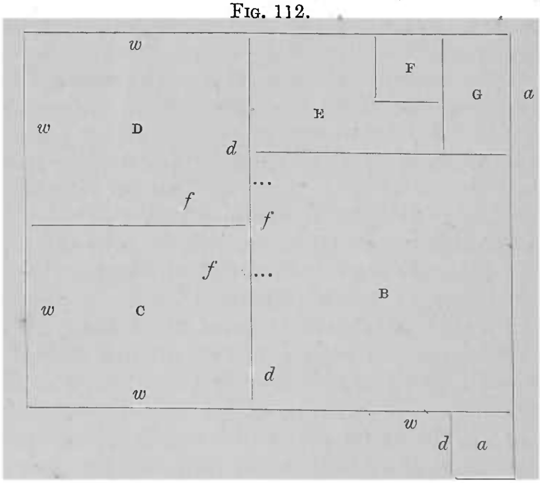
IT is only of late years that the truth has become almost universally recognised that the condition of a man's dwelling exercises in a very marked degree a powerful influence upon his physical condition; but it is still more recently that the higher truth has been recognised that the influence exerted upon a man's moral condition by the state of his dwelling is not less powerful. It would have been a great thing to have been able here to have recorded that the recognition of these important truths had resulted in the complete doing away of those wretched hovels which—a disgrace to any community professing to be Christian—scattered here and there throughout the land, offered, we cannot say shelter, for in many cases they did not do that—but miserable refuges for so many of our agricultural labourers. But although much has yet to be done to rid our land of these standing monuments of our neglect of the best interests of our labouring population in rural districts, still it is gratifying to be able to state that not only has much been done but much is daily being done in improving the condition of the dwellings of our agricultural labourers. The highest praise is due to landed proprietors in many districts for their efforts in this direction; so numerous, indeed, are those who have erected well-arranged cottages on their estates, that space does not permit us to name them here, and it would be invidious to point out a few while all deserve praise. The subject is gaining ground daily in importance, nor will it be long before an improvement in the state of matters above alluded to, will be made, much more marked and decided than any as yet shown. In treating briefly of this important subject, we propose to throw together a few general hints only, on the leading points of the subject. It is obvious that the scope of our work prevents us from going fully into all details. These must be looked for in special treatises on the subject. In commencing to plan a cottage, it will result in some saving if the following points, too often lost sight of, are duly considered. First, the *extent*, and second, the *kind* of accommodation required.

The rule which has generally obtained of making all cottages of equal accommodation is obviously wrong. Families vary in number, and the houses should be built suited for both large and small families. If all the houses are of the same size, and suited in extent of accommodation for very large families, it is obvious that where a family with few members inhabit one of them an excess of accommodation is obtained, and the cost of obtaining this is thrown away. There are, however, certain features of accommodation which must not be overlooked even in the smallest cottage, and it is therefore of importance to know what these are. And by far the best way of ascertaining these will be to make a few enquiries at the labourers themselves, as much to find out what they do *not* require as what they do wish for. Had this been done more frequently than it has, cheaper cottages would have been the rule, and greater progress would have been made in erecting them. For it is lack of means not of will which has prevented cottages being built, where in many instances they would have been, had this common-sense rule been followed.

Mr. Roberts, the great authority on all matters connected with dwellings for the labouring classes, says, with reference to the kind and extent of accommodation required in them, that this varies with the means and circumstances of the occupants; but that the minimum of a cottage for a country labourer having children of both sexes should be 'a small entrance lobby, a living room not less than 150 feet in area, a scullery of from 60 to 80 feet area, in which there should be a stove or fireplace for use in summer, as well as a copper and sink; there should also be a small pantry. Above should be a parents' bed-room of not less than 100 feet superficial, and two sleeping-rooms for the children, averaging from 70 feet to 80 feet superficial each, with a distinct and independent access. Two of the sleeping-rooms at least should have fireplaces. There should also be a ventilated and well-drained closet (privy), and suitable receptacles for fuel and for dust. The height of the rooms, in order to their being healthy, should be scarcely less than 8 feet, and even 9 feet would be desirable, but for the extra expense. With a view to ventilation, the windows should reach nearly to the ceiling, and the upper part be invariably made to open.' It is clear that a 'hard and fast line' cannot be laid down in the case of cottages. Some families require much, others little sleeping accommodation. Every cottage should have, however, a porch, to keep the living-room warm, a scullery, a privy, coal- and ash-place, and cupboards—as many as possible.

In the choice of a site, where choice is within the reach of the builder—not always the case, however—the preference should be given to that which is high and dry. Hollows, and plots at the foot of rising ground, should be carefully avoided. The soil best adapted to secure a healthy site is gravel; heavy close clay the worst. The *sunniest aspect* is the best; and this is obtained by facing the front to the south-east. Light, and plenty of it, is an essential to a healthy cottage. We have already alluded to the drainage of the site; this being properly attended to, the sinking of the foundation should be carefully done. It will be well to dig out the whole space taken up by the cottage at least 2 feet deep; this will secure dryness of floors. This dug-out space should be extended at least 24 inches beyond either line of walls, the space being filled up and well rammed with clinkers or dry smithy cinders, or, if these are not obtainable, small pieces of broken bricks or small stones. If the site is not drained, and the soil inclined to damp, the footings should be laid in concrete, the depth of which should not be less than 12 inches. A layer of slate laid in gas-tar round the whole wall above the ground level will also prevent damp, or Taylor's foundation hollow bricks may be used. The walls should be of hollow bricks, or, if these are not used, what is called a 'cavity' wall should be made. A hollow wall conduces greatly to warmth and dryness, and should be adopted in all cases. Where floors are made of earth, tile, or brick, the plan already recommended of digging out the whole space enclosed by the walls to a depth of 2 feet, and of filling it up with cinders, &c., will secure dryness to the floors. But the healthiest floor of all is a boarded one; and, to secure this from dampness, it should be raised at least 18 inches from the ground level; this will raise the entrance two steps above the level. The joists on which the flooring boards are supported should be made to rest upon small brick piers carried up from the ground. This mode of construction will tend to secure freedom from dry rot. Of materials for roof-covering, tiles are the warmer in winter, cooler in summer, and more economical than slates. Much has been written about the sewerage of cottages, more especially with reference to the carrying away the liquid and solid refuse of the inhabitants. Doubtless good sewerage has its advantages; but, upon the whole, it is open to doubt whether it is worth while carrying out to isolated cottages, or even to rows of three or four cottages, any elaborate scheme involving the laying down of drain tubes, water-closets, or stench-traps, and involving also the risk of stoppages, with their attendant train of nuisances. To make the drain-tube sewage system perfect, a constant and liberal supply of water is essential, and this also at some pressure. This, in country places, is not usually obtainable, unless by erecting cisterns at a higher level than the closet and sinks, and pumping the water up to these cisterns. The plan, therefore, which involves the least outlay of money, and, what is of not less importance, the least demand on the time and attention of the occupants, will be that likely to be of the most general service. This will, therefore, be secured by having the privy and ash-pit outside, and the contents of the privy deodorised by the simple addition of ashes or dried earth; while the sink-water from the scullery may be led to a cesspool made at the foot of the garden, into which also the overflow of the privy may be led. The contents of the cesspool will be of great service in the cottage garden. The cesspool should be small, and frequently emptied of its contents by a scoop or ladle, the point being to economise building material as much as possible. The agricultural literature of the last ten or fifteen years abounds in examples of cottage plans; and so numerous indeed have they been, that a volume of selections could with great ease be got up from them. As it is somewhat difficult, then, to choose where choice is so wide, we must content ourselves with giving one or two examples only, with suggestions of our own as to their improvement or what we consider to be such. The accommodation of any particular class of cottage being decided upon, and the kind or class of construction, as single-storied or two-storied, the changes may be rung—so to say—upon these to any number of tunes almost; so that one or two good examples will enable the reader, if interested in the subject directly, to draw up a series of plans showing different arrangements of the same accommodation till he at last arrives at one likely to meet his requirements. Cottages are either single-storied or two-storied, and these may be either erected singly or isolated, termed detached, or in pairs—termed semi-detached—or a number in line, termed rows.

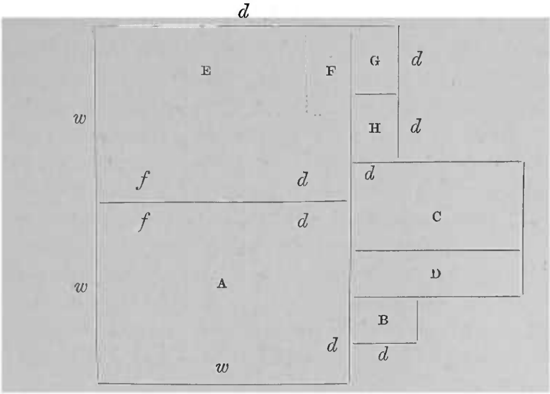
FIG. 112.



PLAN OF SINGLE-STORIED DETACHED COTTAGE.

In fig. 112 we give the arrangement of a single-storied detached cottage, in which *a* is the porch, B the living-room, 10 ft. by 14 ft.; C bed-room, 8 ft. by 7 ft. 6 in.; D bed-room, 8 ft. by 10 ft. 6 in.; E rain-water tank, F coal store; G water-closet; *w* position of windows, *d* of doors, *f* of fireplaces. In this plan both bed-rooms enter through the living-room, a most objectionable arrangement, and there is no scullery. A capital scullery might have been obtained by taking the coal and privy to the back, and giving the space E F G to a scullery, entering from the living-room B. By putting the porch in the centre wall, nearest the front-wall, an independent entrance might have been obtained to

FIG. 113.

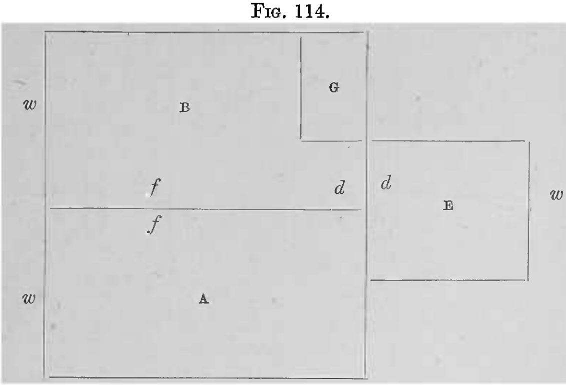


GROUND PLAN OF TWO-STORIED DETACHED COTTAGE.

the living-room B and bed-room C, and the second bed-room D might have been entered from the scullery, which, as we have above shown, could have been placed in the space E, F, G.

In fig. 113 we give the ground plan (exhibited at the Leeds competition of cottage plans) arrangement of a detached cottage

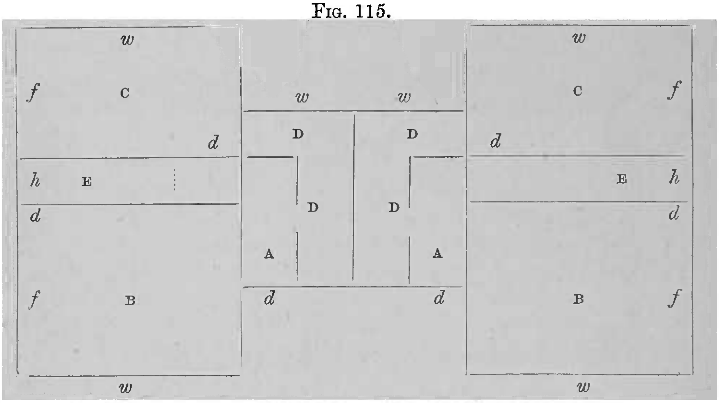
FIG. 114.



UPPER FLOOR OF COTTAGE (Fig. 113).

(two-storied) in which A is the living-room, 13 ft. by 12 ft. 6 in., B the porch or entrance, C the pantry, D fuel store, E the scullery, 10 ft. by 9 ft. F space for stairs leading to chamber floor; G dust and lumber place, H water-closet or privy. The door-spaces are marked *d*, windows *w*, and *f* shows the position of fireplaces. In fig. 114 we show the bed-room arrangement of this cottage, in which A B are the front and back bed-rooms, G the stairs, E small bed-room. In this plan the objection to the ground-plan arrangement is, that the scullery has to be got to by passing through the

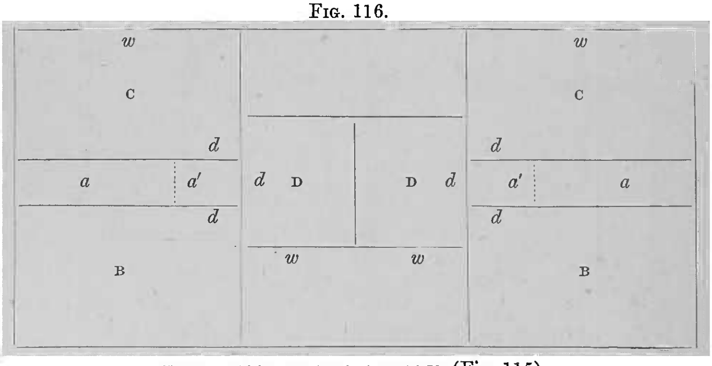
Fig. 115.



PLAN OF PAIR OF TWO-STORIED SEMI-DETACHED COTTAGES.

kitchen, or by going round to the back, and the bed-rooms can only be reached by passing through the scullery. The fuel-place is too far away from the fireplaces, and the privy too near the pantry. In the bed-room arrangement the great objection is that there are no independent entrances to the rooms. This could be obviated by carrying forward a partition separating the staircase G from

Fig. 116.



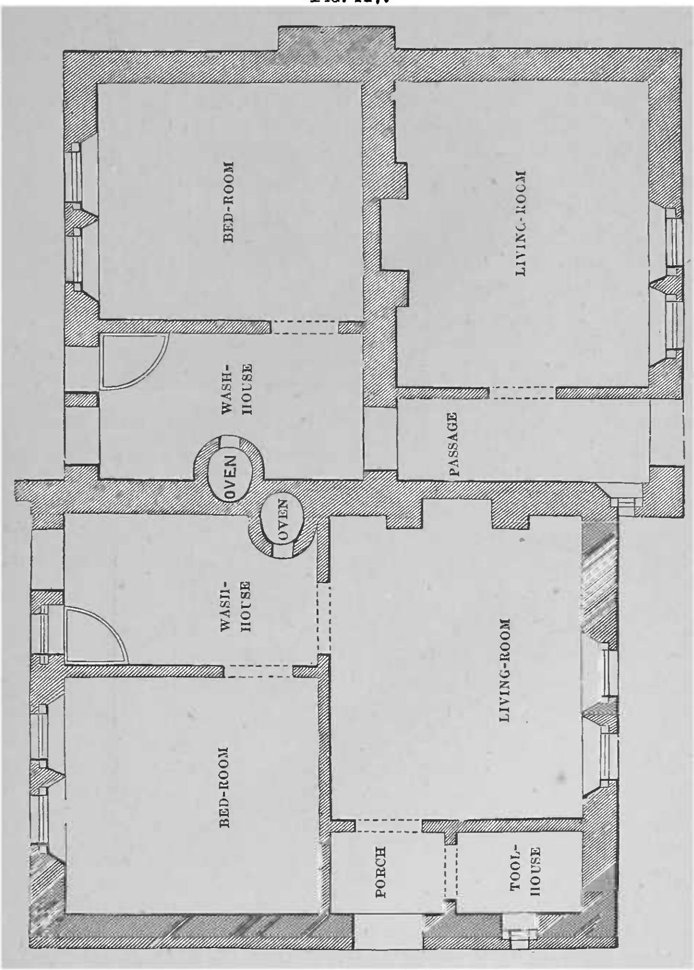
UPPER FLOOR OF TWO COTTAGES (Fig. 115).

bed-room B, and thus leaving an isolated landing-place, from which independent entrances could be obtained to all the three bed-rooms.

In fig. 115 we give another small plan-sketch of a pair of cottages (two-storied, 'semi-detached'), in the arrangement of which there is considerable novelty. A the porch, B the living-room, C the scullery, D the wash-house, E the stairs, entering from the living-room at the end *h*.

In fig. 116, the bed-room plan, *a* is the position of stairs, *a'* the landing from which, through independent entrances, admission is obtained into the three bed-rooms, B, C, and D.

FIG. 117.

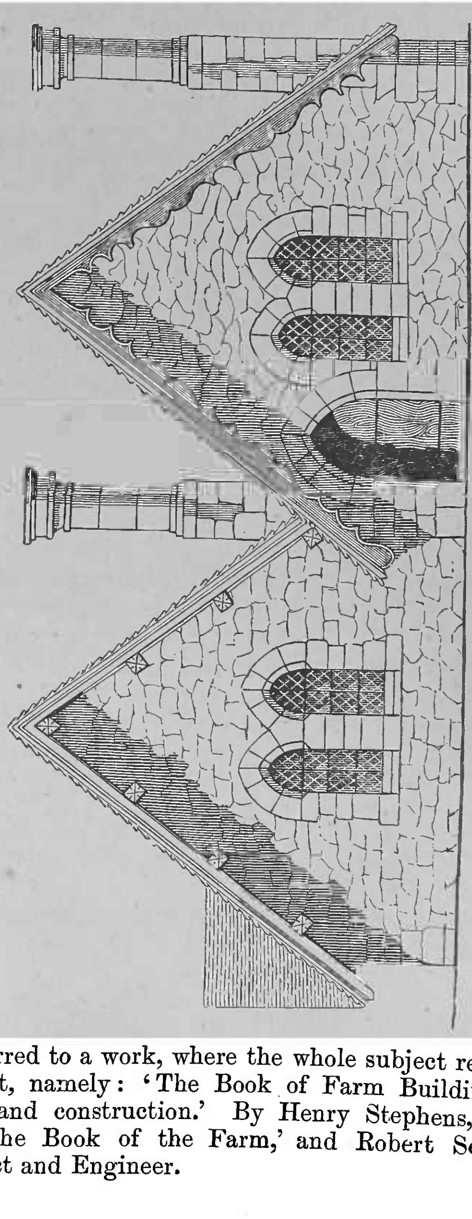


GROUND PLAN OF PAIR OF COTTAGES.

We conclude our series of sketches by giving the plan and elevation of a pair of cottages (figs. 117 and 118).

To describe and illustrate the various details connected with the construction and fittings of farm-houses, farm-buildings, and farm-cottages would occupy so much space that it is impossible here to enter into the subject, and to attempt to do so cursorily would be useless practically in its results to the reader. He is

Fig. 118.



ELEVATION OF COTTAGES.

therefore referred to a work, where the whole subject receives special treatment, namely: 'The Book of Farm Buildings: their arrangement and construction.' By Henry Stephens, F.R.S.E., author of 'The Book of the Farm,' and Robert Scott Burn, Farm Architect and Engineer.

CHAPTER IV.

ON FARM IMPLEMENTS. PLOUGHS—HARROWS—CULTIVATORS.

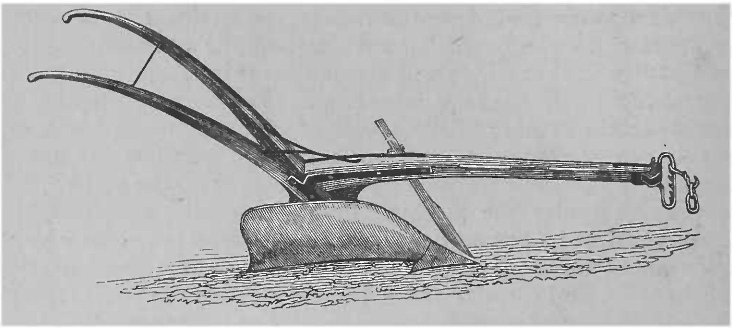
THE plough is the most important implement used on a farm. Its object is to turn over the earth to a certain depth, and thus either bury the manure which is spread upon it, or offer a new surface to the fertilising influence of the atmosphere. The best plough is that which will accomplish this in the most perfect manner, and with the least labour. The surface of the field is cut into a certain number of slices, each of which, on account of a supposed greater convenience, or by a kind of common consent, is taken from the left-hand side and turned over on the right. The ploughman guides the machine by means of the handles of the plough, and, if he has no boy with him, he directs the horses by his voice and by means of the reins. By lifting or by pressing down the handles, he lowers or raises the ploughshare in proportion as any irregularity of surface, or any greater or lesser tenacity of soil, may require. In the same manner the direction of the plough to the right or the left is governed, and after a little practice, the ploughman feels the machine, in his own technical language, *swimming fairly*, i.e. moving forward, without any tendency to swerve to the right hand or to the left, to rise from the earth or to sink into it. The principal circumstances to be attended to are—the breadth of the slice of earth that is to be separated, and which generally varies from eight to ten inches—the depth of the furrow, which, except for deep-rooted plants, is rarely so great as the breadth, and, as a general rule, is seldom more than two-thirds of it; and the degree in which the slice is turned over, which is about half-way, or forming an angle of forty-five degrees.

As the soils of farms are necessarily of various kinds, so are ploughs diversified in their construction, and the purposes to which they are applied; we have only space to notice a few of those that are most deserving of attention.

The ploughs in most frequent use are those denominated *wheel-ploughs*, and *swing-ploughs* which are not provided with wheels.

At one period, the agricultural world was agitated by a keen discussion as to the relative merits of wheel and swing ploughs. That discussion has almost wholly exhausted itself, and has resulted in the establishment of the general superiority of the wheel-plough; this is well corroborated by a suggestive fact mentioned by Mr. Morton, that the great firms connected with the manufacture of agricultural implements send out very few swing, the great bulk being wheel ploughs. Swing ploughs have long been and still are the favourites, however, in Scotland and the northern districts of England, although many wheel ploughs of English make are being gradually introduced, and many are to be met with now in districts where but a few years ago not one was to be seen. This would seem to corroborate the view mentioned in the next

FIG. 119.

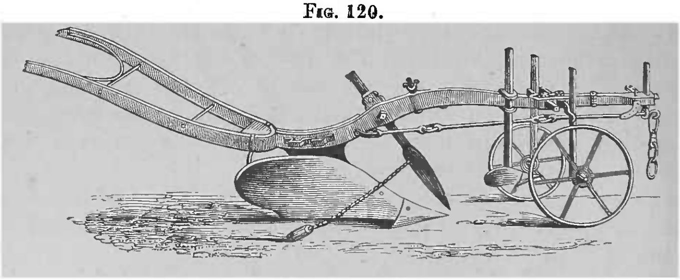


SWING PLOUGH.

sentence. The distinction seems to be that, for well-cultivated lands, free from stones and obstructions, the wheel plough is the best; while for those lands which abound in stones, &c., and are not what are termed free-working soils, the swing plough is the best.

Fig. 119 illustrates a form of swing plough in which the beam and stilts are of wood. In the improved ploughs now in use,

FIG. 120.



WHEEL PLOUGH.

however, wood is dispensed with, and iron, a lighter and stronger material, alone used in their construction. Fig. 120 illustrates the form of wheel plough manufactured by the celebrated firm of Messrs. F. and J. Howard, of Bedford. In fig. 121 we illustrate the double mould-board plough for forming ridges in turnip and potato culture. It is also used as a potato plough, or lifter,

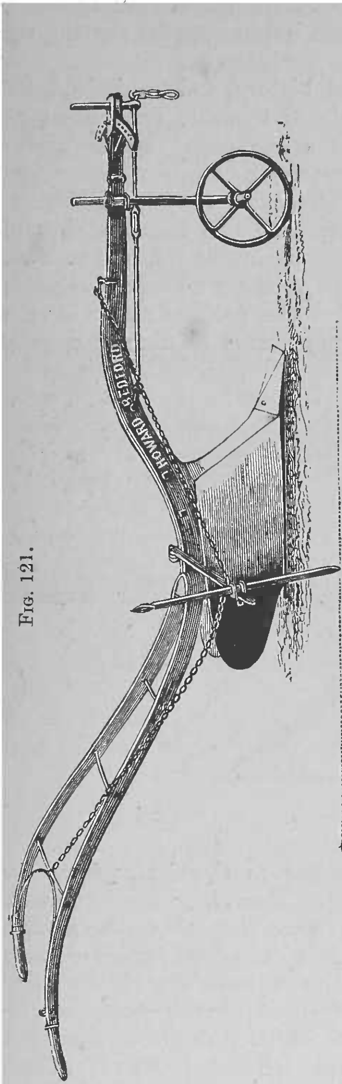


Fig. 121.

Howard's Double Mould Board or Ridging Plough.

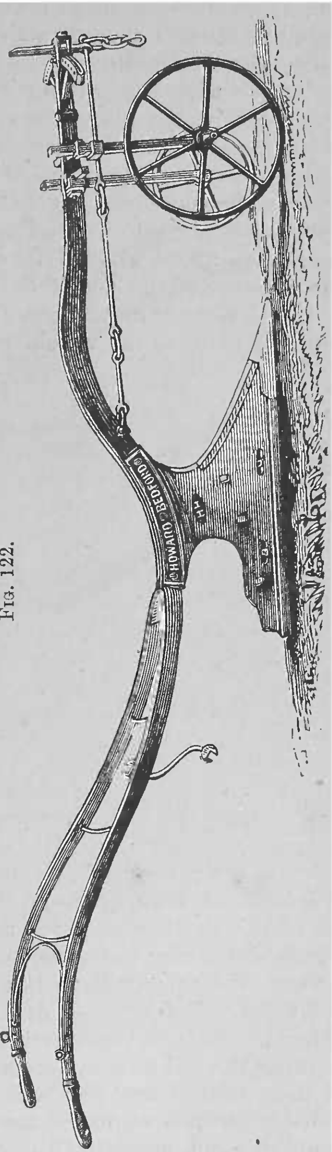


Fig. 122.

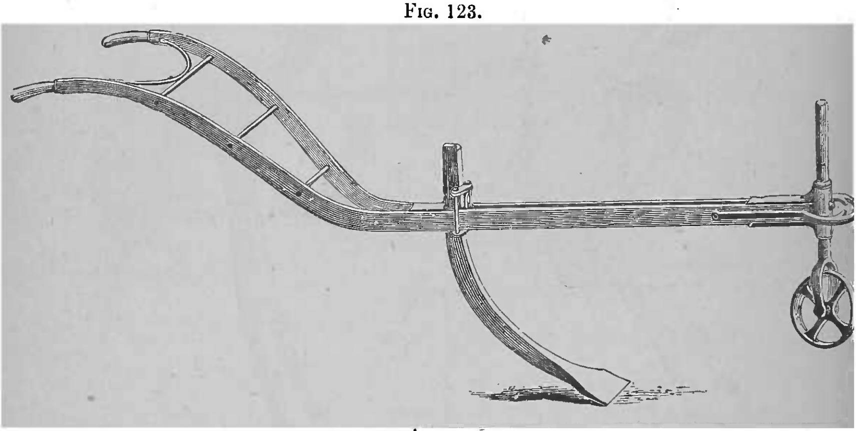
Howard's Subsoil Plough.

splitting the ridges, and by throwing the soil to right and left, exposing the potatoes, to be gathered up by hand.

Of late years, the importance of a deep cultivation of the soil has been generally recognised; and a variety of implements have been introduced by which it is secured. In fig. 122 we illustrate Howard's Subsoil Plough, an excellent implement for stirring the soil to a great depth.

At one period in our agricultural history, and up, indeed, till very recently, the plough was considered the only implement by which the soil could be prepared for a seed-bed. In view, however, of certain defects which characterise its mode of operation, other modes have been recently introduced, by which all the advantages of a good seed-bed are obtained. The disadvantages of the plough above alluded to can only be briefly referred to here. The pressure of the sole of the plough on the land tends to harden it, and to form a crust through which the roots of plants have a difficulty to pass, and which, being impervious to a great degree,

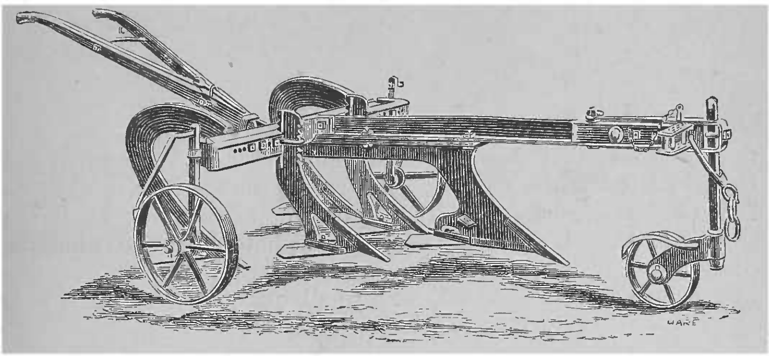
Fig. 123.



SMITH'S SUBSOILER.

prevents the passage of the surface water to the drains beneath. The depth of working the plough being always, or nearly always, the same year after year, the result is that the sole of the plough always slides over the same surface, and in course of years hardens it more and more, till it becomes almost impenetrable to roots and water. But another evil is presented by the action of the plough, namely the enormous friction which its form causes when working the soil to a considerable depth; hence, if the advantages of deep culture are desiderated, they can only be obtained by the expenditure of much animal force, which renders the deep ploughing an operation to be very costly. The 'grubbing' or 'smashing up' principle, introduced and carried out with such success by Mr. William Smith, of Bletchley, proposes to get rid of all these defects of the plough, and at the same time to secure advantages which that implement, working at its best, cannot, from the nature of its construction and operation, give. Fig. 123 illustrates the simplest form of grubber used by Mr. Smith. By the action of this and one or two other forms—modifications of that illustrated in fig. 123—'the under surface is torn up and broken, just as by the spade; and the soil thus treated crumbles loosely and readily, admits the air into its interior, and is rapidly transformed from lumps of hard tenacious bricky clay into that fine elastic lightly and deeply-stirred soil, examples of which can be seen on Mr. Smith's farm. The soil thus treated seems to lose the natural tenacity belonging to clay, and rapidly assumes the fine friable condition of garden land.'

FIG. 124.



BENTALL'S BROADSHARE.

We now proceed to notice other forms of cultivating implements in use on the farm. It is impossible, in the limits of this work, to notice all the forms in use. We can only find space for a few of them, referring the reader to the undernoted work, in which he will find the whole subject of farm machinery exhaustively treated.[1] Fig. 124 is a drawing of the broadshare manufactured by Mr. Bentall, of Heybridge, Maldon, Essex. This is an implement much used for the breaking up of stubble and bringing the land rapidly into good working condition.

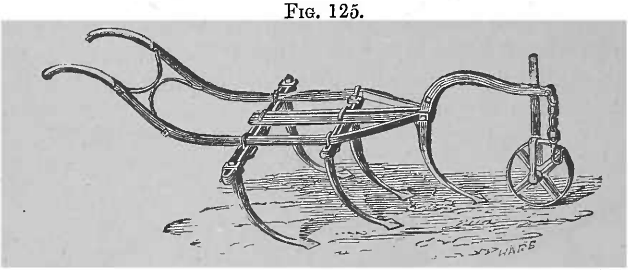
Grubbers and *Scarifiers* are now highly esteemed among 'the Field Implements.' After the land has been once ploughed and suffered to lie fallow for a few months, or after the potato or turnip crops have been taken off the ground, *the scarifier*, which is a kind of harrow, with its teeth made to resemble the plough-

[1] The Book of Farm Implements and Machines. By James Slight and Robert Scott Burn, Engineers. Edited by Henry Stephens, F.R.S.E., Author of 'The Book of the Farm.' W. Blackwood and Sons, Edinburgh and London.

share, stirs and breaks up the ground, without reversing its surface, and thus prepares it for the succeeding crop. Its obvious design—and it is well accomplished—is, the saving of labour and of time. Fig. 125 illustrates the form of Scotch or Tennant's Grubber, manufactured by Ransomes, Sims, and Head, of Ipswich.

The practice of *scarifying* grass lands is of late date; and where the beauty of the sward is not regarded, it is very beneficial, as it conduces greatly to increase the quantity of hay, by loosening

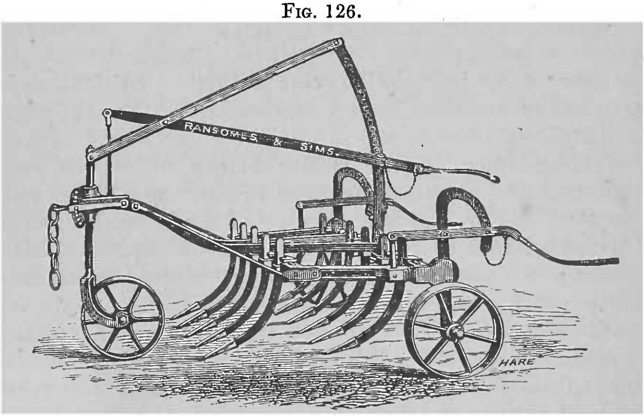
FIG. 125.



TENNANT'S GRUBBER.

the surface, so that the roots have fresh power of vegetation, and throw out many new shoots. The use of the scarifier is particularly advantageous before the laying on of manure; by it the ground is opened, so that the roots immediately receive whatever quantity of it may be laid upon them; thus a saving in this important article is effected, for a small quantity so applied goes

FIG. 126.



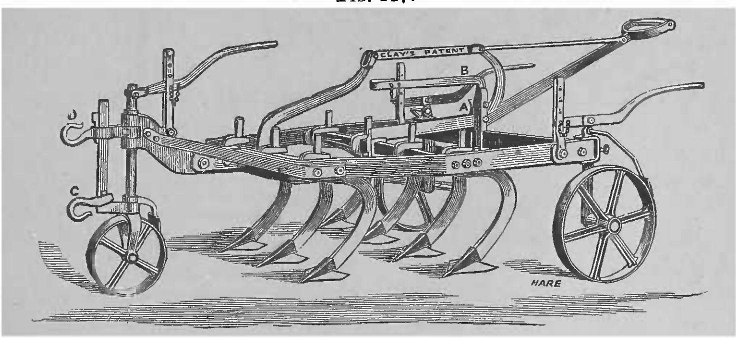
BIDDELL'S SCARIFIER.

as far as a much larger proportion strewed after the old practice. An excellent form of Grubber or Cultivator, perhaps that which has enjoyed the highest reputation in England, is that known as

Coleman's. The most recent form, and one very highly spoken of, is that of Mr. Clay, of Wakefield, illustrated in fig. 127.

Biddell's patent wrought iron scarifier (fig. 126) is intended for cleansing bean, pea, and wheat stubbles directly after harvest, and breaking clover leys, or land after green crops, and preparing it for barley and oats. The teeth of this machine are of wrought iron, and may be set at any distance from each other, or arranged to penetrate to any depth. The greater part of the frame, too, is of the same material, and is furnished with two lifting levers and catches, so that, on sloping ground, one side may be raised higher than the other.

FIG. 127.



CLAY'S GRUBBER OR CULTIVATOR.

Coleman's patent Drag Harrow and Scarifier, though not calculated for quite such deep tillage as the above-mentioned one, will be found very efficient in harrowing weeds and rubbish from foul lands; for opening, raising, and pulverising the soil; and also may be used with advantage as a skim to take off the couch grass.

Horse Hoe.—One of the greatest improvements in practical agriculture has been the introduction of the hoe into the field, for every kind of crop. Peas and beans were probably the first crops that were sown in rows for the purpose of hoeing the intervals. Hand-hoeing not having been found sufficiently expeditious, a larger hoe, drawn by a horse, was invented. This introduced what was termed 'New Husbandry,' the great promoter of which was Jethro Tull, of Berkshire. In this system the horse-hoe is the principal agent, and immediately connected with this system is 'Drill Culture.'

The hoe invented by Mr. Amos has moveable shares, so that it might be varied according to the distances at which the seed had been drilled.

Mr. Cook's horse-hoe formed part of his drill machinery. His shares, however, are fixed, which may perhaps render this implement, although otherwise an admirably effective one, less eligible than the former.

Messrs. Garrett's Patent Horse-Hoe, fig. 128, is one of the most complete implements yet invented. It is well suited to all

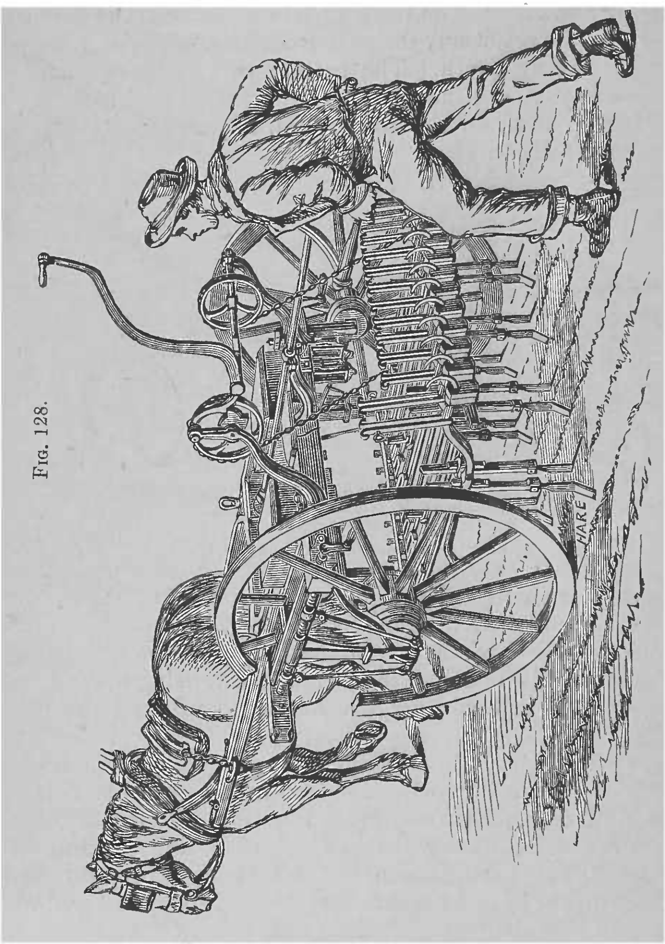


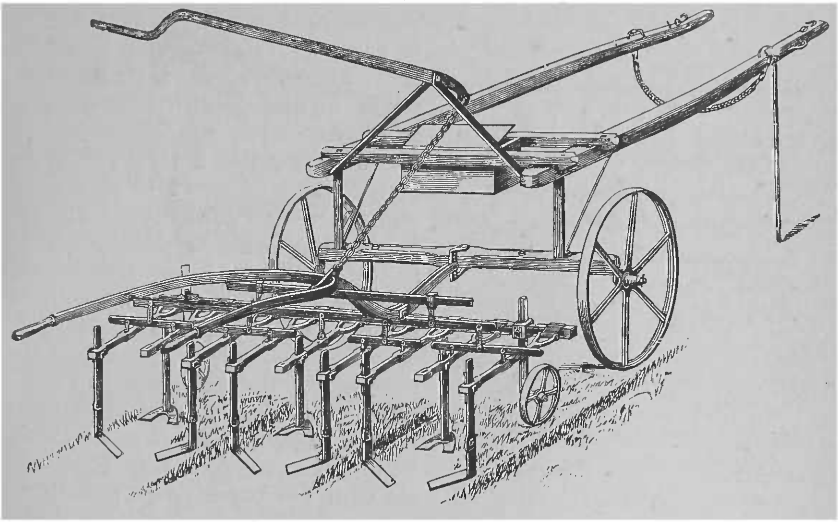
Fig. 128.

GARRETT'S HORSE-HOE.

methods of drill cultivation, whether flat, stetch, or ridge ploughing, and it is adapted to hoeing corn of all sorts, as well as roots.

The *prong-hoe* is chiefly used for the purpose of hoeing or breaking the ground near or among the roots of plants. It consists of a handle, five or six feet in length, to which are attached two hooked points, six or seven inches long. It is an effective implement, particularly in horse-hoeing husbandry, where the plough can only come within two or three inches of the rows of vegetables; as, by means of it, the land may be stirred to the very stalk of the plant.

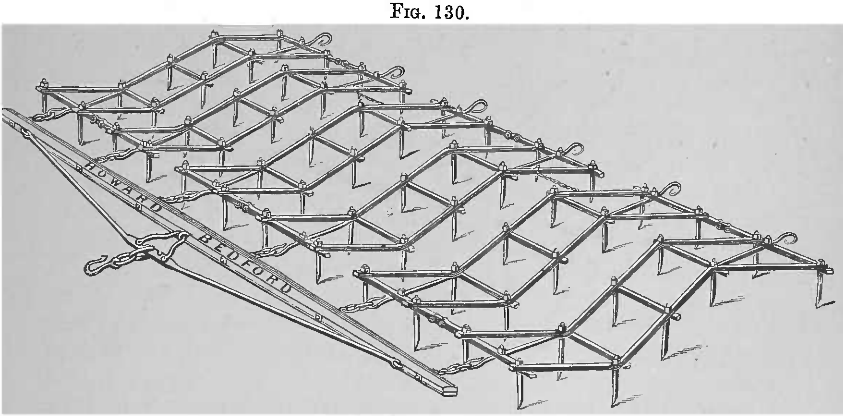
FIG. 129.



HOWARD'S STEERAGE HOE.

Fig. 129 illustrates a very simple form of steerage horse-hoe as manufactured by Messrs. Howard, of Bedford.

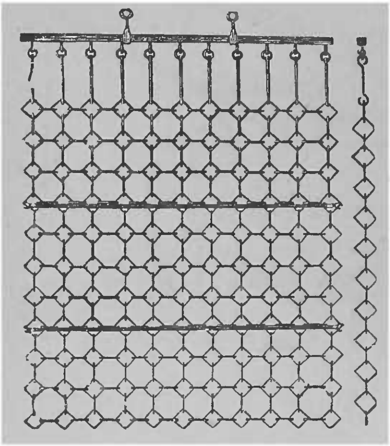
FIG. 130.



HOWARD'S IRON HARROW.

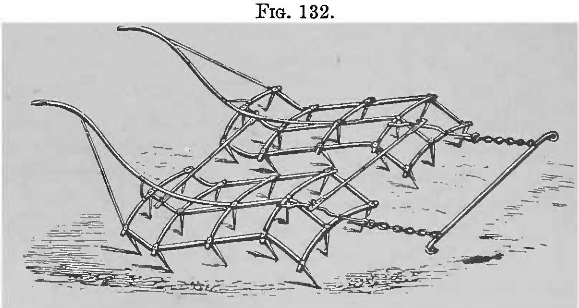
The *Harrow* is an implement of essential importance in the management of farm-lands, not only for the purpose of covering the seed with earth, but likewise for pulverizing the soil previously to its reception of the seed, and freeing it from all the weeds and roots which it may contain. The improvement of the harrow has of late years become an object of considerable attention, and numerous alterations have been introduced in order to suit it to various soils and different modes of tillage. Iron harrows are now in most general use; they are made in sets of three or four, and light or heavy, according to the work for which they are to be used, and arranged to spread eight, ten, or twelve feet. The teeth should be perpendicular, and of a square form—not too close to each other, or they will be needlessly impeded by the obstacles opposed to them, and prevented from penetrating to a sufficient depth; nor should they be too long, lest, when meeting with some obstacle, they should act with too much power; their average length may be seven or eight inches. Fig. 130 illustrates the iron harrow made by Howard, of Bedford. A simple yet effective instrument of this kind employed upon grass land is the *bush-harrow*, which is chiefly used for the purpose of harrowing in dung or seeds. It merely consists of a frame, into which some kind of bushes are

FIG. 131.



CHAIN HARROW.

FIG. 132.



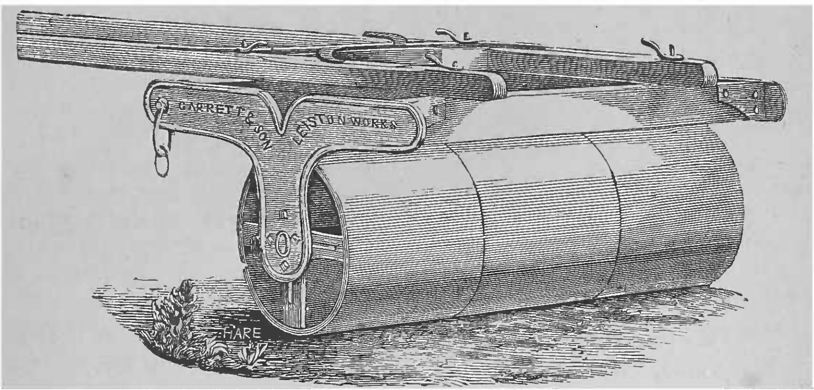
RIDGE HARROW.

interwoven; the fore part of this frame is sometimes raised by means of two wheels, while in others wheels are not employed, but the whole rough surface is applied to the ground and dragged over it. The latter method is preferable when there is much roughness or decayed matter to disperse. Fig. 131 is a form of harrow, now superseding the bush-harrow, and known as the 'chain-harrow.' Fig. 132 illustrates the form of ridge or saddle-harrow, for turnip or potato ridges.

Rollers are constructed of wood, stone, or cast iron; and of various sizes, according to the respective purposes for which they are designed. The common rollers, generally used for pasture-lands, are from fifteen to thirty inches in diameter, and about six feet in length.

The implement given in fig. 133 is manufactured by Garrett and Son. The roll is in three parts, revolving separately on a spindle for the facility of turning without injury to the crop.

FIG. 133.



IRON ROLLER.

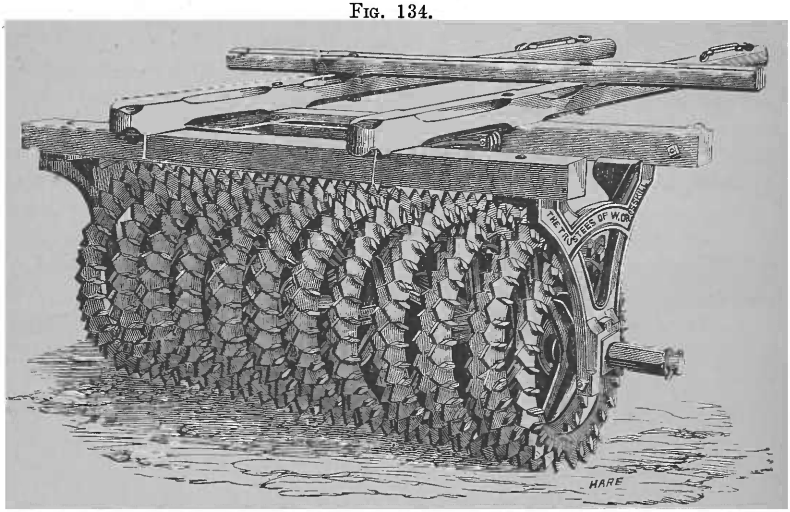
The frame is of cast iron. The shafts are singly joined together, so as to be easily attached to any part of the frame, that the shaft horse may walk in any required direction, each end of the roller having an attachment for a trace-horse. They are fitted with swing scrapers, which, by means of weights, adjust themselves to the cylinders as required, and prevent the soil from sticking to or clogging the roller.

In Scotland, granite has been found preferable to every other material for rollers, being much cheaper, more durable, and so weighty that it may be made of as small a diameter as is necessary.

It is a common and very commendable practice, in rolling meadows, to place a bush-harrow in front of the roller, by which means the two operations are simultaneously performed. A very simple contrivance in the frame of the roller, with which every ploughman is acquainted, is sufficient for the purpose.

We subjoin, in fig. 134, an engraving of another useful implement for the practical farmer. This machine (the invention of the late William Croskill, of Beverley) is made by the same active firm we have already had occasion to notice with commendation.

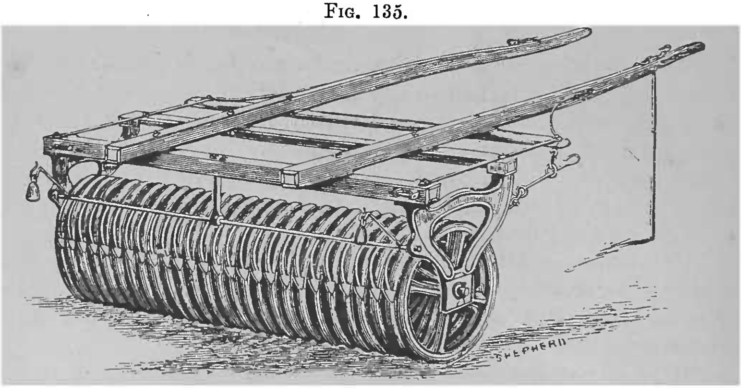
Fig. 134.



THE BEVERLEY IRON AND WAGGON COMPANY'S CLOD CRUSHER.

This implement is most valuable in crushing clods on heavy lands, and, when other machines are useless, in dry weather.

Fig. 135.



HOWARD'S PRESS-WHEEL ROLLER.

In fig. 135 is illustrated Howard's Press Wheel, an implement which is often used to effect the same purpose as the clod crusher;

it is also used to make grooves in the land which is destined to be sown with seed broadcast. It is highly valuable as a destroyer of the worm or grub. In fig. 136, we illustrate a very celebrated

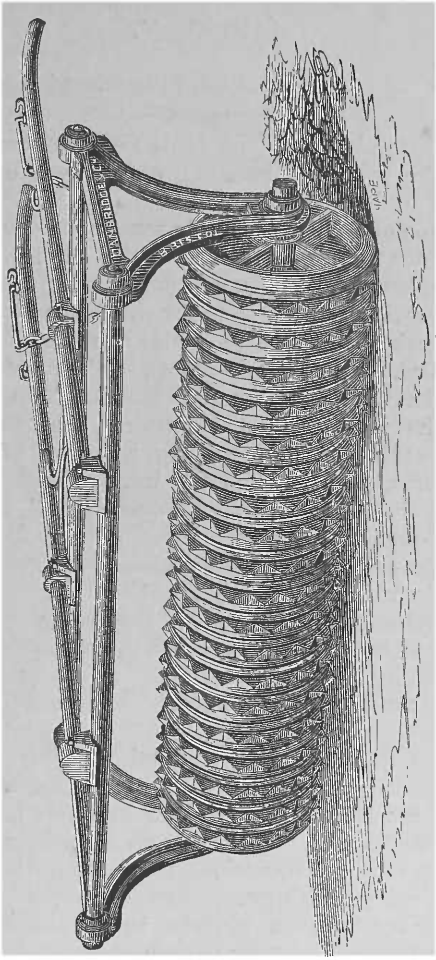


Fig. 136.

CAMBRIDGE ROLLER.

form of roller known as the 'Cambridge Roller' from its inventor, Mr. Cambridge, of the well-known firm of Cambridge, Parham and Webb, of Bristol.

CHAPTER V.

STEAM CULTIVATION.

IN the last edition but one (the tenth) of this work the following were the principal remarks which were offered on this subject:—

'This division of field instruments must not be concluded without some reference to the possibility of the employment of steam for many agricultural purposes, and particularly for ploughing on extensive farms. It has been tried for the purpose of experiment. An interesting exhibition of it took place on April 20, 1837, on a bog in Lancashire, near Bolton-le-Moors, in the presence of a deputation of the Highland Society of Scotland. Two ploughs were urged on by the machine, and it appeared that they worked at the rate of 8 acres per day, making a furrow of 9 inches in depth: in other words, they did the work of eight ploughs, and a corresponding number of men and horses.

'Lord Willoughby D'Eresby has likewise made some experiments with a steam-plough on his Lincolnshire estates. He had a light portable railway placed down the centre of the field to be ploughed, and on this a locomotive steam-engine ran, with two ploughs affixed to each side of it, followed by two subsoil ploughs. There are estimates given, but as they do not include some expenses which must of necessity have been incurred, we forbear to quote them.

'A writer in the "Quarterly Journal" of 1836 takes a period of ten years, which, considering the original cost of a steam-engine, he must do, in order to put the matter in a fair point of view—and supposes one farmer to use the steam plough, and another the common plough with two horses—the quality of the land on both farms being the same, and the same quantity of land being ploughed. The result came out in favour of steam culture, all other incidental expenses being supposed to balance each other, and the same number of men being employed in each experiment.'

Since the date of the edition of this work above referred to, enormous strides have been taken in the advance of steam cultivating mechanism as an integral part of the system of working farm operations by the aid of machinery. It is no longer considered what might be called an extra help, or an aid which was looked upon as a novelty or perhaps a curiosity, which the wealthy and the adventurous might adopt upon their estates—not quite sure whether, as the French proverb puts it, 'the play was worth the candle.' It has advanced, as named above, to a point far beyond this, and large numbers of 'sets' of steam cultivating 'tackle'—the technical phrase seems to have got stereotyped amongst us—are now working as regular parts of farm mechanism in various parts of the kingdom, on the Continent and in the colonies.

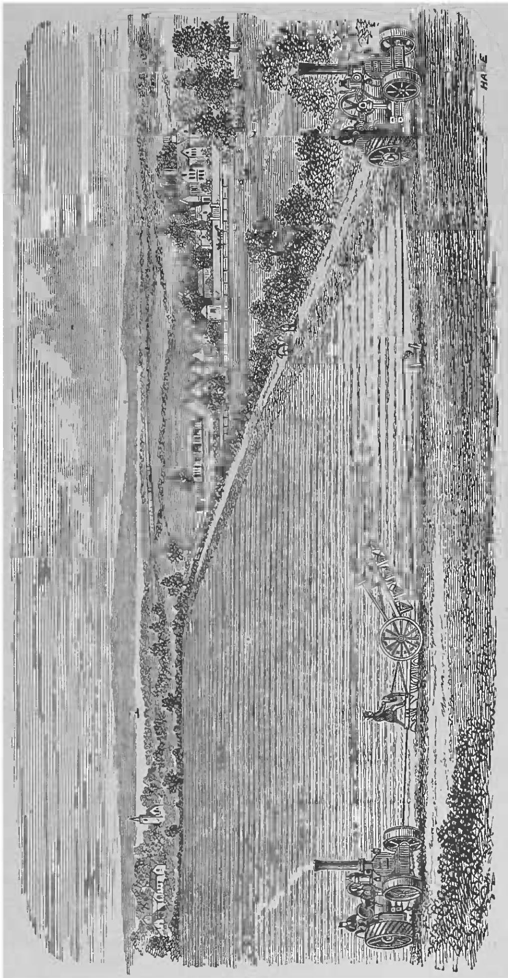
In bringing about this satisfactory condition of matters, while great credit is due to the enterprise of our great landowners and to the most advanced of our farmers, perhaps the most potent influence has been the untiring energy, the business skill, the mechanical ability, and—last, though not least, in a matter involving such large expenditure—the ready, almost lavish way in which the required money has been found by those of our agricultural engineers who have devoted their time to the development of this branch of farm mechanism. Patent after patent has been taken out, improvement after improvement has been made in the workshop, which experience in the field proved to be necessary; and with an amount of business daring and commercial skill which makes the later stages of the history of steam cultivation—if ever it be written—a marked feature in that of the country generally.

In our last edition we named two of the leading firms who had devoted their energies to this branch of mechanism. Now as then, those firms—the Fowlers and the Howards—stand at the head, although, as we shall see as we proceed, steam cultivation owes not a little to the business energy and the mechanical skill of other makers.

The improvements which have since taken place in steam cultivating machinery have been more those in matters of detail, than in the principle of the systems, as regards the mode of setting down and working it in the field. As then, when we wrote our account for the last edition of this work, so now, when about to add what is necessary to bring it up to date, the systems of working may be reduced to two—first, the 'direct,' and second, the 'roundabout;' each of these may, as they in practice have, modification in details, but the leading principle in each remains the same. The chief features of the leading modifications we shall duly describe in their appropriate place. In the systems employed, the 'traction' or dragging of the cultivating implements over and through the soil is performed by the aid of the steel-wire rope. The introduction of this was in point of fact the 'turning point' in the practice of steam cultivation, for it superseded the heavy and cumbrous chains and ropes of the original systems; the weight of which very soon placed a limit to the working of the machinery economically; while at the same time, with their weight, they had comparatively little strength. But the steel-wire rope, with a lightness which not only made it easy and handy, so to say, to work, had remarkable strength; and the smallness of its diameter rendered it easy to be coiled up on drums or windlasses of comparatively small size, and to be passed round pulleys and anchors with the maximum of ease. Its lightness and strength combined, gave it then such a peculiar adaptability to be worked under almost any circumstances likely to turn up in practice, that it enabled the machinery to be worked at an unusual speed. But the light steel-wire rope was not to be without a rival when used to communicate the power of the engine to the windlasses, which in turn yield the power acting directly. Fisken's system—introduced many years ago, and long left to struggle against many difficulties which threatened wholly to ruin its prospects of future usefulness—has, within the last few years, been again brought forward to the front, and under such auspices as seem likely to prove effectual in securing it a good as well as a permanent place amongst the systems of steam cultivating mechanism. This system we shall also in its proper place describe. Having thus in a general preface pointed out the present position of steam cultivation, we shall now proceed to describe the different systems. This must of necessity be done by us in very brief fashion, inasmuch as neither the space at our command nor the scope of the work admits of that full and detailed illustration and description which come within the range of other works of a more special character as regards the minutiæ of general agriculture. Although the 'Grazier' would not be 'complete' without notices of farm mechanism, still but few graziers will be found to possess or require such large tracts of arable land as would necessitate the purchase and the employment of large and complete sets of steam tackle. Still the intelligent grazier should and doubtless desires to be *au courant* with all the improvements of the times, and hence we deem it essential for this, if for no other reason, to place before our readers a brief *résumé* of the most important of these. To notice all would involve the necessity of devoting an extent of space very far beyond what our work can give. It is necessary to name this to save ourselves from the charge of being in appearance partial to certain forms of apparatus, or invidious in the choice of those we describe. This is not so. We would willingly give space to all, but as they are so numerous we are compelled to make a choice; but that is done apart from all considerations save those connected with the scope of our work and the space which it admits of.

We begin with the systems and mechanism of the Messrs. Fowler, of Leeds, as they represent one—the late John Fowler—who did more than any other, and that is conceded by all, to make steam cultivation a matter of commercial success, and as moreover since his death, the firm—inheriting his spirit—have spared neither time, labour, nor the expenditure of large sums of money to bring the system of steam cultivation to a point as near perfection as it is possible to bring it. The Messrs. Fowler are known for their adoption and advocacy of the 'direct-acting system' of steam cultivation. There are three different

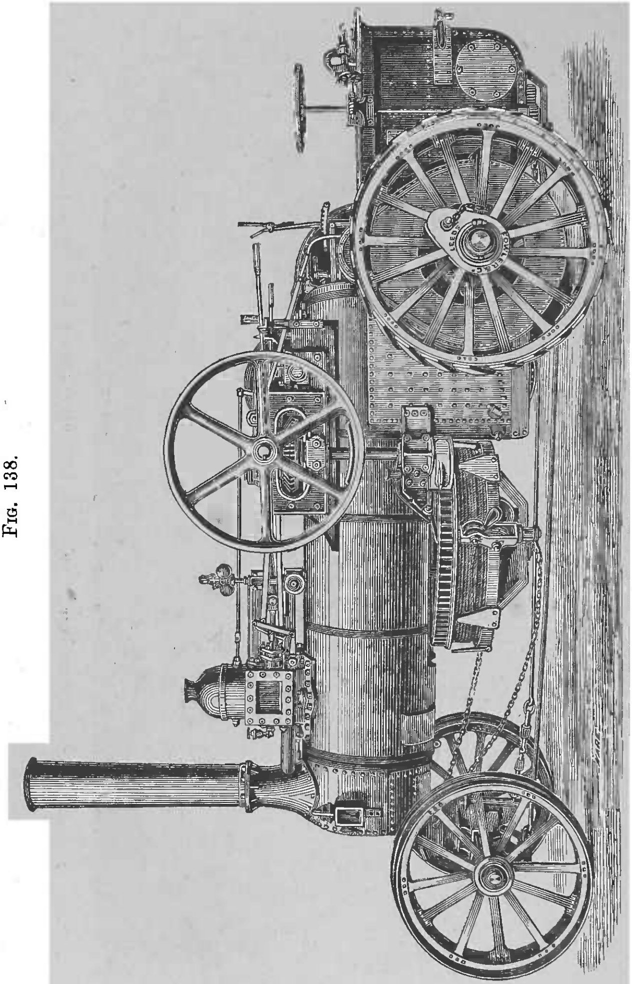
Fig. 137.



FOWLER'S DIRECT-ACTING SYSTEM OF STEAM CULTIVATION WITH TWO STEAM ENGINES.

methods of working recommended by the Messrs. Fowler, each of which is adapted to meet the various circumstances of farms and the pecuniary necessities of farmers. Of these three systems perhaps the most complete, and the readiest and easiest to be set at work, of all the systems—although, as may be supposed, the most expensive—is the one in which two engines are employed, one on each headland, the cultivating implement being dragged to and fro between them; the engine not at work paying out the rope and at the same time working itself forward to be ready to

Fig. 138.



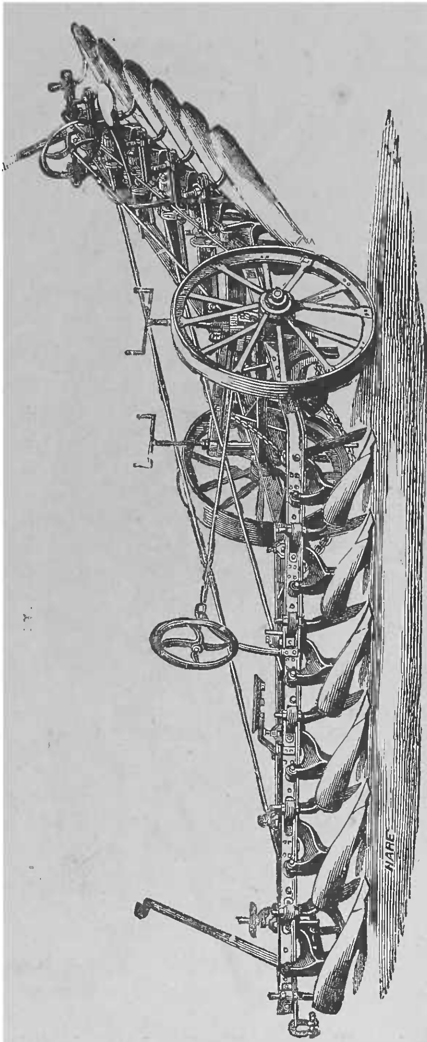
SINGLE CYLINDER STEAM PLOUGHING ENGINE.

assume its position when the next 'bout' or return journey is to be taken. Each engine is provided with a 'winding drum' on an improved principle. The winding drum is provided with a self-coiling gear by which the wire rope is wound and unwound evenly without any 'kinks' being formed.

Fig. 137 illustrates one field arrangement of Mr. Fowler's three systems. Fig. 138, the single cylinder steam ploughing engine adapted to this system.

The plough-frame, as shown in fig. 139, is what is called a balance-frame, one end of which carries six sets of ploughs, the

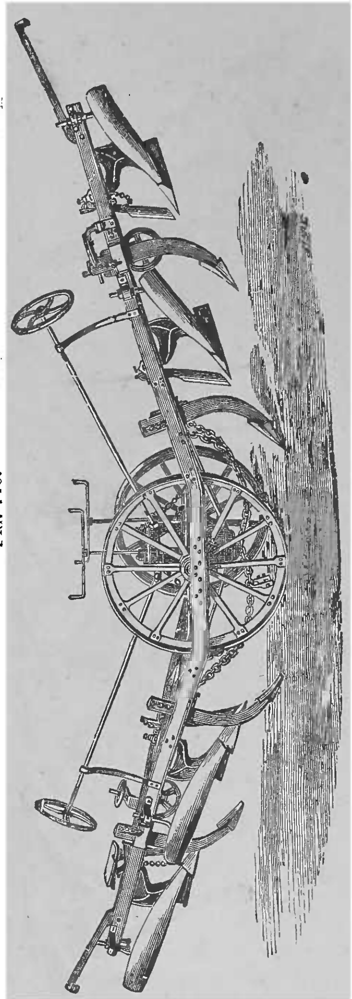
Fig. 139.



FOWLER'S BALANCE PLOUGH FRAME TO TURN SIX FURROWS

other a second set, both sets pointing different ways. When one set has performed its work of ploughing and the plough-frame has reached the end of its bout, it is tilted up, and the set which before was in the air is now brought into contact with the land ready to plough it up; while the set previously at work is lifted up out of contact with the soil. The plough as it passes along is kept in line by a simple steering apparatus; while the 'slack' of the rope is taken up in a very simple, ingenious, and effective way. A form

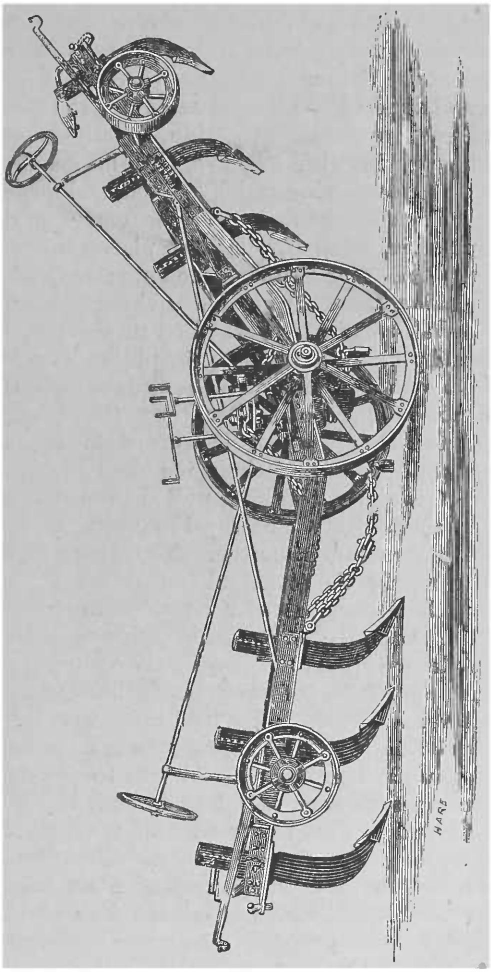
Fig. 140.



BALANCE SUBSOIL PLOUGH.

of subsoil plough is illustrated in fig. 140; in this, as will be seen, the frame is supplied with subsoil tines which precede the ordinary plough bodies or breasts. These tines stir the subsoil to a great depth but do not bring it to the surface, while the plough bodies turn over the furrows in the regular way. This is worked on the balance principle, the frame not being turned at the headlands, but the balance frame being simply reversed. In the 'Cultivator,' also termed the 'Patent Knifer or Grubber,' as in fig. 141, however, manufactured by the same firm, the implement is arranged

Fig. 141.



PATENT KNIFER OR GRUBBER.

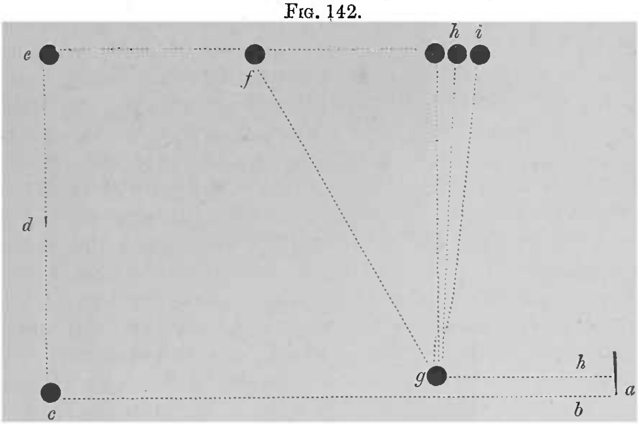
to work on the 'turn about' system, and the method by which it is turned at the headlands without involving the necessity for the man to leave his seat where he sits to guide and work the implement, is as effective as it is ingenious. The framing carrying the tines is made of bar iron, and strongly braced with angle studs; it is carried by three wheels, two behind fixed to the usual form of bent or cranked axle common to both wheels, and by a single wheel in front, which acts as the steering wheel, and which is set in a way thoroughly novel. The axle of this front or steering wheel is placed transversely in a horizontal ring, the ends revolving in bearings at the sides of the ring; the wheel is thus in the centre of the ring within which it revolves. This carrying ring is capable of being moved round from side to side, thus moving at the same time the axle and steering wheel, and placing these at an angle or oblique to the line of framing, so that this can be moved or steered from side to side to any degree or angle required. The carrying ring to have this horizontal movement slides within an external ring which is fixed, and forms part of the framing; and to render the motion of the carrying ring easy by reducing the friction, friction rollers are placed in a space between the two rings to the inner or moveable ring; secured at opposite sides are two chains, these are carried backward and wound round a horizontal barrel, this being worked on its shaft by means of an endless screw and pinion, the shaft of the pinion being vertical and furnished at top with a hand lever wheel, placed within easy reach of the attendant sitting on the seat at the back end of the framing. As this lever wheel is turned in one direction or another, the right or left hand chain is pulled in, and the corresponding side of the moveable ring pulled inward, and the axle of the steering wheel being thus changed in position, the implement is steered in the direction required. The traction or dragging part is thus arranged; the principal feature being the subject of a patent which the Messrs. Fowler consider to be not the least valuable of the long list of patents with which their name is connected. A lever termed technically the 'patent turning lever' lies horizontally on the top of the framing but clear of it by some inches; this lever is forked or has two arms forming a triangle, the open ends or arms of which are to the front and in advance of the framing, and are terminated by hooks to which the dragging and slack wire ropes are secured. The lever is centred on swivels upon a vertical stud secured to the framing at a point considerably behind the position of the steering wheel. The turning lever is extended some distance behind the vertical stud, and a chain is secured to its extremities, which is carried backward and passed over the periphery of a grooved quadrant; this quadrant being fixed in the centre of the bent or cranked axle, carrying the two hind wheels of the implement. The effect of this arrangement is as follows: supposing the wide or extended front ends of the turning lever to be moved round, the short end of the lever behind the vertical stud on which it swivels will obviously turn or move in an opposite direction, pulling the chain with it; acting on and turning round the quadrant on the cranked axle, turning this round, and raising or depressing the wheels, and by consequence raising or depressing the frame and lowering the tines nearer to, or raising them farther from the ground. Stops on the quadrant prevent the axle from being carried or turned round beyond a certain point. The working of the implement thus arranged is as follows. Let us suppose that it has reached the end of one of its bouts, and that it is about to be turned round so as to work the next bout in the opposite direction ; the engine on the opposite headland is set to work, and pulls in what was the 'slack rope' in the bout just completed ; this acts on the one arm of the turning lever, which turns in its centre on the vertical stud, moves the short end of the lever, the chain attached to it, and the quadrants on the cranked axle of the hand, and depressing these, the frame and its tines are lifted up ; the attendant by a lever operates a catch which locks the framing and keeps it in the position which it has now assumed. The drag on the rope still continuing, the implement by it is pulled right round, what was before the dragging being now changed into the 'slack rope.' When the turn is completed, and the head of the implement is in the direction for the next bout, the attendant by the lever releases the catch, unlocks the framing, and this dropping down, the tines will once more take hold of the soil, and the implement moves forward on its journey.

We cannot dismiss our notice of the steam cultivating mechanism of Messrs. Fowler, without directing special attention to the apparatus introduced by them to carry out the work of reclamation of waste lands, adopted on a large scale by his Grace the Duke of Sutherland. In connection with this great, and we may say truly national work, the Messrs. Fowler have introduced a plough invented and made by them, adapted for marsh, or soft and uneven land, and which is encumbered with huge stones or boulders which require to be removed. The implement which is named the 'Marsh Land or Sutherland Plough,' has a rectangular frame, carried upon and by four broad peripheried wheels or rather drums of comparatively small diameter, and which run on the unploughed land, and two large-diametered wheels of the ordinary kind running in the furrow, these being near the centre of the implement. The four drums or fore and hind wheels are long in their periphery, so as to give a large bearing surface on the soft, yielding and uneven land, and to render its motion as steady and uniform as possible. Still further to steady the motion, the axles of these drums carry small rollers, which run on the top of the ploughed land, at a level with or a little below that of the unploughed land. The axles are connected with steering rings constructed and operated upon the same principle as that we have just described in connection with the turning cultivator of the same makers. In the centre of the axle a sharp-edged cutting disc is fixed which cuts into the soil and acts in measure as a coulter. The plough body is fixed on the centre of the framing thus provided with two drums, rollers and cutting disc at each end; and is formed to meet the peculiar condition of soil and the circumstances in which it is to work. The sole or sock of the plough is triangular in form, or rather pointed at both ends; it is like two triangles joined at the base, cast upon and springing from the sock or share of the wings or mould-boards of the plough which turn over the slice: this peculiarly formed plough is suspended as it were from the upper part of the framing, in such a way that, operated upon by appropriate gearing, it can be reversed at the headlands, thus avoiding the necessity to turn the whole implement at these points. The ends of the framing are provided with transverse or cross shafts, which carry two long levers, terminated at their outer and extreme ends by anchor-shaped flukes or single claws; these bending or being curved downwards, and pointing inwards towards the centre of the framing. These flukes or claw-carrying levers, have short bars or beams, pointing upwards at an angle from the line of soil, and these carry through appropriate eyes the dragging and slack wire ropes. Suppose the implement thus constructed is moving in one direction, say from left to right, the fluked or clawed lever is let down, so as to lie near the surface of the soil; to the right-hand lever is attached the dragging rope (the slack rope being attached to the other or left-hand lever), the traction is thus taken from a very low point of the implement, and so acts directly upon the plough body or rather nearly in the line of its sole or sock. The front cutting disc cuts into the soil, and if it comes in contact with any large stone it rides and slips over it, thus lifting the sole or sock of the plough; and as this is dragged forward, the claw of the second lever catches the under side of the stone, 'prises' it out of the soil, and throws it aside. The front disc cutting the soil—under ordinary circumstances when no stones are in its path—as a coulter does, delivers the slice to the plough, and it is turned over by the breasts or mould-boards, when the second disc and rollers press down the slice and consolidate it, with a pressure of nearly a ton. The slack or trailing rope attached to the second or back-clawed lever, is passed over the several joints provided to the triangular lever or beam previously described, thus keeping the slack well off the ground, and delivering it freely to the 'porters.' On the implement arriving at the end of the 'bout' the plough body is reversed, thus throwing the breasts or mould-boards to the opposite side; the engine at the opposite headland is set to work, and the slack becomes now the dragging rope, and what was before the dragging is now the slack rope; and the implement proceeds on its next bout, throwing over the furrow slices in the same direction as the previous one, like a one-way plough—the angle lever or beam of the clawed lever being thrown or put up, so as to keep the slack of the rope off the ground.

We now come to describe very briefly the arrangement of steam ploughing, originally introduced by Mr. Smith, of Woolston—who has done so much to make steam cultivation an accomplished fact, but the very general introduction of which is owing chiefly to the exertions of the Messrs. Howard, of Bedford. This system we have designated as the 'indirect traction,' but it is generally known as the 'roundabout' system. In this the engine and windlass are stationed as at *a*, fig. 142.

The rope *b* is led off from the engine, passed round the pulley *c*, attached to the grubbing or cultivating frame or plough *d*, round the pulley *e*, along to the pulley *f*, down to the pulley *g*,

FIG. 142.



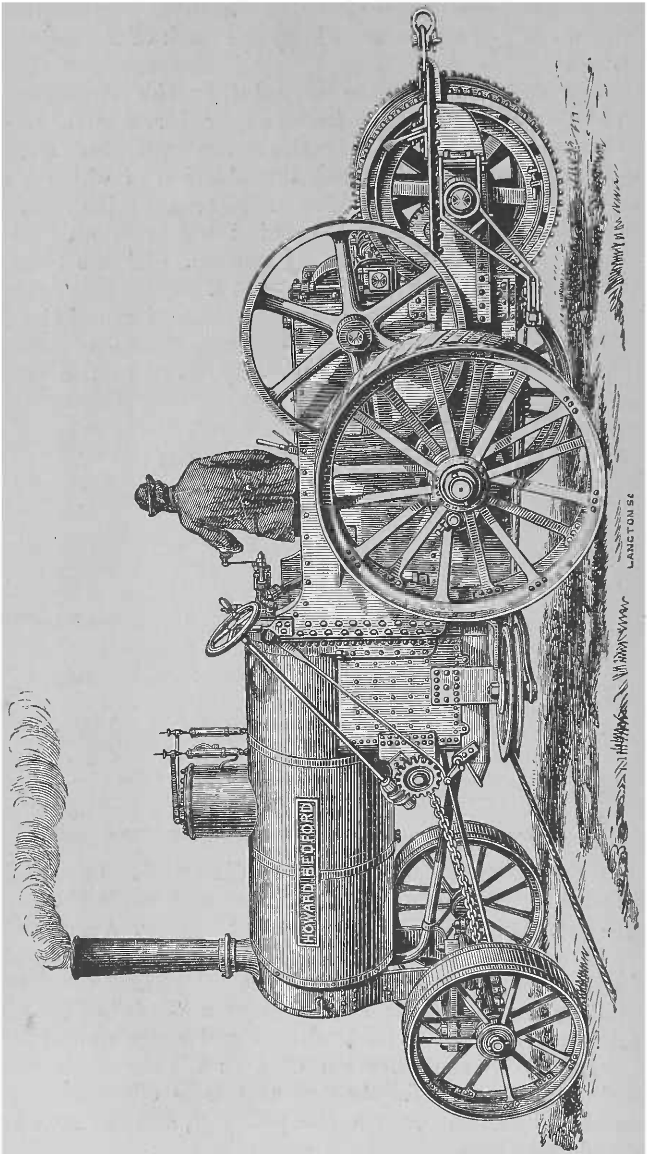
INDIRECT TRACTION SYSTEM OF STEAM CULTIVATION.

and from thence taken up by the windlass at *h*. One pulley is therefore taking up one wire rope at one end, while the other is letting it out. The two fixed pulleys are at *f* and *g*. A series of holes are dug between the pulleys *e* and *f* and *c* and *g*. The distance between these pulleys is equal to the breadth of land taken up and cultivated by the plough *d*; so that when a 'bout' of the plough on one journey is finished, the anchors *c* and *e* are moved forward to the next hole in the direction of *e f*; till the whole space is ploughed between *e* and *f*. As soon as this is effected the pulley *f* is moved and placed opposite the pulley *g*, and the next half of the field ploughed up.

The Messrs. Howard have introduced a form of Portable Steam Engine, to which they have given the name of 'The Farmer's

Friend,' as, by a very ingenious combination of arrangements, it can be made serviceable in a number of ways: as a traction

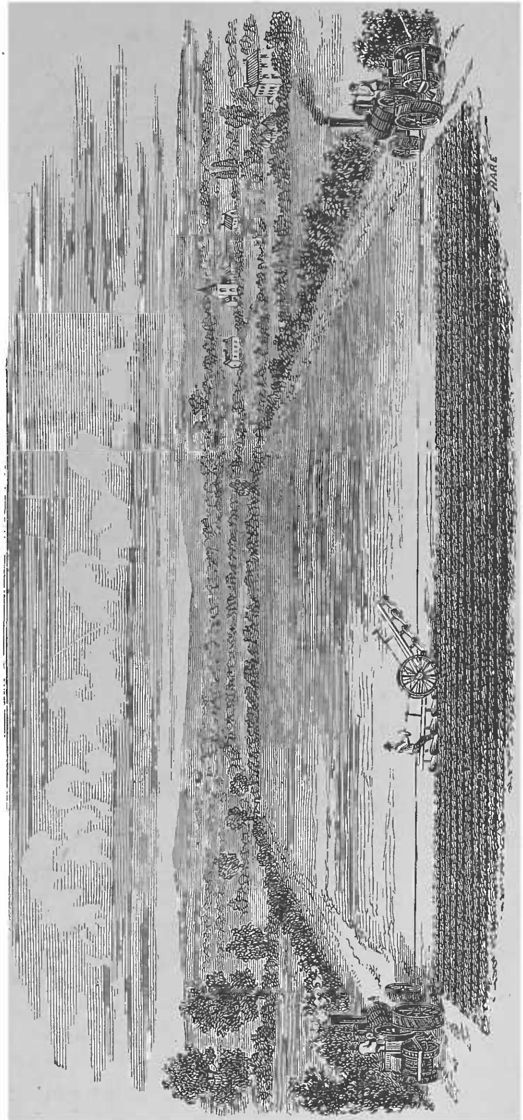
Fig. 143.



HOWARD'S PORTABLE STEAM-ENGINE—'THE FARMER'S FRIEND.'

engine or a self-propelling engine; a steam cultivating engine; and, by taking away the windlass used for this, it may be employed at the homestead for thrashing grain, or for working various machines. (See fig. 143.) Messrs. Howard also work the

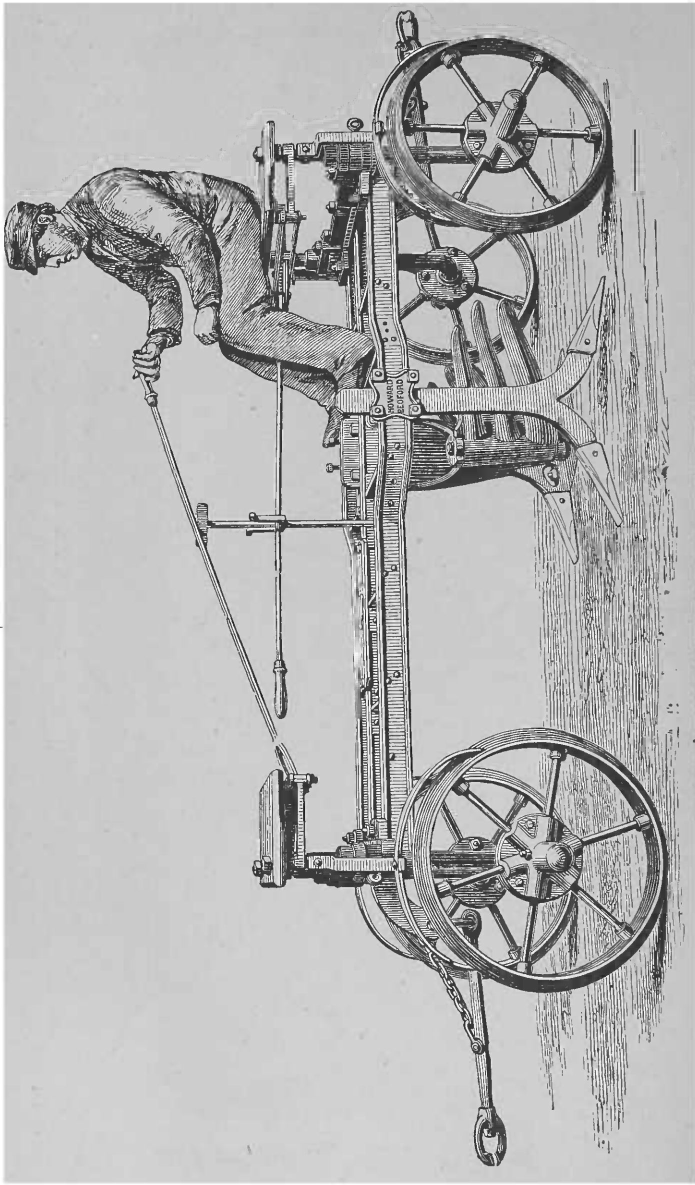
FIG. 144.



HOWARD'S DOUBLE-ENGINE SYSTEM OF STEAM CULTIVATION.

'direct' or double-engine system, illustrated in fig. 144, and as an implement remarkably efficient for ridging up land for wniter, they have brought out a 'combined steam-ridger and subsoiler, illustrated in fig. 145. This is fitted with a 'one way' ridging

Fig. 145.

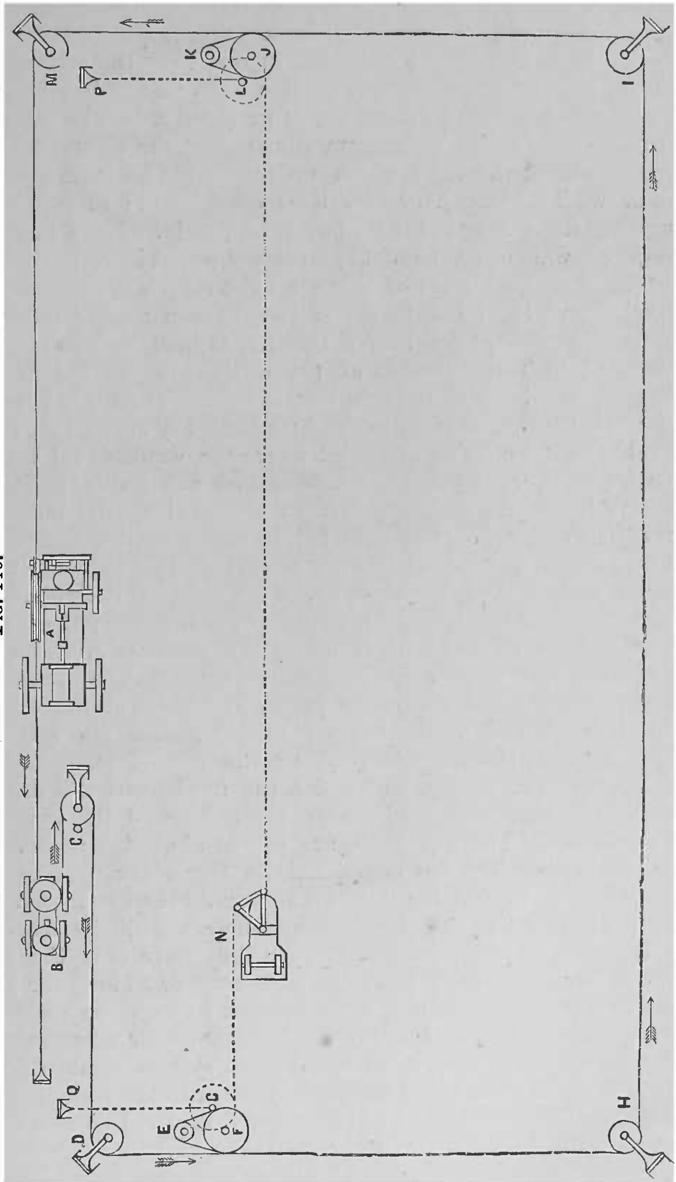


HOWARD'S COMBINED STEAM-RIDGER AND SUBSOILER.

body, and subsoil tine which works between each ridge as it is formed.

In the systems of steam cultivation of the Messrs. Fowler or of the Messrs. Howard, the wire rope which is attached to the

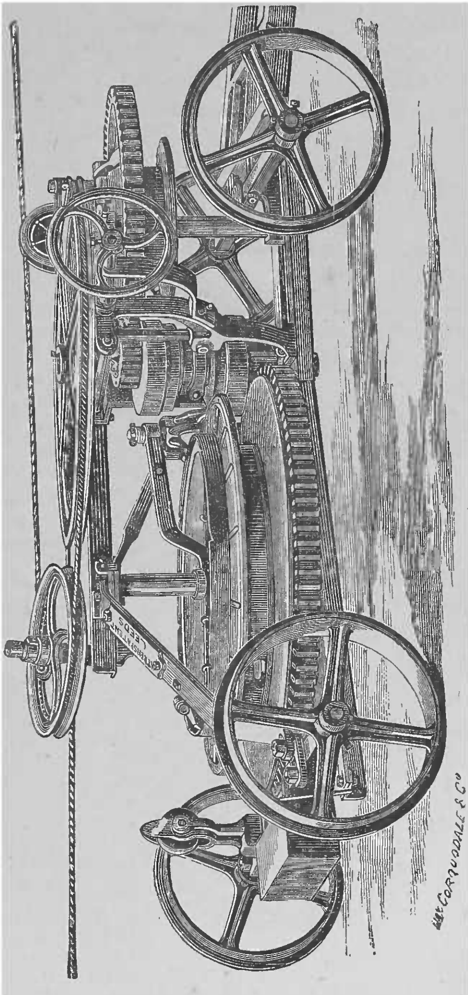
FIG. 146.



GROUND PLAN OF FISKEN'S SYSTEM OF STEAM CULTIVATION.

plough or cultivator is worked at a very slow speed, corresponding to that of the implement, which travels at the rate of two to two and a half miles per hour, or in some cases over the latter speed. In 'Fisken's system,' now to be briefly described, the arrangement and mode of working the implement dragging-rope is quite distinct from either of those two plans; although in one sense the arrangement is on the roundabout plan, still it is on the 'direct' system also, but with a very marked difference, as we shall presently see. The preceding, fig. 146, is a diagram illustrating the arrangement of the apparatus in the field, which we suppose to be rectangular in plan, or with its length greater than its breadth; the ploughing being thus done longitudinally not transversely. Let A represent the engine, which may be of the ordinary portable or farm kind: round the fly-wheel drum of this the light rope takes half a turn, and is led out in the direction of the 'tension anchor pulley' B, round which it also takes half a turn; it is then brought back or 'returned' in the direction of the engine to the far 'anchor pulley' C, round which it takes half a turn. From C it is passed to the first 'corner anchor pulley' D; then led along the end of the field till it comes to the point where the windlass (F) happens to be working, round the double-grooved and guide pulleys of which it takes on; the rope is then passed along the remaining part of the end D H of the field till it comes to the corner H, at which is placed the second 'corner anchor pulley' H, round which it passes, thence along the side, H I, of the field till it comes to the third 'corner anchor pulley' I, round which it passes; then along the end, I M, of the field till it meets the windlass J, which is a little in the rear of the corresponding windlass F. The rope is then passed round the double-grooved pulley and guide of the windlass J, then on to the fourth 'corner anchor pulley' M, and from thence to the steam-engine, where the circuit is completed. Between the two windlasses F and J, the implement N is dragged to and fro by means of a wire rope passing round the pulleys of the windlasses. The windlasses are moved along the 'headlands' when the implement has completed its 'bout' or 'journey,' by ropes attached to two small 'claw anchors,' P and Q in fig. 146, placed in advance of the windlasses. These are all the 'anchors' required, and in their simplicity—for they have only the small strain of the rope which pulls the windlass F or J along the headland to resist—they contrast most favourably with the anchors of other systems. The anchor proper, or that which represents the anchor in other systems, is in the Fisken system combined with the windlass, and the heavy windlass of the ordinary system is thus avoided, and which requires to be anchored itself. In the arrangement here illustrated it will be noticed that while it is a combination of the 'roundabout system' and the 'direct action' system already described, there are points of considerable difference between them. Thus the heavy windlass and the double snatch-block of the roundabout system are avoided, while the long wire rope going round the field is replaced by a light, quick-travelling Manilla rope; and in comparing the Fisken system with the direct

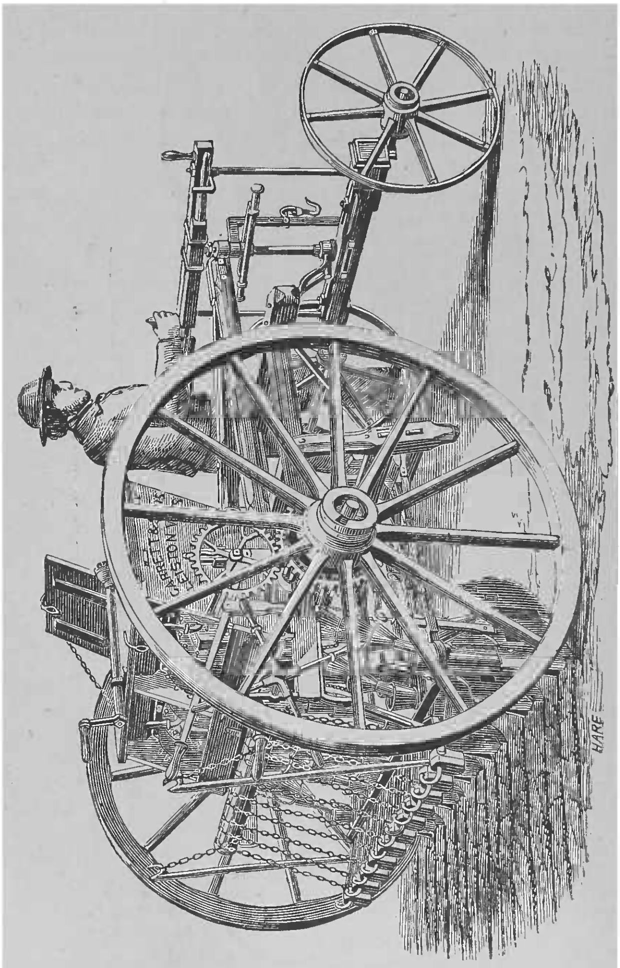
Fig. 147.



FISKEN'S COMBINED WINDLASS AND ANCHOR.

traction, it will be observed that there is only one steam-engine required, and that compared with the roundabout described in last paragraph, the only length of wire rope is that between the two windlasses F and J. So that, as far as mere arrangement is concerned, the Fisken system has apparent advantages over both the other systems in the saving of some parts of mechanism—we say apparent, for of course much, if not all, depends upon the way in which the quick-running rope is found to compete in efficiency and economy with the slow-running wire rope of the other systems,

Fig. 148.



GARRETT'S CORN AND SEED DRILL.

and also upon the efficiency of the general mechanical arrangements. The light-running rope which goes round the field, and conveys the power of the engine to the windlasses to work the plough, is made of the best Manilla, and is found, if fair care be taken of it, to wear out two or three wire ropes used in the roundabout system. The length of the light rope and that of the wire rope used to pull the implement combined, is found to be not greater than that required for the roundabout system. It ought here to be pointed out, that when any one windlass, as that marked J, is pulling the implement along, which it does by one rope only, the strain necessary to work the implement is taken up only by the one corner anchor M, and that portion only of the light rope between the engine A and the windlass J is under the full strain; all the rest of the rope being kept tight enough only to keep it clear of the ground, or rather to run smoothly on the 'porters,' hereafter to be described. When the opposite windlass, as F, is at work, the strain of the light rope is then thrown upon or taken up by the three anchors H, I and M, and the rope tight only between the engine A and the windlass J. The mechanical arrangements of the combined windlass and anchor are exceedingly ingenious, and the whole is very compactly arranged so as to take up little space, as may be seen in a general way in the illustration in fig. 147.

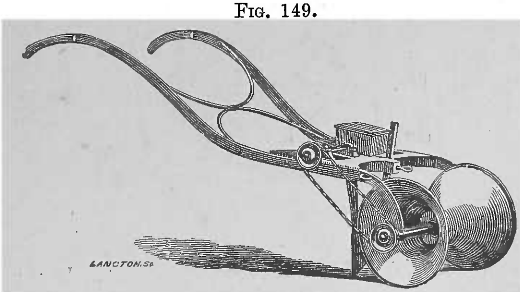
CHAPTER VI.

SOWING MACHINES AND MANURE DISTRIBUTORS.

IN fig. 148 is illustrated the corn drill of Messrs. Garrett and Son, of Saxmundham, Suffolk.

The merits and form of this drill are now from long and constant use so familiar to agriculturists generally, that it is quite

FIG. 149.



TURNIP SOWING MACHINE OR HAND DRILL.

unnecessary here to describe it in detail, or the advantages arising from its employment.

Fig. 149 illustrates a turnip barrow or hand drill to sow one row, and fig. 150 a turnip drill for two rows for horse-power.

Chambers' Broadcast Manure Distributor.—This machine, fig. 151, which is manufactured by Garrett, is for the purpose of

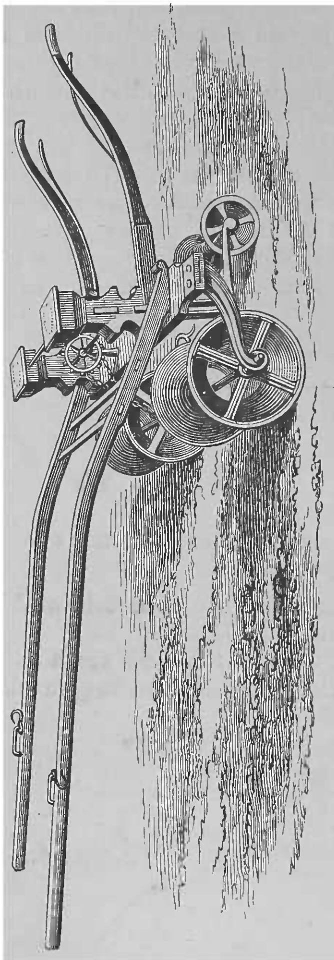
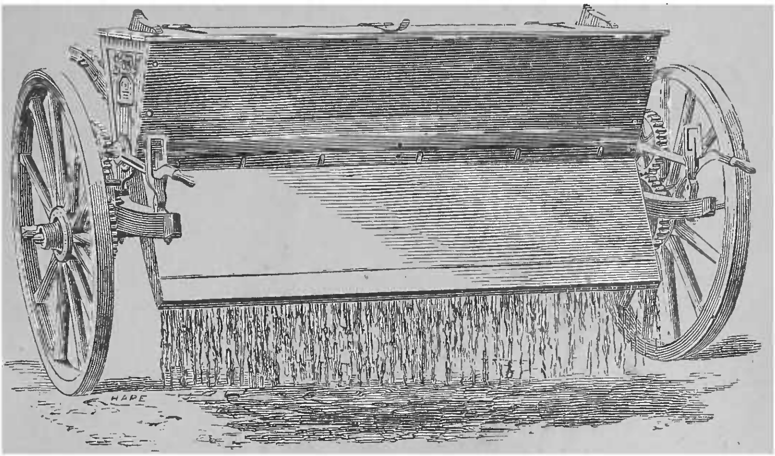


Fig. 150.

HORSE POWER TURNIP SOWING MACHINE.

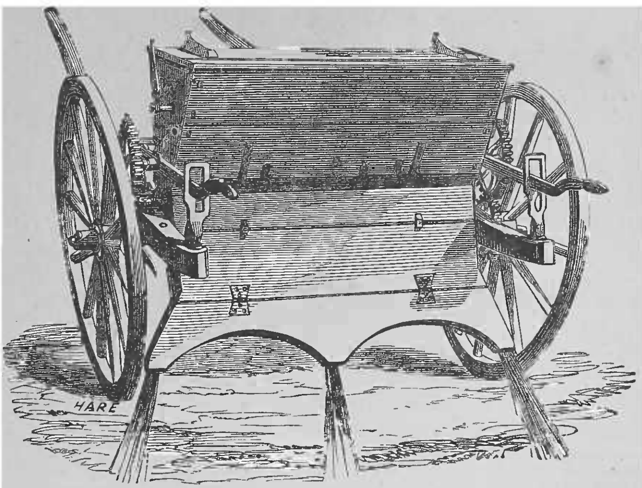
delivering compost and other manures broadcast. It may be regulated so as to deposit any quantity per acre, from two bushels upwards, according to the requirements of the land over which it travels. It acts by means of two slides placed one above the other in the distributing barrel, which are worked at the same time by a crank handle. Conductors may be fixed to this machine, which enable it to sow or manure three ridges at one time.

FIG. 151.



CHAMBERS' BROADCAST MANURE DISTRIBUTOR.

FIG. 152.



LIQUID MANURE DISTRIBUTOR.

In fig. 151 we illustrate this Broadcast Manure Distributor, and in fig. 152 the Liquid Manure Distributor of Messrs. Reeves Bratton, Westbury, Wilts.

CHAPTER VII.

REAPING AND MOWING MACHINES—HAY-MAKING MACHINES—CARTS AND WAGGONS.

REAPING *Machines.*—About the beginning of the present century the first attempt was made to employ machinery for

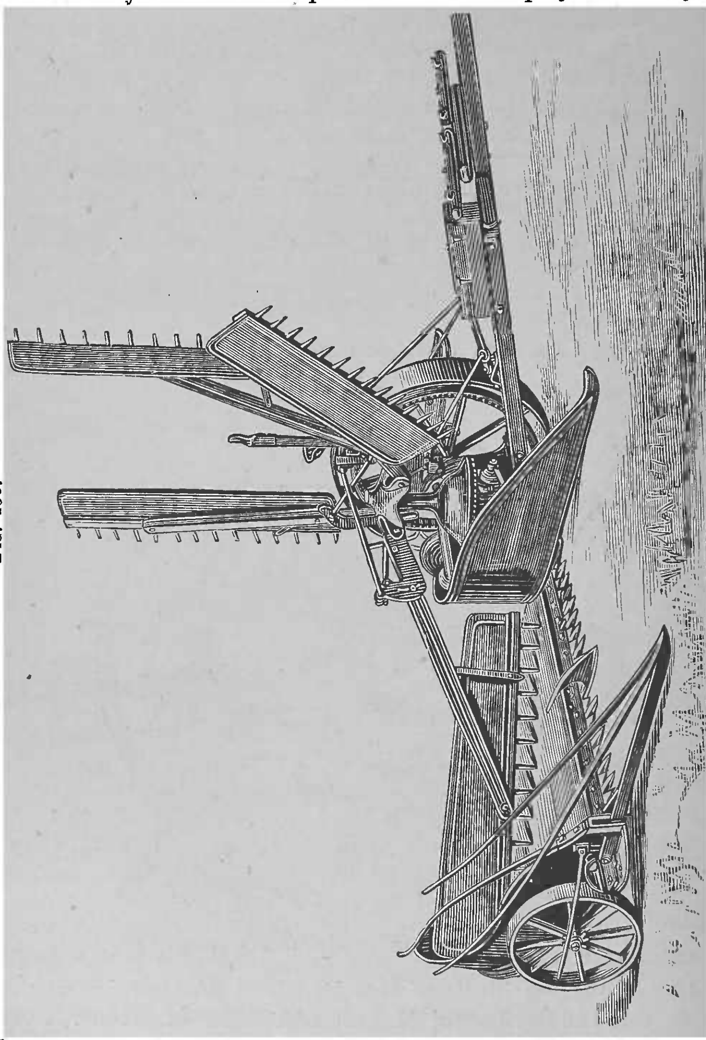
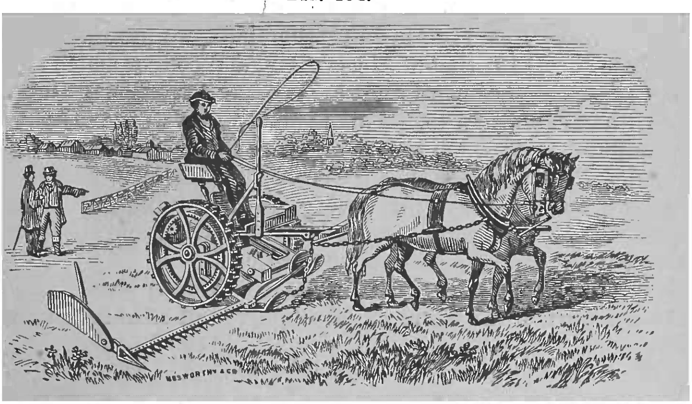


FIG. 153.

WALTER A. WOOD'S REAPING MACHINE.

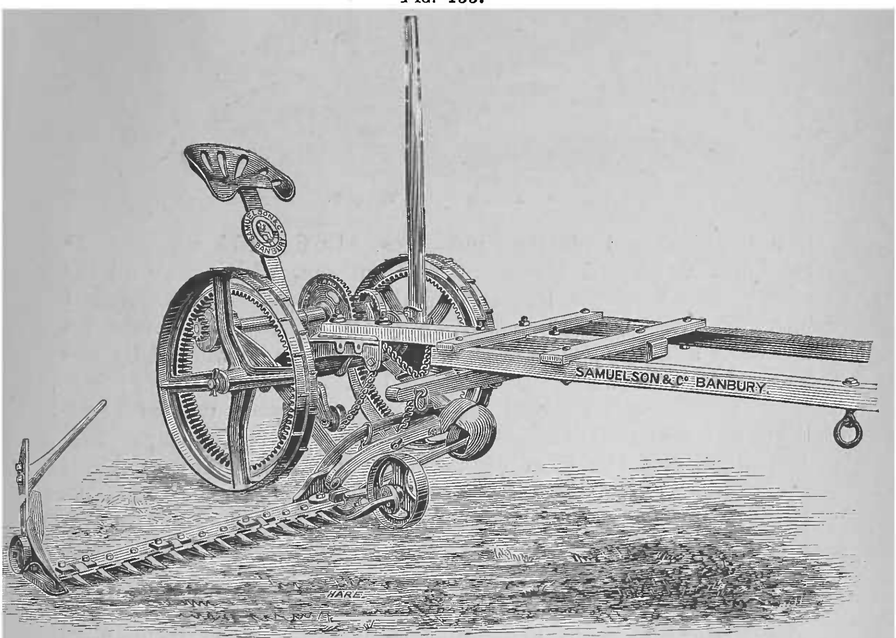
the purpose of reaping corn; but it was not till 1851, the year of the first 'Great Exhibition,' at which a machine, the design and make of McCormick, of America, was exhibited, that a real practical interest was taken in this department of agricultural machinery.

FIG. 154.



HORNSBY'S MOWING MACHINE.

FIG. 155.

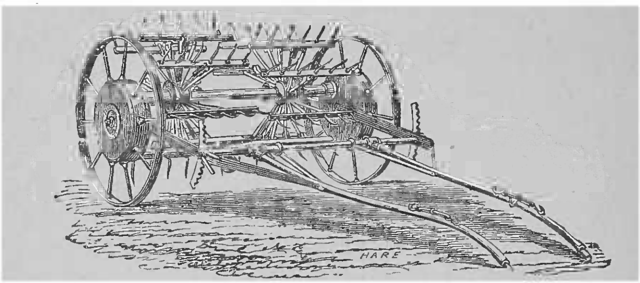


SAMUELSON'S GRASS MOWER.

Since then there has been an uninterrupted flow, so to say, of new inventions and improvements; till now one would be inclined to say that the point of perfection has at last been reached. But still the 'new' machines continue to come out. It will be obvious therefore that where so many compete for public favour, we cannot notice more than one or two which must be taken as representative machines. Of Reaping Machines therefore, we have space only to illustrate (fig. 153) that of Mr. Walter A. Wood, of which the number sold has been so great that it makes one pause and think as to where they can all go to. This at all events is fair evidence as to the estimation in which the machine is held by the farming public. To this machine Mr. Wood has, we believe, succeeded in applying an apparatus for taking up and tying or binding the sheaves, thus effecting what has long been tried and alone wanting to make the reaping machine automatic.

Mowing machines for cutting grass now form part of the regular machinery of the farm, so thoroughly well established are they

Fig. 156.

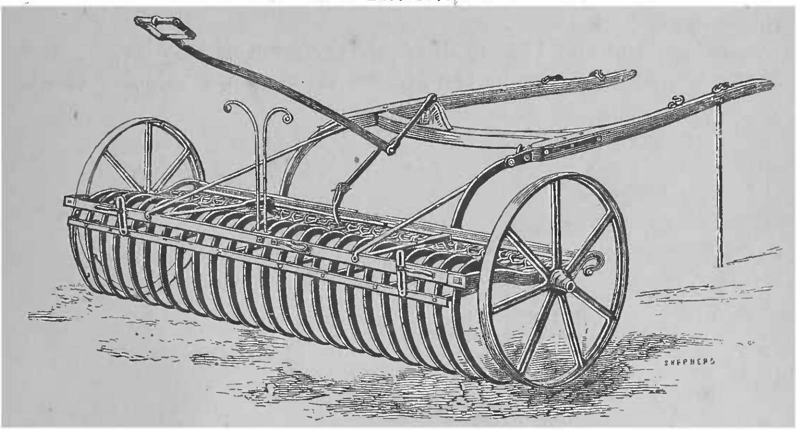


NICHOLSON'S HAY TEDDER.

as economical and efficient machines. In fig. 154 we illustrate that of the Messrs. Hornsby, of Grantham, which took all the prizes offered by the Royal Agricultural Society of England, at Taunton. The Messrs. Samuelson & Co., of Banbury, have introduced a form of Grass Mower, adapted to be worked by one horse only—this we illustrate in fig. 155.

Haymaking or tedding machines are now much used and facilitate to a remarkable extent the operations of haymaking. Fig. 156 illustrates the form of hay-tedding machine invented and manufactured by Mr. W. N. Nicholson, of Newark-upon-Trent. In this machine the 'tines' can have two movements given to them—one the 'forward,' the other the 'backward' revolution. Messrs. Ashby, Jeffery and Luke, of Stamford, have introduced a very clever yet simple improvement in Hay-making Machines or Tedders. This is the addition of a hood made of light wood framing covered with canvas; it covers about one fourth of the revolution of the tine forks, the motion of which, creating a draught or current in the hood, tends to keep the hay from being blown over the shaft and gearing and the horse's head, in the event of the wind blowing in the same direction as the machine is

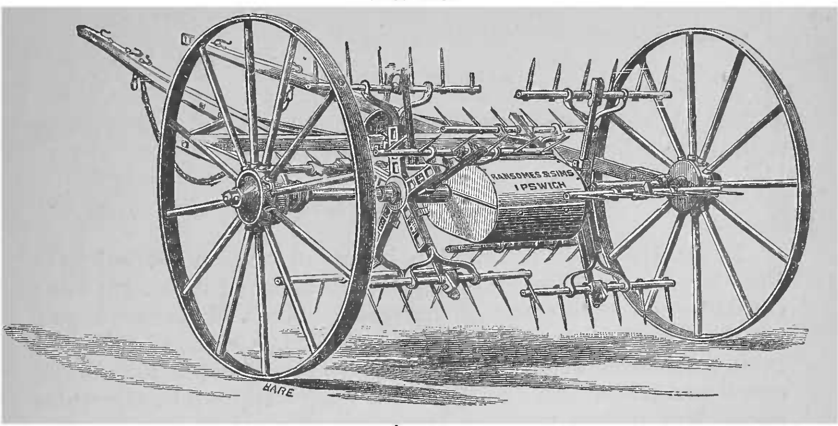
FIG. 157.



HOWARD'S HORSE RAKE.

working; a very troublesome result in the field. By the addition of the hood the hay is thrown out in a stream at the back of the machine.

FIG. 158.



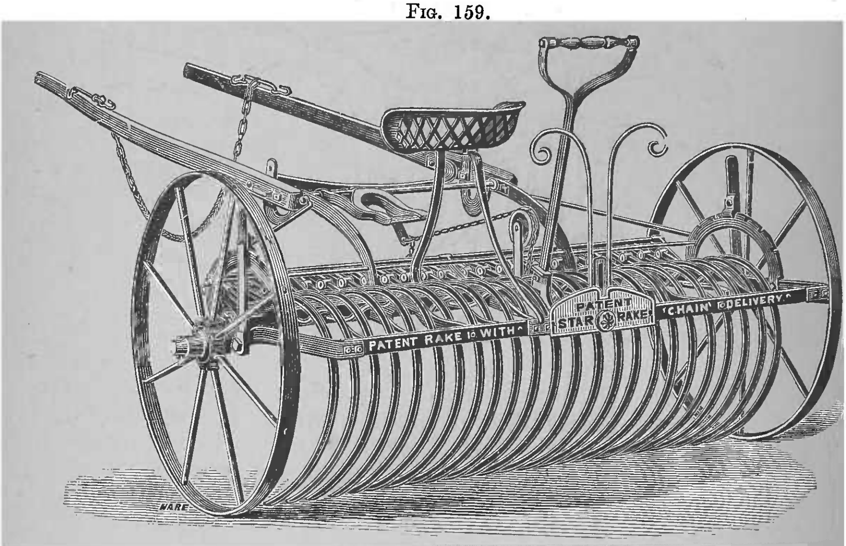
RANSOMES' HAY TEDDER.

In the forward motion the tines revolve so as to throw up the hay and turn it completely over; in the backward movement the action is much less violent, being only designed to move or lift slightly the grass or hay tossed up by the forward motion of the tines. These movements are obtained in the machine under notice by very simple mechanism.

Fig. 157 illustrates the form of *horse-rake* manufactured by the Messrs. Howard, of Bedford. This is an exceedingly useful implement.

In figs. 158 and 159 we illustrate the form of Hay Tedder and Horse Rake introduced by the Messrs. Ransomes, Sims, and Head,

FIG. 159.



RANSOMES' HORSE RAKE.

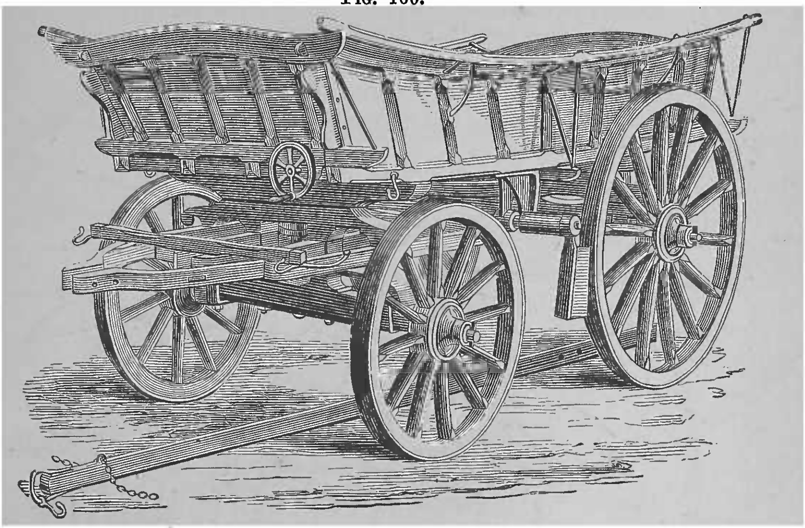
of Ipswich, as the 'star' machines, and which have gained a very high reputation for efficiency.

CARTS AND WAGGONS.

In fig. 160 we illustrate the improved waggon made by the Beverley Iron and Waggon Company, limited, and in fig. 161 their one-horse or Scotch cart with harvest shelvings. It is now almost universally acknowledged that the single-horse cart is by far the most economical mode of conveying farm produce, or for carting out manure, etc. To those anxious to go fully into the whole question of carts *v.* waggons, the article on carriages in 'Morton's Cyclopædia of Agriculture' may be consulted with advantage. The fullest details as to the construction of the Scotch cart will be found in the 'Book of Farm Implements and Machines' already alluded to.

The *Wrought-Iron Rick-Stand* (fig. 162), invented by the late John Springall, and for which he obtained a prize in 1844, is a

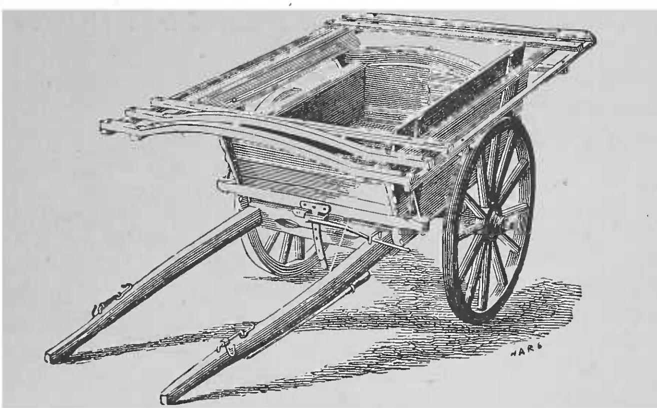
FIG. 160.



ENGLISH WAGGON.

useful article in the stack-yard, being a protection against vermin, as it is impossible for rats or mice to reach the stacks when thus elevated, unless something has been left leaning against them by

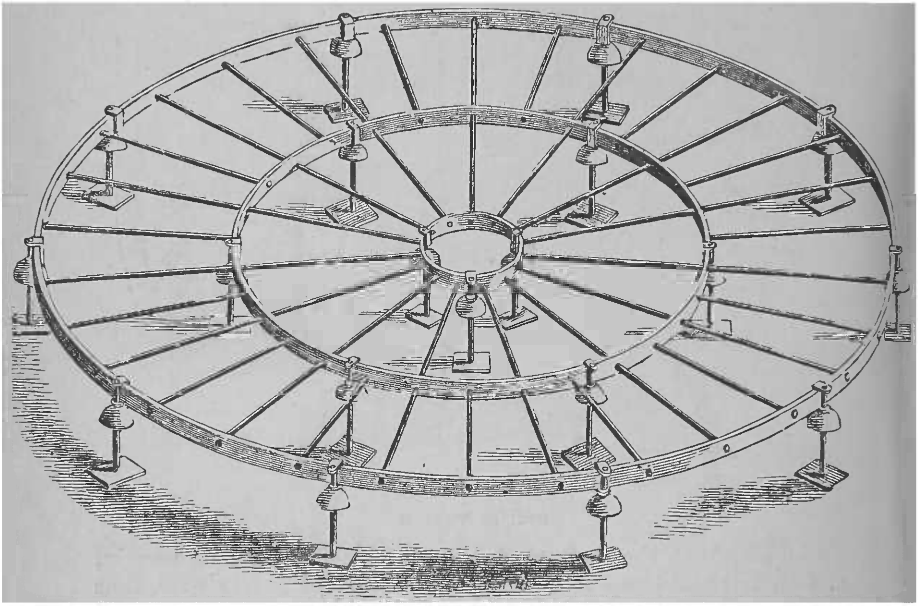
FIG. 161.



SCOTCH CART.

means of which the creatures can ascend. A still further advantage to be derived from the use of these stands is the facility they afford for securing crops in wet seasons, as the free current of air which is admitted under and through the stack soon hardens

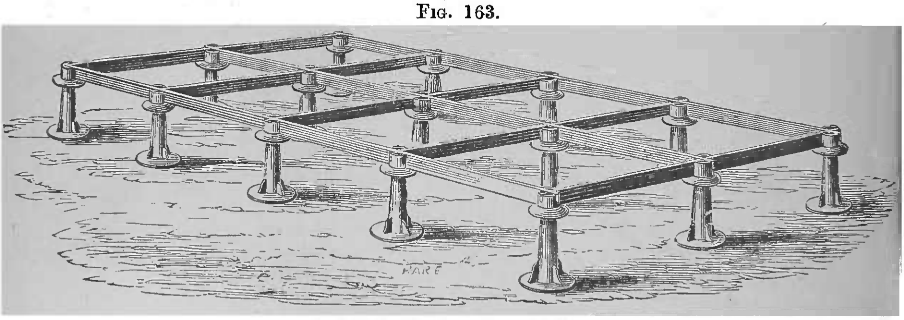
Fig. 162.



CIRCULAR CORN RICK-STAND.

the crop when the rick is on the stand. They can be taken to pieces, in order to be put away or removed from place to place,

Fig. 163.



RECTANGULAR CORN RICK-STAND.

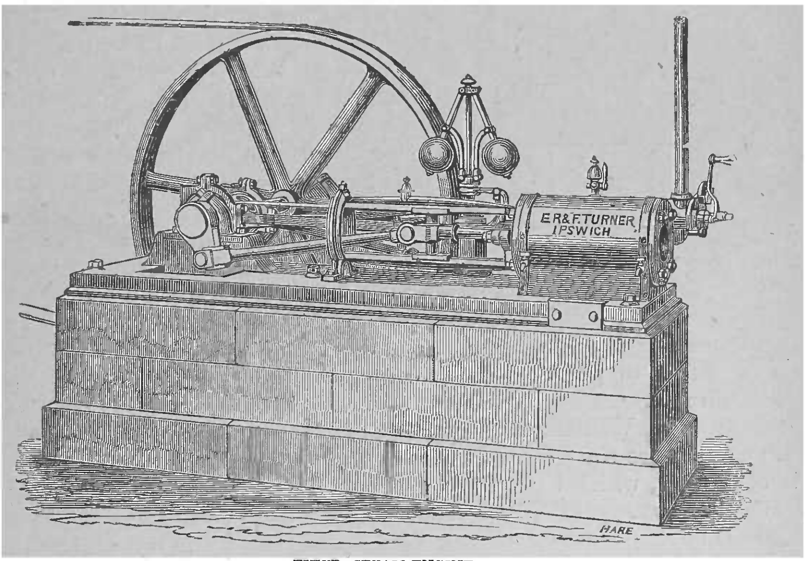
which is a great convenience. Fig. 163 illustrates a rectangular form of stand, made by Mr. Bentall, of Weybridge.

CHAPTER VIII.

STEAM-ENGINES—THRASHING MACHINES—CORN-DRESSING MACHINES—MILLS—BRUISING MACHINES.

STEAM-ENGINES.—There are few operations on a farm that will better repay the outlay on steam power than thrashing, the exertion of driving thrashing mills being very severe for and injurious to horses; and yet it is only on the largest farms, or

FIG. 164.

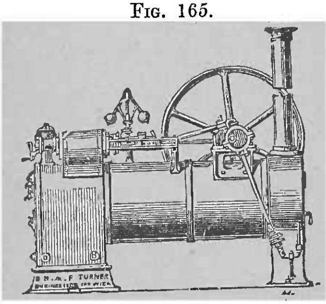


FIXED STEAM-ENGINE.

those held under a long lease or 'tenant right,' that it can be beneficially employed for this purpose alone, and in the now somewhat obsolete form of the fixed or stationary steam-engine. But there are now so many operations required to be performed on a farm, such as cutting roots, grinding grain, crushing oats, beans, &c., &c., and there are so many forms of portable and semi-portable steam-engines, costing comparatively little, and easily applied to the work they have to do, that farmers, even of rather small means, will find it to their advantage to employ a steam-engine, even if of but very limited power. Where these favourable circumstances exist a steam-engine will be a valuable and economical acquisition, as it will thrash and winnow, work the crushing and grinding mills, and the choppers or cutters of fodder, and still have surplus steam, which may be employed for heating or drying purposes, or conveyed to the cooking house, and there employed in the preparation of food for cattle.

Steam-engines, as used for agricultural purposes, may be either portable or fixed. In fig. 166 we illustrate a form of portable engine, and in figs. 164 and 165 two forms of fixed engines, by Messrs. Turner, of Ipswich. The latter may be set down at once, requiring no permanent base, as that in fig. 164.

FIG. 165.



SEMI-PORTABLE ENGINE.

The same remark applies to the vertical portable engine, manufactured by Shanks & Son, of Arbroath, and illustrated in fig. 166.

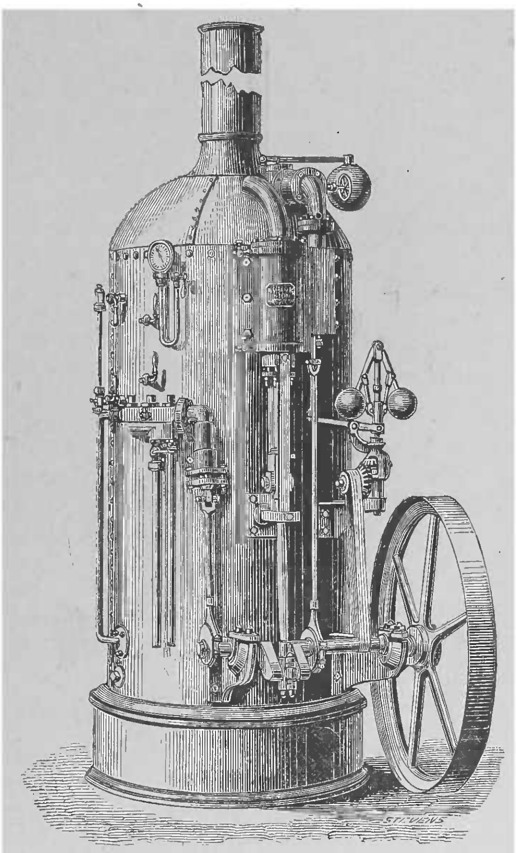
There are many districts where water power is to be had in abundance, and where it could be used with great economy as a motive agent by means of turbines. Turbines are not only suitable for situations where ordinary water-wheels cannot be used, but possess, besides, many very important advantages over them, among which may be enumerated their cheapness in first cost, and their having fewer parts liable to get out of order; they may be applied to all heights of falls, and are more economical in repairs; they occupy very small space, and require no expensive foundations or gearing to get up the speed necessary for the driving of the machinery.

Messrs. Williamson, engineers, of Kendal (Canal Iron Works), manufacture the forms of turbines invented by Professor Thomson, of Belfast, which have gained, under the name of the 'Vortex,' the highest reputation for efficiency.

The construction of the Vortex and the mode in which the water is applied in it, will be readily understood by reference to the succeeding sketch. It consists of a moveable wheel with radiating vanes, which revolves upon a pivot, and is surrounded by an annular case, closed externally, but having towards its internal circumference four curved guide passages. The water is admitted by one or more pipes to this case, and, issuing through the guide passages, acts against the vanes of the wheel, which is thus driven round at a velocity depending on the height of the fall. The water having expended its force passes out at the centre.

The Vortex represented in fig. 167 is shown with a portion of the cover broken away, in order that the internal arrangement may be seen. A is the supply pipe, by which the water enters the exterior case or supply chamber; B, one of the guide blades, of which there are four, for directing the water into the revolving wheel C; these guide blades are made to prone upon gudgeons near their points, so that the size of the orifices can be varied, motion being given to them from the hand-wheel F through the cranks and spindles shown. The revolving wheel is keyed upon the upright shaft D, at the lower end of which is the pivot. This

FIG. 166.

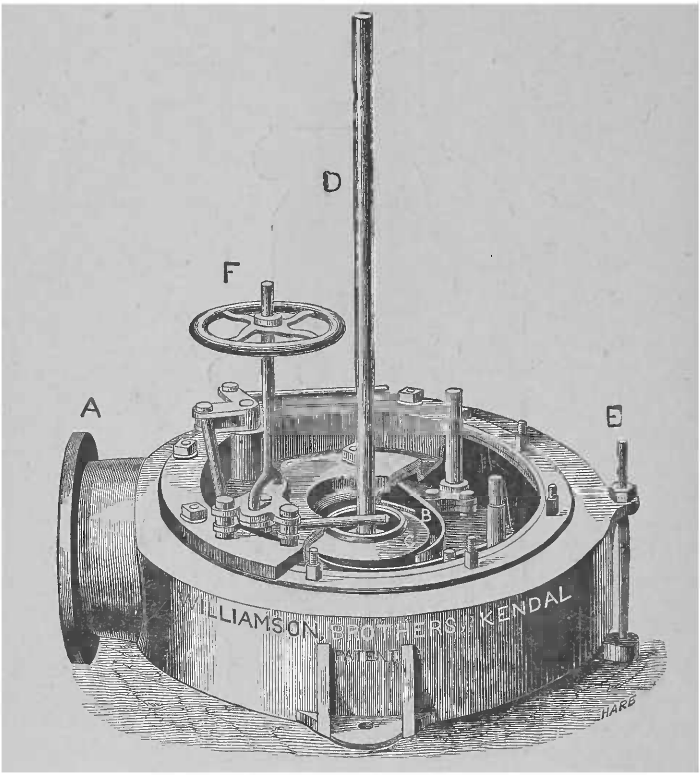


VERTICAL PORTABLE ENGINE.

shaft may be made of any required length, and from its upper end motion is given to the horizontal shaft which drives the machinery. E is a lever for raising the pivot when necessary in consequence of wear.

It may be here mentioned that the Vortex is constructed with the guide blades B, which form the passages for the water, either *fixed* or *moveable.* If the former be employed, the orifices through which the water is directed to the revolving wheel are made of such a size as is necessary for the passage of the quantity of water intended to be consumed when the wheel is in full work. This form is well adapted for use where, when it is necessary to work the wheel, the full supply of water can always be obtained, either by storage in a reservoir, or from the natural supply of the river or stream. In

Fig. 167.

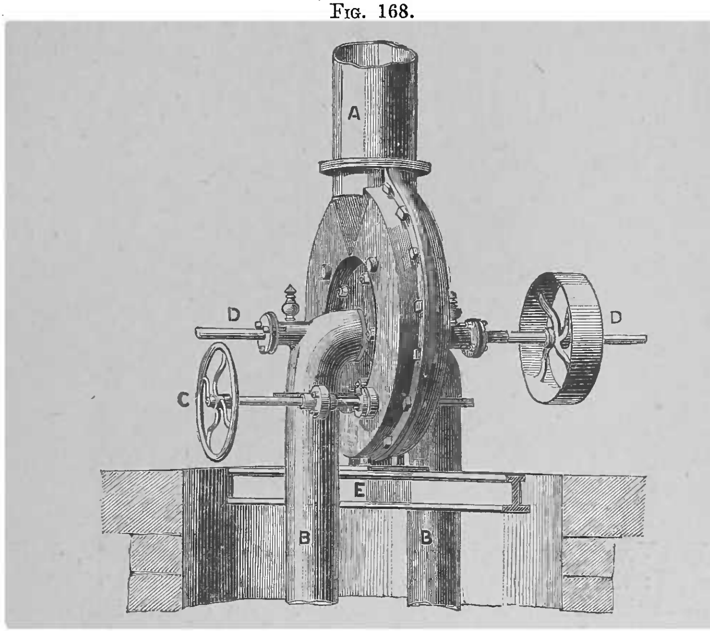


PATENT VORTEX WATER-WHEEL.

cases, however, in which the amount of power employed varies considerably at different times, and the saving of water is important, so that it is necessary or desirable to use as small a quantity as possible to do the work required; or, where the available supply of water is at times less than the full amount for which the Vortex is designed, the guide blades should be *moveable.* The consumption of water can then be economised to the utmost, as the passages are regulated to admit only the exact quantity needed to perform the work to be done, or to suit the available supply. The superiority of the mode of adjustment here adopted over any sluice-apparatus applicable to other Turbines is more fully referred to hereafter.

When circumstances render it desirable the Vortex may be placed at any height, less than about 30 feet, above the tail-race, the fall below the wheel being rendered available by suction pipes descending from the central discharge orifices. This arrangement is shown in fig. 168, where the Vortex is represented as placed at some height above the tail-water.

FIG. 168.



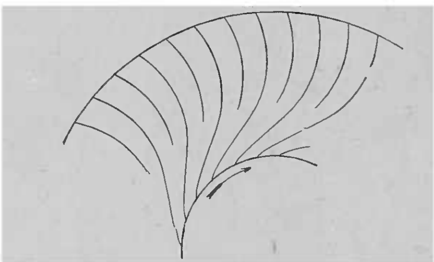
VORTEX WITH PART OF THE FALL ACTING BY SUCTION.

In the engraving, fig. 168, A is the supply pipe, which conveys the water from the head-race to the Vortex. B B are the suction pipes by which the water, after passing through the wheel, is carried into the tail-race. C is the hand-wheel for moving the guide blades. D is the shaft on which the Vortex wheel is keyed. E is a cast-iron beam on which the Vortex is fixed.

In many cases this arrangement is very advantageous, as the shaft being horizontal, the power may be taken directly from it by means of drums and belts, without any wheel gearing; frequently, also, it admits of the placing of the Vortex in a position more convenient for the application of the power than at the bottom of the fall.

Messrs. Williamson make other forms of the Vortex, arranged with a portion of the fall below the wheel and constructed for the unusually high fall of 250 feet, and both side and end elevations are given, one half of each being in section. To resist the great pressure of this column of water the case of the Vortex is made very strong, and is securely held together by an extra number of bolts round the circumference, and by tie-bolts within, the latter being so placed as to avoid obstruction to the water. The channels formed by the guide blades being of very small area, and the water moving through their narrowest parts with a velocity of upwards of 80 feet per second, it is desirable that the surfaces exposed to it should be perfectly smooth, and, in order that no corrosion may take place, the interior of the guide blade chamber and the guide blades are made of brass. The vanes and covers of the revolving wheel are also of sheet brass, fixed upon a tinned wrought-iron centre or boss-plate.

Fig. 169.



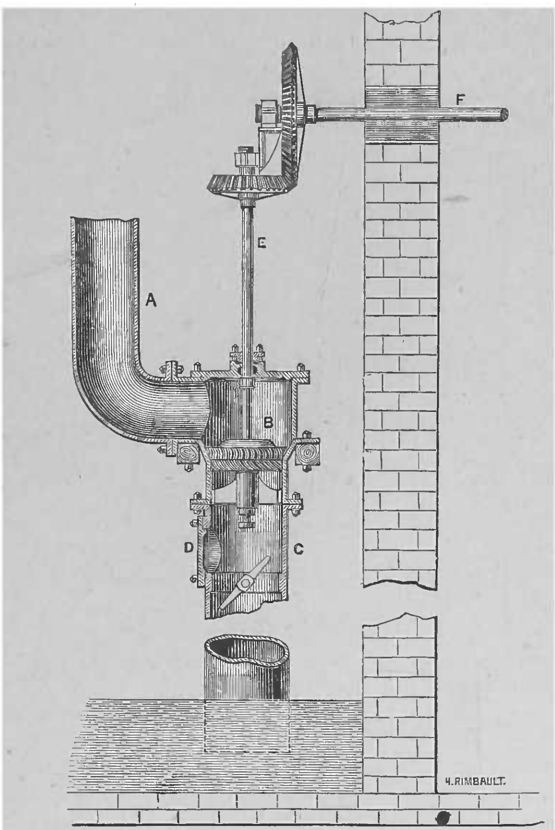
SECTION OF WHEEL OF SIXTY HORSE-POWER VORTEX.

The Vortex is placed upon foundation stones, and stands within the mill; the supply pipe passes under the floor, and the water enters at the bottom of the Vortex case. An equilibrium sluice-valve is worked by a rod passing out below, and is intended to shut off the water. These guide blades are *moveable*, and are connected by links near their outer ends with a ring. The ring when moved round gives motion to the guide blades, and thus the entrance orifices at their points are varied as required. The ring is worked by a screw and nut from a hand-wheel outside the case, the connecting spindle passing through a stuffing box, which prevents the escape of any water.

In fig. 169 is shown a portion of the revolving wheel of the Vortex last described, on an enlarged scale to illustrate the form of the vanes. Some of the vanes do not extend to the central orifice; the object in so making them is that they may not too much fill up the contracted part of the passages and thus impede the flow of the water.

Fig. 170 represents a turbine on the parallel flow principle. This turbine is capable of being arranged in a great variety of positions. In the above illustration it is shown with the shaft perpendicular, and at some distance from the tail-water. If more convenient, this turbine can be laid in a horizontal position, and placed at any distance within 30 feet in perpendicular height from

FIG. 170.

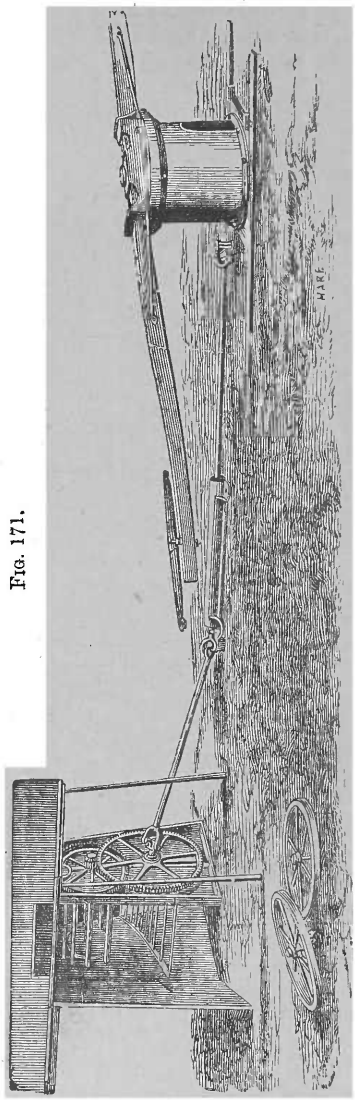


TURBINE, INWARD FLOW PRINCIPLE.

the tail-race. A is the supply pipe; B, the body of the wheel; C, the discharge outlet or suction pipe; D, a door by which the footstep may be adjusted as it wears; E, the shaft from which the power is led, by means of bevel-wheels or belts; and F, the shaft leading into the building. The whole parts are easy of access, and may be readily repaired, which is an advantage this turbine possesses over many of its class.

Thrashing Machines.—Fig. 171 illustrates the simplest form of thrashing machine, and the 'horse gear' by which it is worked. This machine simply thrashes out the grain; but machines are now

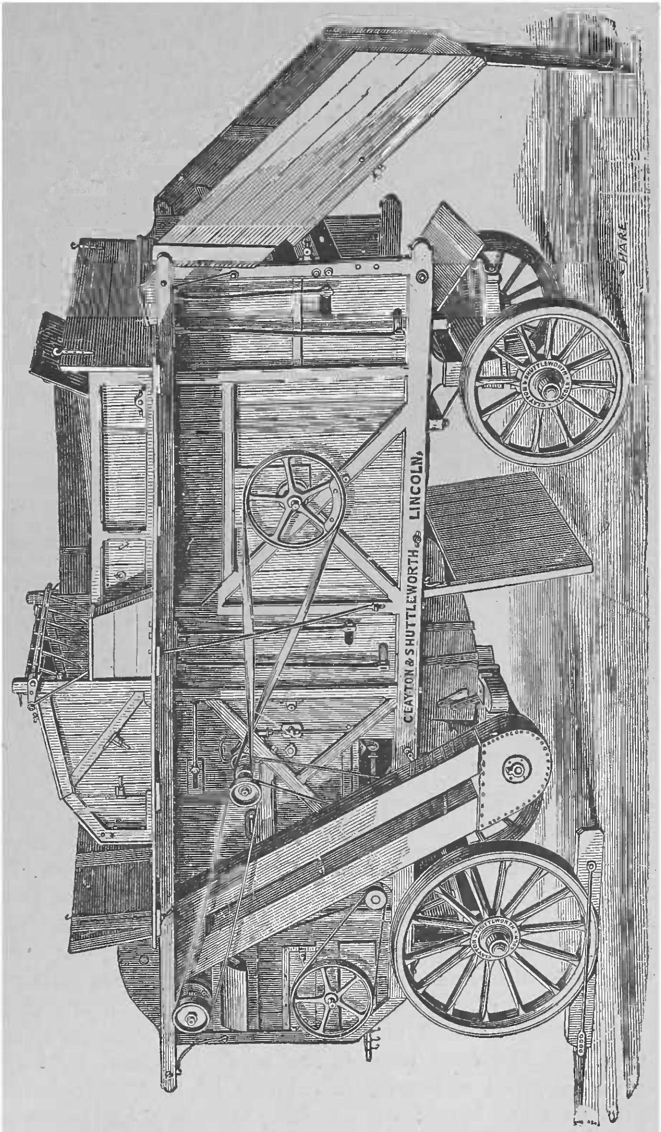
Fig. 171.



SIMPLE THRASHING MACHINE OR BEATING ENGINE.

largely introduced which perform a wide variety of operations—in which the straw is shaken, the corn winnowed, dressed, and put into sacks ready for market. Known as the 'combined thrashing machine,' it effects the several processes of thrashing, shaking, riddling, winnowing, housing, elevating, separating, and sacking

Fig. 172.



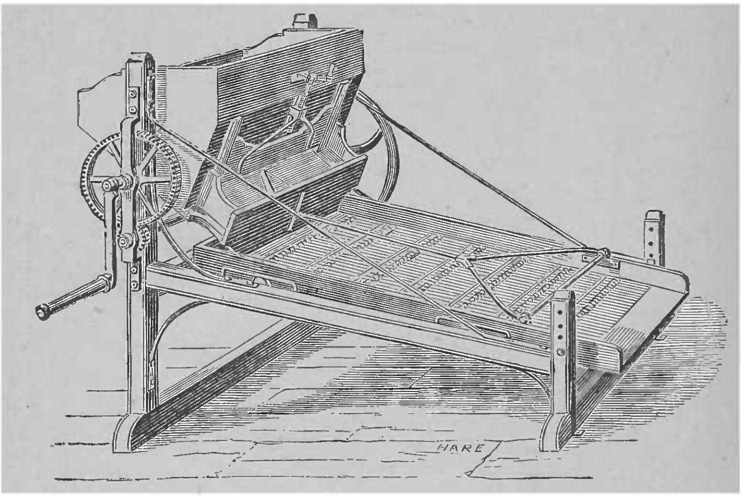
FURNISHING THRASHING MACHINE.

by weight or otherwise; the machine being all carried on one frame, and the whole put in motion by one belt from the engine. In fig.

172 we illustrate one of the admirably-effective thrashing machines of this kind, as made by the Messrs. Clayton & Shuttleworth, of Lincoln. This is also furnished with a self-acting apparatus for feeding the machine with the corn to be thrashed, obviating the necessity to employ manual labour—a fruitful source of accidents and loss of life. The patent feeding apparatus takes up the corn from the feeding board and delivers it regularly to the beaters of the machine, thus no part of the body of attendant can be caught by the beaters.

Corn Screens.—In fig. 173 we illustrate the well-known screen manufactured by Mr. Boby, of Bury St. Edmunds. By a very simple arrangement, the distance between the wires can be ad-

FIG. 173.



BOBY'S CORN SCREEN.

justed so as to suit different sizes of grain. Since the last edition of this work was issued, a new class of corn machinery has been introduced into practice. This is a corn elevator, a machine designed to facilitate the stacking of corn. The general principle on which the different forms introduced by various makers work will at once be seen by inspecting the illustration in fig. 174. The long trough, which is the salient feature of the apparatus, and up which the corn sheaves are made to travel by means of revolving tines on a frame, is capable of being placed at any angle to suit the height of stack. Machines of this kind are now much used; but there are other and several forms in the market, all of them possessing great ingenuity of arrangement. On large farms they save a vast deal of labour, and in these days, when this is so dear, they soon repay the cost of their purchase. Fig. 174 illustrates a form made by Messrs. Clayton & Shuttleworth, of Lincoln.

Straw-Cutters or Chaff-Cutters.—Various machines, under the names of chaff and straw-cutters, have of late years been contrived

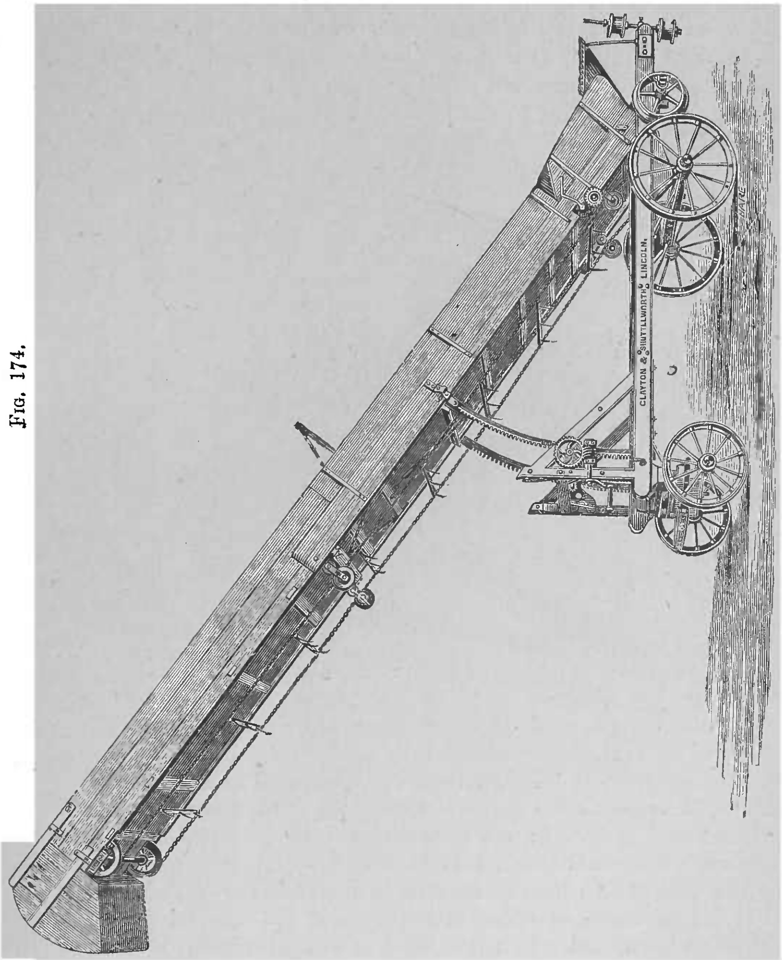
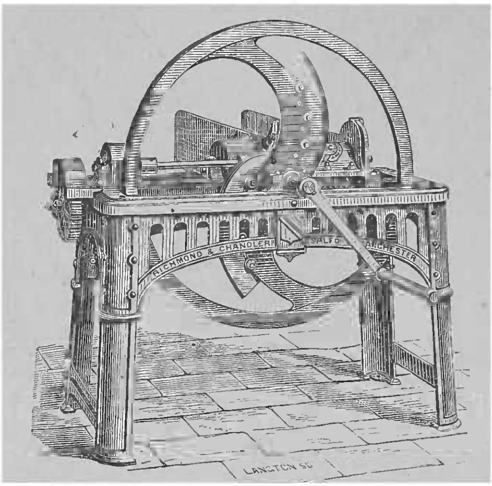


Fig. 174.

STRAW ELEVATOR AND CORN STACKER.

for reducing hay and straw into chaff, and diminishing manual labour. The economy and advantage of this practice has been already adverted to. Most of these machines are well calculated for their destined purpose; but as it would exceed the limits of the present work to enter into a detail of their comparative merits, we shall only notice one, that of which the following is a cut, and which has the highest reputation as an efficient and economical machine. It is manufactured by the well-known firm of Messrs. Richmond & Chandler, of Greengate, Salford. Fig. 175 is a perspective elevation of this form of chaff-cutter, which embodies the most recent improvements of the makers. These may be named here as giving the rollers adjustable bearings, so that each roller can rise and fall independently of the other; in casting the mouthpiece of steel, so that the knives working up against it are kept continually sharpened; and in making the teeth of the rollers tapered, and radiating from the centre.

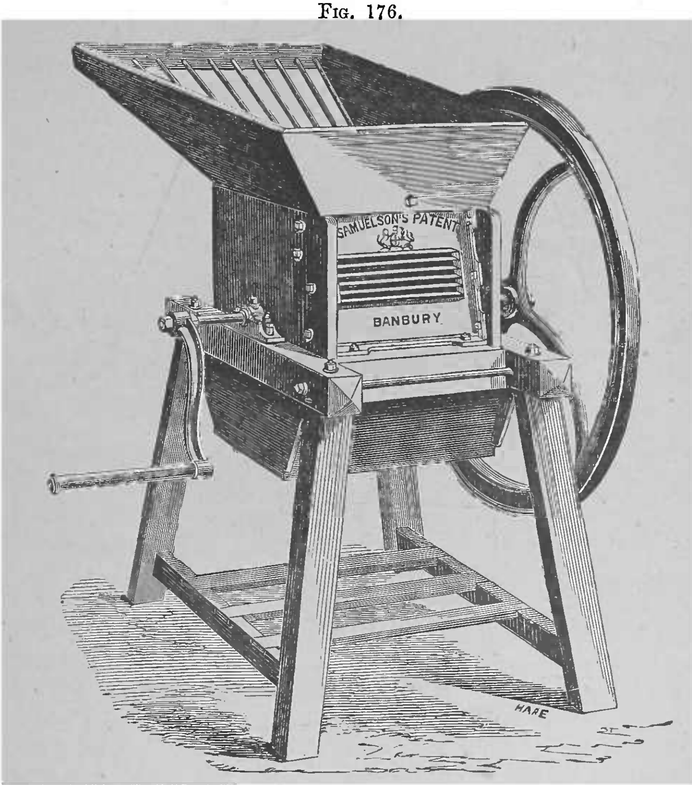
FIG. 175.



STRAW AND HAY CUTTING MACHINE.

Root Cutters and Root-pulping Machines.—These are new adjuncts of every well-conducted farm-steading where the feeding of cattle is carried on. As in chaff-cutters, so in root-slicers, the machines in use are so numerous that we cannot possibly describe the different varieties; we therefore select one, and that is the machine—illustrated in fig. 176—which is the form manufactured by the well-known firm of Messrs. Samuelson & Co., of Banbury. It is the machine invented several years ago by Mr. Gardner, of the same town, and which possessed so many features of excellence that it has maintained its position till now. The form in the illustration has, however, several important improvements, the invention of Mr. Samuelson. At the date of the last edition of this work the pulping of roots was highly thought of by feeders, and is elsewhere noticed; it is not now so much esteemed, and for reasons there named. Still, judiciously used with other materials, pulped roots may be advantageous in feeding. The varieties of machines are therefore not so numerous now as some years ago; but many excellent forms are still at the command of the farmer. In fig. 177 we illustrate a form as manufactured by the Messrs. Barnard, Bishop & Barnard, of Norwich, which has a high reputation as a food machine of this kind; and in fig. 178 their root cutter, or slicer, and pulper combined.

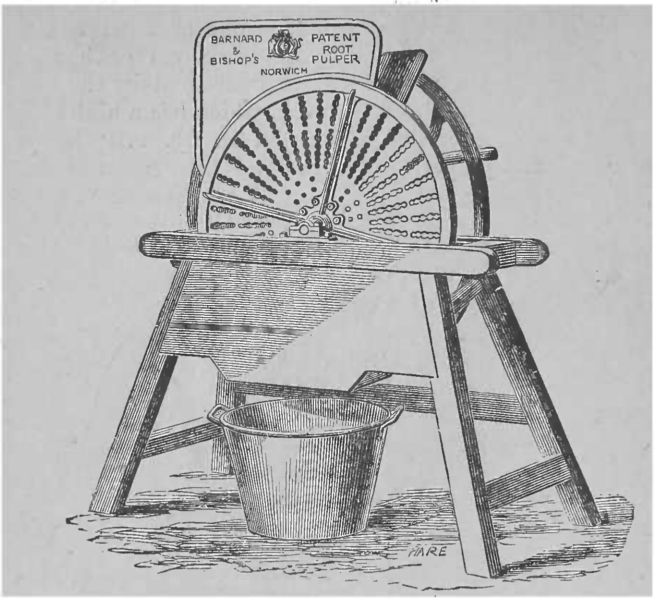
FIG. 176.



ROOT SLICER.

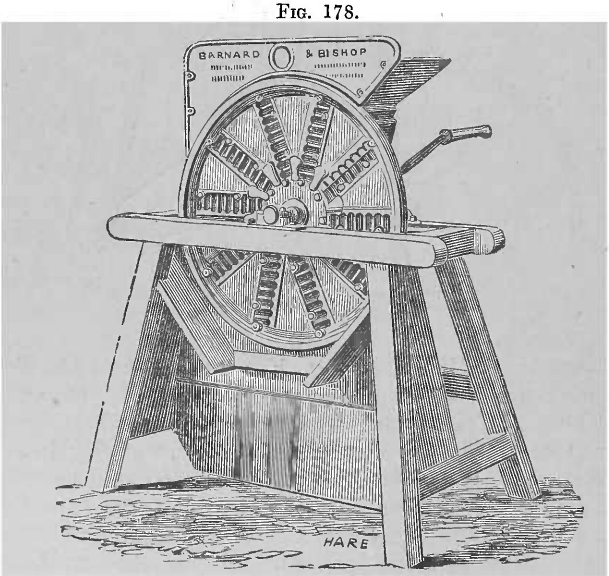
Corn-crushing Mills.—In fig. 179 we illustrate the form of 'corn-crusher and bean-splitting mill combined,' as made by Messrs. Turner, of Ipswich. The corn is crushed between the smooth surface of a large roller or flat pulley, working in contact with a small one. Fig. 180 illustrates a stone grinding-mill, and fig. 182 an oil-cake crusher, made by the same firm. In fig. 183 we give a view of the bean-cutter or oat-crusher manufactured by Messrs. Ransomes & Sims, of Ipswich. In this, the barrel, or cutting-roller, is hollow, and is formed of a number of separate steel

FIG. 177.



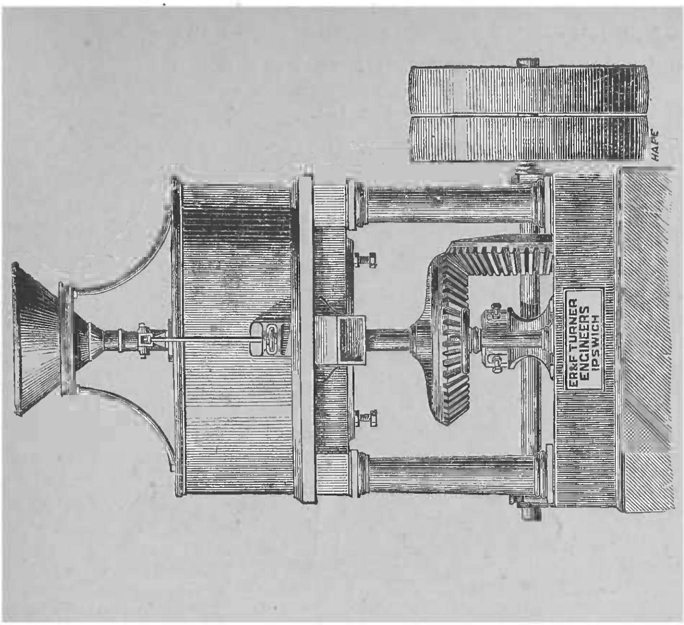
ROOT PULPER.

FIG. 178.



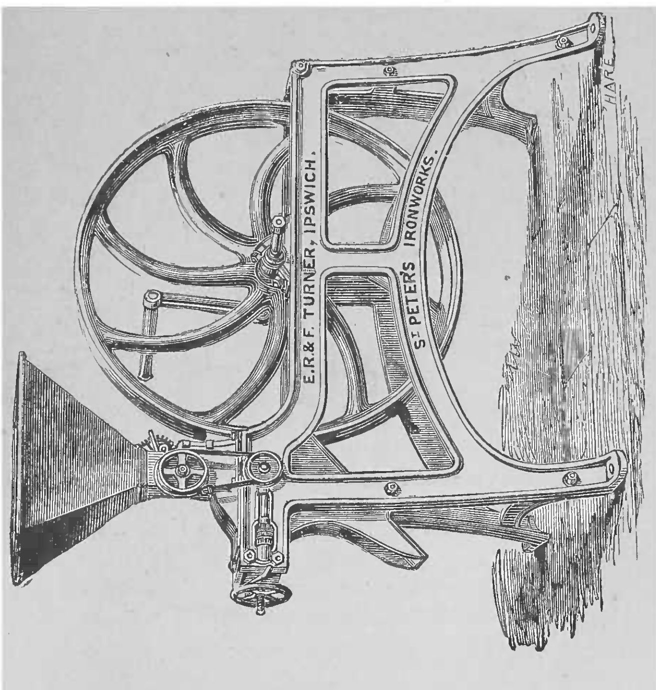
COMBINED ROOT CUTTER AND PULPER.

Fig. 180.



CORN-GRINDING MILL.

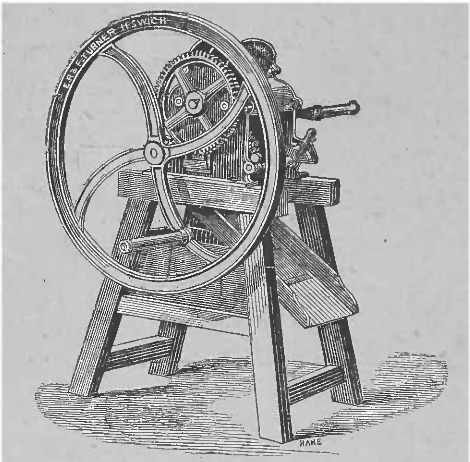
Fig. 179.



GRAIN-CRUSHING MILL.

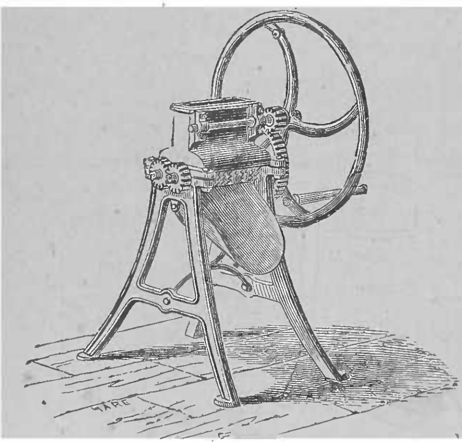
cutters of triangular shape, arranged round the circumference of the end rings in such a manner that a wider space is left at the

Fig. 181.



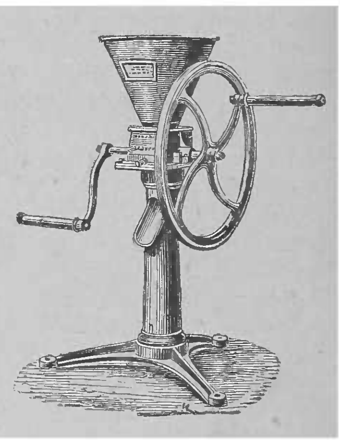
OIL-CAKE BREAKER.

Fig. 182.



OIL-CAKE CRUSHER.

Fig. 183.



BEAN AND OAT CRUSHER.

back than at the front of the cutters, so that all choking is prevented.

BOOK THE EIGHTH.

ON THE CULTURE AND MANAGEMENT OF GRASS LANDS.

CHAPTER I.

ON THE SIZE AND SHAPE OF FIELDS.

IN the article of expenditure on a farm, the items for fences usually constitute a prominent feature. There is no doubt that much unnecessary expense, and also much waste of land, are incurred by dividing the land into small enclosures; but farmers are too generally bound to maintain it as it was originally laid out. The extent of the fields should be regulated by the size of the farm, the nature of the soil, and the uses to which they are to be converted; and, in making new enclosures, the following hints may be found of service.

The enclosures that are chiefly designed for the production of grass should be smaller than those in which grain crops are intended to be raised. On light, sandy, or gravelly soils, the divisions should be small, in proportion to their drought and to the particular crops that can most advantageously be grown upon them. On sheep-downs enclosures are generally impracticable, and there shelter is only to be obtained from the standing fold; but on other lands of considerable elevation, their extent should be reduced in proportion to their height and to the dryness of the ground; the thickness of the hedges being likewise regulated by the same circumstances.

It has been ably remarked by a judicious writer, that 'equal care should be taken to guard against the extremes of too much exposure, and a thick damp atmosphere; for the health, thrift, and beauty of animals are greatly promoted by proper shelter, and a due circulation of air.'

But, while the stagnation of the air in confined situations may have an injurious effect on vegetable as well as animal life, by preventing the proper degree of evaporation from taking place, and encouraging the production and continuance of putrid or injurious miasmata, the too free circulation of the wind over a given space is not less injurious to the feeding of animals than the growth of vegetables, especially where the elevation is considerable, as in mountainous and hilly farms; this is evidenced by the luxuriance of that part of the herbage which is sheltered by the fence, and the poverty and often barrenness of the centre of the fields. In such situations, therefore, the hedges should be planted so as best to break off the winds to which the land is liable to be most exposed. 'It is as much,' says the writer we have just quoted, 'on account of the shelter, shade, and equal warmth, as of occasional fresh supplies of grass, that the Leicestershire graziers have founded their opinion, that *fifty acres in five enclosures, are equal to sixty in one.*'

In laying out our pastures, it may be remarked that extensive enclosures are less adapted for feeding than fields of a moderate size, because the animals wander over them, destroying as much grass with their feet as they consume, and eating it off unequally, and in patches; the whole should be fenced with good hedges, of sufficient height to prevent the cattle from being able easily to overleap them, and to afford shelter in cold and tempestuous weather. The enclosure, however, should not be too small, especially when the hedge-rows are to be planted with timber-trees, which are exceedingly prejudicial, as they overshadow the ground, exhaust its fertility, and cause all the grass in the neighbourhood to be sour, thus injuring the quality of the whole crop. Whatever be the dimensions adopted for the enclosures, much attention should always be paid to the convenience of access to water, especially in all enclosures where it is intended that live stock shall at any time be kept; for the best of pasturage will never prove of that benefit to cattle which it might be, unless aided by the digestive effects of pure and wholesome water. The purposes of drainage, the position of the ground, and the bringing together, as much as is practicable, lands of a similar quality, or that can be cultivated or stocked under the same circumstances, even although this may tend to render them in some degree unequal in size and irregular in form—are all objects of importance. Where there are no circumstances to prevent their being formed in a regular manner, the size of the farms, and the course of cropping that can be most beneficially practised on them, should be principally regarded, and they should be laid out to suit the nature and extent of the farm, and the peculiar mode of cultivating it, and carrying off its products.

In the first division of the farm, regard should be paid to the rotations of cropping which its soil or other circumstances will probably require, and, if possible, *two enclosures should be allotted to each division of rotation.* This is the principal consideration with regard to moderately-sized farms, both in grain crops and in pasture. In the former, one field may be devoted to potatoes that are to be followed by wheat, and another to turnips succeeded by barley; and, in pasture ground, the shifting of the pasture, so beneficial to every kind of stock, can be more easily effected.

With regard to the *shape* of fields, although this must be in some degree influenced by the hilly or level situation of the land, the position of roads, and many other local circumstances, it is evident that for ploughed ground it is most advantageous to have the fences in straight lines, and that the fields, when large, should be rectangular, and when small, of an oblong rectangular form, in order that the ploughing may be despatched with as few turnings as possible; irregular-shaped fields often giving much annoyance, and wasting much time in their tillage.

In the laying out of pasture land, the material object should be shelter from the most prevalent and piercing winds. When, in the laying out of a farm, it is necessary to have some of the fields of an oblong shape, it should be contrived that the longer direction should run, as nearly as possible, north and south, for the ploughing will then be usually performed in that direction, and the sun's rays will have freer access to both sides of the furrows, not only before sowing but also during the growing crops, both of which are circumstances of considerable importance. There is another convenience in having the fields to run as much as possible north and south—that the cattle have greater shelter from the east and west winds, which in our country are most frequent and annoying.

CHAPTER II.

ON FENCES.

THE nature and construction of these strangely vary in different districts, according to the peculiar circumstances of situation and convenience, and, in many instances, according to the absurd custom of the country. The principle on which they are constructed is, protection from too much cold, and yet the preservation of a proper circulation of air. On these two circumstances depends the health both of the animal and the vegetable. Fences may be classed under the heads of banks, walls, hedges, wire fencing, ditches, and gates.

I. EARTH BANKS are chiefly employed in those districts where other materials for constructing fences are difficult to be procured. They will be found in most of our hilly or upland districts; and they are not only durable but useful and cheap, especially if the turf can be procured from any surface immediately adjoining. The following is the ordinary method of forming them. The line of the fence being fixed upon, the turf should be pared off, about 4 or 5 inches in thickness, from the farther edge of the future ditch on one side to that on the other, regard being had as much as possible to what was stated at the close of the last chapter respecting the direction in which the hedge should run. The level of the ground should likewise be considered, in order that the ditches may act as useful and efficient drains. The turf being piled on the sides, the earth which is dug up from the ditches should be piled on the centre space between them, in a somewhat sloping direction, and well and firmly beaten down. The ditches, being about 2 feet deep, will furnish sufficient earth to make the bank 4 feet in height. 'Great care must be taken,' says an eminent foreign agriculturist, 'in cutting the turfs with which the bank is to be covered, especially where they are thick. They must be cut in a direction oblique to their surface, so that when placed upon the surface they may fit into each other exactly, and the lower edge of each turf adjust itself above the upper edge of the one below it. The operation of covering or turfing the bank must, of necessity, be commenced from the bottom; and it is of importance that the first row of turfs should be of the same width throughout, and also that all the individual pieces of which it is composed should be of a uniform breadth. When the first row is completed, another may be placed above it, care being taken to adjust the turfs together with all possible exactitude, so that they may join evenly, with the lower edge of one row slightly overlapping the upper edge of that beneath it. Before the turfs are put on, the earth should be well beaten, and the surface rendered as even and free from hollows as possible.' The slope should be so contrived that the top of the bank shall be about 2½ feet thick, and planted with hawthorn, or with any of the other shrubs useful for fencing. These earthen banks should be raised in moist, or even in rainy weather, as the turf will then be most likely to adhere and to grow. When they are raised in dry weather, and much rain falls soon afterwards, there is danger that the soil between the sods will swell, and by bulging outwards, materially affect, if not totally destroy, the solidity as well as the symmetry of the bank.

II. WALLS are a very useful kind of fence in districts where stones can readily be obtained. When well constructed they are of great durability. Although not so ornamental as hedges, they are every way preferable in point of utility, for they require no nursing, or cleaning, or pruning; and are not so easily destroyed by the trespassing of various animals. The benefit is immediate; the shelter is more perfect, they occupy little space, and neither afford a harbour for vermin, nor a nurture for weeds.

Lime-stone, rag-stone, grit-stone, or any other kind that is most convenient, may be used for this purpose; but lime and grit are preferable, on account of their being most easily prepared. Walls are either made with stones only, in which case they are termed *dry stone walls*; or with stones and earth intermixed, when they are termed *earth and stone walls*; or with lime and mortar, in which state they are denominated *lime and stone walls*; the last-mentioned, although possibly expensive in the first instance, are ultimately the most durable, and, consequently, the best adapted for fences.

In constructing lime and stone walls, the foundation should be about 2½ feet in width, and the wall taper upwards to 10 inches or 1 foot. The foundation should be placed at such a depth in the ground as to be unaffected by frost, and the wall carried up to the height of 6 feet, and coped at the top with stones placed edgewise. Where lime cannot be procured to cement the stones, a dry wall may be constructed in the same manner, and, if judiciously arranged, it will last nearly as long. The foundation should be laid on firm ground or on greensward, or, if this is impracticable, the loose earth should be dug away until we arrive at some solid base. The largest and flattest stones should be placed at the bottom, and, at certain intervals, stones should be introduced of sufficient size to reach from one side of the wall to the other. This will materially add to its solidity. A wall, 2½ feet thick at the base, half as wide at the top, and about 4½ or 5 feet high, will answer every useful purpose. On the top of it, but included in the aggregate height, should be placed a layer of flat stones, and upon them a row of upright ones, each fitting together with tolerable accuracy, or cemented to each other. A coping, consisting of two sods of turf laid on the wall, with the earthy sides towards each other, is cheap and easily formed, but apt to get out of repair.

III. HEDGES are usually formed by intertwining the branches of dwarf trees, the nature of which necessarily varies according to the quality of the soil.

The plants which have been chiefly used for hedges are the following:—

1. The WHITE-THORN, or HAWTHORN (*Cratægus Oxyacantha*),

which grows very rapidly, is durable, will flourish in almost any situation, excepting on gravelly soils, and is, perhaps, better adapted, in every respect, for the formation of a compact and serviceable fence than any of the plants commonly employed. The thorns should be raised in a nursery, and transplanted, when a year old, into some open piece of ground where the soil and space admit of their roots and branches freely developing themselves; a poor soil should be chosen. Here they may be kept from one to two, or even three years, before being set in the hedges; and then they will fully repay the care bestowed upon them. The different species of the hawthorn are very interesting on account of their ornamental appearance, especially when loaded with their fragrant white or pink blossoms, or their brightly-coloured fruit.

2. Next is the BLACK-THORN (*Prunus spinosa*), so far at least as strength and hardihood are concerned, but it is difficult to keep this shrub within proper bounds; the growth of it is less certain than that of the *white-thorn*, but its bushes are superior to those of the other for mending dead hedges, and are, also, less liable to be cropped by cattle.

3. The HOLLY (*Ilex Aquifolium*), though slow and less certain in growth, forms a hedge which, by its thickness and strength, fully compensates for the delay and expense incurred. The holly constitutes a beautiful feature in the winter scenery of many parts of England.

The best mode of making hedges with holly is, first, to mark out the line of ground, and, by ploughing or digging prepare it for the purpose; the young plants, having been carefully removed, so as not to hurt or injure their roots, are then to be placed in the ground, in the proportion of four or five quick or white thorns to one holly. Both will flourish. As the hollies increase in size, the thorns may be pulled up, and when the former have attained their full growth they will occupy the whole space, and form a most permanent fence. Should any intervals occur, they may be easily filled up, by bending down the lower branches and covering them with earth. In the following year these will take root, and shoot forth so as to present an impenetrable barrier.

White-thorns do not flourish on thin and gravelly soils; and there is often a considerable failure of them in an ill-constructed hedge. Where the centre of the bank has not been sufficiently manured or prepared, or where they are planted so much on its slope as to receive little benefit from the rain which runs down the bank into the ditch, they generally fail. In the first construction of the hedge, a flat bed, 3 feet broad and well manured, should be left on the top of it, and in the middle of this the quicks are to be planted. *Quicks*, or cuttings from the hawthorn, thus planted, will meet with sufficient nutriment in the soil before the tap-roots reach the barren, gravelly bottom; and the earth thrown up from the ditches will retain sufficient moisture to nourish the plants, that will in a short time form an excellent fence.

As thorn or quickset hedges are not more admired for their beauty than their utility, the following account (communicated by an intelligent correspondent) of their culture and management, in Northamptonshire, may form a proper supplement to what has already been stated:—

'The largest haws, being gathered in the autumn from the finest and healthiest growing thorns, to the amount of one, two, or three bushels, according to the quantity which may be wanted, are first put in pits or holes, to clear them from the pulp, and in the spring are sown, not too thick, in beds duly prepared as if for onions, about the breadth of asparagus beds, with paths between, for convenience of weeding, etc. Sift over these a quantity of fine earth, sufficient to cover them equally about half an inch. Observe to keep them very free from weeds throughout the summer; and the next or following spring, according to their size, thin and transplant them into rows in narrow trenches across similar beds, the rows being about three or four inches distant, according to the strength of the plants, to remain till the following spring; keeping them clear of weeds in every stage is of the most essential importance, as it not only expedites their growth, but prevents mildew, to which they are very liable in damp, foggy weather, and unfavourable seasons. If the mildew affects them in the spring quarter, they will often revive at midsummer; but afterwards, it commonly stops them for the rest of the year.

'About the latter end of March, or early in April, draw out the best of the young plants, from one-eighth to one-fourth of an inch in thickness, which will sooner take root than larger ones, and form them into bundles of 1,000 each, the ground being first prepared for planting them, by cutting out a small trench, not deeper than the good soil, on each side of the proposed fence-row, and throwing over it turf, on which the plants are to be deposited. Hollow it out in the form of a basin or punch-bowl, the outer side of which, where the plants are to be fixed, should be rather higher than the inner side; and sloping off by a line of equal height from the bottom of the hollow into the fresh earth which is thrown up, to form a bed for the plants. Having first cut off the small end of the plants, so as to leave only two or three buds above the ground when planted, or at the utmost about 3 inches, cut off also as much of the root end as to have only 4 or 5 inches in the ground, when covered with earth, taking care to leave on some of the tender fibres of the root, slightly trimming the fine ends with a sharp knife. These may be placed about 3 inches asunder, a little more or less, according to the strength of the plants, so that 12 of these will extend a yard, and 264 a chain, or what they call for that purpose only, an acre. Having covered a sufficient length of these, and the side inclining as before, another line is to be sloped off, about 3 or 4 inches above the other, in which another row of plants is to be deposited in the same way, and at the same distances, covered with earth as before, care being taken to place each plant in this upper row against the intervening spaces of the plants in the lower row. This row will, therefore, contain as many plants as the other; and both of them about 528 plants in a chain of 22 yards in length. Then finish off the inclination of the sides, with a small flat or hollow on the top above the upper row; and so proceed until the whole is finished. The sooner the plants are thus deposited in their new situations, after removing from the seed-beds or nursery-beds, the better; but especially be careful to put them in speedily after cutting and trimming, before the sap dries up; and no time should be lost in laying them in their places, whilst the natural moisture continues in the soil from the trenches, both for bedding and covering them.'

The hollow or basin form of managing the ground for planting the sets is an essential consideration, although in many other counties greatly neglected. If the weather should prove dry, it serves as a reservoir for collecting every particle of moisture that falls in the space between its extreme edges, whether proceeding from dews or partial showers. This serves to feed the roots of the plants that are just above it, and will soon strike down towards it, and also, when duly attended to, will prevent weeds from injuring the roots, and robbing them of their nourishment. The weeds, which will naturally push forward, must be kept under by hand-hoeing and weeding, both above and below the rows of plants, as well as between them; and this will also have the effect of fitting the soil to receive the full benefit of the night dews, etc. The operations of hoeing and weeding are performed four times every summer. Early in the spring, before the hay-harvest, and before and after the corn-harvest, are the usual seasons of performing these operations.

All this trouble and expense would be of little use, if no care were afterwards taken to preserve these young hedges from the injuries arising from the bite and tread of animals. It is customary, therefore, to have rough posts and rails on each side of the bank, which form a secure fence against large cattle; these posts being placed at such a distance from the edge on each side, that the cattle cannot put their necks over to crop the plants.

Where any plants have accidentally failed, they should be replaced on the first spring-hoeing by fresh sets. In two years, or three at most, where this care has been taken, and the soil is not too poor, the plants will have gained sufficient strength to be cut down to about 7 or 8 inches high, which will cause them to throw out numerous strong and thick shoots; so that, in two or three years more they will become a fence sufficient for any purpose. Before this time the posts will have begun to decay at the feet, and must be occasionally repaired and guarded; but common attention will always obviate any serious injury, and this need not be made the object of particular directions.

In addition to the plants that have been recommended for the construction of fences, may be noticed the HORNBEAM tree (*Carpinus Betulus*), which is chiefly used on the Continent. It is propagated from slips or sets, and will thrive admirably well on poor, barren, and exposed lands. When well pruned and carefully attended to it forms a compact green fence; but where this is not done it is apt to run to wood.

PRIVET (*Ligustrum vulgare*), when planted with the hawthorn, makes, with a little care, a good close hedge. It is a well-known and beautiful shrub, flowering in June and July, and preserving its verdure almost throughout the year; for it scarcely sheds its leaves till March, and they reappear in the following month. It is, however, better adapted, and more generally used for gardens, shrubberies, etc., than for fields or such-like enclosures. It flourishes in dry and friable soils and puts forth many trailing branches, that take root when they come in contact with the earth; its cuttings also grow very freely.

We have omitted giving a notice of the trees at one time considered suitable for planting in fences, inasmuch as we conceive them to be there altogether out of place, and, indeed, as acting highly prejudicially. The best authorities agree with us in this. Mr. Stephens—and there is no better authority—was decidedly averse to them in his 'Book of the Farm.' He says, 'I am decidedly inimical to the planting of trees in hedge-rows. It is quite impossible, even with the greatest care, to rear thorns to a good fence under forest-trees. Even trees growing on the top of the mound of a double hedge abstract the moisture from the earth, and injure the foliage of both the hedges.'

We are, however, of opinion, that where hedges can be dispensed with altogether the farmer becomes a considerable gainer; he escapes the evils, and expenses, and annoyances entailed by them, and gains, besides, the space they cover. Of course, in some cases they are positively necessary, but we cannot help thinking that there are far too many of them, and that a simple fence of wood or iron, or a wall, would answer every purpose. Fencing of iron is now easily and cheaply obtained, and in a great variety of forms. At the same time it should be remembered that, as in other departments, so in this, extremes are dangerous. In especial situations and cold climates, fences, as affording shelter at once to crops and cattle, if judiciously placed, i.e. on the side most exposed to the cold and prevalent winds—are very valuable.

On dry sandy situations, *Furz* (*Ulex europœa*) may be made use of, and with advantage, if it is planted at a proper time, and managed with care. For this purpose a bank should be raised about 4 feet in height, 5 or 6 feet broad at the bottom, and 18 inches wide at the top, with a shallow ditch on each side, the upper surface of which is to be thickly sown with furze seeds. The seeds should be sown in March or April. They will speedily vegetate, and in the course of two or three years form a fence that will continue for several years, requiring no rails after the first year or two, and be impenetrable to almost every animal. As, however, the furze increases in size, the old prickles will decay, and consequently leave the lower parts of the stems exposed. This inconvenience can only be remedied, or partially prevented, by supplying the bank with new plants, which should not be permitted to shoot up to such a height as to leave the lower parts naked. If one side of the hedge is cut down close to the bank, the other half will continue as a fence, until the former part attains a proper size, when the opposite side may be cut down in a similar manner; so that the bank will continue for many years to have a strong hedge upon it, without being liable to become bare at the roots. All this, however, is attended with considerable labour, as the furze is far from being a hardy plant.

The proper season for hedging is in the autumnal quarter, whence it may be continued through the winter, as opportunity will allow or circumstances require. Mr. Young very judiciously advises the farmer to get his fences into good order during the first three winters of his lease; and afterwards to divide them into equal portions, one of which may be attended to every year, and thus bring the whole into regular cuttings. It is, however, an erroneous, though common practice, to clip the thorn hedges every year. This practice confessedly promotes the *beauty* of the fence, but at the expense of strength and durability; inasmuch as the main stems are impeded in their growth, and become thin and weak, while a number of small stems shoot from the places which have been cut, each requiring its share of nourishment, which is thus drawn off from the lower and most essential parts, on which the strength and value of the hedge mainly depends. Thus the top of the hedge becomes full and heavy, while the bottom grows thin, woody, and open. If, on the contrary, they are carefully lopped or clipped every seventh or eighth year, with a sharp pair of shears, and *in a sloping direction on both sides, from the* *bottom to the top*, there will not only be a very material diminution in the labour, but the hedges will also become more close and luxuriant, and, in a few years, only require the straggling lateral branches to be shorn off in the manner above directed. The proper season for this purpose is the autumn, when the circulation of the sap is less vigorous, and, consequently, the plants do not suffer so materially from its loss.

As to the management of the thorn hedge, when once made, some excellent observations occur in a very elaborate paper by Mr. Stephens, in the first volume of the 'Quarterly Journal of Agriculture.' The reader will duly estimate the following quotations:—

'There is no specific time of the year to *clean* a hedge, but the safe rule is, always to do it before the weeds grow too rankly over it. The most common weeds which infest hedges are, the coltsfoot, way-thistle, common sow-thistle, common dock, sorrel, ribwort, groundsel, bind-weed, sticking-grass, wild mustard, chickweed, dead-nettle, rest-harrow, great white ox-eye, white-lychnis, and several of the grasses. The coltsfoot, rest-harrow, ox-eye, and docks, are most difficult to eradicate. The bind-weed, sticking-grass, vetch, and the yellow-flowering trailing-plant, interlace the branches of the thorns, and can scarcely be got rid of; and if there is but a single fibre of the wild mustard left, it will grow again with vigour.

'A hedge will hardly require pruning in the first year of its growth; but should it grow luxuriantly, the upper parts of the longer sproutings may be cut off, for it is very desirable for the well-being of a hedge that all the plants grow alike. In the second winter, some of the lateral branches that have shot over the ditch may be switched off, the stroke of the switching bill being made upwards and not across the top of the hedge. In this manner, year after year, let the lateral branches be reduced, and those which grow vertically be encouraged, until the hedge attains its proper height.

'A fence, of some kind or another, is absolutely necessary on both sides of a young thorn hedge, if that hedge separates fields that are to be pastured; but what that fence is to be made of depends, of course, on the nature of the materials that can be most readily obtained for the purpose.

'The management of hedges, after they have arrived at maturity, is often as difficult a task as the training of the young hedge. The principle, however, is simple enough. The thorns must be always so cut as to be kept thick near to the ground. They must not be permitted to grow up as trees, to shade, or kill, or curb the shoots beneath. When the hedge gets heavy in the top, and begins to affect the density of the foliage at the roots, it must be cut down in a sloping direction *from* the root. The blows of the hedger must cut upwards, and not downwards. This operation should take place in mild and favourable weather, and then it is astonishing how luxuriant a growth of stems is almost immediately developed; but in an old thorn hedge, and one that had been improperly treated in its youth, young plants will not easily take root and thrive between the gaps, partly from their being so much overshadowed, and partly from want of nourishment in the earth, the juices of which have been already extracted by the older tenants. To remedy such defects, *plashing* has been resorted to, and when that has been judiciously done, by laying the plashes near to the ground, a small gap may be filled up for some time; but I perfectly agree with the observation of Lord Kames, that plashing an old hedge—an ordinary practice in England—makes, indeed, a good interim fence, but in the long run is destructive to the plants; accordingly there is scarcely to be met with a completely good hedge where plashing has been long practised.'

If plashing is actually resorted to, the hedger should be directed to cut no deeper into the stem than is necessary to bend it down with considerable difficulty, as near to the ground as possible. Plashing at a considerable height above the ground defeats its own object, namely, that of filling up the gaps below. The end of the plash should be kept down by inserting it under wooden pegs, or the hooked branch of a neighbouring thorn, or by a hooked stick driven into the ground. Some softened clay should then be stuffed into the cut, in order to preserve the stem from the effects of wet and of drought. Instead of this plashing —ultimately destructive to the hedge—it will be better to renew the earth in the gaps with fresh soil, and then to take a stem from each side of the gap, and lay them in the soil so prepared, fastening them down with pins. They will then soon strike root, and grow up as young plants, and, when they have acquired sufficient strength, may be cut away from the parent stem.

If the gap is considerable, it would scarcely be practicable to fill it up with layers; therefore the old earth must be taken away, fresh and good earth substituted, and new plants inserted.

IV. Ditches are cut with various intentions, either to serve as drains, or fences, or to answer both purposes. Those which are made or repaired at the feet of banks on which quickset hedges are raised, should be, in no case, less than 3 feet wide at the top, by $2\frac{1}{2}$ in depth, and 9 inches wide at bottom, in the dryest soils; but in all wet or moist situations they should be both wider and deeper. Thus each side acquires a slope, which is a great advantage, and an indispensable necessity; for when ditches are cut perpendicularly the sides are continually washing down. Whatever be their purpose, whether for drainage or fencing, ditches ought to be so constructed that the water they contain may never become stagnant, but pass off into a contiguous rivulet or brook. They should likewise be regularly cleaned out every year, and the mud thus obtained will defray the expense of the additional labour. Loudon states that, in their simple and original state, they were considered more in the light of open drains than as fences. In a variety of instances, ditches are made for this purpose only; there is no intention whatever to enclose the field. They are, however, sometimes meant as a fence; but in such cases they are made very deep and wide, and the earth taken out of them is occasionally formed into a bank, the height of which, when added to the depth of the ditch, constitutes a tolerable barrier; and also occupies a considerable surface of land, which is thus lost to cultivation. In general, however, the ditch is of greatest value when used in conjunction with other fences. The form of ditches is various, some of them being of a uniform width, both at top and bottom; others, wide above, and having a gradual slope downward; a third kind have one side sloping, and the other perpendicular. For whatever purpose the ditch is meant, the sloping form is by far the best, as it not only costs less money in the digging, but is at the same time much more durable as the sides have not the tendency to fall in as when perpendicular or nearly so.

We cannot help here again reiterating our opinion, that where ditches and fences, one or both, can be dispensed with, by any possibility, it is advisable that they should be; for, besides the impediments they offer to agriculture, and the evils they bring with them (nursing weeds, harbouring birds, &c.), they occupy in the aggregate an enormous portion of valuable land. At the same time it should be remembered that where shelter sheds are not specially provided in fields, fences do afford shelter to exposed cattle which cannot well be dispensed with if sheds be not provided.

V. Gates are of various kinds and denominations, according to the form and materials of which they are constructed. The principle, in all of them, is to combine strength with lightness and cheapness. The wood usually employed for this purpose is oak, ash, beech, and other solid timber; though the Dutch willow, and some lighter kinds of wood, may be beneficially converted to the same purpose. In constructing gates, the chief points to be attended to are, the *fixing* of the post, so as to resist the attacks that are often made in the forcible swinging of the gate, and the *hanging* of the gate itself, so that it may shut easily and truly, without dragging on the ground.

With regard to the gate-post, where timber is used, it should be that of the oak or larch, and either prepared by tar or pitch, or charring, in that part which is to be buried in the earth. Such posts should always be firmly and deeply fixed, five or six feet being let into the ground. All the upper part, that which is exposed to the air, should be covered with one or two coatings of oil-paint, which will be attended with comparatively little expense, while the advantage thence derived, in point of durability, will be very considerable. Gate-posts are more durable if their *natural position is reversed*, that is, if their top is buried in the soil, and that part which was nearest to the root is planted out of the ground. No reason has hitherto been assigned satisfactorily to account for this singular fact; but it cannot be too extensively known where timber is used for gate-posts. Stone gate-posts, however, are preferable, where they can be readily obtained.

Iron is often used for ornamental gates. Some forms are very elegant, and if painted yearly will last a long time.

For convenience, and in point of size and security, a *five-barred gate*, properly braced, is preferable to any other. The dimensions of such a gate should be from eight to nine feet in width or length, and from four and a half to five feet in height. The bars should be strong, three inches and a half deep, and the lower ones so arranged as to prevent small cattle from forcing themselves through them into the field. Gates of the common construction are usually hung on hooks, and fastened with latches or catches, without regarding the adjustment or proportions of the whole, or the easiness or difficulty with which they are shut. With a view to remedy this inconvenience, it has been suggested to make the lower hinge circular, and to move in a groove of the post, instead of having two forks to fall on bars driven into the post. By this contrivance it will be impossible for swine or other cattle to throw the gate off, by creeping under it. With the same view it has also been recommended, in the 'Agricultural Survey of the County of Northumberland,' after perpendicularly fixing the hanging post on the ground, to let a plumb-line fall upon it. On this line, at a suitable height from the top, is to be placed a hook, projecting three inches and a half: and, at a proper distance below it, another hook, projecting one inch and a half on one side of the perpendicular line, and two inches from the face of the post. The top loop, or eye, is next to be placed two inches from the *haw-tree*, and the bottom loop three inches and a half from it. Gates hung upon this principle are said to possess a sufficient fall, in every situation, and will shut without any difficulty.

CHAPTER III.

ON PASTURE LAND.

THE excellence of pasture land depends greatly upon its situation, and the different classes of animals for whose use it is intended. Thus *uplands*, or high hills, will only suit stock of peculiar kinds, while land of less elevation, though still hilly, will be found profitable for feeding sheep; and on those which are still lower in point of situation, and more enclosed, neat cattle may be fattened to the greatest advantage. It is generally found that the older pastures are best calculated for feeding or fattening stock, while the *new lays* are more adapted for feeding young store cattle. It is also irrefragable, that the size or extent of the enclosure influences the use and value of pastures.

Nothing improves pasture land more than a judicious top-dressing; thus, under proper circumstances, the application of lime, either in its natural state or in the form of a compost, will be found of great service. Marl, or well-rotted dung, or ashes, may also be spread over the pasture with manifest advantage.[1] The folding of sheep on pastures, while they are fed or fattened with other succulent food, will prove of essential advantage; because the dung thus dropped will be richer in point of quality, and more in point of quantity, than could be obtained, if they were only fed or pastured on the grass; while at the same time, the sheep will, by their close biting, contribute partially to check the too luxuriant or coarse growth of the grass; and favour the production of a sweet and tender herbage. Numerous experiments have manifested the efficacy of several artificial manures. Guano, alone, or mixed with charcoal dust, is productive of the most beneficial effects, and renders the grass exceedingly luxuriant and succulent, and so fine in flavour that cattle eat it with more avidity than any other. This manure is equally applicable to pasture or meadow land.

Bones have also been found useful, especially when applied to clayey soils, or such as are undrained.

Saltpetre has likewise been proved to be an excellent stimulant to the production of grass. Nitrate of soda, alone, or mixed with the salt in the proportion of three parts of the former to one of the latter; soot and rape dust, have also been used with great success as top dressings. But great caution is requisite in the use of highly nitrogenous manures to pasture lands. The reader interested in this important question may consult with advantage a

[1] See Book x. chap. i.

small treatise entitled 'Outlines of Landed Estates Management,' issued by the publishers of this present volume.

Where land is intended chiefly for sheep pasture, it has been recommended to sow three kinds of grasses, in order to obtain the benefit of successive growth. Agreeably to this practice, Mr. Parkinson was accustomed to sow four bushels of ray grass, or red darnel seed, ten pounds of trefoil, and ten pounds of white clover. He calculated that the ray-grass would be fed off early, before the white clover appeared, and while the trefoil or common clover was just springing forth; so that when the ray-grass was eaten down, the common clover would shoot up, and afford excellent food; and that this would be succeeded by the white clover. Moreover, when the last is eaten, the ray grass will again vegetate, and afford a supply of food during the winter months. From this practice, Mr. Parkinson inferred, that one-third more sheep may be kept than by any other method.

Generally speaking, however, where the lands thus laid down to grass are intended for sheep, it is not an object of very great moment to sow only the finer sorts of grass, because close feeding will, after the first year, make any kind fine, sweet, and productive. It is to this close feeding, or preventing the seeds from growing up and ripening, that the Wiltshire downs are indebted for the *sweetness of their bite*: for, as it has been judiciously remarked, this depends more on the grass being kept close and eaten as soon as it shoots, than on any peculiar good quality of the herbage itself; there being many downs that, when closely fed, appear to be sweet pasture, but if suffered to run one or two years without being fully stocked, become so coarse that sheep will almost prefer starving to eating such grass.[1] Mr. Young, jun., had two hundred acres of land under his management, laid down chiefly for sheep, the fields of which he stocked so early in the spring, and so thickly, as just to keep down the seed stems; by which arrangement the cock's-foot, oat-grass, and Yorkshire white, proved sweet-feeding grasses, that were not rejected even where the flock had a choice.[2] It would seem, however, that where a field has been long pastured in this way with sheep, and closely fed, it should never be converted into a meadow or mown for hay, for the plants, by being constantly cropped down, do not acquire any considerable bulk or weight, however quick their growth may be in that early stage.

In addition to the intimations that have already been given on this subject, we would observe, that from the latter part of March to the close of April or early in May, the pasture lands in the warmer districts of the southern counties will be found beneficial and profitable, in proportion as the season is more or less backward;

[1] Agricultural Survey of Wiltshire, p. 18.
[2] Communications to the Board of Agriculture, vol. iii. p. 151.

but in such as are situated further north, the turning of cattle into the pasture may be delayed for one or two weeks, or even longer with considerable advantage. The cattle will eat off the central stems of the grass-plants, in consequence of which new leaves will be produced around the first joint of the stem thus grazed; and as this management is equally applicable to meadows, a more abundant crop of hay will be produced.

Grass lands may be much improved, both in the quality and amount of herbage, by cutting them three or four inches deep, with either a fine coulter-cutting plough, or the common scarifier, already described. The surface is thus divided into slips of a few inches asunder, but without being either raised or turned. Manure being at the same time laid upon the land, is carried down by these incisions to the roots of the plants, and thus supplies them with immediate nourishment. Nor is it merely in this application of manure that the advantage consists: it loosens the moss-bound sward, and by dividing the roots of grass, occasions them to throw out new shoots, by which the herbage is not only increased, but rendered most succulent and palatable to cattle. It is one of the most valuable means we have of improving exhausted pasture land without breaking it up. The operation should be performed early in the spring, when vegetation is just commencing, and when the soil is dry, and in the following manner:—

The grass having been previously close-fed, the shares of the scarifier should be set at such a distance as the state of the land may appear to require. The more dressing it demands the closer they should be placed. The field should first be cut lengthwise, and, if very poor, also across, so that the sward may be divided into squares. Such grass seeds as are most appropriate to the soil, or appear to flourish best in the locality, should then be scattered while the incisions are fresh; after this the top-dressing should be applied, and the field well bush-harrowed and rolled. If sheep are afterwards folded on it, the amelioration will be complete.

Bush-harrowing and rolling should never be omitted in the spring; and they are at all times useful after cattle have been removed. The former spreads the manure; and the latter, by compressing the roots of the grass, occasions it to acquire a thicker bottom.

There are, however, two seasons of the year when the close-cropping of young grass has been found prejudicial, viz., early in the spring and late in the autumn. A writer of the first authority on this subject remarks—'That where a given space of the same species of grass was cut close to the roots towards the end of March, and another space left uncropped until the last week in April, the produce of each space being afterwards taken at three different cuttings, the produce of the space that was left uncut until the latter end of April exceeded that of the early-cropped space, in the proportion of 3 to 2; and in one instance, during a dry summer, the last cropped space afforded a produce superior to that of the early-cropped space as 2 to 1.'[1] Depasturing during the first year is also prejudicial; for though sheep are considered useful, and actually are so to old sward, yet they crop the seedling plants too closely. A better plan is to roll frequently, and mow; and as the young plants will be deprived of the benefit of the sheep dung, a good top-dressing should be supplied, and, with it, another portion of seed sown, the whole being rolled closely to the roots of the plants.

Valuable as our pasture lands undoubtedly are at all times, and especially where feeding and grazing is more profitable than raising grain crops, it is astonishing how few have been the experiments made with a view to improve them. One of the most efficient means of regenerating poor pastures is draining. Harrowing, too, has an excellent effect on hide-bound or mossy land; ameliorations of clay benefit sandy and peaty soils; composts, liquid manures, wood ashes, soot, bones, salt, nitrate of soda, guano, chalk, and lime, are all excellent as top-dressings for different soil; sea-sand, too, has been applied with advantage; and there are few localities where irrigation will not be found highly beneficial. But, in endeavouring to improve pasture lands, the nature of the soil must be first of all ascertained, if we would apply to it that manure which will act most efficiently on its component parts; and in sowing grass land those grasses should chiefly be selected which observation shows us flourish most abundantly on soils or in localities such as we have to deal with. It seems an invidious task—but we have no desire to do otherwise than add to the value of our work—to name two or three out of so many, all equally worthy of the distinction, if distinction it be—but a choice must be made, where choice is so varied and extensive, and space at the same time so limited—but we may name the Messrs. Sutton & Sons, of Reading, the Messrs. Wheeler, of Gloucester, as having specially devoted their attention to the improvement of pasture lands by seeding according to soil, climate, and locality. A trio may be made by adding the name of the Lawson Seed and Manure Company, Limited, successors to Messrs. Peter Lawson & Sons, the head of which firm did a vast deal to improve agriculture, and in a way not yet acknowledged, and in fact by many not known.

[1] Sinclair's *Hortus. Gram. Woburn.* p. 389, 8vo. 3rd Edit.

CHAPTER IV.

ON MEADOW LAND.

UNDER this head are included those grass lands that, lying for the most part in low or moist situations, are reserved chiefly for the making of hay. There is sometimes, however, great difficulty in determining what species of land is fit for grass, and what for the plough. The best meadow land does not always make the best tillage land, nor does the best arable produce the best pasture; but frequently the reverse.

The lands that are most proper to remain in grass, and which, if in a state of tillage, ought to be converted into meadow, are the following, viz. :—

1. Lands in the vicinity of large and populous towns, where manure is cheap and plentiful, and where the produce of grass land is always in demand, and consequently dear.

2. Lands situated near rivers or brooks, which are capable of being improved by irrigation to a greater value than can be effected under any other mode of culture.

3. Lands lying in the valleys of mountainous countries, particularly calcareous soils, where old meadow land is scarce and valuable.

4. All cold, strong, grass lands, which if ploughed up, would be inapplicable to the growth of turnips, and to the general purposes of modern husbandry, and which, under the best systems of wheat tillage, would not be so valuable as in their natural state of grass.

5. Peaty soils are also best adapted to the purpose of yielding grass; for although they may be most perfectly reclaimed from producing rank aquatic plants by tillage, yet, being too tender and moist to continue long in an arable state, they should be converted into that of permanent grass land as soon as it can be accomplished.[1]

It should be observed, that land intended for grass ought to be that in which it will spontaneously thrive and flourish; where there is too much moisture the grass will be injured in the winter by rain and frost, and will soon become superseded by rushes, and other aquatic plants, unless an effective system of drainage be established; and, on the other hand, if the soil is too dry, the grasses will be killed by the intense heat of the summer, and succeeded by mosses, fern, and heath, unless we can apply irrigation

[1] See Communications to the Board of Agriculture, vol. iii. pp. 79, 80, &c.

to it. It might be supposed that this could be remedied by sowing such land with better grasses, and to a certain extent this may be done; but experience has proved that all land has a tendency to reproduce those plants which are indigenous to the soil, and that, after a few years, varying according to the care and attention that have been bestowed on the cultivation, the natural productions will supersede those which have been artificially sown. This is one of the strongest reasons why sound old meadow land of a rich quality should never be broken up without the most mature consideration; and to reproduce it, from land newly laid down, is one of the most difficult and uncertain operations of husbandry.

No land will make a good meadow unless the soil is sufficiently deep to allow the roots of the grasses to run out of the reach of the summer heat, and sufficiently retentive to hold water long enough to contribute to the growth of the plant, and possesses such an absorbent substratum as will drain away the moisture before putrefaction takes place. None but land of this description, therefore, should be laid down to grass, unless lime, clay, chalk, marl, or other fossil manures can be procured on or near the spot and in sufficient quantities to render soils of opposite qualities retentive.

Besides these considerations, there are other circumstances of very material importance in the laying down of lands for meadow pastures. In fact, whoever examines the composition even of our best pastures, will find them—with the exception of such as have been recently laid down with rye grass or clover—full of an indiscriminate mixture of plants, some of which afford good, and others bad food; some good crops, and others scarcely any crops at all. The following principles will, therefore, be found worthy of every person's notice who designs to lay down land for grass:—

1. A perfect acquaintance with the best *natural grasses*, their *peculiar soils*, and the best mode of collecting the grass or the seeds.

2. Attention to *early growth* is of equal moment, especially as, from a variety of unforeseen accidents, the most careful farmer may not always have a stock of food adequate to the consumption of his cattle. The variation of climate will often produce considerable variation in the forwardness or the backwardness of grass crops. Hence the necessity of having enclosures that are warmly situated, not too humid, of a moderate size, and well sheltered, will be more clearly obvious; for then the ill effects resulting from severe winters, or the prevalence of north-easterly winds during the spring, will be in some measure counteracted. The early grasses appear to be most coveted by cattle, and they will naturally thrive best on that which is most agreeable to their

palate; so that, an early bite, and an early hay-making and hay-harvest, and the consequent early use of the after-grass, or rowen, are very important objects to the farmer.

3. An acquaintance with the *peculiar soils*, and relative hardiness of grasses, is another requisite, without which no good meadow can be formed; and this can only be derived from actual experiment. Some grasses are less able to endure moisture than others, and of course flourish best in dry and upland situations; while others are totally unfit for dry soils, but vegetate luxuriantly in *moist* lands; and a third class is only fit for the most *barren* lands, and such as are unable to support any other kinds of grass. Of the *first* description are the smooth-stalked poa, or smooth-stalked meadow-grass, sainfoin, &c. Of the *second* are the rough-stalked poa or meadow-grass, the flote fox-tail and flote-fescue, water-poa or meadow-grass, &c.; and to the *third* belong the sheep's fescue, the hard fescue, &c. There are likewise numerous grasses that will flourish in almost every soil, except the extremes of wet and dry, and which it is unnecessary here to specify, as they will be detailed in a subsequent chapter.

4. With regard to the procuring of good seed, considerable difficulty has prevailed, from the frauds practised by mercenary individuals, who often mix seeds of nearly the same size, but gathered from various plants, in order to save time and trouble in separating them. Speaking of *separated grass seeds*, Mr. Young, who was determined to have them perfectly free from all mixture, observes, that he found it cheaper to have them gathered by the hand, by women and children, than to raise them himself. He states,[1] that he has had large quantities of cock's-foot and tall oat-grass gathered at four shillings per bushel, and the crested dog's-tail at a shilling a pound.[2] Where, however, a farmer is desirous of obtaining pure seed for his pastures and meadows, and can command the necessary time for raising a supply of seed for future use, he may profitably avail himself of the following directions, given for this purpose by the late Mr. Curtis.[3]

'If a piece of ground can be had, that is neither very moist nor very dry, it will answer for several sorts of seeds and they may be sown on one spot; but if such a piece cannot be obtained, they must be sown on separate spots, according to their respective qualities, no matter whether in a garden, a nursery, or a field, provided it be well secured and clean. Dig up the ground, level and rake it, then sow each kind of seed thinly in a separate row, each row about a foot apart, and cover them over lightly with the earth. The latter end of August or beginning of September will be the

[1] Farm. Cal., p. 242.
[2] See a previous note at end of Chap. iii.
[3] Practical Observations on British Grasses, p. 31.

most proper time for this business. If the weather be not uncommonly dry the seeds will quickly vegetate, and the only attention they will require will be to be carefully weeded. In about a fortnight from their coming up, such of the plants as grow thickly together may be thinned, and those which are taken up transplanted, so as to make more rows of the same grass.

'If the winter should be very severe, though natives, as seedlings they may receive injury; therefore it will not be amiss to protect them with mats, fern, or by some other contrivance.

'Advantage should be taken of the first dry weather in the spring to roll or tread them down, in order to fasten their roots in the earth, which the frost generally loosens; care must still be taken to keep them perfectly clear from weeds. As the spring advances, many of them will throw up their flowering stems, and some of them will continue to do so all the summer. As the seed in each spike or panicle ripens, it must be very carefully gathered, and sown in the autumn, at which time the roots of the original plants, which will now bear separating, should be divided and transplanted, so as to form more rows; the roots of the smooth-stalked meadow grass, in particular, creeping like couch-grass, may readily be increased in this way; and thus, by degrees, a large plantation of these grasses may be formed, and much seed collected.'

In laying down lands to grass, the most important primary object is duly to prepare them for the reception of the seed. Hence the soil should be previously brought into the highest possible degree of cultivation; for although land may be too rich for the production of corn, and of such crops as are raised for the seed, it is quite different in the case of grass or other crops, where the object in view is the largeness and luxuriance of the plants. The richness of the soil is, in this case, a most important consideration; because the richer and more fertile it is made, the more abundant crops will it produce, and the larger is the stock of cattle that it will support; whereas the contrary effects must result from laying down to grass either poor land, or such as has been impoverished by successive exhausting crops.

On account of the minuteness of the seeds, and the generally fibrous nature of the roots of grass-plants, it is also essentially requisite to the formation of a good meadow, that the ground should be previously brought into the highest possible degree of pulverization; otherwise the irregularity of the surface will not only occasion irregularity in the produce of the grass, to the great injury of the crop, but will likewise be found highly inconvenient when the meadow is mown. This may be effected in various ways, according to the nature of the different soils: either by frequent ploughing and harrowing, or, on lighter soils, by the rearing of turnips, potatoes, tares, and other fallow crops, which, by the shade they afford, as well as the culture they require during their growth, are calculated to reduce the ground to a friable state.

On the breaking up of old worn-out pastures and meadow land for the purpose of relaying, and the best mode of cropping them, some excellent remarks have been lately given by Mr. Homer of Martinstown, before the Dorchester Farmers' Club, which we here reproduce:—

'There are two modes of breaking unencumbered land—first, that of paring and burning the sward; and secondly, that of ploughing the land, and allowing the sward to rot. The former will make the quickest return, as the greater part of the vegetable substances will be converted to ashes, which will act powerfully on the land, and generally produce a great weight of roots, and is usually followed by a good crop of corn. Nevertheless, I consider the second system, viz., that of breaking with the plough and rotting the sward, to be more (better) husbanding of the producing qualities of the land, and therefore in my estimation it is the best. I know I shall be told that the wireworm is more prevalent under this mode of treatment than the other. I admit that it is so at first; but experience has shown me that, after the first rotation of cropping, land which has been pared and burnt is more subject to their ravages than the other. We have, however, in the Crosskill and Cambridge rollers, powerful enemies to wireworm, and those implements, properly applied, will in a great measure overcome the difficulty. I will now state to you the system of cropping and management which I found to answer best in the first five years after breaking unencumbered land. Plough the land as deeply as it will bear in February, or the first week in March, using the skim coulter, the land-presser closely following the ploughs. Early autumn or winter ploughing will not do if it is to be sown to spring corn, as the decomposition of the sward will be going on at the time the corn is sown, and it will then be impossible to prevent the land becoming loose and spongy while the plant is growing; consequently there will be a great loss of plant, and the crop will be almost a failure; but when the land is ploughed early in the spring, decomposition does not take place to any great extent until the following winter, and you thus keep it firm while your first crop is growing. Sow five bushels of oats per acre with the broadcast machine, the harrows following as many times in a place as may be required; put on the Cambridge or Crosskill roller, and cross off with the harrows; finally, go over it with the roller. By adopting this management, the oats will have a firm soil to grow in, and in general will produce a good crop. If the land is not to be chalked the following winter, I should recommend sowing one bushel and a half of mixed rye-grass and trefoil before the last harrowing. The land will be paying something in feed for sheep during the autumn and spring months following, as the land must not be ploughed again before May, otherwise the sward, not being sufficiently decayed, will cause unnecessary labour in the cultivation for turnips. In the second year plough, as I said before in May, the same depth as before, and across the first ploughing, put on heavy drag, roller, and harrows at different times until the land is firm, and in good tilth for turnips. Sow about the middle of June to autumn, turnips or rape, as wanted for feeding purposes, using two cwt. of superphosphate and one cwt. of guano per acre, mixed with ashes or compost. This will produce a weight of roots in almost any season, as the change is so great on new land. If the field is large, I should recommend that the turnips be sown at different times, so as to come to feed in rotation, as turnips, when ripe, will not keep sound on new land as well as on old. Third year, wheat. As fast as the turnips are fed off, and while the manure left by the sheep is fresh on the ground, sow wheat with the broadcast machine, and plough it in to about half the depth the land was ploughed at first, leaving a firm bottom for the roots of the plant, which will prevent the wheat from becoming weak in the straw and lodged. If drilling be preferred, the land should be ploughed very shallow. I have found nursery wheat to answer much the best on new land, as it will plant thick, and is less subject to blight. In the spring of the year, as soon as the land is fit, sow the grass seeds; harrow and roll them in. Those I should recommend would be 1 bushel of rye-grass, 12 lbs. of trefoil, and 5 lbs. of Dutch per acre. In the fourth and fifth years the land will be in grass, which may be either fed or mown for hay; but in the last winter it should have a good dressing of farmyard manure before the ploughing for oats. If the land be pared and burnt, I should recommend the same course of cropping, with this exception, that you take the turnip and wheat crops in the first and second years, and the oats in the fifth, after the two years' ley. In both cases the five-field system may be adopted in the same rotation, the advantages from which are, that the land, which is in general of a light nature, will bear the best wheat after turnips, as it is then firm from the recent feeding off the root crop with sheep; whereas, if it were sown to wheat after ley, it is often lifted by the frost, and thus loses plant, which is not the case when sown to oats in the spring. Another advantage of this five-field system will be the getting of six months more sheep-keep on the old ley. In general, new land requires chalking, as it will make it more solid, sweeten the green crops, and make them more healthy feeding for sheep. I have found about 2,000 bushels of chalk per acre to be the best quantity; and this, if it can be obtained in the same field at proper distances, and is wheeled out by manual labour, will cost about 40s. per acre.'

CHAPTER V.

ON THE CULTURE OF GRASS LAND.

THE quality of the land intended to be laid down to grass having been ascertained, it becomes important to select the plants which are most congenial to the soil, and to sow their seeds in such proportions as may be most likely to produce a close sward and succulent pasture. Professor Buckman's—a celebrated authority on grasses—remarks on these points, as given in the 'Mark Lane Express,' will be useful here.

'We will suppose,' says the Professor, 'that we are going to lay down a certain amount of land now in arable, for what we call permanent pasture; and as the management of these will include that of even old meadows, we shall at once give an account of the allocation of grasses and other plants, which we should lay down in the former position, simply remarking that we have chosen our specimens upon the principle that they will be found to include the best portions of the pastures in the positions indicated, so that while they show what to lay down on the one hand, they also acquaint us with what nature had provided on the other.

'In conformity with this view, then, we offer mixtures for the following positions:—

1st. Rich deep loamy, or best meadow land.
2nd. Light lowlands.
3rd. Uplands.
4th. Irrigation meadow.
5th. Green glades between trees.
6th. Cricket-grounds or lawns.

'Now, in offering lists it must be premised that we leave the quantity of each to be determined according to skill and judgment; so also, as it will be impossible to prescribe accurately for intermediate cases, these two points being duly attended to, must be left to the skill of the farmer or his adviser; and we would state as a precaution, whatever your admixture, get the seeds in separate parcels, and mix them yourself; and if you can have each sample well examined to test its goodness and purity, so much the better. Of course we know that more money must be paid for seed so purchased, ostensibly for the packages being many instead of one. But were this all a few more pence would suffice; but it will be found that much more will be charged than that of a fair equivalent for extra labour. Something must be allowed for extra quality, and the fact of getting the quantity of each, instead of a make-up with mixed sweepings and old rubbish.'

Mixture for Deep Loams.

Lolium perenne	Phleum pratense
Dactylis glomerata	Anthoxanthum odoratum
Poa pratensis	Trifolium pratense
Festuca pratensis	Trifolium repens
This will not take on the reed-fescue form in rich soils.	Achillæa Millefolium

For Uplands.

Lolium perenne	Festuca ovina
Poa pratensis	Anthoxanthum odoratum
Avena pubescens	Trifolium repens
flavescens	pratense
If on limestone these will both do well.	Onobrychis sativa
	Achillæa Millefolium

For Irrigation Meadow.

Alopecurus pratensis	Lolium perenne
Poa pratensis	Festuca loliacea
Agrostis stolonifera	duriuscula
This grass becomes good by the action of water.	Anthoxanthum odoratum

Cricket-grounds, Lawns, &c.

Lolium perenne	Festuca ovina
Poa pratensis	Festuca duriuscula
Cynosurus cristatus	*One or both: the former if upland, the latter in good land.*

Now, the smallness of the number of grasses recommended, and yet the different allocation of them for diverse positions, is very striking. The cultivative process will involve, amongst others, the following:

1. Draining.

2. Sow, in the spring, on land prepared with a previous potato crop, to get it into fine tilth, and not with barley or wheat, as that draws up the young grass, and starts it with a weakened and poor constitution.

3. Only lightly harrow after sowing, as the shallower grass seed can be sown the better.

4. Roll even and smoothly with the common cylindrical roller.

5. Weed out all objectionable plants, and never let them seed; a little trouble in this respect, the first year or two, is of the utmost importance.

6. The following spring roll again.

7. Afterwards bush-harrow.

8. Depasture slightly.

9. The following spring the same process; but previous to bush-harrowing apply a light dressing of a mixture of soot, old mortar, or road scrapings from a limestone-made road: this to strengthen, but not to force growth too much; while the soot also kills insects of several kinds.

10. Towards winter, well spread all droppings, skim over brown lumps of tussacs, leaving the bents to decay on the land, as also, if any should seed, the seed to grow.

11. Whenever the first crop of hay be taken it should be cut as soon as in flower; greediness in this respect being the inevitable cause of great deterioration in a pasture.

The following are the recommendations of the Rev. Arthur Young, son of the veteran agriculturist, as to the laying down of grass lands. He divides the soil as follows:—

CLAY.	LOAM.	SAND.	CHALK.	PEAT.
Cow-grass	White clover	White clover	Yarrow	White clover
Rough cock's-foot.	Italian rye-grass	Ray	Burnet	Dog's-tail
Meadow fox-tail	Yorksh. white	Yorksh. white	Trefoil	Cock's-foot
Meadow-fescue	Fescue	Yarrow	White clover	Rib
Oat-grass	Fox-tail	Burnet	Sainfoin	Yorksh. white
White clover	Dog's-tail	Trefoil		Ray
Italian rye-grass	Poa	Rib		Fox-tail
Timothy-grass	Timothy			Fescue
	Yarrow			Timothy
	Lucerne			

In regard to the quantity per acre of these seeds, the proportion must necessarily depend both on the peculiar nature of each variety of these grasses, and also on the means of procuring the seeds, of which it is sometimes difficult to obtain a sufficient quantity. In the latter case the farmer must be content with what he can procure. Of the plants above enumerated, the following quantities may be safely recommended:—

I.—CLAY.

SEEDS.		SUBSTITUTES.	
Cow-grass	6 lbs.	Yorkshire white	2 bush.
Trefoil	5 ,,	Timothy	3 lbs.
Dog's-tail	10 ,,	Ditto 4 lbs or Yorkshire white 1 bush.[1]	
Fescue, Fox-tail	1 bush.		

[1] Communications to the Board of Agriculture, vol. iii. p. 150.

The difference between the various quantities required or substituted is very remarkable. In addition to those above-named, the intelligent steward of Sir James Graham, at Netherby, uses Pacey's rye-grass and cock's-foot, which he also employs on light lands.[1]

II.—LOAM.

SEEDS.		SUBSTITUTES.	
White clover	5 lbs.	Ray	1 peck
Dog's-tail	10 ,,	Rib-grass	4 lbs.
Ray	1 peck.		
Fescue	3 pecks.	Yorkshire white	2 pecks.
Fox-tail	3 ,,	Timothy	4 lbs.
Yarrow	2 ,,	Cow-grass	5 ,,

On loams that lie on a substratum of *stone-brash* (of which description are almost the whole of the Cotswold Hills, and a great part of the counties of Gloucester, Somerset, Warwick, and Wilts), Mr. Davis[2] recommends the following quantities to be sown per acre, after marling in July, viz.:—

Ray-grass	1 bushel
Marl, or cow-grass	10 lbs.
White, or Dutch clover	3 ,,
Trefoil, or hop-clover	1 lb.

All dry soils, however (and it should be recollected that *loam* includes every species of soil except clay, peat, and sand), Sir John Sinclair[3] thinks, may have from two to four pounds of hop or yellow clover, in addition to four pounds of white, and from four to six pounds of marl-grass, or of perennial clover, per acre; and he gives the following plan, as recommended by Dr. Bridge, a respectable farmer in Dorsetshire, for laying down lands for permanent pasture, namely:—To sow marl or cow-grass, hop or yellow clover, and white clover, in the proportion of from six to seven pounds of each, with one bushel of the best Devonshire rye-grass; 'by which means there is a perpetual feed for five or six years.' The hop-clover and rye flourish early in the spring; the marl-grass is in perfection in July, when the other goes off, and the white clover is not in perfection until August, but continues during the remainder of the season. In some meadows of very rich soil, it is suggested that lucerne should be preferred. It would be of considerable importance to ascertain the extent to which the culture of that plant could be carried.

III. SAND

SEEDS.		SUBSTITUTES.	
White clover	7 lbs.		
Trefoil	5 ,,		
Burnet	6 ,,		
Ray	1 peck.	Grass-seeds	2 bushels.
Yarrow	1 bushel.	Rib	4 lbs.

[1] Library of Useful Knowledge; Farmer's Series, No. 12.
[2] Communications, vol. iii. p. 90.
[3] Ibid. p. 10.

Mr. Greenall strongly recommends the following proportions for soils of a sandy nature, and which he has always found to answer, viz., white clover and trefoil, of each five pounds; ray-grass and the best grass seeds (the last collected as they fall from the hay), of each one bushel to the statute acre.[1] There is, however, this great objection to the common practice of sowing hay-seeds indiscriminately—that, besides the impossibility of forming a judicious selection of those most appropriate to the soil, the seeds of weeds are unavoidably propagated.

IV.—CHALK.

SEEDS.		SUBSTITUTES.	
Burnet	10 lbs.		
Trefoil	5 „		
White clover	„		
Yarrow	1 bushel.	Ray	1 bushel.[2]

For these soils Mr. Boys, of Betshanger, in Kent, advises four bushels of grass-seed, from an old pasture, to be sown with eight pounds of rib-grass; white clover and cow-grass seeds, of each four pounds, and a similar quantity of yellow trefoil: which proportions will be sufficient for an acre of land.

V.—PEATY SOILS.[3]

SEEDS.		SUBSTITUTES.	
White clover	10 lbs.		
Dog's tail	10 „	Yorkshire white	6 pecks.
Ray	1 peck.		
Fox-tail	2 pecks.	Rib-grass	5 lbs.
Fescue	2 „	Cow-grass	4 „
Timothy	1 peck.		

Although the preceding assortment of seeds, adapted to the nature of different soils, may appear sufficiently full and diversified to render any further details on this head unnecessary, yet, as it is a matter of fundamental importance to have seed apportioned to every possible variety of soils, particularly in returning tillage land back again to grass, the following additional remarks, by Mr. Tollet, on this subject, may not be out of place.

Conceiving the degrees of moisture or dryness, rather than the component materials of the land, to be the leading characteristics that should determine us in the choice of seeds for future pasture, Mr. Tollet divides the different soils into the four following classes, and specifies the relative proportions of seed best calculated in his opinion for each acre.[4]

I. UPLANDS, or such dry and light soils as are adapted to the growth of turnips.

[1] Communications, vol. iii. p. 283.
[2] Ibid. p. 151.
[3] Young, Communications, vol. iii. p. 151.
[4] Ibid. p. 439.

Smooth-stalked poa, or meadow grass	6 quarts.	Vernal-grass	1 quart.
Ray-grass	4 „	Marl-grass	3 quarts.
Crested dog's-tail	6 „	White clover	2 „
Yellow oat-grass	4 „	Rib-grass	2 „
Cock's-foot	2 „	Yarrow	2 „

to be sown with barley. On this, however, it may be remarked, that although barley is the least prejudicial grain for sowing with grasses intended for permanent pasture, yet the practice of sowing any kind of grain along with grass-seeds is not to be recommended. For sandy loams, two quarts of meadow-fescue may be added.

On calcareous, hilly soils, sainfoin should be substituted for the four last plants; and, as the soil approaches to a pure chalk, the sainfoin should be gradually increased, to the exclusion of the rest.

II. Midlands, or such soils as are too moist for the turnip husbandry are, by Mr. Tollet, subdivided into the three following classes, for which he proposes the respective quantities of seed annexed:—

1st Class includes the driest in point of soil and situation, of which description are those clayey loams that approach to the nature of turnip-land.

Meadow-fescue	8 quarts.	Vernal-grass	1 quart.
Smooth-stalked poa	6 „	Marl-grass	3 quarts.
Ray-grass	4 „	White clover	2 „
Crested dog's-tail	4 „	Rib-grass	4 „
Cock's-foot dactylis	2 „	Yarrow	2 „

2nd Class comprises such lands as, from their situations, are higher, though the soil is retentive of moisture.

Meadow-fescue	6 quarts.	Vernal-grass	1 quart.
Meadow-foxtail	4 „	Marl-grass	3 quarts.
Smooth-stalked poa	4 „	White clover	2 „
Ray-grass	2 „	Rib-grass	4 „
Crested dog's-tail[1]	2 „	Yarrow	2 „
Cock's-foot dactylis	2 „		

3rd Class contains those lands which, from soil and situation, though sound, are of a moister nature.

Meadow fox-tail	6 quarts.	Vernal-grass	1 quart.
Rough-stalked poa	6 „	Marl-grass	3 quarts.
Meadow-fescue	6 „	White clover	2 „
Smooth-stalked poa	4 „	Rib-grass	2 „
Ray-grass	2 „	Yarrow	2 „

It is impossible to give general rules for every variety of soil

[1] We apprehend this is the quantity intended, though none is specified in Mr. Tollet's memoir.

and situation; a little practice will, however, sufficiently regulate the proper habitation of each plant; after having cultivated them a short time, the farmer will know the meadow fox-tail, the meadow-fescue, and the poas, as well as he knows the ray-grass, and, by observing where they grow naturally, he will have a certain indication of the soil best suited to them.

III. Lowlands comprise such lands as are occasionally overflowed by rivers or brooks, and from which we derive our greatest crops of hay; because 'their natural moisture is propitious to the growth of our best grasses, and the sediment of the inundations operates as a constant manure.' If it is intended to clean the meadow of all improper and noxious plants, the turf, early in the spring, should be lightly ploughed up, and afterwards cross-ploughed, dragged, and harrowed in dry weather, until the whole of the plants are killed, and the ground becomes perfectly fine and level. With the first showers in August, it should be sown with the following grasses:—

Meadow fox-tail .	2 pecks.	Vernal-grass	1 quart.
Meadow-fescue .	2 „	White clover . .	2 quarts
Rough-stalked poa	2 „	Marl-grass . .	2 „
Ray-grass .	2 „	Rib-grass . .	2 „

The foregoing mixture is adapted to the *soundest meadow land*, where the floods are drained off; but, where the water lies longer, the composition should be as follows:—

Rough-stalked poa .	2 pecks.	Flote-fox-tail .	4 quarts.
Meadow fox-tail .	2 „	Flote-fescue . .	3 „
Meadow-fescue	2 „		

And for situations still more wet the following:—

Rough-stalked poa .	2 pecks.	Flote-fox-tail	1 peck.
Meadow fox-tail	2 „	Flote-fescue .	1 „

IV. Fens include such unsound lands as have, by a certain degree of draining, become capable of some cultivation, whether they are fens, properly speaking, or morasses, or peat bogs.

In the first stage of the improvement of *fenny lands* and *morasses*, the water poa is the best plant to be cultivated, and the great service which it renders in its spontaneous growth will be hereafter shown. Mr. Tollet says that he has never heard of its having been cultivated from seed; but there is every reason to conclude, that in situations resembling its native haunts, it might be introduced with much advantage. He directs that the land intended to be sown with it should be breast-ploughed, in April, May, or June, as the weather may permit, and the turf burned. If the land in a favourable season will bear the plough, it should afterwards be ploughed and cross-ploughed, well dragged and harrowed, and the seed sown in August. If the land is very tender it would be better to breast-plough and burn it in the middle of summer, to sow the seed in August, and to cover it as well as can in that case be done, by men drawing light harrows over it, and afterwards bush-harrowing. Upon land a degree more sound than the former, and subject to less violent inundations, the flote-fox-tail and the flote-fescue will be the proper plants; and, in a more improved state, the fiorin.

The land should be prepared for them as before directed, and they should be sown in August, at the rate of one bushel of seed of each per acre.

On lands still more sound, and approaching to the moister meadows, Mr. Tollet recommends the rough-stalked poa to be added, sowing equal proportions of each, at the rate, in the whole, of two bushels per acre. However, on lands like these, a more eligible mode of cultivating the plants suited to them would be, to set them at the distance of eight inches from each other. The land should be prepared by breast-ploughing, burning, &c., as before. The young plants having been raised from seed sown in the preceding August, should be taken up, divided, and set at the distance before directed as soon as the season will permit, after the ground is prepared for their reception.

The first rains after midsummer will probably afford an eligible opportunity. The distance between the plants will enable the hoe to be used in order to keep them free from weeds. This should be attended to the first autumn and the following spring. The process will entail a certain amount of expense, but it would occur once only, and create a valuable and durable pasture.

Peat bogs, or *mosses*, in favourable situations, admit of very great improvements. These lands, consisting almost entirely of decayed vegetable matter, require the stimulating aid of some alkaline substance, and with this they are capable of being brought to a high state of fertility. When thoroughly drained, the first step should be, to pare and burn the peat in considerable quantities; after which the land should be set with potatoes. This, with the draining, will allow it time to settle.

As soon as it will bear the team, the first opportunity should be taken of giving it a plentiful top-dressing of marl, where that can be procured easily; and then, after a light ploughing, the ground should be sown with oats and proper grass-seeds. In the following winter, or early in the spring, a good top-dressing of marl should again be applied; and thus lands of this nature may be converted into tolerably good pastures. If they could be irrigated, their value would be greatly increased; and if the water carried over them were impregnated with calcareous matter, they would become an artificial imitation of the famous Orcheston meadow, and rival it in produce.

Next to marl, lime is the proper agent to be employed;[1] but it should be always mixed with some kind of soil: clay is the best, in the proportion of one part of lime and two of the soil. Mr. Tollet would even use gravel rather than not mix it, as it tends to give a firmness and soundness to the surface.

The different degrees of moisture should regulate the choice of the plants, as before directed. Where the peat land is made thoroughly sound and marled, the plants recommended for meadows are proper to be cultivated thereon, adding, in all cases, a quart of the sweet-scented vernal-grass to the composition.

In moister situations, equal quantities of rough-stalked poa, flote-fox-tail, and flote-fescue, with two quarts of vernal grass, will be suitable; and in situations still more wet, a bushel of flote-fox-tail, and the like quantity of flote-fescue, with two quarts of vernal grass, will be the proper composition. These grow with such luxuriance, that in some meadows there is barely room, when it is made into hay, for the cocks to be arranged without touching each other.[2]

As a general rule for laying down *pasture* of *ordinary quality*, for the purpose of forming a good meadow—one greatly superior to the generality of pastures, and without reference to any particular soil—the late Mr. Curtis recommends the six following grasses, and two species of clover, to be mixed in these proportions:—

Meadow-fescue grass, one pint.	Crested dog's-tail, one fourth of a pint.
Meadow fox-tail grass, ditto	Sweet-scented spring-grass, ditto.
Rough-stalked meadow grass, half a pint.	White or Dutch clover, half a pint.
Smooth-stalked meadow grass, ditto.	Common or red clover, ditto.

(For wet land, the crested dog's-tail and smooth-stalked meadow, Mr. C. says, may be omitted, but especially the former.)

These are to be mixed together, and about three bushels of them sown on an acre, in rows, in order that they may be more conveniently hoed; in consequence of this they will vegetate with increased luxuriance. Towards the end of August, or early in September, Mr. Curtis states, that it will be necessary to weed and thin the grasses occasionally, and also to roll them in the spring; for by these means the roots, that may have been raised by the frost, will be pressed into the ground. For *moist lands*, he conceives the meadow fox-tail and meadow-fescue grasses are best adapted, as the smooth-stalked meadow and crested dog's-tail are for *dry pastures*; while the sweet-scented vernal-grass and meadow-fescue will suit land that is either moist or *moderately dry*. These plants being, for the most part, vigorous perennials, are not

[1] Where chalk is to be had, it will answer, if used in sufficient quantities, for every purpose of lime.

[2] Agricultural Survey of the County of Antrim, vol. i. p. 249.

liable to be overpowered by the spontaneous growth of coarse vegetables indigenous to such soils; and, if the land is previously cleansed from all weeds and noxious plants, the combination of grasses above specified will, in the course of two years, produce a most excellent turf.[1]

Having already adverted to the necessity of bringing grass lands into a fine pulverised state, we shall now only remark, that where a spring sowing takes place, with a crop of corn, the tillage should be conducted with more than common care. The land should be ploughed thrice, and afterwards harrowed, or scuffled and rolled, according to the nature of the soil; for, whatever that may be, the ground should be well reduced for grass-seeds. This, however, is not so necessary for an August sowing; because the time and season afford so ample an opportunity to prepare, that, if the first ploughing has been given in autumn, the most negligent farmer can scarcely find any other difficulty than what arises from an uncommonly wet season.

In order, however, completely to secure the formation of a good meadow, it is necessary that the seed be sown as early as possible after the soil has been ploughed, and with as much regularity and uniformity as is practicable. Uniformity of delivery is a point of the greatest consequence. In using these seeds, none of the lighter sorts of grass-seeds should ever be sown in windy weather, or in wet seasons, when poaching is likely to ensue. All grass-seeds should be covered in, by passing a very fine light pair of harrows once over them; and, where the soil is light or porous they may be rolled with advantage.

If these instructions are duly attended to, little apprehension need be entertained of a failure, although such an event may possibly take place in extremely unfavourable seasons. It will, however, rarely happen that more than one or two of these sorts of seed fail; and should this be so, or in any case of failure, fresh seeds must be sown in moist weather, during the spring.

CHAPTER VI.

ON HAY-MAKING.

IT is impossible to specify any precise period for cutting grass for hay, as so much depends upon its growth and maturity, or power of affording the best and most nourishing food, and the state of the weather. It is extremely detrimental to grass-crops to

[1] Practical Observations on British Grasses, 8vo. p. 33.

cut them too early, for then the sap has not properly circulated throughout the blade, and therefore when the grass is converted into hay, it will shrink, and be materially reduced in point of quantity. It will, however, receive equal injury, if it is allowed to stand until it sheds its seed. The best time, therefore, for mowing water meadows, is just when the herbage is about to come into flower; and with respect to other grass lands, this operation should be performed before the grass comes into full flower, and while the nutritive saccharine fluid is partly retained at the joints of the flower stems. In proportion as the flowers expand and the seeds ripen, the juice is taken up to form the meal or starch of the seed lobes, or it is dispersed by the winds, or fed upon by the birds. Another criterion for directing the farmer's opinion on this point, where grass is very thickly spread over the field, is afforded by the yellow hue which the lower parts of the blades assume just before the grass comes into full flower. In this case, also, it will be necessary to mow as speedily as possible, or it will be liable to rot, or at least to acquire an unpleasant flavour that will diminish its value. The quantity of the first produce may be increased by allowing the grass to perfect its seeds before it is cut, but the quality and goodness of it will be impaired, as will also the value of the after-math, which will generally receive much more injury than the additional quantity thus gained will atone for; besides the impoverishing effects of the plants on the soil, and the less palatable quality of the hay.[1]

The very early or rich meadows, and highly-manured upland pastures, in the neighbourhood of large towns and cities, are usually ready for mowing some time in June; and all the meadows and pastures which may not be cut in that month should be mown in July. In the act of mowing, the grand object is to have the grass cut as close to the ground as possible, and perfectly level, without, however, touching the necks of the plants, or injuring the sward. It is thought that grass will not thrive well that is not mown perfectly level and close; and the loss in the crop of hay is very considerable, for 'one inch at the bottom weighs more than several at the top;' and besides, it is more advantageous to the young shoots to cut the grass close, than it is to leave it long and uneven. While great care should be taken, in mowing, to cut the grass as close to the ground as possible, and perfectly level, the swathes should be pointed so as scarcely to leave any ridges under them. This operation (mowing) calls into action almost every muscle of the frame; it is, in fact, one of the most laborious of all the agricultural operations which the labourer is called on to perform. Mowing machines are now so thoroughly effective, do their work so cheaply—as compared with manual labour—and

[1] See Sinclair's *Hortus. Gram. Woburn.*, p. 214, third 8vo. edition.

cost comparatively so small a sum; that except in the case of very small occupations it is now scarcely excusable in a climate so uncertain as ours is if they be not used. And even, indeed, where small occupations are numerous, the letting or hiring out system is so universally adopted that there is now scarcely an excuse left for the farmer losing money and perhaps the chance of his hay crop by using manual labour.

In converting grass into hay, it is of essential importance to have a proper supply of hands ready for the work. In some districts, two or three, men or women, are reckoned to be sufficient to attend upon each mower, who, if he is an expert workman, and has the soil and crop favourable to his labour, can cut from three-quarters of an acre to one acre per day.

In the county of Middlesex the allowance is five haymakers, of both sexes, including loaders, pitchers, stackers, &c., to one mower. The making of hay has been there brought to a degree of perfection altogether unequalled in any other part of the kingdom.

As the method there pursued is little known beyond the boundaries of that county, we shall introduce, for the information of our readers, Mr. Middleton's interesting but singular account of it, contained in his 'Corrected Report of the Agriculture of Middlesex.'

'*First day.*—All the grass mown *before* nine o'clock in the morning is *tedded* (or spread), and great care taken thoroughly to shake every lump out of it, and to strew it evenly over all the ground. Soon afterwards it is turned, with the same degree of care and attention; and if, from the number of hands, they are able to turn the whole again, they do so, or at least as much of it as they can, until twelve or one o'clock, at which time they dine. The first thing to be done after dinner is to rake it into what are called single wind rows,[1] and the last operation of this day is to put it into grass-cocks.'

'*Second day.*—The business of this day commences with tedding all the grass that was mown the first day *after* nine o'clock, and all that was mown this day *before* nine o'clock. Next, the grass-cocks are to be well shaken out into staddles (or separate rows or patches) of five or six yards in diameter. If the crop should be so thin and light as to leave the spaces between these staddles rather large, such spaces must be immediately raked clean, and the rakings mixed with the other hay, in order to its all drying of a uniform colour.

'The next work is to turn the staddles, and after that, to turn the grass that was tedded in the first part of the morning once or

[1] That is, they all rake in such manner as that each person makes a separate row, and these are three or four feet apart.

twice in the manner described for the first day. This should all be done before twelve or one o'clock, so that the whole may lie to dry while the work-people are at dinner.

'After dinner, the first thing to be done is to rake the staddles into *double* wind-rows;[1] next, to rake the grass into *single* wind-rows; then the double wind-rows are put into bastard-cocks; and, lastly, the single wind-rows are put into grass-cocks. This completes the work of the second day.

'*Third day.*—The grass mown and not spread on the second day, and also that mown in the early part of this day, is first to be tedded in the morning; and then the grass-cocks are to be spread into staddles, as before, and the bastard-cocks into staddles of less extent. These lesser staddles, although last spread, are first turned; then those which were in grass-cocks; and next, the grass is turned once or twice before twelve or one o'clock, when the people go to dinner as usual. If the weather has proved sunny and fine, the hay, which was last night in bastard-cocks, will this afternoon be in a proper state to be carried;[2] but, if the weather should, on the contrary, have been cool and cloudy, no part of it, probably, will be fit to carry. In that case, the first thing set about after dinner is to rake that which was in grass-cocks last night into double wind-rows, and then the grass which was this morning spread from the swaths into single wind-rows. After this, the hay which was last night in bastard-cocks, is made up in full-sized cocks, and care taken to rake the hay up clean, and also to put the rakings on the top of each cock. Next, the double wind-rows are put into bastard-cocks, and the single wind-rows into grass-cocks, as on the preceding days.

'*Fourth day.*—The great cocks just mentioned will usually be ready to be carried before dinner, but this depends on the weather. The other operations of the day are similar, and occur in the same order, as before described, and are to be continued daily until the hay-harvest is completed.

'In the course of hay-making the grass should, as much as possible, be protected both day and night, against rain and dew, by cocking. Care should also be taken to proportion the number of hay-makers to that of the mowers, so that there may not be more grass in hand, at any one time, than can be fully managed. This proportion is usually about twenty hay-makers (of which number twelve may be women) to four mowers; the latter are, however, sometimes taken half a day to assist the former: in hot, windy, or

[1] In doing which, every two persons rake the hay in opposite directions, or towards each other, and by that means form a row between them of double the size of a single wind-row. These double wind-rows are about six or eight feet distant from each other.

[2] It seldom happens, in dry weather, but that it may be carried on the third day.

very drying weather, a greater proportion of hay-makers will be required than when the weather is cloudy and cool.

'It is particularly necessary to guard against spreading more hay than the number of hands can get into cocks the same day, or before rain. In showery and uncertain weather the grass may sometimes be suffered to lie three, four, or even five days in swath. But before it has laid long enough for the under side of the swath to become yellow (which will be the case if it is suffered to lie long), particular care should be taken to turn the swaths with the head of the rakes. In this case it will cure so much in about two days as only to require being tedded a few hours, when the weather is fine, previous to its being put together and carried. In this manner hay may be made and stacked at a small expense, and of a good colour; but the tops and bottoms of the grass will be insufficiently separated by it.

'The Middlesex farmers are desirous of preserving the green colour of their hay as much as possible, though a lightish brown is of no disservice to it. Hay of a deep brown colour, occasioned by its being heated too much in the stack, is said to weaken the horses that eat it, by promoting an excess of urine, and consequently always sells at a reduced price.

'In the making of hay much depends upon the quality of the soil, and the kind of herbage growing on it. The hard, benty hay of a poor soil being in little or no danger of firing in the stack, may, therefore, be put very early together, in order to promote a considerable perspiration, this being the only means of imparting such a flavour to this hay as will make it agreeable to horses and lean cattle. It will be almost unfit for every other sort of stock.

'It is the succulent herbage of rich land, or land highly manured, that is most likely to generate sufficient heat to burst into flame, as it sometimes does. Therefore the grass from such land should have more time allowed in making it into hay. The Middlesex farmers are perfectly aware of this; and when the weather proves moderately drying, they make most excellent hay: but when very hot, or scorching, they, as well as most other farmers under similar circumstances, are sometimes mistaken. In such weather the grass becomes crisp, and rustles, and handles like hay before the sap is really sufficiently dissipated to render it fit to put into the large stacks. Where that is done, when it is thus insufficiently made, it generally heats too much, sometimes becomes *mow-burnt*, and in other cases, although such are very rarely met with, spontaneous ignition takes place.' With the use of the mowing machine, the tedding or hay-making machine, and the horse-rake, the process of hay-making is wonderfully reduced in time, from at least to one half to one third, as compared with the old hand system.

It would be difficult to improve on this practice here detailed.

The following remarks by a 'Practical Farmer,' writing in the 'Mark Lane Express,' on making hay in *bad* weather, will be valuable here :—

'Under continuous rains, it is better to let the grass alone, and wait a more favourable season; but if already mown the difficulties are great, and it is almost impossible to prevent its receiving great injury, or in all probability from becoming entirely spoilt. The better practice in such a season is to let the grass lie untouched in swath as long as it does not manifest symptoms of rotting on the ground, or the grass is seen to grow through it. It is of no avail to shake or stir it about. The more it is exposed to rains and moisture, so as to be alternately wet and partially dry, the more it is injured, and in fact spoilt. Neither will it do to collect it in small, or what is commonly known as foot cocks, because it soon decays, and unless speedy intervals of favourable weather are experienced it becomes rotten, and is soon no better than straw or dung. The whole process is a choice of evils, and there is great difficulty in choosing the least. My own practice is to exercise great watchfulness, and to have at hand a sufficient staff of haymakers, who, when not engaged amongst the hay, are in the meantime hoeing and weeding potato and turnip crops, &c., and such other farm operations as may be necessary or desirable. As soon as the weather gives tokens of a respite, they are all brought to the hayfield, and a portion is shaken over, and made to dry as fast as possible. This is rolled up into hay-cocks large enough to require two men to turn them, and they are then trimmed and secured down, so as to shoot off the rains. At every interval of fine or windy weather they are turned over, and the wet portions are laid out to dry; the whole being again put together, trimmed down, and secured against the weather, as before, in accordance with our best judgment at the time. If only intervals of a few hours of fine weather are experienced, it may be very serviceable to turn over every hay-cock and re-trim it down, so as to prevent the rains from penetrating deeply into it. In this way it gives the small heap air, opens it out more to the wind, and thus prevents moulding or taint. I have known many fields of hay which have in reality by this means been converted from a steaming and tainted state into good hay. I am doing so now, and to-day (July 10) have through this process and the influence of a stiff breeze, restored to a satisfactory state about twenty acres of greatly-injured hay.

'In wet or mountain districts the process of hay-making is always a difficult one. The patience exercised is extraordinary —the speedy shaking after the mowers, the thousands of foot-cocks not bigger than mole-hills that are made, the early spreading these undergo every morning—and the constant watchfulness these haymakers exhibit is highly commendable; and, after all, the hay is none of the best, and has often to lie in cock for weeks before a favourable time for leading it appears. This is only the case generally this season; so we must exercise this commendable quality of patience, and wait our time, taking care to keep all as much as possible from rains and atmospheric influence after the like fashion, i.e. by making the innumerable small cocks we may have made into large ones to be closely "topped up," and raked down, so that they may shoot off the heaviest rains and defy the most boisterous winds; indeed they are frequently tied closely round with hay-bands made from the cock.

'A word or two about stacking hay when out of condition. In the first place the stack should be small, and likewise narrow in its proportions. Air-shafts should be also made from the bottom to the top; this is readily done by drawing up a skep or sack well stuffed, taking care to keep the hole perpendicular, otherwise when the stack settles it closes the hole. It is not desirable to salt the hay under such circumstances, as it only adds to the moisture: this application should only be made when the hay is almost burnt by a hot sun, or, at all events, exceedingly dry when carted. I think a few ounces of some aromatic seed occasionally scattered over as the stacking proceeds would be serviceable. Caraway-seed adds a pleasant flavour to the hay. I am making some to-day which has a satisfactory admixture grown with the grasses, and although the hay is considerably injured, it yet smells fragrantly, and I doubt not will lead to its economical consumption. I must again reiterate the often-told remark—"It is better to spoil in the field than in the stack."'

Before we dismiss this subject, we would call the attention of the farmer to some minutiæ of management that might otherwise possibly escape him, amid the multiplicity of his necessary engagements. His store-cattle should be turned into the meadow for a few days immediately after the hay is cleared out of it, in order 'to pick about the hedges,' as it is termed in West Devon, for the herbage which, though then succulent and edible to the store cattle, would, before the after-grass was ready to be pastured off, become unpalatable, and be altogether rejected by young cows or fatting stock, with fresh succulent herbage before them. Such cattle must not, however, be continued on the newly-mown land after they have effected the object for which they were placed there.

Various modes are practised in order to make the most of the AFTER-GRASS or *rowen*, *after-math* or *eddish*—for by all these names is the second crop designated—which is in much request for cows. In the vicinity of large towns, or where lambs are suckled to any great extent, it may be advantageous to take a second crop of hay, in the mowing of which, however, more attention is necessary than in the first, from the greater difficulty of cutting the grass crops, occasioned by their lightness. Hence, unless the mowers are very skilful, the scythe is apt to pass over the grass without fairly cutting it. The proper time for taking this second crop is, as soon as there is a sufficient length of rowen to cut; and the operation of mowing should be performed early in the morning, before the sun can have evaporated the dew. The subsequent business varies in no respect from that pursued in preparing the first crop of hay. Less time, however, will suffice: but rowen hay should be well made and preserved, otherwise it will become mildewed or mouldy, and be rejected by the cattle. The hay from the eddish or after-grass of water meadows is inferior to that of upland meadows; and the grass not having had sufficient sun or time to harden it, is soft and woolly, and *has no proof in it.* Cattle are fond of it, but will not thrive on it, and it is chiefly used for cows. On this account, therefore, it will be advisable to turn the neat cattle into the eddish of water meadows, and to retain the after-math of other grass lands for the trying season of spring; for when other kinds of fodder are scarce, the rowen will prove not only a most seasonable supply for ewes and lambs, but is said to be far preferable for them to turnips, cabbage, &c. The rowen is never so good as the first crop, either in quantity or quality; in addition to which, the late period of the season renders the preparation of it precarious and difficult. It is, therefore, good husbandry, except under the particular circumstances to which reference has been made, to pasture the after-math, and not to make it into hay. Low says, 'Wherever the system of cultivated grasses is perfectly understood, they will never be mown for hay more than once, and then the after-math used for herbage only.'

If after-grass is consumed in the usual way by feeding, and shortly after the fields are cleared of hay, or in autumn, its value will be small, unless in the case of water meadows, on account of the abundance of food usually prevailing at that season; but when kept for ewes and lambs, and other stock, in the depth of winter and the trying season of spring, when food is scarce, it becomes of the greatest value. Tolerable rowen will carry ten ewes and their lambs to an acre throughout the month of April, and will then be worth thirty or forty shillings; indeed, should the season prove backward, a farmer who is provided with it would not be tempted to dispose of it even for a larger sum. It would be well always to make as large a reserve as can possibly be spared, in order to meet any pressing contingencies.

Having stated in the preceding part of this work the most useful modes of consuming the after-grass, we have only to add a word or two as to the time proper for shutting it up for use during the following winter and spring. This depends on the character of the soil. Land of moderate fertility should be shut up immediately after it has been mown; but in fields of greater luxuriance, August is a better month, and still richer lands need not be closed until September. On the fine salt marshes of Lincolnshire, however, there is so plentiful a spring of grass throughout the winter that two sheep an acre can be fed without any previous exclusion. 'This branch of husbandry cannot receive too much attention, for it is by far the most certain dependence a man can have for his flock at the most pinching period of the year.'[1]

CHAPTER VII.

ON STACKING HAY.

THERE is great difference of opinion among agriculturists respecting the relative advantages of stacking hay or housing it in barns. In Lancashire, and other of the most northern counties, *hay-barns* have been erected on pillars, and covered with slates. The floors of some of them are boarded with loose planks, perforated with holes, and lying hollow for a certain space above the ground, for the purpose of admitting a free circulation of air beneath. These buildings are cheap, useful, and very convenient; in the dry season they save much litter and waste, and in wet seasons the advantage afforded by them of quickly securing the hay will often prove of no slight pecuniary importance to the farmer. Besides, they admit of the hay being cut, weighed, and bound, during bad weather, none of which operations could then be performed without shelter. Experience has proved that the quality of hay is improved by moderate *sweating in the stack*; and it will generally be found to be preserved sweeter in stacks than in close barns. A barn, however, consisting merely of a floor and roof supported by posts, and open at the sides, will be found exceedingly useful; and when these are not employed, rick-cloths and poles should always be used while the stack is forming, in order to preserve it from rain until thatched.

Although a slight degree of fermentation or *sweating*, as the farmer calls it, always takes place, both before and after the hay is stacked, and its taste and nutritive quality are improved by it,

[1] Farmer's Calendar, p. 551.

great care must be taken that the process is not carried too far, or, occasionally, the result will be the heating and firing of the rick; or if the fermentation does not proceed to such an extent, the nutritive power of the hay will be lessened or destroyed, and it will acquire a dangerous and poisonous quality. Some of it obtains a sweet sugary taste, and is eaten greedily by horses and cattle, but it is too apt to produce disease of the urinary organs, and, occasionally, lays the foundation of some fatal malady.

Parts of the hay become changed to a dark-brown colour, and altered in texture. It is as short and brittle as rotten wood, and has a disagreeable taste.

Another portion, perhaps, becomes mouldy, stinking, and perfectly rotten.

The principal mischief of mow-burnt hay is, that it does almost irreparable harm before its dangerous consequences are suspected. The animal will eat greedily of it at first, but, in the course of a little time, he begins to be disgusted, not only with it, but with all other food, and becomes hide-bound and emaciated. Cattle are less injured by it than the horse, but it ought not to be given to any animals. An admixture of salt may correct its bad properties to a certain extent—but, in point of prudence, it should be used for litter only, and not for food.[1]

The form of hay-stacks is a matter of little moment; perhaps circular stacks are generally to a certain point preferable, particularly where straw is scarce, as they require less thatch than those which are square, and leave less surface exposed. The square or oblong form, however, is most convenient where straw is plentiful, as the hay can be more easily cut from them, either to form trusses for the market or for consumption, care being taken to cut it off perpendicularly and on the opposite quarter to that whence most bad weather may be expected; they also admit the air more fully. But whatever their shape, they should be so formed as to spread gradually outwards as they ascend, such a mode of formation tending more effectually to secure them against moisture, and requiring less framework than when they are built up square from the bottom. The size, likewise, depends on circumstances, and should always be adapted to the quantity of hay; in general, however, the proper dimensions for the *staddles*, or stack-bottoms, will be from twenty to twenty-four feet in length, by thirteen or fourteen in breadth.

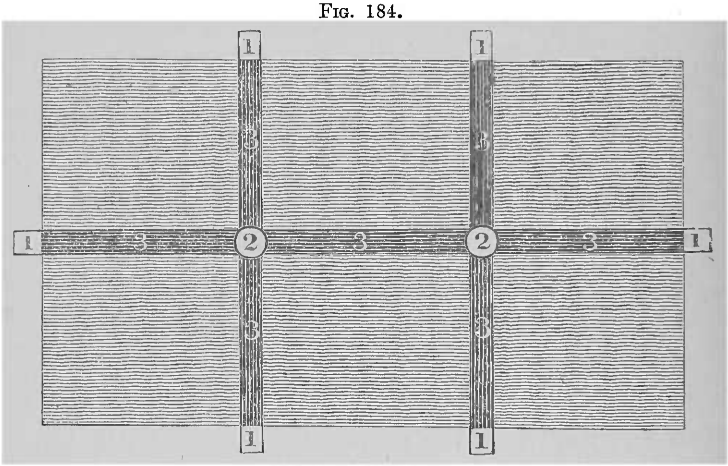
In order to stack hay in the most compact manner, framed stages are commonly made use of. The hay should be well trodden down; and, in erecting the stack, the middle should be uniformly raised somewhat higher than the sides. Should the hay have been

[1] See that excellent manual of all that concerns the feeding and management of the horse, 'Stable Economy,' by Professor Stewart, of Glasgow.

damaged by sudden or continued rains, and apprehension be entertained that it will turn out unprofitably, it should be salted as it is stacked—a peck of salt in proportion to a load of hay being sprinkled upon the successive layers of it. This will be found to have considerable effect in preserving it; and experience proves that every species of cattle will prefer inferior hay, when salted, to the best hay stacked without salt. That condiment, by assimilation with the juices of the hay, prevents too great a degree of fermentation from taking place, while it imparts a superior flavour.

The following is the ground plan of *an improved hay-rick*, in order to prevent hay-stacks from taking fire, communicated to the Board of Agriculture, by A. H. Chambers, Esq.; in it we see

Fig. 184.



IMPROVED HAY RICK.

the gutters and channels through which the air passes. These being open, a supply of air is constantly circulated through the centre of the rick, and so freely admitted as to check all fermentation.

1. Is the opening of a trench one foot wide and one foot deep.

2. 2. Are funnels or chimneys, to be kept open while the rick is making, and until the heat has subsided, when they may be thatched over.

3. 3. &c. Are channels covered with faggots.

A channel or gutter, one foot wide and one foot deep, is cut through the ground marked out for the rick, and two of these channels are cut across it. Two chimneys are introduced like the common hay funnels, with this difference, however, that Mr. Chambers's chimneys go full home to the earth, and the channels, previously covered with faggots, except where the chimneys are placed, leave them open at all points; so that, from whatever quarter the wind may blow, the current is uninterrupted.

The advantages stated by Mr. Chambers to result from the use of this contrivance are various. *Firstly*, The hay may be carried at least one day earlier, and hence is less exposed to the weather. *Secondly*, There is a saving of one day's expense in the labour. *Thirdly*, The weight of the hay is greater; for, if it is made one hour later than is absolutely necessary, it loses much in weight by evaporation; and it is of the utmost importance to retain as much sap as possible in the hay, as thus it is rendered more nutritious, provided that there is not sufficient to heat it and to injure its colour. The chimneys are to be kept open until the heat has subsided, and then thatched over.

The common practice for preventing hay-stacks from taking fire is far less efficacious than the preceding. It consists in leaving vacuums, or forming funnels in the centre of them, in order to let off the superabundant heat; but the advantage thus gained is counterbalanced by the increased degree of moisture attracted and absorbed by the hay, and those portions of hay round about the openings are generally the first to spoil. By adopting the precaution of salting the hay, the use of funnels may be altogether dispensed with. As, however, it is of some importance to be able to ascertain the precise degree of heat in the hay-stacks, the simple and effectual method practised by the late Mr. Ducket may be had recourse to. It consisted in thrusting a scaffold-bolt, or some other stout or long piece of iron, into a hay-rick, in order to give easy admission to a ramrod, furnished at the end with a strong worm. With this he used to screw out a sample, and thereby discover not only the heat, but also the colour and quality of the hay. If the stack required air, he perforated it in several parts with the same instrument, which answered every purpose of a chimney or funnel. Where, however, a hay-rick is discovered to be in a state of fermentation, and the convenience of a ramrod and screw cannot be obtained, instead of *throwing down the hay-stack*, which only increases the heat until it bursts into a flame, from the sudden access of air, we would recommend that the stack be gradually lowered, and the exterior layers carefully detached, by which means any sudden ignition from contact with a current of air will be effectually prevented.

The iron rick-stand, of which a cut is given in the chapter on implements, may be used for building hay-stacks on. There have been hay-rick ventilators introduced from time to time with varying success—that by Mr. Gillett was on the Archimedean screw principle, a modification of Mr. Ducket's plan named above. The plan introduced by the Messrs. Garrett is said to be very efficacious; this is simply a horizontal tube connecting with centre of stack punctured with holes, and a vertical one leading upwards to top of stack, and furnished with a ventilator.

CHAPTER VIII.

ON IMPEDIMENTS TO THE SCYTHE AND THE ERADICATION OF WEEDS.

GRASS lands are subject to various impediments, that prevent the soil from receiving all the benefit of which it is capable, and claim the attention therefore of the industrious farmer.

I. ANT-HILLS are very detrimental to dry pastures, not only by wasting the extent of the soil which they occupy, but obstructing the free use of the scythe during the season of mowing. The ant-hills are not only unsightly and injurious, but there is great difficulty in driving the insects from the habitations which they have so carefully constructed. The common mode of removing these excrescences consists in dividing them into four parts from the top, and afterwards digging sufficiently deep to take out the core below; so that, when the turf is replaced, it may be somewhat lower than the level of the rest of the soil, and thus render this spot moister than the neighbouring parts, and prevent the ants from returning to their former situation.

In Norfolk, the process recorded by Mr. Marshall is as follows: —'With a heart-shaped spade or shovel, the hills are cut up in irregular lumps of from ten to fifteen inches in diameter, and from two to six inches thick. The grassy sides of these are turned downwards, until the mould side is perfectly dry; and then the former is exposed to the air, until the heaps are sufficiently dry to burn. A fire is now kindled by means of brushwood, and kept smothering by gradually laying on the sods or lumps, as the fire breaks out, until ten, fifteen, or twenty loads of ashes are raised in one heap. This,' as Mr. Marshall observes, 'is a cheap way of raising manure, while at the same time it removes a nuisance; and no person having such an opportunity in his power should neglect the making of the experiment. Ashes are, on some soils, an excellent manure; and, perhaps, generally, ashes thus raised would be found highly advantageous as a basis, or *bottoming* for farm-yards and dunghills.'[1]

Whatever method may be adopted for removing such obstruc-

[1] Rule Economy of Norfolk, vol. i.

tions, the work should be performed in November, or during some part of the winter; because if the places or spots are then left open and exposed, the frost and succeeding rains will exterminate all ants that may remain in the lower part of their habitation. A contrary practice, however, has been recommended by some farmers, viz., the destruction of ant-hills in the month of April, on account of the advantage of sowing grass-seeds immediately on the spot, and for which purpose a dressing of manure, in which chalk has been mixed, is recommended to be thrown over it, as tending greatly to accelerate the growth of the seeds.

II. MOLE-HILLS.—With regard to the removal of *mole-hills*, various practices are in use; but the most effectual is that derived from the experience of a successful mole-catcher, whose operations do not require to be described here.

Stones are sometimes so firmly fixed in the soil that they cannot be removed without considerable difficulty; but when they are found in a loose state on the surface of the land, and are likely to impede the scythe, they should be picked off. This, however, should only be done in a dry season, in the month of March. If too many stones are taken away, the land will receive very material injury, especially if it is thin or of a light kind; because they not only prevent the crop from being scorched during summer, but also hinder the exudations of the earth from evaporating. In stiff binding land, they also prevent its running together and hardening, and consequently promote vegetation. The injury which soils are exposed to by picking off all the stones has been clearly ascertained by the late Mr. Macro, an experienced agriculturist of Suffolk, who, suspecting that this practice on his turnip lands had produced more harm than benefit, tried an experiment in the spring, by picking off the stones from one square rod, after the turnips had been folded off, and laying them equally over another square rod by the side of it. He then sowed these two portions with barley, marked them out, and at harvest-time collected their produce separately, as well as that of another contiguous square rod that had only the natural quantity of stones. The following was the result:—

			Or per acre.		
	Qts.	Pint.	Q.	B.	P.
Produce of the rod that had the double quantity of stones	6	1	8	0	2
Ditto from that whence the stones were gathered	6	0	7	2	0
Ditto from that in its natural state	6	$0\frac{1}{2}$	7	3	1

This experiment coincides with various observations that have been made in several counties, particularly Hertfordshire, and also in France; and although it is more particularly applicable to arable, yet the lesson it suggests is worthy of attention even in regard to grass land.

Von Thaër, however, thus expresses himself on this subject:

'Those loose stones which give way before the plough and harrow are exceedingly prejudicial to agriculture, where they exist to any great extent. They yield no nutriment, and may, therefore, be regarded as superfluous in the layer of vegetable mould of which they form a part. They are prejudicial, for they are likely to injure the agricultural implements—they impede the action of the scythe, and compel the labourer to leave the stubble very long—and they take up the space which should be occupied by the crop. Every agriculturist, therefore, who wishes to benefit his land, and derive all possible profit from it, should endeavour to get rid of these stones by having them picked up or otherwise separated from the soil.

'Some persons have considered that it injures land thus to deprive it of these stones, and allege in support of that opinion that their office is to refresh the soil, and supply it with heat; also that they protect the seed, and have a tendency to retain moisture; but such assertions will not bear the test of inquiry.

'We do not, however, mean to deny that limestones are beneficial to argillaceous soils, because the manure with which they come in contact, as well as the roots of the plants, serve to decompose them; and thus the soil is ameliorated, and an additional supply of nutriment afforded to the vegetation. But where the stones are of a silicious nature, as is too often the case, we cannot admit their utility, at any rate until some positive experiment shall convince us of our error.'[1]

III. Weeds.—Under this denomination are comprehended all those coarse rank vegetables which flourish spontaneously, to the injury of other plants, and to the consequent loss of the farmer. As they thrive without care, and even in defiance of the efforts made to suppress them, it is evident that they are of a more hardy and vigorous nature than the plants which require the fostering hand of man, and will, therefore, always be apt to obtain the superiority, and appropriate to themselves every kind of vegetable aliment. The vegetation of the crops will uniformly be diminished in proportion to the prevalence of the weeds; and hence it is of the utmost importance to prevent, as far as possible, the production of every kind of vegetation except that which is designed to be cultivated. Weeds are *annual*, *biennal*, or *perennial*. The first two die in the *first* or *second* year, as soon as their seeds are perfected, and are propagated only by their seeds shed on the ground. *Perennial* weeds are such as continue several years, being not only renewed and multiplied by their seeds, but also by their roots, which lie in the ground during the winter, and put forth new shoots in the spring. It is to these that grass land is the most subject.

[1] Principles of Agriculture, by Albert de Thaër.

Some weeds germinate as soon as they obtain moisture, and although they are not in immediate contact with the earth, thrust down their roots to its surface; others do not succeed unless they adhere to some mellow soil, and enjoy the reviving influence of the atmosphere. Many seeds, even those of the most diminutive size, will remain dormant for a long series of years, and then vegetate as soon as any accident has placed them in a favourable situation.

Some seeds are connected with a kind of wing or feather, by means of which they are conveyed from the place of their birth, and disseminated over the fields. Thus the dock genus have small wings like those of a bat, on which they are sometimes carried, in a high wind, to a very considerable distance; others are surrounded with a light glume or husk, like a mantle; while the buoyant feathers of the sow-thistle, bur-thistle, coltsfoot, and other weeds of a similar class, bear them to the most remote places.

The vivacious roots of weeds run in various directions. Some are branched, others entire, or perpendicular, or inclining, or fibrous, or tuberous, or creeping, or jointed, &c. All of them have the power of shooting forth new plants from different parts or joints. Some of these roots extend no farther than the cultivated soil; others penetrate much deeper, and their ramifications are prolonged into the inferior strata to a considerable length and depth.

From the different characters of the plants which we term weeds, it is obvious that different means of extirpating them are required. Annual and biennial plants may be destroyed by pulling them up by the roots, or dividing the stem under the lowest or first-formed leaves, or seed—or after they have begun to flower, by cutting them anywhere below the lowest branches.

Ferns and thistles should not be cut with a sharp instrument, as they are then apt to spring up again the same season, but bruised or clipped with blunt wooden shears or pincers. It must not, however, be expected that land can be freed from weeds by extirpating those which spring up one year; these have been propagated by former plants that have shed their seeds on the ground, and many of those seeds, if not in a situation favourable to germination, may lie dormant for years, and then shoot up.

Vivacious roots cannot be destroyed, except by turning them wholly out of the ground, and either carrying them away or exposing them to the air, until they become dry and incapable of vegetating; but as this can only be effected by the plough, they cannot be fully eradicated out of grass land, but only checked to a greater or less degree. As the roots are fed and supported by leaves, they may be considerably discouraged by repeatedly depriving them of their leaves and stems. The cutting them through the stems, about the middle of June, or when the weeds are in full vigour, and before they generally shed their seed, will considerably tend to diminish their future growth, for the sudden interruption in the circulation of the sap causes the latter to stagnate in the roots, and consequently the weeds perish.

The preceding remarks apply chiefly to annual and biennial weeds. With regard to *perennials*, a summer fallow is the only remedy, when once they have been allowed to get possession of the soil.

It sometimes happens that pastures are so overrun with large weeds as scarcely to afford a mouthful of wholesome food to the animals feeding in them. As most of these may be eradicated by the hand, or the hoe, or the plough, or by other means, they demand a distinct consideration: the chief of them are—(1) the common dock; (2) thistles; (3) ragweed, or ragwort; and (4) coltsfoot.

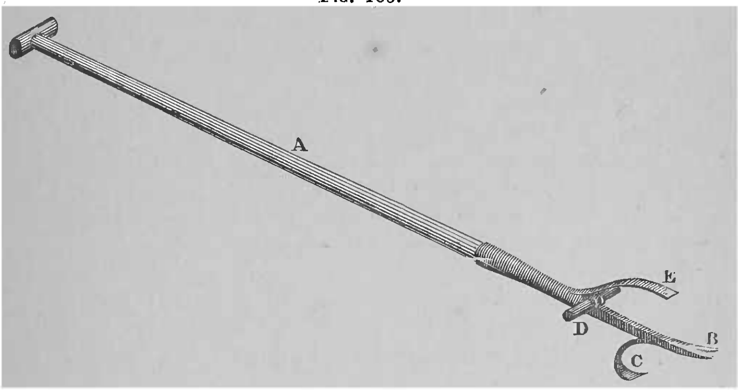
The Common Dock (*Rumex crispus*) is too well known to require any description; it is a most troublesome plant, especially in clayey soils, where it is always most frequent. The least portion of its long tap-root, if left in the ground, will form a new stem. It should be fully turned out with the dock-iron as soon as the flowering-stem is formed; and as the plants of this genus rise at two seasons, the fields should be weeded twice in the summer, in order that no seeds may be allowed to ripen. The roots must be thoroughly desiccated; for, if suffered to lie in a moist place, they will continue to vegetate on the surface, and strike many an outside root into the ground. Mr. Kerr, the intelligent reporter of the Berwickshire husbandry, recommends that docks should be *pulled up by hand after heavy rains*, when the soil is soft enough to allow their long tap roots to be drawn without breaking, and before their seeds approach to ripeness; but this is a matter of extreme difficulty, unless the ground is very loose, and considerable precaution is taken in not drawing them up too suddenly, and breaking the root.

In the sowing of clover care should be taken that none of the seeds of the *dock* are intermixed. They cannot be separated by the sieve, for they are too nearly of the same size as the red clover; but they may be distinguished by their bright brown colour and triangular form. Should the dock unfortunately be sown, it must be carefully drawn or spudded up as soon as it appears above ground; but the only really effectual method of extirpating the dock is by a summer fallow or cleansing crops. A dressing of nitrate of soda—2½ cwts. to the acre—is found in heavy soils to be a complete extirpation of the dock.

Of *Thistles* there are several kinds; but the most noxious are the Bur-thistle, the Corn-thistle, or corn saw-wort, and the

SOW-THISTLE. The bur-thistle, being a biennial plant, may be killed at any time by cutting it under the first leaves. But the corn- and sow-thistles, which are perennials, and extend their creeping-roots beyond the reach of the plough, are more difficult to eradicate. They are usually cut down by means of a well-known implement, called a Thistle-extirpator, which we have delineated in fig. 185.

FIG. 185.



THISTLE EXTIRPATOR.

A is the handle; B the claws between which the thistle is received; the curved iron C is the fulcrum, by means of which a purchase is obtained for extracting the root. D is an iron rod or bar, upon which the foot is placed to thrust the claws into the ground. In case the root of the thistle breaks, while we are endeavouring to extract it, the curved blade E, which has a sharp end like a chisel, is thrust into the ground, in order to cut off the root some inches below the surface, and thus prevent it from vegetating. There is a more simple form of this in use.

If thistles are cut down in rainy weather, or if much rain falls soon afterwards, the water descending into the fresh wound of the stem (where they are cut in the ordinary way) debilitates the roots, and prevents the growth of the plants for a time. But if such critical rains do not occur, fresh leaves will immediately arise to support the roots, and the cutting will produce very little effect. They should, therefore, be annually pulled up as soon as possible after the flower begins to form, taking advantage of the first shower that happens to fall to soften the ground and make them draw freely. By pursuing this practice regularly during several years, the deep-lying perennial roots will become gradually weakened, and fall into decay.

The CORN-THISTLE (*Seratula arvensis*), often known as the COMMON WAY-THISTLE, is a weed which grows chiefly in rich clayey soils; its presence, therefore, speaks well for the goodness of the land. It is difficult, if not impossible, to eradicate it, for from each root spring numerous stalks, which multiply only the more rapidly for being cut; and its seeds, being light and feathery, float on the wind, and sow themselves everywhere. Cattle avoid it, on account of its prickles. Even after the best fallow many of these weeds will rise in the following spring. They should, therefore, be hand-weeded, or cut close with the spade. It is a difficult but necessary task to keep them under, for there is no weed so unsightly or so injurious as this. It is frequent in the southern parts of Europe, and in Pennsylvania.

The Sow-thistle (*Sonchus arvensis*, or *oleraceus*), which is remarkable for the regularity with which it opens its flowers at six o'clock in the morning and closes them at noon, sadly teases the farmer, and impoverishes the soil where it is permitted to gain any head. Each single plant bears on an average 19,000 seeds —100 flowers, and 190 seeds in the flower.

The Spear Plume-thistle (*Cnicus lanceolatus*) is a weed which often grows in abundance in old pastures: this is to be attributed to neglect on the part of the farmer, for it could be easily destroyed by cutting it when in flower, and before its seeds were ripe.

Thistles of all kinds are widely disseminated by means of their light downy seeds. They should, therefore, be cut down before the seeds are ripe; and it should be a golden rule with the farmer never to suffer a thistle to grow in any of the waste places or hedges of his farm. In some countries there are penalties inflicted on those who allow thistles to remain in their hedges, or along the king's high-road which borders their land.

Ragweed (*Senecio Jacobæa*), or Ragwort, as it is also called, not being deeply rooted, is best extirpated by the hand. Cutting it down will be of little service, for, though some of the plants die, many survive, and branch out more copiously in the following year. It is a mere weed, of no beauty. When the ground is softened by rain, about the period of its flowering, it should be pulled up by hand; or it may be kept down by pasturing with sheep, as these animals will eat it when it is young.[1]

Coltsfoot (*Tussilago farfara*), with its broad leaves, is, of all perennial weeds, the most vexatious to the farmer, whose utmost vigilance it will frequently elude, not only because its seeds come to maturity before the leaves expand, but also from their ripening so early in the spring.

The months of September and October are the best for cutting down coltsfoot, as the plants are then at their full growth, and may be easily discovered. The best way of getting rid of them

[1] Naismith's Elements of Agriculture, p. 403.

is, to pull up and carry off every root that can be laid hold of; for if we inspect the roots about an inch below the surface, we shall observe numerous buds, about the size of a pea, springing from that part of the root. These, if allowed to stand until the next spring, will shoot up fresh stems, flower, and shed their seeds, in spite of every possible attention, the flowers coming out early in April; hence it is very difficult to prevent the increase of this weed. If, however, the above plan is steadily continued for a few years, it will be attended with success. The operation must be performed before the leaves wither and fall off, as afterwards the roots cannot be easily discovered. If the weather is moist, there will be little difficulty in pulling up the roots to a sufficient depth; but, should it be dry, or the ground hard, the pullers should be furnished with a small piece of iron, split at one end like the toes of a hammer, and about ten inches long,[1] to enable them to get the root up to the required depth. A few boys or girls, under the direction of a careful overseer, will execute this work at a trifling expense; but care must be taken that all the roots, so pulled, are carried off and destroyed; for if merely thrown on the sides of stone walls or hedges, they will flower in the succeeding spring, and shed their seeds, which, being of a winged description, will fly about the field in all directions. Where land is much infested with this pernicious weed, it should be carefully examined in the spring months, lest any of the stalks should have escaped in autumn; and in this way, by attention and perseverance, ultimate success may be relied on.

Paring and burning early in the spring, and this followed by a naked summer fallow, will usually conquer this weed, and so will the drill culture and horse-hoe husbandry. This plant should never be suffered to flower, or fully expand its leaves.

It would greatly exceed our limits were we to enumerate all the weeds that annoy the farmer; we will, however, mention a few which are among the most formidable and vexatious impediments to his labour. With respect to all other inesculent herbage growing on pasture grounds, as well as all weeds bearing winged seeds by the sides of roads, ditches, &c., we would remark, that they should invariably be cut down as soon as they begin to flower, in order to prevent their increase by their seeds being dispersed over the fields.

The Burdock (*Arctium Lappa*) is a frequent weed on the hedge-side. It is known by its hooks sticking obstinately to the clothes of those who rub against it, and particularly to the hair of animals. Beyond this it does no harm, and, growing singly to a large size, may be easily extirpated.

[1] The weed-extirpator, already described (fig. 185), might probably be employed with success, instead of this implement.

GOOSE-GRASS (*Galium Aparine*), sometimes called catchweed, and sometimes goose-tongue. The seeds of this plant are also furnished with hooked bristles, which attach themselves to everything that rubs against them, and thus are widely disseminated. Where it is once suffered to establish itself it will not be eradicated without some difficulty.

The DAISY (*Bellis Perennis*).—We are sorry to have to record this pretty flower among the weeds which the farmer should endeavour to extirpate. An old writer terms it, we scarcely know why, 'the dissembling daisy.' Cattle certainly will not eat it, but we know not any further harm about it than that it occupies the ground which might bear nutritive plants. Where it grows in great abundance it tells tales of the poverty of the soil.

GROUNDSEL (*Senecio vulgaris*) is one of the most common of the annual weeds, flowering from March to December. It can scarcely be extirpated where it has once grown. It is not remarkable either for beauty or utility, but it is gathered as food for caged birds, and particularly the canary-bird, and it contributes largely to the support of most small birds. The number of flowers borne by each plant of the groundsel is 130; number of seeds in each flower, 50; and thus each plant bears 6,500 seeds.

The CHICKWEED, or common STICHWORT (*Stellaria media*), flowering also from March to December, is, under careless management, often a nuisance to the agriculturist. This and the former are very troublesome weeds, and will almost choke the true crop. It has small white flowers, open almost all the year. It is sometimes eaten as a potherb, and small birds are very fond of its seeds.

COUCH, or common WHEAT-GRASS (*Triticum repens*).—This weed appears and accumulates in every soil, and under every possible system of management. If once a field has become infested with it, and especially one that is at all liable to suffer from dampness, the very best fallow will leave some of it, for its creeping netlike roots will shoot again if a bite be left of them. It shoots and grows with all our barley crops, and flourishes with every species of clover; and so long as the ground remains infested with this weed it will not yield the crops which might otherwise be expected from it. The most effectual means of destroying it are, frequent ploughing and harrowing, naked summer fallows, and collecting the roots with the hand. But a plan still more effectual, or at least which was always so in the management of one of our most eminent practical agriculturists, now gone to his rest, was the ploughing in of common salt in lands under culture at autumn, at the rate of $2\frac{1}{2}$ cwt. to the acre; this never failed to reduce the crop of this pest of the farm on heavy soils.

KNOT-GRASS (*Polygonum aviculare*), known among farmers by the names of *surface twitch* or *red robin*, is a species of buck-wheat, or bear-bind, and not a little mischievous, both among the corn and in the turnip crop. Poverty of the soil, and neglect of the hoe, are its principal encouragers.

SNAKE WEED (*Polygonum lapathyfolium*) infests meadows and corn-fields; when dry it resembles the folds of a snake, and is of a brownish-red hue and fleshy appearance. It has no smell, but a peculiarly astringent taste.

CORN MINT (*Mentha arvensis*).—This weed chiefly prevails in moist pastures, and its creeping roots are difficult to extirpate. It will always be best conquered by correcting those defects of the soil which encourage its growth, by draining and paring, and burning the surface, and also by means of drill and horse-hoe husbandry.[1]

WILD MUSTARD, OR CHARLOCK (*Sinopis arvensis*).—This weed thrives most in rich soils, and such as are strongly impregnated with humus, and there, if not attended to, will inevitably destroy the crop. It abounds in fields of young turnips, and contends for mastery with them, and often seriously injures corn. It flowers in May or June, and should then be pulled up by hand. If neglected at this season the difficulty of extirpating it will be very much greater, as it sheds its seeds before harvest. Perseverance in constantly pulling it is the only effectual mode of extirpation. Thaër says, 'Careful agriculturists pull this plant up while in full vigour and give it to their cattle for fodder, and it is found very profitable for that purpose.' This plant bears 400 flowers of 10 seeds each, or 4,000 seeds.

SMALL NETTLE (*Urtica urens*).—This plant too often spreads

[1] See, on this subject, Holdich's Essay on the Weeds of Agriculture.

At page 33 of his work, Mr. Holdich makes some remarks on the subject of weeds, so original, and founded on so much sound sense, that the editor cannot refrain from copying them. 'Now what is the conclusion from the fact that couch-grass and thistles, and various other agricultural weeds, can by no means be extirpated? Some may be inclined to say that this is a melancholy reflection; but I say no—not at all. Providence could not have better contrived than that exertions should be perpetual, and that success should be in proportion. There is not a weed that we ought to wish out of our fields, unless we remove or destroy it; because, if there were none, or a very few, all fields would be clean, and no praise could light on superior modes of tillage. Some may say again, "So much the better!" but I say *no*. Does any man think that our various soils would have been sufficiently pulverised and worked, had there been no enemies of this sort to challenge forth our labour? Sterility would have seized on our turnip lands, which are only continued in a state to bear their successions of crops by the necessary periodical renewals of their fertility. So might all our clays have gone to perpetual grass; for neglect of proper tillage would have rendered them unprofitable. "By the sweat of thy brow thou shalt eat bread," is an ordination of the highest authority, and the fulfilment of it is that precise principle which puts all mankind in motion. The necessity of existence produces industrious hands for every department of labour; but the sluggish nature of man requires every stimulus to exertion. The weeds of the fields excite emulation among farmers, and foul fields are always a reproach to the occupier. Thus we are compelled, by an unseen hand, to better habits and more active industry.'

itself from the hedges and under the walls, which nature seems to have selected for its domicile, to the better and cultivated parts of the farm. It should be carefully eradicated before the seed time. Its presence usually indicates that the soil is rich in humus.

The Red Dead Nettle (*Lamium Purpureum*).—This plant has established itself in all our hedges, and there it should be carefully kept, for it is apt insidiously to encroach on land devoted to better purposes. It has an aromatic smell, and is of the same family with the mint and thyme tribe.

The Great Nettle (*Urtica dioica*).—This plant also is found in all waste places, under walls, and on the banks of hedges. It is exceedingly destructive to the farmer, for it is not only difficult to extirpate, but when it has once taken possession of a piece of ground, every other vegetable dies away. It must be dug up by the roots and before it flowers. Although we are describing it as an injurious weed, a kind of parasite, we cannot refrain from quoting a sentence from Jesse's 'Gleanings of Natural History.' It expresses the feelings with which the agriculturist should look around him. 'Nettles are never touched by cattle of any description, neither will they trample upon them. What a secure retreat, therefore, do they afford for birds to build their nests amongst, and for hares to deposit their young amidst the shelter they afford.'

Bindweed, or Bearbind (*Polygonum Convolvulus*).—This is a very injurious weed, and difficult to get rid of, on account of the roots penetrating so deeply into the soil as to render it almost impossible to eradicate them. It is one of the prettiest of the hardy exotics of this species; but it twines round wheat, turnips, and other plants, and prevents them from attaining their proper growth; and cannot be too carefully extirpated.

Crowfoot (*Ranunculus*).—There are various species of this weed, known under the name of 'butter-cup,' 'king's cup,' 'golden cup,' &c. They all possess an acrid or poisonous principle, and are said to be injurious to the cattle and to the milk. It is only, however, when they exist in large quantities that they are injurious; where but a few of them mix with the grass, they serve as a condiment, and cause the coarse herbage of the water meadow to be more easily digested. It is a popular error to suppose that they impart a yellow colour to the butter. Experiments have been made on the poisonous quality of the ranunculus. A small quantity of the expressed juice has killed a dog, and many a time, the most painful and troublesome swellings have been produced by the absurd practice of applying poultices or plaisters of the root of the butter-cup to sores. In some cases the ulceration thus set up has produced caries of the bones. It is far from improbable that many of those diseases of the digestive organs with which cattle and horses are attacked, in the spring and fall of the year, are attributable to these and other poisonous plants.

WILD RADISH (*Rhaphanus Rhaphanistrum*) closely resembles the wild mustard, and both these plants are commonly termed charlock.

CORN POPPY (*Papaver Rhœas*) is well known from its brilliant red flowers; it abounds most in dry, sandy, or gravelly soils. This plant bears 100 flowers, each having 500 seeds, so that the produce in seeds of one plant alone is 50,000 seeds.

CORN BLUE-BOTTLE (*Centaurea Cyanus*).—This is also chiefly found in corn-fields, but it never thrives to any great extent, or where proper attention is paid to the cleansing of the soil.

CORN MARIGOLD (*Chrysanthemum segetum*).—This plant grows amongst corn; in some parts it is only found here and there, and may be easily extirpated; but in sandy districts it is a most pernicious weed, growing so vigorously and multiplying so rapidly as to ruin the crops. It possesses a great degree of vitality, and, when pulled up and thrown aside, does not perish and decompose, but vegetates and bears seed. Thaër says, that the seeds of this plant will pass through the bodies of horses and other animals without losing their vitality, and thus the chrysanthemum is frequently propagated by means of the dung. Frequent summer tillage will alone destroy this weed, when once it has overrun the land.

THE BEARDED WILD OAT (*Avena fatua*).—This is another very pernicious weed, but is much more easily extirpated, provided sufficient care is bestowed and it is got rid of before it actually flowers.

RYE BROME GRASS and SOFT BROME GRASS (*Bromus secalinus* and *mollis*).—Several varieties of these are found among the weeds of cultivated land. They thrive chiefly in damp soils, and will then often choke the crops, but on dry, gravelly, or sandy soils they are scarcely ever met with.

BLACK KNAP WEED (*Centaurea nigra*).—This weed is very injurious to the pastures where it prevails, and cannot be extirpated without difficulty; it is propagated by its roots as well as its seeds.

CORN-COCKLE (*Agrostemma Githago*), the CORN-SPURREY (*Spergula arvensis*).—These plants are of the pink tribe, and come up singly. They indicate a poor soil, or neglect in the cultivation, and can easily be pulled up by hand and got rid of. This plant bears seven flowers of 370 seeds each, or 2,590 seeds to the plant.

The HAIRY TARE (*Ervum hirsutum*), WILD VETCHES (*viscia cracea*), are leguminous plants, which, when they are found in cultivated land, must be regarded as weeds: they can be very easily extirpated.

Brambles, shrubs of the rose and dewberry family, must also come under the head of weeds, where they encumber land which is or ought to be devoted to agricultural purposes. They are not easily destroyed, and their long thorny shoots twine round and destroy all vegetation within their reach. Their roots penetrate very deeply, and shoot out in every direction. They must be thoroughly hoed up before the land which has been occupied by them can be tilled.

FERNS are also a species of weed. They chiefly grow in hedges, or on mountainous and upland pastures.

MOSSES will close our list. These are not wholly innutritious in themselves, but they have a tendency to overrun the ground, and, by their closely-woven fibres, to prevent the growth of vegetation. A careful course of tillage and the application of lime will effectually destroy them.

RUSHES (*Junci*).—When these intrude into situations that should be occupied by better plants, they must be destroyed. They are common in moist meadows with a retentive subsoil. They not only occupy a space that might produce good herbage, but greatly deteriorate the hay with which they are mixed, and the farmer should leave no means untried to get rid of them. Where they have once been permitted to grow, they can only be effectually destroyed by draining.

HEATHS (*Ericæ*).—These plants, both useful and ornamental on the sandy waste, ought never to be found among cultivated grounds, and when they are, must be regarded as weeds. Their richness of colour, elegance and variety of form, and delicacy of texture, are such as no words can truly describe. At the Cape of Good Hope they are even more beautiful.[1]

[1] There is a weed common in Belgium, and which, from the seeds of it adhering closely to the clover seed, is not unlikely to be imported, and, therefore, may not be considered out of place here. It is a parasite called *Orobanche*, or broom rape, and grows on the roots of the clover. M. Van Aelbroeck, in his *L'Agriculture Pratique de la Flandre*, speaks of it, and mentions the difficulty of separating the seeds of this weed from those of the clover. 'I examined some clover seed through a microscope, and was thus enabled to detect the seed of the orobanche adhering closely to the clover seed by means of a kind of glutinous substance, and so small as not to be visible to the naked eye. The next step was to detach it; and for this purpose I rubbed some clover seed, mixed with wood ashes, well in my hands, and then plunged it into water. The seed of the orobanche, which is light as dust, rose to the top, and was easily skimmed off, while the clover remained at the bottom. This latter I washed several times in fresh waters, and then put it in a sieve and stirred it well about while pouring water on it. I subsequently spread it upon a cloth, with wood-ashes to dry it, and it was sown the same day, and came up free from orobanche; while, wherever seed was sown without washing, quantities of the parasitical weed sprang up and deteriorated the crop.'

This simple agricultural experiment may not prove useless, even if only regarded as a specimen of the manner in which such things should be conducted.

In the foregoing paragraphs, we have here and there given statements showing how prolific are our common weeds in seed bearing, and with what ease those seeds are transported from place to place, and how rapidly they take root and flourish. The great importance will be seen, then, of preventing the seeding of weeds, remembering the truth of the old adage :— 'One year's seeding is seven years' weeding.'

Further, the utmost care should be taken to see that the seeds used in sowing down meadows or pasture land are pure and free from weed seeds. Professor Buckman has done agriculture good service by pointing out the importance of this, and by experimenting largely and carefully in connection with it.

CHAPTER IX.

ON PARING AND BURNING.

THE *paring* of land is a practice of long standing in this island,[1] particularly in the west of England, where it is also denominated (in conjunction with *burning*) *den-shiring*, *burn-baiting*, or *sod-burning*. It consists of cutting or paring off the turf, or surface of the ground, and piling it in heaps to dry, which are afterwards kindled and burnt to ashes that are spread over the surface and ploughed in. The best season for this operation is, from the latter end of February, throughout March if the north-east wind prevails, and to the end of May. The ashes should be spread out as regularly and equally as possible before the plough, and turned in immediately. By breaking up old grass, or sainfoin leys, in this manner, they are prepared for turnips with only one ploughing ; and thus not only much expense and tillage are saved,

[1] We have more ancient records than the history of our own country affords. Virgil describes it as an acknowledged and useful practice among the agriculturists of ancient Rome :—some of the reasons which he gives are singular and valuable.

'Oft, too, it has been gainful found to burn
The barren fields with stubble's crackling flames.
Whether from thence they secret strength receive
And richer nutriment ; or by the fire
All latent mischief and redundant juice
Oozing sweats off ; or whether the same heat
Opens the hidden pores, that new supplies
Of moisture may refresh the recent blades ;
Or hardens more, and with astringent force
Closes the gaping veins, lest drizzling showers
Should soak too deep, or the sun's parching rays,
Or Boreas, piercing cold, should dry the glebe.'

Trapp's Georgics, i. 125.

but the destructive turnip-fly never attacks turnip crops on burnt lands.

This operation is performed on different soils with different implements. Thus, in *old pastures* or *meadows*, the breast-plough is an effective implement, but Bentall's broad-share or paring plough is perhaps the best to use, as giving the most work in the most economical way. From one inch to one inch and a half is the usual depth, although two inches are preferable, in the opinion of some agriculturists, on account of the greater quantity of ashes thus produced; but this is a point which must be regulated by the nature and depth of the soil. The burning, however, will be more certain, in case of unfavourable weather, in proportion to the thinness of the turf. The expense of paring such land (including its burning and the spreading of the ashes) varies from 1*l.* 5*s.* to 2*l.* per acre.

In *fenny* or *boggy* situations, like those in Cambridge, a useful implement denominated the *paring* or *skim-plough* may be employed. It turns off a furrow from twelve to sixteen, and even eighteen inches in breadth, and not exceeding one inch in depth. By using this instrument, the cost of paring, burning, and spreading is considerably reduced; but it is calculated for such soils only as have been in a state of cultivation. In many of our western counties this operation is performed with the common plough, a wing being turned up on the furrow side of the share, in order that the furrow may be cut of the required depth. The manner of piling the sods is different in different districts; but, in general, the operation of burning will be most effectually performed by piling the parings into small cocks, or heaps, similar to those made in hay-fields, placing the grass sods downwards for the admission of air, and leaving apertures both at the top and at the bottom of each heap; these apertures must afterwards be closed up with fresh sods, in order that the burning may be thoroughly completed.

There is great difference of opinion among agriculturists as to the propriety or impropriety of paring and burning land. By some it is pronounced to be a wasteful, extravagant operation, dissipating that which should be retained, annihilating the oils and mucilage, calcining the salts, and reducing fertile organic matter into ashes of very weak efficacy.[1] Such is the opinion of several eminent agriculturists; but their sentiments are strongly controverted by others equally experienced in the various departments of rural economy. In Suffolk the general feeling is in favour of clod-burning. By the advocates for paring and burning, it is asserted that the objections are not founded on sound reasoning or practical experience, that the most extensive experience pronounces

[1] Farmer's Calendar, p. 171.

this system to be advantageous, and that the disadvantages said to result are chiefly attributable to the *abuse* of the operation. With this last opinion we cordially agree; for the large quantities of green food thus raised, and generally eaten off the ground, return to it far more than it loses, and the vast crops of corn obtained from land that has been pared and burned evidently prove that the soil, so far from being deteriorated, is rendered light, friable, porous, and highly absorbent. It is, in fact, the only mode of bringing sour uncultivated land into cultivation without incurring more expense than it is generally worth.

The operation of paring and burning may be advantageously performed on *heaths* and *downs* that have a thin, weak, and loamy sand, with a calcareous bottom. The burning can only be effected in dry weather. Considerable tracts of such land have been broken up and reclaimed in many parts of the kingdom. Immense crops have been obtained; but from the bad system afterwards pursued of taking successive crops of grain, the land has become exhausted, and the system unjustly brought into disrepute. Land thus treated is generally of the very worst kind. The chief object of paring is to get rid of coarse herbage and perennial weeds, which, by the process of burning, are converted into a stimulating manure.

The inert excrementitious matter thrown into the soil by previous crops, such as coarse grass, weeds, woody fibres, &c., is decomposed by the operation of fire and exhaled into the air, and the soil, thus freed from a portion of its noxious constituents, is rendered more fertile. The main object of the operation is to purify the soil from that which is chemically noxious; injurious substances, as partly-decomposed roots, sand, stems, insects and their eggs and larvæ, and coarse herbage, are, by means of the fire, converted into carbon; and every chemical agriculturist well knows that, next to nitrogenous elements, carbon is the principal constituent in the food of plants: and this carbon, spread over the ground in the form of ashes, supplies us with a highly valuable manure. In some instances a slight dressing of dung is added.

Moory, *fenny*, and *boggy* or *peaty* soils derive very essential benefit from this practice, it being scarcely possible to reclaim ground of such descriptions without the aid of fire, which effectually destroys spontaneous growth: it only fails when the labourers do not pare to a sufficient depth.

The observations that have just been made respecting the charring and carbonising of the woody constituents of the soil will readily explain the strangely-increased fertility of these soils after paring and burning.

Chalk lands are also greatly improved by paring and burning, and so likewise are *loams*.

Clayey soils may occasionally be pared and burned with much benefit to them, especially when broken up for the first time, for not only is a certain portion of carbon added to the land by the burning of the grass roots, but it also opens part of the stratum of clay next the soil so much that the roots of vegetables can afterwards feed therein, and fine crops of wheat may be raised. There is one objection to this practice on clay land, arising, however, from abuse, viz., that if the burning is carried too far the *soil* is often converted into masses of red brick: clay ashes, or rather the nodules of burnt clay, tend to loosen and open the stubborn adhesion of stiff tenacious clays, and form an excellent addition to the soil. The breast-plough is the best implement for such soils.

Liebig thinks that the benefit of burning the soil is attributable to its thus obtaining increased powers for the absorption of ammonia. He says, 'Soils which contain oxides of iron and burned clay must absorb ammonia, which is favoured by their porous condition; they further prevent the escape of ammonia once absorbed by their chemical properties. The ammonia absorbed by the clay, or ferruginous acids, is separated by every shower of rain, and conveyed in solution to the soil. Powdered charcoal possesses a similar action, but surpasses all other substances in the power which it possesses of condensing ammonia within its pores. Charcoal absorbs ninety times its volume of ammoniacal matters, which may again be separated by simply moistening it with water.'[1]

Upon the whole, then, the paring and burning of land may be beneficially resorted to on many soils, especially those which have been barren for any length of time, or old grass lands, provided it is conducted with caution, and the ashes are spread as speedily and uniformly as possible over the surface, and that especial care is afterwards taken not to exhaust the land by repeated crops of corn when it is intended to be again laid down to grass. On arable land the operation does not answer so well.

CHAPTER X.

ON DRAINING.

THERE is no operation more important in the improvement of land than draining, and there are few that have been more neglected, until within the last quarter of a century; although much has been done during this period, a vast deal still remains

[1] Organic Chemistry, p. 90.

to be effected. Though vegetation cannot proceed without an ample supply of water, yet there are many soils in which there is so great a superabundance of that element as to render it productive of the most injurious consequences to the growth of plants, causing the herbage to be coarse, aqueous, and inadequate to the proper support of cattle fed on such pastures, as well as dangerous to their health.

Draining often constitutes a *sine quâ non* of good farming, without which all other means, however tedious, or laborious, or expensive, would be utterly ineffectual. While the soil is saturated with water, it cannot be subjected to any successful system of tillage, or pulverised to any extent; for such operations, even if practicable, would prove injurious rather than beneficial; and by affording greater facility for the retention of moisture, render the land still more unwholesome instead of fertilising it. Neither can manures be productive of anything like their full and proper effect, unless the soil has first been brought into a fit state to receive them.

It is, therefore, of the utmost importance to the farmer, that he set to work duly to consider the cause of that excess of moisture which is so prejudicial to his interest; and he will trace it to one of two causes, viz., to rain water or other moisture stagnating on a surface which is either impervious itself or rests upon an impermeable stratum, and has no descent, or to the water of springs pouring over it, or confined under it. In strong clays the first-mentioned is usually the predominating cause, but in most other soils the evil chiefly arises from the second. It is, therefore, necessary that the farmer should inquire into and fully ascertain the cause, before he takes any steps towards removing the evil.

In past years, to undertake the drainage of a farm or a certain portion of land was a serious and responsible matter, especially for parties holding it only for a term, or having but a life interest in it; but the incorporation of various drainage companies, and the passing of the 'General Drainage Act,' has of late years greatly facilitated this invaluable operation, and been the means of effecting the reclamation of many hundred thousands of acres of waste land, as well as of increasing greatly the productive powers of a vast area of land which had been long under cultivation.

As it is a universally-admitted fact, that no one system of drainage can be laid down as applicable to all soils—and as experience, or a series of experimental trials, will be the only guides which can direct the agriculturist—he must either have recourse to a scientific man who has made the subject his study, or he must try for himself several of the most approved systems on small extents of land; and, by watching the working of each, come to a conclusion as to that which it will be most advisable to select.

If the land is not marked by any great inequality of surface, and the wetness proceeds from the texture of the soil, particularly the substratum, the system of furrow or thorough draining applied to the whole surface is, perhaps, the best cure of which the evil will admit. On the contrary, where the land is situated on a declivity, and springs break out on the slope of it, which greatly damage the land below, the first object must be to intercept these at their head, and carry them off before they saturate the soil with their moisture. Their site may be ascertained by means of an auger or borer, and the subsequent measures taken accordingly. But here a different and much more complicated system must be adopted.

Where there is much irregularity of surface, it will usually be found that the clayey and impervious strata do not extend far up the rising ground, and that more porous strata cover and encircle the top. These, from their elevated situation, receive the largest quantity of moisture from the rain and dew. This percolates through the open and porous soil until it meets with an obstruction from a more impervious one; there it accumulates and forces a passage, either oozing almost imperceptibly, or bursting out in streams. In either case it seriously injures the ground, both at this spot and immediately below. The object of draining must be to intercept these streams, and lead them by an artificial channel to some outlet where their waters, if not turned to some useful purpose, may at least cease to be injurious.

The method of proceeding which was formerly resorted to in the counties of Essex and Herts, and is even now used for tolerably level lands, and which has been generally found to answer, was termed *hollow-draining*, or *land-ditching*. It consisted in digging main and ploughing side drains; the depth of the main drain varying from 22 to 24 inches, and that of the side drains from 20 to 22. The length to which the main drain was continued without a vent depended on the situation of the land. If there was a gentle slope, as much water as possible was carried off by means of side drains; where, however, the surface of the ground was unequal, it became necessary to form additional main drains. The length of the side drains and their distance apart depended upon the nature of the land. The trenches being cut off of a sufficient depth were filled up with stones, or with brushwood, or thorns; and perhaps the branches of the alder, willow, &c., are better than any other, being less liable to decay, and also, being smooth, they do not disturb the shape of the drain so much. They should, however, be used in a green and never in a dry state. The stones or twigs were then covered over with straw, fern, heath, &c., in order to fill up the interstices and prevent the earth from sinking in, and the *surface earth* laid on *archwise*. In making drains of this kind, the chief object was, not the durability of the materials, but the proper *arching* of the earth, which, when of a tenacious nature, remains perfect after the other materials are decayed. The soil immediately over the trench was left a little higher, as it invariably sinks. In several parts of Essex there are drains of this kind, which answer very well, although they were only filled with twisted straw, and made more than forty years ago. The expense is stated to be about 3*l.* per acre. Mr. Pusey was of opinion, that on heavy clay-lands this mode of draining answered better, and was very much cheaper, than any other; but this was before draining-tiles could be manufactured at the price, and with the rapidity and facility which machinery has now brought them to.

The antiquity of this mode of draining, especially in our midland counties, is demonstrated by various accounts, collected together by Mr. Pusey, and published in the 'Journal of the Royal Agricultural Society.'

As straw will eventually rot, and in that case become a receptacle for breeding worms, and tempt the moles to burrow there, Mr. Naismith recommended that boughs of pine should be laid in the conduits or drains, as moles are said to shun all substances containing resin.[1]

Mole-plough drains, for rapidly taking off excess of surface water, have also been extensively used, and some of these in the North, which had been made thirty years, were lately examined and found to be acting perfectly.

Sod or turf-drains, which are usually adopted on tenacious grass lands, are thus formed: a wedge-shaped sod or piece of turf is cut from the furrow or line of the intended drain, the point of the wedge is cut off, and the turf or sod then again inserted into the soil. But land in which drains of this sort are used is never sound or fit for cattle.

In all cases, the apertures or mouths of drains should be effectually guarded by a railing, or grating, to prevent the watercourse from being obstructed; and the passage for the water should uniformly be narrow at the bottom, as the force of that fluid will be fully adequate to remove any accidental impediments to its course, and consequently such drains will be more durable.

Where the materials are not too dear, *stone drains* may be resorted to with advantage. They should be cut 10 or 12 inches wide, with perpendicular sides; and lined with flat stones so disposed as to leave a watercourse at the bottom, by setting two of them in such a manner as to meet triangularly at the points. The cavity of the drain should be filled nearly to the top with loose stones, for which coarse-screened gravel may be advantageously substituted, where a sufficient quantity can be obtained.

[1] Elements of Agriculture, p. 311.

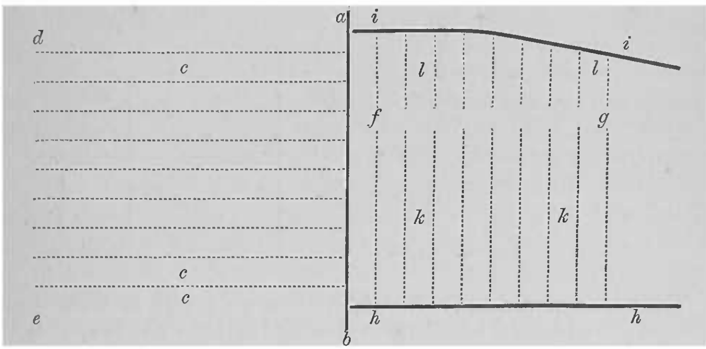
In loose sandy or peaty soils, where earth drains would last but a short time, pipes or tiles should be employed. The expense of these was formerly an obstacle to their being employed to any extent, but now, by the aid of improved machinery, they are within the reach of all agriculturists.

The varieties of soils met with in the practice of draining may be classified thus: 1st, *Light soils:* light gravelly loam, light marly loam, sandy loam, soft light loam, sandy soil, light gravelly sand, deep gravelly sand, coarse gravelly sand, loose gravelly sand. 2nd, *Medium soils:* clayey loam, marly loam, gravelly loam, friable loam. 3rd, *Heavy soils:* compact tenacious gravelly clay, soft adhesive clay, free soft clay. The practice of draining may be divided into three classes of operations: *first*, the laying out and direction of the drains; *second*, the depth of the drains; *third*, the distances between the drains; *fourth*, the materials used in the construction of the drains; and *fifth*, the cost of the drains. The laying out and the direction of the drains has been a subject of considerable controversy, two opinions having been brought forward; namely, one, that the direction of the drains should be in the line of greatest fall, in the slope of the ground; and the other, that the drains should be transversely to or across the fall or slope of the ground. The weight of evidence is decidedly in favour of the first mode, namely, running the drains in the direction of the slope. The following give nearly all that can be said of the respective merits of both plans. Of the first mode, Mr. Smith of Deanston says: 'Drains drawn across a steep, cut the strata or layers of subsoil transversely, and as the *stratification generally* lies in sheets at an angle to the surface, the water passing in or between the strata, immediately below the bottom of the drain, nearly comes to the surface before reaching the next lower drain; but as water seeks the lowest level in all directions, if the strata be cut longitudinally by a drain directed down the steeps, the bottom of which cuts each stratum to the same distance from the surface, the water will flow into the drain at the intersecting point of each sheet or layer, on a level with the bottom of the drain, leaving an uniform depth of dry soil.' In favour of the second mode of running the drains across the slope, Mr. G. Stephens, author of a treatise on drainage and agriculture, has the following: 'A drain made across the slope or declivity of a field, or any piece of land, will undoubtedly intercept more water than when it is carried straight up the bank or rising ground; this principle holds good in every case, whether the drain be made to receive surface or subterraneous water. Drains winding across the slope or declivity of a field, whatever their number or depth may be, their effect upon tenacious or impervious substrata will be much greater than if they were made straight up and down the slope;

and when the soil is mixed with thin strata of fine sand, which is the case nine times out of ten, the effect will be increased in proportion, and accordingly a much less number will answer the purpose.'

Drains are ranged under three classes, 'main-drains, sub drains, and small, or furrow-drains.' The main-drains are those into which all the other drains deliver the water, and which lead the united flow to the point of outfall, as a river. The position of these mains should be invariably along the lowest part of the field, or principal hollow; where the length of the small or furrow drains is such as to give them a great quantity of water to deliver, it will be advisable to divide the length, and allow the first half to deliver into a 'sub-main'—this communicating directly with the 'main.' Where there are minor or secondary hollows in the field to be drained, 'sub-mains' should be placed in these hollows.

FIG. 186.



PLAN OF DRAINAGE.

Thus let *a b* be the main drain; all the drains *c c*, running down the slope tending from *d e* to *a b*, drain directly into the main drain *a b*. But, on the other side of the main drain *a b*, the field does not slope towards the main, but slopes in two different directions. Thus the line *f g* represents the ridge or highest part, the slope being on one side of this, as from *f g* to *h h*, and on the other from *f g h* to *i*. The one side or slope of the hill *k k* is therefore drained by drains *k k*, leading into the 'sub-main' *h h*, which again communicates with the main drain *a b*—the other side or slope *l l* being drained by the drains *l l*, leading into the 'sub-main' *i i*, and that finally into the 'main' *a b*.

The Depth of the Drains.—This is decided by a variety of circumstances. It is usual in many cases to dig a series of holes called 'test holes' in the field; or, in place of these, deep cuttings may be made; these should be made in the line of intended drains, in order to become ultimately available as drains. Mr.

Bailey Denton, one of our best modern authorities on drainage, states, with reference to test holes, that they are only trustworthy when applied to light or free soils, and that they afford no index to what is required in the drainage of heavy clay soils.

The great object to be had in view, in deciding the depth of drains, is to give that depth which draws the greatest amount of water from the widest extent of land on each side of the drain; the greater the number of cubical yards of soil drained the more perfect is the drain; and this is, in fact, a test of the work; or, as Mr. Parkes puts it, this is the true expression of the work done, as a mere statement of the cost of drainage per acre of surface conveys but an imperfect idea—a very erroneous idea—of the substantive and useful expenditure on any particular system. This will be apparent on reference to the two last columns of the table, which give the cost in cubic yards and square yards of soil drained for one penny, at the above-mentioned prices, depths, and distances.

Depth of the drains in feet	Distances between the drains in feet	Mass of soil drained per acre in cubic yards	Mass of soil drained for 1*d.* in cubic yards	Surface of soil drained for 1*d.* in square yards
2	24	3·226½	4·1	6·27
3	33½	4·840	8·93	8·93
4	50	6·453	12·00	8·96

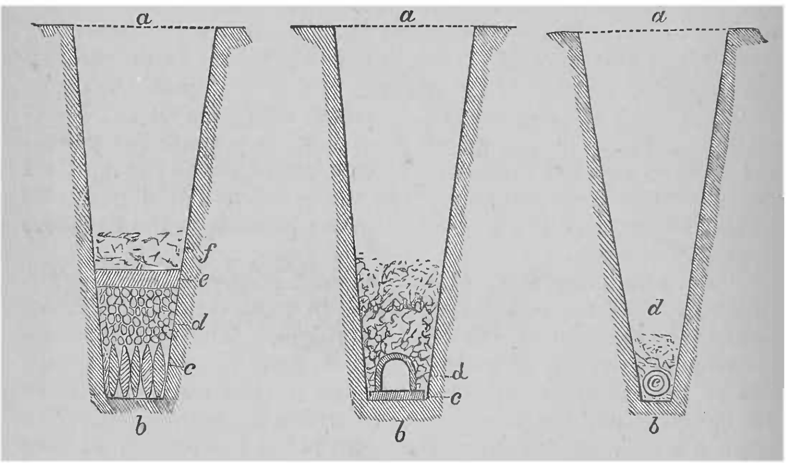
The value of a deeply-drained and aerated soil is now almost universally admitted; and so valuable is this to the growing plants, that it is difficult to place the limits to which their roots will descend. The roots of wheat with other cereals have been found to go three and four feet into the soil, and those of mangold wurzel more than this; three feet has, however, been placed as the least depth to which land should be well drained, but four feet is a usual depth in drains. Much has been written to prove that deep drains cannot possibly draw off the water from above them; whereas the truth is, that deep drains in clay soils are those which drain the quickest. 'From the nature of the interstitial canals,' says an authority on drainage, 'which exist in the soil, we are justified in comparing it to an extensive series of vertical and crooked or diagonally arranged tubes, bundled together with their mouths at the surface, and their exit openings a little above the level of the drainage channels. If the drains are shallow, these tubes must of course be short, and the hard pressure being less than if they were long, they will necessarily evacuate the water more slowly than would otherwise be the case. This theory is completely borne out by practical observations, for in most cases (other circumstances being equal) deep drains run sooner and faster after rain than shallow ones. And as the pores or tubes of dense soils are more minute than of light or open land, and will therefore require to have hard pressure to promote free circulation of water, the theoretical reason comes out why drains *require* to be deeper in clay land than in any other kind of soil.'

The distances between the drains is a point which has been as keenly disputed as the depth to which they should be cut. It is obvious that circumstances of soil must decide the distances between as well as the depths of the drains. The distance which suits a light free soil will not suit a close heavy one. As an authority well remarks, a good deal depends upon the after treatment of the surface of the soil, in deciding on the distances between the drains. The object is to allow the water, as soon as it falls, to descend at once, not to cause it to run along the ground; wherever it falls it should descend, finding its way externally to the drains. The surface should therefore be made as level as possible, having no ridge and furrow and rounded parts. Much practical evidence on the depth and distances of drains has been given in a Parliamentary Report, and this we would strongly urge the reader to procure, all the more that the cost is but trifling; it may be obtained on application at the Parliamentary Paper Office, Abingdon Street, Westminster. The following extract from it gives perhaps the gist of the point as adopted in practice; although, as stated above, much depends upon circumstances. The tables yet to follow give also further information or suggestions on the point as to the distances between the drains.

'The circumstance which has the most influence in ruling the distances of drains, and through these in some degree the depths, is the arrangement of the existing ridges. The width of the ridges runs generally from 12 to 24 feet, most commonly 18 feet; and as the ridges are usually thrown up in the middle from 12 to 18 inches above the levels of the furrows, a great saving in the cutting is effected by placing the drain in the line of the furrow; and besides, when the ridges are much raised, there is a tendency of the surface water to run towards the old furrow, even after the land has been drained; and if there is not a drain below or near to the furrow, there is an undue collection of water, which obtains for some years after the drainage has been executed, and until the ridges have been levelled down and the subsoil fully opened. The loss by this wetness or damp, or incompleteness of thorough and uniform dryness, is greater than the cost of having the drains somewhat less distant. There is also some difficulty practically in getting the drains cut to uniform depths, when the surface in the lines of the drains is of various altitudes from the datum level of the bottom of the drains. Practically, therefore, it is found to be a much more ready method, and upon the whole cheaper and much more immediately fully effective, to adopt the furrows for the lines of the drains. In some cases, when the ridges are under 12 feet in width, I have found it expedient to place a drain in every second furrow only; and in cases where an inequality in the width of the ridges existed, I have found it proper to adopt those unequal distances for the drains. Where such distances have been adopted generally, it has been found that depths of from $2\frac{1}{2}$ to 3 feet have, on all soils, and at all times, produced a thoroughly dry condition of the soil.'

The Materials used in the Construction of Drains.—Stone drains may be made where stones are very plentiful. Fig. 187 shows a mode of filling up a drain with stones; *a b* the trench, *c* stones on edge, *d* small stones, *e* a turf or sod, *f* soil. Fig. 188 shows the mode of filling up drains with horse-shoe tiles; *a b* the

Fig. 187. Fig. 188. Fig. 189.

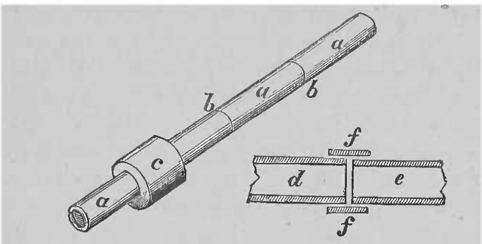


DIFFERENT METHODS OF FILLING UP DRAINS.

trench, *c* the 'sole,' on which the (tile) *d* rests. Stones are placed above the tile, and then the whole filled up with the soil. This is considered a very excellent mode of filling up drains by some authorities. The mode of filling up drains, however, almost universally adopted now is the 'tube' drain in fig. 189; *a b* the trench, *c* the tube, *d* the filling up of soil, &c. In some cases the tubes *a a*, fig. 190, are placed in the trench simply end to end; in other cases it is thought best to put a loose collar, as *c*, round the joint. The tubes thus provided are shown in section at *d* and *e*; *f f* the collar.

It seems to be generally admitted that the 1-inch bore pipe-tiles are not to be depended upon for drains, being very apt to become clogged, and not to afford a sufficient channel for the water. Plain cylindrical pipe-tiles are, however, the best that can be employed. For strong lands, and where the drains are frequent, a bore of 2 inches in diameter will suffice—some say $1\frac{1}{2}$ inch—and the size of the pipe may be increased as it approaches the outfall. For deeper drains in friable subsoils a bore of nearly twice that size will be requisite. The pipes for the main drains must always be twice or three times the size of the others.

FIG. 190.



COLLAR FOR JOINING DRAIN TUBES.

The following remarks on various points of detail in laying down drains, from an able Essay in the 'Transactions of the Highland and Agricultural Society of Scotland,' will be useful here:—

'In laying out the main drains and outlets, therefore, care must be taken to calculate with as great certainty as possible the quantity of water likely to be discharged. To determine the capacity in square inches of any circular pipe, square the diameter, and multiply by 0·7854. For example, a pipe having the diameter of 12 inches will, when squared, equal 144, and this, multiplied by 0·7854, will give 113·0976, or a little more than 113 square inches. The discharging power, however, of these large circular pipes is much greater than a square or horse-shoe tile drain of equal cubical section. There is little friction in the interior, and this, taken along with the contraction of channel, gives the water a much faster current in circular than any other kind of drains. Even in ordinary main drains, tiles of a round or a reversed elliptical section should always be preferred to those that are flat-bottomed. The flow of water in any kind of under drains, but especially in main ones, is also greatly dependent on the accuracy with which the levels are kept; and a very slight fall, if the bottom is cleaned out with a very great nicety, will give a good run, when a considerable fall with inaccurate levels will fail to secure this end. In cases where main drains have a long stretch without a discharging outlet, and run some risk of being flooded during heavy rains, it will be found conducive to their safety to provide at different points, if possible, a line of pipes branching off into some adjoining open ditch, which, while too shallow to receive the discharge from the main drain itself, may yet be low enough to catch the overflow water that is likely to do harm if not allowed an exit. Suppose, for instance, that a main drain 4 feet 9 inches deep is provided with a branch pipe at intervals, laid $3\frac{1}{2}$ feet under the surface, it will be obvious that the vertical pressure on the former can never exceed 15 inches; and when the nature of the ground permits of it, may be so arranged as to be a great deal less. To catch any solid matter which may be likely to get into the main drains, it is always a safe provision to form, at intervals of 180 to 200 yards, small sediment wells, with brick on bed. A depth of a foot below the level of the drain will be sufficient in ordinary cases; and the building being carried up to within about 18 inches of the surface, a flat closely-fitting stone with a ring in it will cover up the opening. Wherever there is an overflow branch tile, there should be one of these wells in the main; and those that may be necessary at other points can have a mark set up near them, that the cover may easily be reached, and the well cleaned out at pleasure. In practice this will be found to add greatly to the efficiency of the drains; and the expense of providing wells such as have been described is very trifling. Another provision well calculated to promote the continued efficiency of outfalls and main drains is that of providing some sort of protection at the various mouths. A grating is sometimes placed before the vent, but the water is necessarily obstructed by it to an injurious extent; and, whenever drains are to be finished in the best possible manner, a light cast-iron valve, working on pivots, should be furnished for each outlet, in preference to a grating. By a number being placed on the valve, and a reference made to it in the drainage book, there is less fear of the outlet being forgotten than would otherwise be the case. How often, even on well-drained land, do we see the entire efficiency of the drains hazarded by the outfalls being neglected. The principal main drain is perhaps run into an open ditch; but beyond putting a turf or two round the tile, no special building is provided to mark the place. As the ditch grows up from want of attention, the drain mouth is concealed, and by-and-by it becomes choked altogether, and destroys the drains. Now, if a substantial stone or brick-built mouth, in the form of a very short culvert, were in all cases put round the farthest out-tile, a little valve provided, and its exact position and everything else described in a book kept for the purpose, it could scarcely be lost sight of, except under the grossest mismanagement. Care should also be taken, in every instance that the ground at all permits of it, to give a drop of 9 or 12 inches from the sole of the outmost tile to the bottom of the open ditch.'

As to the cost of draining operations, much need not be said, as this will depend upon a variety of local circumstances; so that the results of experience of one place will be no guide to the probable results of another. 'The principal circumstances,' says Mr. Spooner, 'which determine the cost of drainage works are: The labour of cutting and filling the drains, the material of which the drain itself is formed, and the outlets for the discharge of water. Of these, the last increases in proportion as the ground is steep and irregular or unusually flat, and can only be included in a general estimate where the surface gently undulates; the material also varies greatly in cost, arising, in the case of tiles, in the supply being near at hand and equal to the demand or otherwise, and, in the case of stones, in the distance of carriage.

'It was formerly considered that the cost of drainage was equally divided between that of the labour and material; and in 2½ to 3-feet drains filled with stones or horse-shoe tiles, on soles, this is about the case; but the more general introduction of pipes, and the improved methods of making them, have occasioned a considerable balance in favour of material, while increase of depth has increased the cost of labour.

'This latter item can be determined with sufficient accuracy by referring it to a standard pretty generally known, viz., the value of moving a solid yard of earth of any one description of hardness; and to illustrate this I have drawn up the following table, which supposes two sets of drains, the one open for stones, the other for tiles, and at depths of 3 feet and 3½ feet, and 4 feet respectively. I have shown the average width of the cutting for each size and sort, the number of lineal yards required to equal a solid yard in each; and assuming three descriptions of soil, the differences in hardness of which make the cost of moving their solid yard 4*d.*, 6*d.*, and 8*d.* respectively. I have calculated the labour value per yard and per rod linear of the different depths and sorts: and these will be found to tally very closely with the prices at which the work is done.

'It is a common remark that the cost of making drains is double by every foot of increased depth given, and the same in proportion for every part of such increase. The following table shows that this is so:—

Stone-filled Drains as in Fig. 187.

Depth of each drain in feet	Average width of drain	Running yards of drain to the cubic yard.	Sandy soils, light loams and light clays, easy digging		Stiffer clay and gravel requiring some pick-work.		Hard clay and close soils requiring pick-work before they can be done	
			At 4*d.* per cubic yard.		At 6*d.* per cubic yard		At 8*d.* per cubic yard	
			Per yard	Per rod	Per yard	Per rod	Per yard	Per rod
	Inches		*d.*	*d.*	*d.*	*s.* *d.*	*d.*	*s.* *d.*
4	14	2 +	2	11	3	1 $4\frac{1}{2}$	4	1 10
$3\frac{1}{2}$	12	$2\frac{1}{2}$ −	$1\frac{3}{5}$	9	$2\frac{2}{5}$	1 $1\frac{1}{4}$	$3\frac{1}{5}$	1 $5\frac{1}{2}$
3	10	$3\frac{1}{2}$ +	$1\frac{1}{7}$	$6\frac{1}{4}$	$1\frac{5}{7}$	0 $8\frac{1}{2}$	$2\frac{1}{2}$	1 $0\frac{1}{2}$

Tube or Pipe-filled Drains, as in Fig. 189.

			d.	*d.*	*d.*	*s.* *d.*	*d.*	*s.* *d.*
4	$10\frac{1}{2}$	$2\frac{1}{2}$ +	$1\frac{3}{5}$	9	$2\frac{2}{5}$	1 $1\frac{1}{4}$	$3\frac{1}{5}$	1 $5\frac{1}{2}$
$3\frac{1}{2}$	$9\frac{1}{2}$	$3\frac{1}{4}$ −	$1\frac{3}{13}$	7	$1\frac{11}{13}$	0 $10\frac{1}{4}$	$2\frac{6}{13}$	1 2
4	$7\frac{1}{2}$	$2\frac{1}{15}$ +	$0\frac{3}{4}$	$4\frac{1}{4}$	$1\frac{1}{5}$	0 $6\frac{1}{2}$	$1\frac{1}{2}$	0 $8\frac{1}{4}$

'Where a fraction more or less than the number stated is due, the signs — or + are put respectively.'

In calculating the cost of executing drainage, the following table, given in the 'Report of the Board of Health's Minutes of Information on the Drainage of Buildings, Sites, and Roads,' will be useful. The cost of cutting drains obviously depends upon the quantity of earth thrown up. To ascertain the cubic contents of a drain, multiply the length, depth, and mean width of the drain. The mean width is the half of the sum of the width of drain at widest, and that at the narrowest part; thus, if the width at top is 18 inches, and width at bottom 4 inches, 11 inches, half of 18 + 4, is the mean width. The following is the table above referred to:—

Depth	Mean Width											
Inches	7 in.	8 in.	9 in.	10 in.	11 in.	12 in.	13 in.	14 in.	15 in.	16 in.	17 in.	18 in.
30	0·89	1·02	1·14	1·27	1·40	1·53	1·65	1·78	1·91	2·04	2·16	2·29
33	0·98	1·12	1·26	1·40	1·54	1·68	1·82	1·96	2·10	2·24	2·38	2·52
36	1·07	1·22	1·37	1·53	1·68	1·83	1·98	2·14	2·29	2·24	2·60	2·75
39	1·16	1·32	1·49	1·65	1·82	1·98	2·15	2·32	2·48	2·65	2·81	2·98
42	1·25	1·42	1·60	1·78	1·96	2·14	2·32	2·49	2·67	2·85	3·03	3·21
45	1·34	1·53	1·72	1·91	2·10	2·29	2·48	2·67	2·86	3·05	3·24	3·43
48	1·42	1·63	1·83	2·04	2·24	2·44	2·65	2·85	3·05	3·26	3·46	3·66
51	1·51	1·73	1·95	2·16	2·38	2·60	2·81	3·03	3·25	3·46	3·86	3·89
54	1·60	1·83	2·06	2·29	2·52	2·75	2·98	3·20	3·44	3·66	3·89	4·12
57	1·69	1·93	2·18	2·42	2·66	2·90	3·14	3·56	3·66	3·87	4·11	4·35
60	1·78	2·03	2·29	2·54	2·80	3·05	3·31	4·38	3·82	4·07	4·33	4·58

Along the top of the table is placed the mean widths in inches; and on the left-hand side the depths of the drains, extending from 30 inches to 5 feet. The numbers in the body of the table express cubic yards and decimals of a yard. In making use of the table, it is necessary, first, to find the mean width of the drain from the widths at the top and bottom.

Thus, if a drain 3 feet deep were 16 inches wide at the top and 4 inches at the bottom, the mean width would be half of 16 added to 4, or 10; then, by looking in the table for the column under 10 (width), and opposite 36 (inches of depth), we find the number of cubic yards in each rod of such a drain to be 1·53, or somewhat more than one and a half. If we compare this with another drain 20 inches wide at the top, 4 inches at the bottom, and $4\frac{1}{2}$ feet deep, we have the mean width 12; and looking at the table under 12 and opposite 54, we find 2·75 cubic yards, or two and three quarters to the rod. In this case the quantity of earth to be removed is nearly twice as much as in the other, and hence, as regards the digging, the cost of the labour will be nearly double. But in the case of deep drains, the cost increases slightly for another reason, namely, the increased labour of lifting the earth to the surface from a greater depth.

Having succeeded in draining the land, the next point for the consideration of the agriculturist is, the use to which he can apply the drainage water. That coming from high ground can often be applied to the irrigation of grass-lands situated at a lower level. When the land drained lies low, the 'Centrifugal Pump' may be of use in raising the water for the purpose of working machinery, or an ordinary water-mill will effect the same object. Or, if water-power is not required on the farm, the drainage water may be filtered, and applied to various useful purposes about the house or homestead. Here, as in all other agricultural operations, nothing should be wasted, but an endeavour made to derive the utmost benefit even from that which at first sight would appear valueless or refuse.

CHAPTER XI.

ON IRRIGATION.

WATER, forming either directly or by its decomposition by far the greatest portion of the sap of plants, is absolutely necessary to vegetation; hence, although injurious to land when it soaks into or *stagnates* upon it, it effects a great improvement where the land can be flooded with it, or where it can be conveyed upon it and withdrawn again at pleasure. The knowledge of this has given rise to the practice of watering meadows, now so successfully adopted, wherever circumstances admit of it, under the name of 'Irrigation.'

Water is essential to the life of plants. Nature supplies it in the form of rain and dew; but these are uncertain, and it is often necessary, in order to ensure the fertility of the soil, to convey and distribute water over the country.

This practice, which was not introduced into England until nearly the end of the seventeenth century, has been adopted from the earliest periods of history. The oldest book in the world gives an account of it: Moses speaks of the children of Israel, when in Egypt, sowing their seed and watering it with the foot.[1] They raised the water of the Nile by means of machines which they worked with their feet, and poured it over their fields in places to which the inundation did not reach, or in seasons of the year when, in that hot country, water was necessary to the continuance of vegetation. These *sakias* still exist. The Greeks and Romans also practised various methods of watering their fields, as is evident from passages in the writings of Virgil, Cato, Columella, and Pliny. At the present day, in Southern Asia, the watering of land from rivers and brooks, and, if no better source can be obtained, from wells, is essential to the support of the inhabitants. In every part of southern Europe the water is conveyed in little channels to the corn-fields, the vineyards, and the olive-trees.

The irrigation the practice of which has established itself in our country may, in a very few instances, be intended to supply the natural deficiency of moisture in the soil; but, generally speaking, a different purpose is to be answered. The water flows over the meadow at seasons when there is already a supply of moisture. It flows over it, but is not permitted to stagnate upon it, or the plants would be rendered in some degree aquatic. It often apparently contains no fertilising material. There is no rich vegetable sediment. It merely flows over the land for a while, and is then carried off as quickly as it entered, and many persons are inclined to attribute the beneficial effects resulting from irrigation simply to the refreshing influence of the cool current; while others, on the contrary, conceive that the water contributes warmth to the soil and thus benefits it; but more scientific reasoners consider that irrigation is most fertilising where the chemical elements held in solution by the water are such as most readily act on the component parts of the soil. Pure water is seldom so beneficial in its effects as water which is impregnated with organic, or earthy, or vegetable matter. Certain it is that

[1] Deut. xi. 10.

these considerations have not hitherto been sufficiently attended to, or it would have ceased to be a problem why irrigation should be so successful in one place and such a failure in another.

We will now proceed to describe the ordinary mode of watering meadows. Suppose that there is a stream of water lying contiguous to and somewhat lower than a river, and that the field to be watered forms or does not form an inclined plane between: a dam is thrown across the stream, or a sluice is dug in the bank, communicating with a channel or head main in the highest part of the field, which is filled with the water until its banks overflow. From this there run certain trenches, or small mains, improperly called *carriers* or *carriages*, which branch off from the main channel at right angles to it, and parallel with it; these are filled until they run over throughout the whole length. Drains are made in the lowest part of the meadow, as nearly parallel with the small drains as possible; the design of which drains is to discharge the water into a tail or main drain, which conveys it off the meadow.

In order to make the water run equally over the sides of the trenches, stops are placed in them at proper distances, which, by obstructing the course of the water, cause it to rise a little and overflow the neighbouring ground to a greater or less extent. These stops are formed by laying across the trench pieces of turf, which reach as high as its banks next the sides: but are lower towards the middle; and, when they are of a proper height and distance from each other, the water will flow uniformly over all parts of the bank.

The trenches should be made with a small ascent in the bottom, from the river to the farther end, and should all unite near the river, where a sluice should be placed with gates or hatches. This being shut, in order to keep back the water coming from the river, and a small sluice in the side, communicating with the main drain of the canal, being opened at the same time, the water in all the trenches or mains will, to a greater or less extent, return from the farther end, and, passing through this small sluice into the main drain, leave the trenches, in a short time, perfectly dry. The bottoms of the drains are, on the contrary, to be made highest next to the river, and thence deepening to a large drain at the lower end of the meadow; so that, when the water ceases to run into them over the sides of the trenches, they will soon be emptied into the main drain, and the whole meadow thus be laid dry.

When the meadow is to be watered again, the small sluice must be shut and the large one opened, which will admit the water from the river, and irrigate the meadow as before. The water should be made to flow over the sides of the trenches, and over the surface of all the land lying between them and the drains, as equally as possible; and, for this purpose, the earth dug out of the drains and trenches at first, and afterwards, when they are scoured or cleansed, should be spread upon the lower part of the ground, in order that it may lie even and form a regular descent towards the drains. The soil, thus dug or scoured out, also serves to repair the banks of the trenches. The land should be as level as possible, and where its surface is very uneven, the inequalities should be removed; for, although the expense of so doing is considerable, it will be more than counterbalanced by the improvement.

The construction of sluices is one of the principal articles of expense, partly because they are usually made of timber, a material subject to decay in the course of a few years; whereas brick and stone, cemented with terras, are equally proper, and would be much more durable, particularly when the sluices are constructed upon correct principles, so as to prevent them from being *blown up*, or the water from forcing a passage at the bottom. Great improvements have latterly been made in conducting this operation. The land is more carefully prepared, levelled, and inclined; the trenches, drains, &c., are better constructed, as are the sluices. In the Hampshire watered meadows, sliding water-doors, regulated by a cogged-wheel, turned by a moveable winch, have been introduced.

It would be foreign to the plan and design of this work to detail the mode of constructing the sluices, stops, &c., necessary in the system of flooding land; we shall, therefore, proceed to illustrate our remarks by the following plan and explanations, and at present only observe that the different works should be carefully examined and scoured out in autumn, and all necessary repairs made, and refer the reader to Mr. Boswell's very interesting 'Treatise on Watering Meadows.'[1]

Fig. 191.—*w*, *c*, *c*, *w*, *a*, *a*, is the meadow, highest at *c c*, whence it has a slight gradual descent towards *a a*.

The whole meadow is divided into ridges, each about nine yards broad, which slope from the crown about thirteen inches towards the lower sides, or about one inch to every foot in breath.

c c c is the main carriage, which, when the meadow is to be flooded, is filled with water from the river R R, through a sluice at S. *c a*, *c a*, are carriages which communicate with the main carriage at the upper side of the meadow, whence they are also filled with water, which, running over the sides throughout their whole length, flows over the grass, and then, falling into the drains

[1] The reader may also consult Mr. Wright's Art of Floating Land; and will find some valuable hints on the subject in the Farmer's Calendar, page 301; the Agricultural Survey of Wiltshire; Stephens's Practical Irrigator; Thaër's Principles of Agriculture; Annalen des Ackerbanes, vol. ii.; Driver's Hampshire; and the Journal of the Royal Agricultural Society.

on each side, *d r*, *d r*, is conveyed into the drain *r r*, and from thence out of the meadow at *n*.

All the carriages of water-meadows should be broad enough to contain a sufficient quantity of water to flow over the whole surface of the land, and as quickly as the supply from the river will permit, for those meadows have been observed to be most fertile where the fall is quick, without being too sudden. To make the carriages deep would be of no use, because it is only the water at the surface that flows over their sides. A carriage kept full, that

Fig. 191.

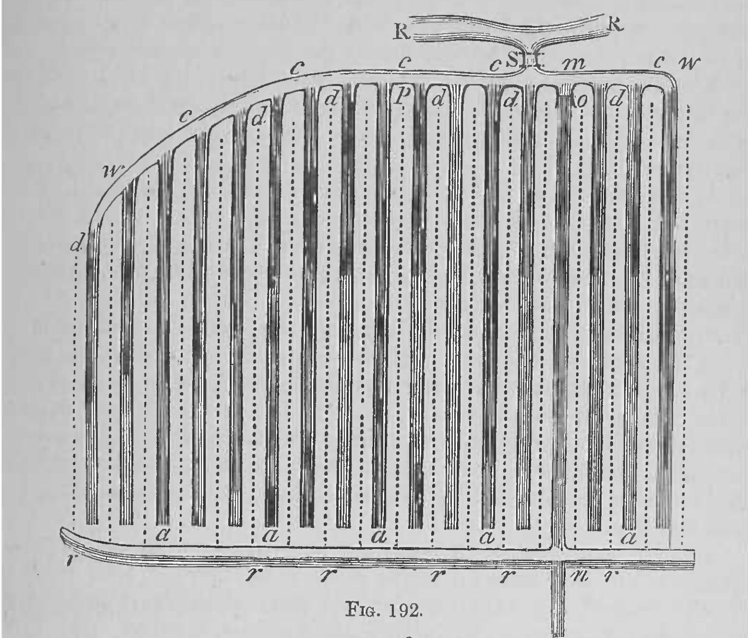
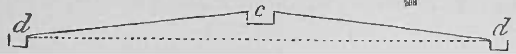


Fig. 192.



IRRIGATION BY SLOPING RIDGES (RIDGE AND FURROW).

has only six inches of water, will throw as much over upon the meadow as if the water in it were six feet deep. There is also an evil in deep carriages; a larger body of water, by its weight, forces deeper into the ridges and chills the land, and makes it produce flags and other aquatic weeds, to the great injury of the hay; whereas the object of the operation is merely to pass the water over the surface.

The drains *d r*, *d r*, are made between the ridges in the furrows, and parallel to the carriages; they are 18 inches wide, and of a similar depth, at the upper ends *d d*, and 24 inches wide, and the same depth, at the lower ends *r r*.

The carriages *c a*, *c a*, are widest (24 inches) at their upper ends *c c*, in order to receive a sufficient quantity of water, and are gradually contracted from 24 to 18 inches at their lower ends *a a*; by which contraction the water, being more and more confined, rises a little, runs over the banks, and flows upon the grass on each side.

The drains, on the contrary, being made narrower at their upper ends, and widening, and also deepening towards the lower, are on that account capable of receiving the accumulating water from the carriages, which they discharge into the large drain *r r*, in order to be conveyed out of the meadow at *n*.

The main drain *m n* is four feet wide, and is made to receive the water out of the carriages through a small sluice near *n*, which is to be opened for that purpose when the meadow has been sufficiently watered.

If the bottoms of the carriages were level from one end to the other, the water could not be drawn out of them, but would stagnate there and chill the ground, and make it produce sedge, flags, and such coarse aquatic plants; for which reason the carriages are deeper by six inches towards their upper ends next the river than at their further ends *a a*. This being the case, it results that, when the meadow has at any time been sufficiently watered, and is to be laid dry by shutting the sluice at S, to prevent more water coming in from the river, and opening the sluice near *n*, the water immediately begins to run out of the carriages into the main drains, all the former are emptied very speedily, and the water in the drains running off at the same time, the whole meadow is soon laid dry.

It is not necessary to continue the carriages so far as the drain *r r*, but they may be made shorter by three or four yards; for the water that runs over at the ends of the carriages will spread and flow over the intermediate spaces, from *a a* to the drain *r r*.

Where the water does not run over the sides of the carriages, or not equally, stops are to be put into the carriage a little below, which will make the water rise somewhat above the stops, and flow over the bank. These stops are made with pieces of turf laid across the carriage by way of a dam. The turfs are to be made higher than the surface of the water next the banks of the carriage, but a little lower in the middle, in order that the water may pass there; in this form .

The sluice S, by which the meadow is watered, is two feet wide, and three feet nine inches deep. While the meadow is watering, the hatch or gate of the sluice is drawn up about $2\frac{1}{2}$ feet, and then the water passes through an aperture of 5 square feet; by which means, supposing it runs at the rate of 2 feet in a second, the quantity of water thrown upon the meadow is 10 cubic feet in a second, or about 560 tons in an hour. A much larger quantity would be more beneficial, though even a less supply would benefit the land.

Fig. 192.—*d c d* is a section of one of the ridges; *c* the carriage on the top of the ridge; and *d d* the drains into which the water falls after it has flowed over the land on each side from *e* to *d*.

If there is not sufficient water to irrigate the whole meadow at once, it may be done in two or more divisions. As, suppose the part *w c m p*, or about half of it, is to be watered first, make a dam across the main carriage at *c p*, and then the part *w o p* may be watered in the manner already described, and the other part will remain dry. In order to water this other part by itself, make a dam across the main carriage at *o m*, and at the upper ends of the other carriages from *o* to *p*; the water being then let in from the river will fill the other carriages, and flow over this part of the meadow only.

These dams across some of the carriages do very well occasionally; but where there is not a sufficiency of water—and a meadow must always be watered in divisions—it is the best way to put in small sluices in convenient places of the carriages, to turn the water on and off the several divisions of the meadow at pleasure.

When the water has flowed over the meadow, and is all discharged, if there are any other meadows situated below *n*, they may also be flooded in the same manner as the first, and with the same water; and in some places it is thus thrown over several meadows in succession for some miles. But it is now very generally known that the fertilising properties of water are diminished after it has been once used for irrigation, and the second or third meadow over which it is made to pass derives less and less benefit from it.

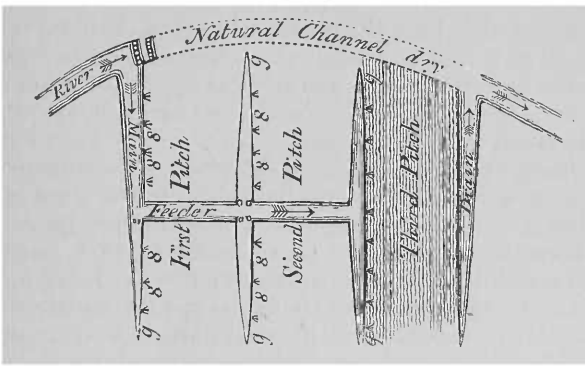
Any meadows contiguous to a river may be watered without being laid out in so accurate a manner. If the river is a little higher than any part of such meadows, head mains may be made, and the water conducted to the highest parts, and trenches or small mains made branching from them and between the drains; which, even though it may not be possible to cut them quite parallel to these latter, on account of the unevenness and irregularity of the ground, will, notwithstanding, answer the purpose very well, and be a great improvement—care being taken not to place either the trenches or drains too far asunder. The nearer they are together, if there is room left to mow between them, the greater will be the improvement. Where there are any hollows, they should be filled up, and the surface laid smooth, with the earth dug out of the drains, in order that the grass may be mown very close. And it has struck us that, where the river lies lower than the land, Appold's centrifugal pump might be made available; it discharges at the rate of 1,200 gallons a minute, and the lower the lift the more water it works. It is remarkably simple, consisting of a hollow wheel with curved arms shut in by flat sides, so as to form a number of passages radiating from the centre to the circumference. The water is admitted by passages at both sides of the centre, and discharged at the circumference. It is capable of accommodating its discharge to a varying height, without the necessity of changing its speed. Might it not be used to raise water from lower levels, rivers, drains, sewers, &c., and pour it into channels, whereby it might be distributed over higher ground?

There is another description of irrigation practised in the county of Gloucester, where it is termed *catch-work*. It is calculated for meadow and pasture lands that lie on a steep declivity, or on the side of a hill. This method is denominated *catch*, because, when the whole is watered at once, the water is carried up by the main cut or *feeder*, and, having attained the top of the piece of ground, floats over the uppermost pitcher or *panes*, and is caught in or falls into the floating gutters which distribute it from one *pitch* to another, until at length it reaches the bottom of the field, where it is received into a drain made for the purpose of carrying it off, or conveying it to other lands situated on lower levels. In this method of watering, fewer cuts are necessary than in the one previously detailed; and these are made as nearly in parallel lines below each other as the bank will permit.

In this delineation, fig. 193, of a catch meadow, selected from Mr. Wright's 'Art of Floating Land,' the lateral, horizontal, feeding gutters, which distribute the water over the first and second *pitches*, are represented as shut by sods or stones, consequently they appear dry. The whole body of water is delineated as passing down the main feeder into the lowest floating gutter, whence it reaches the bottom or third pitch, and is thence received into the drain at the bottom of the meadow, to be returned by it into the natural channel.

When the whole is to be floated at once, the obstructions are taken from the lateral floating gutters, other obstructions being in the meantime placed in the main feeder, immediately under the floating gutters, in order to force the water into them. In obstructing the main cut or feeder, care must be taken not to stop it *entirely*; a part of the water it contains should always be allowed to escape *in it* to the lowest panes or pitches; for, supposing the main feeder to be entirely shut under the feeding gutter (g 1), so that the whole is made to run over the first pitch from such gutter, and the horizontal part of the main drain, the water filtrated through the grass of the first pitch would be so much divested of its fertilising qualities as to be almost incapable of communicating any perceptible benefit to the pitches lying beneath. Water thus filtrated is, in the language of Gloucestershire irrigators, termed *used water*, and is regarded as next to *useless* : and hence it is that the grass growing nearest to the floating gutters is most abundant, and of the best quality, in all kinds of meadows. There is no doubt that the water does deposit a certain quantity of fertilising sediment, yet in many cases this is very small, and water

FIG. 193.



PLAN OF CATCH-WATER MEADOW.

from the clearest brook may be employed with very great advantage, though streams in which cresses and some few weeds grow are more beneficial.

The proper breadth of the panes or pitches of catch-meadows, from gutter to gutter, is by no means correctly determined; but it should seem that they ought not to be much broader than the distance from the floating gutter to the receiving drain in *float-meadows*—now most generally known as 'ridge and furrow' irrigation—that is, from four to six yards. *Catch-meadow* is not held in such estimation, or so profitable, as float-meadow, but it is the only kind available for hilly lands.[1]

All lands that lie low, and are contiguous to the banks of rivulets, brooks, and springs, are capable of being watered, particularly where the watercourse is higher than the lands, and kept within its bounds by the banks; and if the current has a very quick descent, the improvement by irrigation will be very great,

[1] For an excellent paper on Catch-meadows, see Journal of the Royal Agricultural Society, vol. x.

and attended with comparatively little expense, because, in proportion to the greatness of the descent, the improvement is more speedy. The lands most suitable for this purpose are, in Mr. Boswell's opinion—

1. A *gravelly*, or sound, warm, firm, sandy soil; or, which is more frequently the case, a mixture of each, or almost any soil partaking of these qualities. Such soils, where there is a descent from the river, exhibit an almost instantaneous improvement. It will in no case be advisable to attempt a large improvement by irrigation until the quality of the water is known. This, however, may in most instances be discovered by observing the effect it produces upon the herbage of the land which is sometimes overflowed by it; or may be easily ascertained by watering a small piece of land with it, by way of experiment. Water impregnated with ferruginous or calcareous particles is unfit for irrigation, as is peat and bog water; while trout-streams, brooks, favourable to water-cresses, and springs which feel warm and soft, or, as some describe it, oleaginous, to the hand, are almost invariably found to be fertilising.

2. *Boggy*, miry, and rushy soils, which always occur near the banks of rivers where the land lies tolerably level, are capable of equal improvement with any others, when their respective values in an unreclaimed state are considered. In that state, indeed, swampy marsh-land is of little worth; but, by being judiciously watered and drained, it may be made to produce an ample crop of hay. Much expense and judgment are, however, necessary to bring this sort of land into cultivation; and when it is very boggy, it requires more and longer watering than any sandy or gravelly soils. Here the larger the body of water that can be brought upon it, the more beneficial will be the consequence, as the weight and strength of the fluid will greatly assist in compressing the soil and destroying the roots of the aquatic weeds growing upon it.

3. *Strong, wet,* and *cold clay soils* are the least susceptible of improvement from irrigation, not only because of the dead level of their situation, but also from their tenacity, which will not admit of their being drained without great expense and trouble. But where this can be effected, and a strong body of water can be thrown over them from a fertilising river in the winter, and a warm spring succeeds, it has been stated that the crops of grass upon such lands are immense.

4. It may also be observed, that *springy land* is by no means fit to be watered, until it has been rendered firm and compact by a thorough draining; for the water thrown upon it will soak into it, and cause it to produce, at best, only a coarse and rank herbage.

Nor is it, as we have before observed, always that the water itself is adapted to the soil over which it is thrown. Instances have been repeatedly met with in which the same water has materially improved one meadow, and either produced no effect whatever on another, or deteriorated it.

A system of irrigation has been proposed by Mr. Bickford which is spoken highly of as economical and effective. The following is a description of it, which we have given elsewhere:—

'In a communication to the "Journal of the Royal Agricultural Society of England," Sir Stafford Northcote described the peculiarities of the system, from which we derive the following particulars:—Along the line of the highest ground a carriage gutter is cut, about 12 inches broad and 6 deep, these gradually diminishing as the gutter approaches its termination, till at last it merges into the ground. On this gutter becoming filled, the water overflows; and were the slope of the land below uniform over all its surface, it would be shed uniformly over it; but the inequalities in the land prevent this, causing it to flow in streams over the lowest parts. To obviate this, subsidiary or smaller gutters are cut in the same direction as the main carrier gutter, but lead throughout their length. The water shed from the carriage gutter is caught by the subsidiary one till it fills, and in turn overflows, shedding the water over the land between it and the next subsidiary gutter in succession; this having, as the other one, no fall throughout its length, also fills, and in turn overflows, shedding the water over the land between it and the next gutter; this is continued till the water finally reaches the drain at the bottom of the field. The method by which these catch-waters or subsidiary gutters are formed level through their length, or nearly so, forms, from its simplicity and effectiveness, the peculiar feature of Mr. Bickford's system. In laying these catches out, the spirit level is set aside, and a simple instrument substituted. Two rods are joined at one end, and fixed at an angle so as to place the feet four feet apart; between these a cross piece is fixed, with its centre marked by a notch; from the apex of the triangle is hung a cord, from which a ball is suspended. When the instrument is placed on the ground, and the cord crosses the notch in the cross piece, the two feet stand on the same level. The workman places one foot of the instrument on the ground, and on this, as a pivot, turns the instrument round as he would turn a pair of compasses, and continues to place and replace the other leg, until he finds that both stand on the same level. Marking the position which the first or pivot leg occupied, he raises the second leg as the next pivot, and proceeds as before, until he finds a spot on which the other leg resting, places both legs on the same level. Obtaining thus a series of markings, he by this means traces out a level line throughout the field, and finally, by means of a plough invented for the purpose, cuts out on the line thus indicated a gutter four inches wide, and the same number of inches deep. At points where it is impossible to obtain a level, a step is put in the gutter, and a fresh level taken for the continuation. On the supposition that the water employed for irrigation contains fertilising matter in suspension, it is evident that, in the plan just described, the upper part would receive most of this matter, the second a less portion, and the third the least; to obviate this difficulty, cross feeders are made, connecting the main gutter with the subsidiary one below it, and this with the succeeding gutter, and so on. By a simple system of stops, the water from the main source can be passed to any one of the gutters without being shed over the intervening land. Sir Stafford Northcote estimates that the cost of irrigating land similar to his own, where the system has been carried out, would be not exceeding 1*l.* per acre, the annual expense of cutting new gutters by the side of the old ones being 1*s.* per acre. It is of importance to know the best mixture of grasses to be used for irrigated meadows; this will necessarily vary according to circumstances of soil and locality; but Professor Tanner gives the following as mixtures which may be useful in general circumstances:—

'*Poa aquatica* (or *Glyceria aquatica*).—This water meadow grass, also known as the reedy sweet water grass, is a valuable plant for irrigated land, as it has a *rapid growth of good quality.*

'*Poa fluitans* (or *Glyceria fluitans*), *floating sweet water grass*, is exceedingly *early* in its growth, and for this reason is generally sought after in seeding new meadows.

'*Agrostis stolonifera*, fiorin grass or marsh bent, takes a high position as a water meadow grass. It is very productive, and yields *both early and late* herbage of good quality. It always *spreads* rapidly, and maintains a firm plant.

'*Alopecurus pratensis*, meadow fox-tail grass. Its *early*, *abundant* and *rapid growth*, together with the excellent qualities of the herbage, place this among our best grasses for meadows; and it answers very well for water-meadows, *provided* the management is good.

'*Festuca elatior*, tall meadow fescue. This grass, although rather coarse in its nature, is *relished by stock*; it is, however, best suited to land which lies low.

'*Festuca pratensis*, meadow fescue. The produce is *abundant*, without being coarse; the *quality* is *excellent*, and its growth regular.

'*Lotus major*, great bird's-foot trefoil. Moist situations are its natural localities. It yields an *abundance of nutritious food*, and is much sought after by stock.

'*Trifolium hybridum*, hybrid clover, is not grown so much as its merits justify; it is highly esteemed on the Continent, and where it is grown in this country it answers very well. It is the *most suitable of all the clovers* for a water meadow.

'*Phleum pratense*, meadow cat's-tail, or Timothy grass. The growth of the grass is both *early* in the spring *and late* in the winter; it produces an abundance of herbage, and the quality is exceedingly good.

'These are the principal grasses which are suitable for irrigated land; and the following mixture of these seeds, which has been recommended,[1] appears to be a judicious receipt:—

Agrostis stolonifera	2 lbs.	Brought forward	21 lbs.
Alopecurus pratensis	2 ,,	Lolium perenne	12 ,,
Festuca elatior	2 ,,	Phalaris arundinacea	2 ,,
Festuca pratensis	2 ,,	Phleum pratense	2 ,,
Festuca pratensis coliacea	2 ,,	Poa trivialis	3 ,,
Glyceria aquatica	1 ,,	Lotus major	2 ,,
Glyceria fluitans	2 ,,	Trifolium hybridum	1 ,,
Lolium stalicum	8 ,,		
Carried forward	21 lbs.	Total	43 lbs.

'These seeds should be sown on the land after it is well cleaned, and brought into good order by previous cultivation. The surface must be gently harrowed, and then rolled, the birds kept off, and with ordinary care a good plant of grass will soon establish itself, producing herbage of the very best quality. No water should pass over the surface until the soil has settled firmly and the grass is strongly rooted. The water gutters may then be cut according to the plan decided on, and the irrigation may proceed as usual.'

CHAPTER XII.

ON WARPING.

THE improvement of land by *warping* is very extensively practised in some districts. It consists in admitting the tides of large rivers, or the waters of any that are under the influence of the tide, suffering them to deposit the sediment or warp which they contain, and then letting the water run off again as the tide ebbs. The water is admitted by sluices into some still pond, or over a certain extent of country. An embankment preserves it in a great measure from the agitation of the waves, and the earthy matter which the water contains is thus deposited. On the banks

[1] Morton's Cyclopædia of Agriculture, vol. i.

of the Humber this operation has long been practised on a most extensive scale. The water is there more than usually turbid, on account of the meeting of the tide and the fresh water. The tide runs for a very considerable way inland, and in the course of a season a foot of rich soil, on an average, is added to the former surface, and, in low places, two or three or four feet, so as to have a perfectly level surface.

In order to render this process more efficacious, the water must be perfectly at command, so as to be excluded or admitted at pleasure; and the land should be below the level of high tide. Hence it is necessary not only to cut a canal communicating with the river, but also to have a sluice at the mouth of it, which may be opened or shut as circumstances require; while, in order that the water may be of a proper depth on the surface of the ground to be warped, and also to prevent adjacent lands from being overflowed, strong banks are raised around the fields, from three or four to six or seven feet in height, according to circumstances. Thus, if the tract is too large, the canal which takes the water may be made several miles in length. It has been tried as far as *four*, so as to warp the lands on both sides the whole way, and lateral cuts may be made in any direction for the same purpose; allowing the water longer time to deposit its sediment, because the effect decreases in proportion to the distance of the land from the river.[1]

The following practical instructions for conducting the important process of warping we give in the words of Thornton J. Herepath :—

'An excavation having been made in the river-bank, under the bed of the stream, a *clough* is built, which directly communicates with a main drain or duct. This drain is furnished with substantially-built raised embankments of very solid earth, and is formed for the purpose of conveying the muddy water from the river to the land intended to be warped, over which it is gradually and equally distributed by numerous smaller lateral drains, the said land having been previously laid as nearly upon a level as circumstances will admit of. In order to confine the water to this particular spot, and prevent it from overflowing the adjacent country, the land is surrounded and divided into compartments by strong well-formed banks, which are of the same height as those of the main feeder, but neither so wide nor so solid. Then again, there is an inner bank all round, which has openings in it adjacent to the lowermost parts of the land, for the purpose of getting the muddy water to these places as soon as possible. In this way every flood-tide is conducted into every one of the compartments in succession, and as it ebbs, the hydrostatic pressure of the water

[1] Farmer's Calendar, page 390.

alone suffices to force open the swinging doors of the return sluices, thus allowing itself to escape into the main canal and thence into the river, after having deposited nearly the whole of its mud upon the surface of the enclosed land. Of course, the higher the tides are, the greater is the depth of water to produce the deposit, and *vice versâ*. Considerable skill must be exercised in adjusting the size of the *cloughs*, so as to discharge the whole of the water before the rise of the next tide, as otherwise only every other tide can be admitted.

'By the above plan it has been found possible to warp land in one year to the depth of two or three feet, and this is generally considered to be quite deep enough, and is permanent in its action. This statement, however, only applies to those lands which are sufficiently below high-water mark; where the level is higher, a longer time—often from two to three, or even sometimes four years—is required.'[1]

The effect derived from warping differs greatly from that produced by irrigation; the former being simply the deposition of mud from turbid water, by means of which a new soil of almost any depth we wish is formed. In floods, and also during winter, this business entirely ceases. Its tendency is not to *manure*, but *create* soil; hence the nature of the land is a point of little moment, almost every soil, whether peat, sand, bog, or clay, but especially light land, being benefited by the process; and yet, as warped land must be kept well drained, the porous nature of peat and sand renders soils of this class best adapted for receiving the amelioration, and the former even more so than the latter. From a careful analysis by the eminent chemist from whom we have already quoted, we find that warp consists of—

	Per cent.
Organic matter	7·003
Carbonate of lime	9·775
Carbonate of magnesia	1·520
Potash and soda	0·085
Lime	0·905
Magnesia	2·684
Peroxide of iron	4·465
Oxide of manganese	traces
Alumina	4·494
Perphosphate of iron	0·092
Silicic acid	68·778
Sulphate of lime	evident traces
	99·801

A remarkable instance of the beneficial effects resulting from the practice of warping occurred in the farm of Mr. Webster, of Bankside, which contained 212 acres, and was entirely warped. To evince the immense importance of this improvement, it may

[1] Journal of the Royal Agricultural Society, Part I. vol. xi.

be proper to state, that he gave 11*l.* per acre for the land, for which he afterwards refused *seventy pounds* per acre. His whole expenses for sluices, banks, cloughs, &c., did not exceed 2,500*l.*, or 12*l.* per acre; which may, indeed, be reduced to 1,000*l.*, or 5*l.* an acre, as a neighbour below him offered 5*l.* an acre for the use of his sluice and main cut, to water 300 acres. Estimating it then, however, at the highest sum, 12*l.*—11*l.*, the purchase-money, must be added, making the whole 23*l.* per acre; which, if he could sell at 70*l.*, leaves a clear profit of *forty-seven pounds* per acre; a prodigious sum, and which is sufficient to prove that warping is indeed a most valuable process.

Mr. Webster warped to various depths, from eighteen inches to two feet, two feet and a half, &c.; he had some moor land, which, previously to being warped, was worth only *one shilling and sixpence* per acre, that was afterwards as good as the best land; and some of which let at 5*l.* for flax or potatoes, and the whole at 50*s.* an acre. Our limits forbid us to enter into further particulars respecting the efforts of this enterprising agriculturist; we shall, therefore, only mention a few circumstances relative to the crops which his warped land produced.

The practice of warping commences in the month of June, and is carried on throughout the summer; in fact, that is the only season in which this admirable improvement can go on, and, therefore, the agriculturist should carefully avail himself of every aid and keep his works in constant repair, that, if possible, he may not lose the benefit of a single day. This method of ameliorating land is at present chiefly practised by the farmers residing on the banks of the Don, Humber, Ouse, and Trent, to whom it proves a source of immense profit. But it might also be successfully adopted on lowlands adjoining rivers, the tides of which are often impregnated with mud. The land thus created, when of sufficient depth, is of almost inexhaustible fertility. It does not require manure; it admits of courses of cropping, which no other soil could support; and by merely keeping the sluices in repair, its productive powers can always be maintained in full vigour.

BOOK THE NINTH.

ON THE CULTIVATION AND APPLICATION OF GRASSES, PULSE, AND ROOTS.

CHAPTER I.

ON THE NATURAL GRASSES USUALLY CULTIVATED.

BEFORE we proceed to discuss the various particulars connected with this department of our work, it may not be useless to observe, that as the present volume is chiefly calculated to assist those who are exclusively occupied in the *grazing and feeding of cattle,* the subject of tillage-lands will be introduced so far only as these are auxiliary to the farmer in affording a variety of vegetable crops, best adapted to supply him with succulent food for his stock. Our attention will be chiefly directed to the plants best adapted for pasture land.

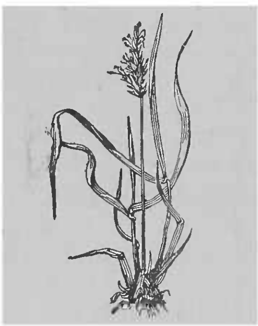
'Nature,' says Sir Humphry Davy, 'has provided in all permanent pastures a mixture of various grasses, the produce of which differs at different seasons. When pastures are to be made artificially, such a mixture ought to be imitated; and, perhaps, pastures superior to natural ones may be made by selecting due proportions of those species of grasses fitted for the soil, which respectively afford the greatest quantities of spring, summer, latter-math, and winter produce.'[1] As similar observations on this topic have already been made in our notice of the culture of grass lands,[2] we shall in the present chapter invite the reader's attention to the description and produce and value of the principal British grasses.

We shall adopt the arrangement of Mr. Sinclair, who speaks of the different grasses in the order of their flowering.

[1] Agricultural Chemistry, page 351. [2] Book viii. chap. v.

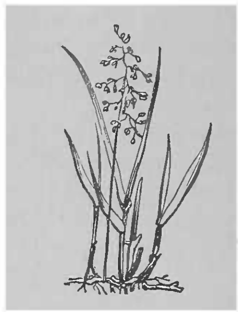
1. Sweet-scented Vernal Grass, fig. 194 (*Anthoxanthum odoratum*).—This is one of the earliest of the British pasture grasses; and, although not equally productive in every situation, it grows almost anywhere. It flowers as early as the last two or three days in April, and inhabits most of our meadows. Its average produce, if mown at the time of flowering, is 7,827 lbs. of grass per acre, containing 122 lbs. of nutritive matter, or one part in 64. The hay produced from this grass amounts to 2,103 lbs., or in the proportion of 21½ to 80. The seeds are ripe about the 21st of June, when the grass is diminished to 6,125 lbs. per acre; but the proportionate quantity of nutritive matter is increased to

Fig. 194.



SWEET-SCENTED VERNAL GRASS.

Fig. 195.



SWEET-SCENTED SOFT GRASS.

311 lbs., or 3½ in 64 parts. The hay is also reduced to 2,103 lbs., or 24 to 80. The produce of the after-math is 6,806 lbs. of grass, containing 239 lbs. of nutritive matter, or in the proportion of 2½ in 64 parts.

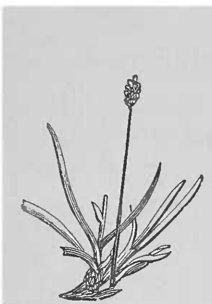
It appears, therefore, that this grass is not a very productive one. It is not liked either by cattle or sheep, and is only eaten in combination with others, and sometimes when they can get no other grass; but it forms a portion of the herbage of all good natural pastures, and is, doubtless, useful in combination with the rest. Its principal value consists in its early growth, its hardiness, and its property of continuing to produce its flowering stems until late in autumn.

It used to be supposed that this grass was the source of the peculiar and beautiful scent of newly-mown hay. This has, however, lately been denied, but without just cause, for the greater part of the grasses are altogether destitute of smell, while this retains its delightful scent almost undiminished for more than twelve months. One reason, perhaps, why it is not freely eaten by cattle, is because the scent of the plant is too powerful, until partly neutralised by the addition of other grasses. It grows best on deep moist and peaty soils. In certain situations, and particularly in dry seasons, its leaves are liable to become blighted by a disease which changes their colour to an orange tint.

2. SWEET-SCENTED SOFT GRASS, fig. 195 (*Holcus odoratus*).—This is found in our moister meadows, and blooms at the same time with the sweet-scented vernal grass. It yields, at the flowering season, 9,528 lbs. of grass per acre, containing 610 lbs. of nutritive matter, or $4\frac{1}{4}$ in 64 parts. The weight of the hay will be 2,441 lbs., or, in proportion to the grass, $20\frac{1}{2}$ to 80. The seed ripens about the same time as that of the preceding grass, but the crop has then increased to 27,225 lbs. It has increased in quality as well as in quantity; for it contains 2,233 lbs., or more than $\frac{5}{64}$ths of nutritive matter. The proportionate weight of hay is likewise augmented; for it is in the proportion of 28 to 80; therefore to mow this grass before the seed is ripe would be very bad policy.

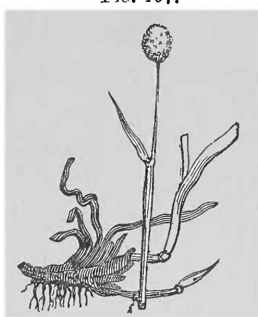
The after-math is more productive than from any other grass; and, though its early produce is inferior to several that will presently be mentioned, it is greater than is obtained from any of the other early-flowering grasses.

FIG. 196.



BLUE MOOR GRASS.

FIG. 197.



ALPINE FOXTAIL GRASS.

3. BLUE MOOR GRASS, fig. 196 (*Cynosurus cœruleus*).—This grass flowers and produces its seed at the same time with the two preceding ones. It is a tender grass, and often suffers materially from the frost. It is somewhat more productive and nutritive than the first; although it scarcely deserves cultivation, it endures the summer droughts better than many other grasses.

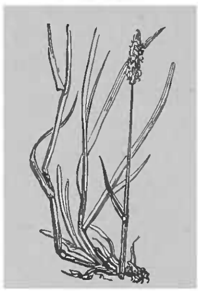
4. ALPINE FOXTAIL GRASS, fig. 197 (*Alopecurus Alpinus*).—This grass seldom flowers until the end of the third week in May; but its seeds ripen about a week after the three first mentioned. It is found in most of the high grounds in Scotland. Its produce

is small in quantity—the proportion of nutritive matter is still less, and it also scarcely deserves culture.

5. Meadow Foxtail Grass, fig. 198 (*Alopecurus pratensis*).—This flowers in April and May, and its seed ripens in June and July. Its produce differs widely in different soils. In a clayey loam it produces, at the time of flowering, 20,418 lbs. of grass per acre, the proportion of nutritive matter being $1\frac{1}{2}$ to 64, and the quantity of hay being 6,125 lbs., or in the proportion of 24 to 80. In a sandy loam it yields only 8,507 lbs., the proportion of the nutritive matter being only 1 to 64, and the quantity of hay 2,552 lbs., or the same proportion to the grass as in the loamy soil.

At the seed time, in the clayey soil, the weight of produce is diminished nearly $\frac{2}{5}$ths; but the proportion of nutritive matter is almost doubled. The loss in the sale of the hay would, therefore, be very considerable; in the weight of nutritive matter it

Fig. 198.



MEADOW FOXTAIL GRASS.

would be $\frac{1}{15}$th part of the value. Calculations of this kind are exceedingly important to the farmer, and have been too much neglected.

The value of the after-math, from a clay soil, is about $\frac{13}{24}$ths of the crop at the time of flowering, and $\frac{5}{9}$ths of the seed crop.

The luxuriancy of the meadow foxtail is so great that it sometimes is cut three times in the year. Its stalks are strong, and provided with soft juicy leaves, of an agreeable sweetish taste. It has been objected, that its foliage appears to be coarse, but no grass can be productive that is not in some degree coarse; and when made into hay, it is free from the unpleasant roughness of some other grasses. It may, therefore, be justly considered as holding the first place among the good grasses, whether used in a fresh state or made into hay. The soil best suited to it is sound meadow land, occasionally overflowed, although it will succeed in almost any soil, except the extremes of wet and dry. It even grows luxuriantly on some of the stiffest soils. It produces a great quantity of seed, which may be easily gathered while the grass is growing, as this plant out-tops most of the others; but the seeds are not found in hay, for they ripen and fall out before the other grasses are fit to be cut. Many of the seeds, however, thus gathered, will be found very defective. It does not attain its full growth for several years, and, therefore, is not well suited for the alternate husbandry, but for perennial herbage it is most excellent. Sheep and horses are fonder of it than oxen are. About one-third of a bushel of seed should be sown per acre.

6. Alpine Meadow Grass, fig. 199 (*Poa Alpina*).—A native of Scotland. It produces at the flowering time, at the end of

Fig. 199.

ALPINE MEADOW GRASS.

Fig. 200.

SMOOTH-STALKED MEADOW GRASS.

May, only 5,445 lbs. of grass per acre, containing but $1\frac{1}{4}$ portion of nutritive matter in 64. It is scarcely worth cultivating except for lawns.

7. Smooth-stalked Meadow Grass, fig. 200 (*Poa pratensis*).—This useful grass flowers at the end of May, and seeds about the middle of July. At the flowering time it yields 10,209 lbs. of grass, having $1\frac{3}{8}$ part of nutritive matter in 64, and drying into 2,871 lbs. of hay, or only 22 to 80. When the seeds are ripe, the produce would be 8,507 lbs. of grass, possessing $1\frac{1}{4}$ portion of nutritive matter, and yielding 3,403 lbs. of hay, or 32 to 80.

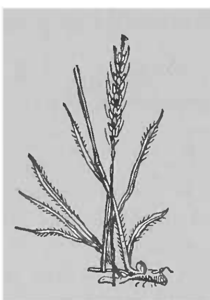
The after-math is of about the same value as the seed crop. This is a good early hay-grass, but loses nearly one-fourth of its value if left until the seed time. It is a very sweet grass, and readily eaten by cattle. It preserves its verdure in the winter better than most other grasses, and in the following spring throws out numerous young shoots, making exellent spring food. Sheep are said to prefer the fescues, although they will readily eat this grass.

The produce of the latter-math is about half of that when the seed is ripe, and contains $1\frac{3}{8}$ part in 64 of nutritive matter. It possesses the valuable property of resisting excessive drought, and is frequently seen green when every other grass has been parched. It produces a good crop of leaves at the bottom, and makes exceedingly fine hay, as it is fit for cutting early in the spring. Where early grass is the principal object of the cultivator, it cannot be better obtained than by a mixture of this grass with the sweet-scented vernal and the meadow foxtail; the last, perhaps, should predominate.

The only objection to the *Poa pratensis* is, its creeping root, which is difficult afterwards to extirpate, and, therefore, it cannot be introduced in any great quantity where the land is not intended to remain in a permanent state of sward. It has the valuable property of continuing to flourish in the same ground, while a great many other grasses are liable to deteriorate; this, however, presupposes that the soil is not too dry, for in this case it will soon be exhausted, and the produce diminished.

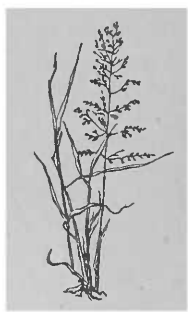
The author is compelled to add, that Professor Low, speaking of it as he finds it in Scotland, says, 'that it comes early, and, after being cropped in summer, grows slowly, and it may be questioned whether it deserves to be reckoned among the superior grasses.'

Fig. 201.



DOWNY OAT GRASS.

Fig. 202.



ROUGHISH MEADOW GRASS.

8. Downy Oat Grass, fig. 201 (*Avena pubescens*).—This grass flowers about the middle of June, and the seeds are ripe at the end of the first week in July. At the time of flowering, the produce is 15,654 lbs. of grass, with $1\frac{1}{4}$ proportion of nutriment in 64, and drying to 5,820 lbs., or 30 in 80. When the seed is ripe, the produce is only 6,806 lbs., yielding 1,361 lbs. of hay, or at the rate of 16 in 80; but the nutritive matter is increased to 2 in 64; so that the value of the grass at the flowering time exceeds that at the seed time in the proportion of 4 to 3. The

after-math is about the same in quantity and value as the grass at seed time. A good soil improves it very considerably. It is early and hardy, and adapted for permanent pasture on rich light soils.

9. ROUGHISH MEADOW GRASS, fig. 202 (*Poa trivialis*).—This grass is found in rich moist soils, and in sheltered situations. If it is not a very productive one, it is valuable on account of the quantity of nutriment which it contains, and the fondness of sheep and cattle for it. It flowers about the middle of June, and the seeds are ripe at the middle of the second week in July. The grass, at flowering time, averages about 7,057 lbs. per acre, containing full $\frac{2}{64}$ths of nutritive matter, and drying into 2,246 lbs. of hay, or in the proportion of 24 to 80. When the seeds are matured, the grass has increased to 7,827 lbs., containing nearly $\frac{3}{64}$ths of nutriment, and yielding 3,522 lbs., or $\frac{36}{80}$ths, of hay. In the latter-math the quantity of grass is diminished to 4,764 lbs., but the quantity of nutriment still remains at $\frac{3}{64}$ths. A peck of seed will sow an acre and a half.

This is a very striking illustration of the different value of certain grasses at different times. The actual quantity of this grass is not a great deal more at the seed than the flowering time, but the quantity of nutriment is so much increased that it is worth more than the early grass in the proportion of 11 to 8. The quantity of nutriment which the *Poa trivialis* contains, and the season when it arrives at perfection, render this a most valuable grass; but it is very tender, and is liable to be injured both by cold and drought, and must have a moist soil.

10. GLAUCOUS FESCUE GRASS (*Festuca glauca*).—The time of flowering and seeding in this grass are the same as in the *Poa trivialis*, but there is a remarkable difference in its quality at these periods. Another striking illustration is thus afforded of the importance of attending to these things. At flowering, the quantity of grass is 9,528 lbs., containing $\frac{3}{64}$ths of nutriment, and drying into 3,811 lbs. of hay, or about $\frac{32}{80}$ths; but when the seed is ripe, although the weight of grass and of hay remains nearly the same, the nutriment is not more than one-half what it was. The cause of this difference lies in the altered state of the straws—they continue, but they have become dry and wiry. This is a most valuable grass in rich moist soils.

11. SMOOTH FESCUE GRASS, fig. 203 (*Festuca glabra*).—Found in Scotland, and adapted to Highland pasture. It flowers a little later in June than the *Poa trivialis*, and the seed is ripe about the same time in July. The crop is better when the seed is ripe, in the proportion of 8 to 5. It is not a bad pasture grass in its native and any similar situation and soil.

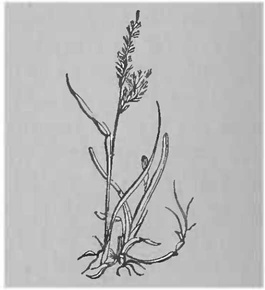
12. PURPLE FESCUE GRASS, fig. 204 (*Festuca rubra*).—Flowers

a little later than the *glabra*, and is in seed at the same time. It is one-third more valuable at the seed time than when in flower. The after-math is as valuable as the latter. It is best adapted for lawns.

FIG. 203.

SMOOTH FESCUE GRASS.

FIG. 204.



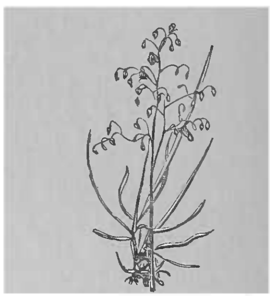
PURPLE FESCUE GRASS.

13. SHEEP'S FESCUE GRASS, fig. 205 (*Festuca ovina*).—Flowers yet a little later,—the seeds ripen at the same time. The produce is comparatively small. It is considerably less than that of the *rubra*. It is altogether unfit for hay, and the grass yields only 1¼ of nutritive matter in 64. It has, however, a fine soft foliage, which may be easily masticated, and all its nutritive matter expressed; hence, small as is the quantity produced, and

FIG. 205.

SHEEP'S FESCUE GRASS.

FIG. 206.



COMMON QUAKING GRASS.

inferior the portion of nutriment, it is for sheep equal to most of the grasses. They are exceedingly fond of it, and thrive wherever it is found. It is doubtful, however, whether this grass would be worth cultivating on arable ground.

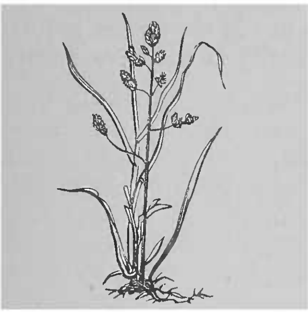
14. COMMON QUAKING GRASS, fig. 206 (*Briza media*).—It blossoms and seeds at the same time as the *Festuca ovina*, fig. 205. At both the flowering and seed time it yields about 9,528 lbs. of grass per acre, but the nutritive matter is 3¼–64ths in the latter

time, and $2\frac{3}{4}$–64ths in the former, and the hay is $\frac{28}{80}$ in the latter, and only $\frac{28}{80}$ in the former. Therefore the proportionate value of the grass at the seed time is as 13 to 11.

The after-grass is nearly equal to that yielded at the other periods, and the proportion of nutritive matter $\frac{2}{64}$ths. It is not an uncommon grass in our pastures, and deserves more cultivation than has hitherto been bestowed upon it.

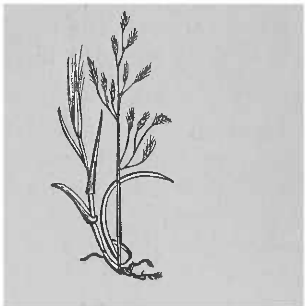
15. Round-headed Cock's-Foot Grass, fig. 207 (*Dactylis glomerata*).—The flowering at the same time, the seeding a little later, than the former. At the first its weight is 27,905 lbs. per acre, at the latter 26,544 ; the weight of the nutritive matter in the first being $2\frac{1}{2}$–64ths, and in the latter $3\frac{1}{2}$–64ths. The hay in the

Fig. 207.



ROUND-HEADED COCK'S-FOOT GRASS.

Fig. 208.



BROME GRASS.

first is diminished to 11,859 lbs., and in the latter to only 13,274, there being $\frac{34}{80}$ remaining in the former, and no less than $\frac{40}{80}$, or $\frac{1}{2}$, in the latter. In the after-math the quantity of grass is inferior to that of the seed time, in the proportion of 5 to 14, but the quantity of nutriment is diminished to $1\frac{1}{2}$–64th.

Different opinions, however, have been held with regard to this grass, and some farmers have gone so far as to condemn it altogether, as a coarse common grass, unfit for meadows or pastures, and rejected by cattle of every description. It cannot be denied that it is a coarse and a rough grass, but it is a very hardy and a very productive one. It is particularly profitable when cut at the seed time. In moist loamy soils, when kept closely fed down, it affords early and excellent pasturage for sheep. The principal value of it depends upon its being closely cropped, for if it is suffered to grow, it rises in tufts and patches, and loses much of its nutritive property. Oxen, horses, and sheep eat this grass readily. Professor Low recommends that it should be sown in combination with the rye-grass, the meadow fescue, and the other finer grasses.

16. Brome Grass, fig. 208 (*Bromus*).—There are several

varieties of the Brome grass, but they are all annuals, and consequently their produce is but for one year, and very inferior in quantity in that year. They are scarcely worthy of culture.

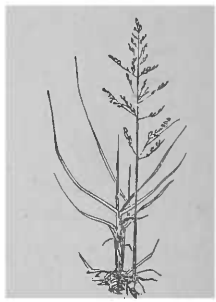
17. Welsh Fescue Grass, fig. 209 (*Festuca Cambrica*).—The only difference between this grass and the *Festuca ovina*, fig. 188, is, that it usually flowers and its seeds ripen a few days later, and that its produce, and the comparative quantity of nutritive matter which that produce contains, are somewhat greater.

18. Narrow-leaved Meadow Grass, fig. 210 (*Poa angustifolia*).—This grass flowers about the end of May or the beginning of June, and its seeds ripen early in October. It is a variety of the *Poa pratensis*, and superior to it in value. At the time of flowering, the grass weighs 18,376 lbs., and at seed time, 9,528 lbs. per acre, or nearly twice as much at the former as at the latter period. The weight of the hay in the former is 7,810 lbs., in the latter, 3,811 lbs. The quantity of nutritive matter is $\frac{5}{64}$

Fig. 209.

WELSH FESCUE GRASS.

Fig. 210.



NARROW-LEAVED MEADOW GRASS.

in the former, and $5\frac{1}{8}$–64ths in the latter; or, in point of fact, the weight of nutritive matter lost by leaving the crop until the seed is ripe exceeds one-third part of its value.

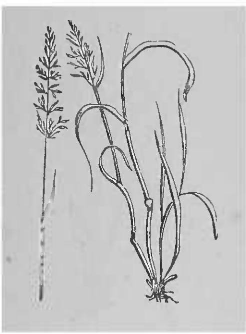
The early growth of the leaves of this grass is very considerable; for by the middle of April they are often twelve inches in length, and soft and succulent; presently, however, *the rust* begins to attack the plant—it ceases to grow—the leaves wither away, and, as has been just stated, the whole weight of the grass scarcely exceeds one-half of what it did at an earlier season. This is a valuable grass on account of its superior and early growth.

19. Tall Oat Grass, fig. 211 (*Avena elatior*).—It flowers at about the same time as the last, but a very different account is to be given of it. At the seed time it certainly produces 16,335 lbs. per acre; but that, in drying, dwindles down to 5,718, and contains but $\frac{1}{64}$th part of nutritive matter. The produce of the

aftermath is 13,612 lbs., containing $1\frac{1}{8}$-64th of nutritive matter. This plant is not subject to the rust like the last, which accounts for the superior value of the latter-math. It is an early coarse and productive grass. It is most beneficial when eaten closely down. It thrives best on a strong tenacious clay. It is said to be disliked by cattle, and especially by horses, which seems to agree with the small portion of nutritive matter which it contains.

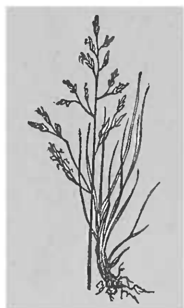
20. Tall Meadow Grass (*Poa elatior*).—The same time of flowering and seeding. The produce per acre at the flowering time is not so great as in the *Avena*, being only 12,251 lbs. per acre, but the residue after drying is 8,634 lbs. These are singular circumstances, and the farmer should be well aware of them. The quantity of nutritive matter is also greater, being $3\frac{1}{4}$–64ths. This grass is of very much greater value than the last.

Fig. 211.



TALL OAT GRASS.

Fig. 212.



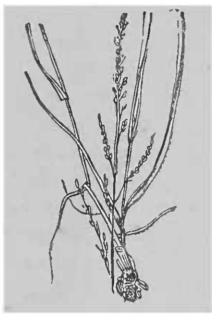
HARD FESCUE GRASS.

21. Hard Fescue Grass, fig. 212 (*Festuca duriuscula*).—The time both of flowering and of the ripening of the seed is three or four days later—July 1st and 20th. The quantity of grass, when mown at the flowering time, is 18,376 lbs. per acre, which yields 8,269 lbs. of hay, and that containing $3\frac{1}{2}$–64ths of nutritive matter. If the crop is suffered to remain until the seed time, it will weigh 19,075 lbs., yielding 8,575 lbs. of hay, being a little more; but against this must be set a sad defalcation of only $1\frac{1}{2}$–64th instead of $3\frac{1}{2}$–64ths of nutritive matter. This, again, is an interesting and startling fact, and of which no one dreamed until the invaluable experiments of Mr. Sinclair were instituted. The weight of the hay remains nearly the same, but that of the nutriment has diminished almost two-thirds. The after-math is still more deficient in weight and comparative nutriment. This grass affords a most wholesome food, much liked by cattle of every sort. It is an early and productive grass, with good foliage both on downs and in

meadows, and is well adapted for being combined with other grasses in the formation of sheep pastures. The hay at the flowering season is particularly valuable; yet Professor Low, speaking of Scotland, says that 'it is one of the small grasses suited to the pasturage of sheep—it is superior in size to the Sheep's Fescue, but is not sufficiently productive to deserve cultivation.

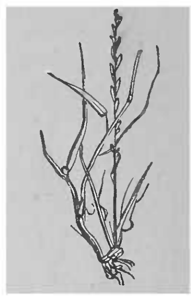
22. Meadow Fescue Grass, fig. 213 (*Festuca pratensis*).—The time of flowering is the same as with the last grass. At that period 13,612 lbs. of grass were yielded per acre, producing, when dry, 6,465 lbs. of hay, with $4\frac{1}{2}$-64ths of nutritive matter. At the seed time the grass had increased to 19,057 lbs., but the hay had only risen to 7,623 lbs., while the quantity of nutriment had sunk to $1\frac{1}{2}$–64th., or not one-third of what it was at the flowering time. This is another startling fact, the explanation of which is not difficult. The straws and leaves that were cut when in a green

Fig. 213.



MEADOW FESCUE GRASS.

Fig. 214.



PERENNIAL RYE GRASS.

and succulent state, retain the greater part of their nutritive matter; the straws and leaves that have been exposed to the action of many days' sun and wind wither and dry away.

This is a strictly perennial and hardy grass, thriving well both in wet and dry grounds—the produce is great, and the grass is remarkably sweet; it is eaten with much avidity by every sort of cattle. It also produces abundance of seed, which may be easily gathered. Professor Low's testimony in favour of this grass is gladly quoted. 'This is justly ranked among the superior grasses. Although a large it is not a coarse plant, and does not, like some of the other larger grasses, form tufts in growing. The leaves are succulent and readily eaten by the larger pasturing animals. The root is perennial and fibrous. It is found in the natural meadows of all our richer clay-land vales, and may form a part of the pasture of all land of tolerable quality laid down to perennial herbage. It is, however, longer in arriving at its full maturity than some others of the superior grasses, and consequently less suited than they are to the alternate tillage.'

23. Perennial Rye Grass, fig. 214 (*Lolium perenne*).—The flowering and seed times are the same as in the last plant, but there is a singular difference in the crops. At the flowering time the grass weighed only 7,827 lbs., which yielded but 3,320 lbs. of hay; the quantity of nutriment, however, was in the proportion of $2\frac{1}{2}$–64ths. At the ripening of the seed the crop of grass was 14,973 lbs., which yielded, however, only 4,492 lbs. of hay, the quantity of nutriment in which was increased to $2\frac{3}{4}$–64ths. The produce of the after-math was but 3,403 lbs., and possessing only the small proportion of $\frac{1}{64}$th part of nutriment. There is a crop at the flowering time, of somewhat beneath an average quantity, but fairly rich in nutritive matter. The grass wonderfully increases in weight before the seed time—it is nearly double its former weight—but there is some delusion here. A strange quantity of aqueous fluid has been imbibed—a vast number of stalks are thrown out, filled with a succulent fluid; but this escapes in the drying of the grass, which loses nearly three-fourths of its weight, retaining, however, a considerable portion of nutriment. The grass of the after-math is scarcely more than a fifth of that at seed time, and but little more than one-fourth of the nutriment remains. To what good purpose may a knowledge of this be directed in the management of the crop! The *rye-grass* is a valuable crop, on account of the wide range of temperature which it will bear—the different soils on which it will prosper—the abundance and facility with which it can be raised from its seeds, and the advantage with which it may be mixed with other grasses, and particularly the clovers. It should always be sown with some of the clovers, for no other method has been discovered equal to this for producing a crop of hay cheaply and certainly. Russell's and Stockney's varieties are the best; a peck of seed will sow an acre and a half of land.

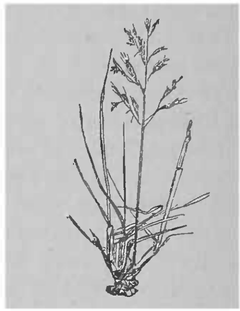
24. The Crested Dog's-Tail Grass, fig. 215 (*Cynosurus cristatus*).—Both the flowering and seed time are about a week later in this grass—about July 6 and 28. The produce is small at the flowering time, and its weight is diminished more than two-thirds in drying. It is rich, however, in nutritive matter, possessing $4\frac{1}{4}$ parts in 64 of nutritive matter. When the seed is ripe, the weight of the grass is doubled, and the loss in drying is not so great, but the nutritive matter is decreased nearly one-half, being only $2\frac{1}{2}$ parts in 64.

This grass is very useful in the formation of upland pastures, as it produces a thick short turf, and sheep are exceedingly fond of it. It grows naturally in dry situations, and will not thrive in wet meadow-land. The appearance of its bents in poor and moist pastures would encourage the suspicion that it is not a valuable plant, but its abundance in the richest grazing pastures, in almost every part of the kingdom, is a pledge of its value. Sheep eat it very greedily until it has perfected its seed, but after that the stalks become hard and wiry. The thick sward which it produces, and its easy cultivation, are its chief recommendations.

FIG. 215.

CRESTED DOG'S-TAIL GRASS.

FIG. 216.



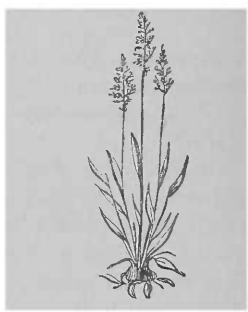
MEADOW OAT GRASS.

25. MEADOW OAT GRASS, fig. 216 (*Avena pratensis*).—This flowers at the same time with the preceding plant, but perfects its seeds nearly a week earlier. It affords but a small crop at flowering time, more than three-fifths of which are lost in its conversion into hay; the nutritive matter also not being more than $2\frac{1}{4}$ parts in 64 of the grass.

FIG. 217.

VERNEL-LIKE FESCUE GRASS.

FIG. 218.



CRESTED MEADOW GRASS.

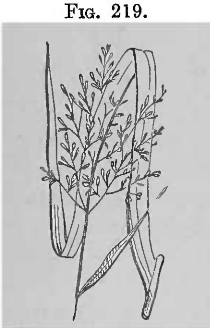
At the seed time the produce of grass is one-third more than at the flowering time—nearly two-thirds of which, however, are lost in drying, while the nutriment is reduced to $\frac{1}{64}$th part of its weight.

26. VERNEL-LIKE FESCUE GRASS, fig. 217 (*Festuca loliacea*).—This plant flowers in June, and perfects its seed at the end of

July. At the flowering time it yields a good crop of no less than 16,335 lbs. of grass, reduced to 7,146 lbs. by drying for hay, and containing 3 parts in 64 of nutritive matter. At the seed time the grass weighs but 10,890 lbs. and the hay 4,492 lbs., but the nutritive matter is $3\frac{1}{4}$ parts of 64. The latter-math is very poor. The grass weighs but 3,403 lbs., and the nutritive matter is reduced to $1\frac{1}{4}$ part of 64. The value of the grass at the flowering time exceeds that at the seed time, in the proportion of 13 to 12. It flourishes and abounds in rich lands, and is to be found in most good pastures.

27. Crested Meadow Grass, fig. 218 (*Poa cristatus*).—The times of flowering and seeding are nearly the same as in the last grass. The produce is 10,890 lbs. of grass to the acre, which is diminished to 4,900 lbs. in the process of drying, and, when dried, it contains 2 parts in 64 of nutritive matter.

Fig. 219.



REED-LIKE FESCUE GRASS.

Fig. 220.

TALL FESCUE GRASS.

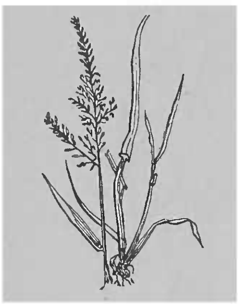
28. Reed-like Fescue Grass, fig. 219 (*Festuca calamaria*).—This plant at the time of flowering yields the great quantity of 54,450 lbs. of grass, which is reduced to 19,057 lbs. in the process of hay-making, and contains the unusual quantity of $4\frac{1}{4}$ parts in 64 of nutritive matter. When the seed is ripe the weight of grass is much diminished—to 51,046 lbs.; the loss in drying is not great—12,123 lbs. remain, but the quantity of nutritive matter is reduced to $\frac{3}{64}$ths. Mr. Sinclair remarks on this, that 'the produce is very great, and the nutritive powers considerable, but we are not aware of any record of the trial of it on a fair and extensive scale.

29. Tall Fescue Grass, fig. 220 (*Festuca elatior*).—The flowering of this grass is about July 12, and its seeding August 6. Its produce in grass is nearly equal to that of the Reed-like Fescue Grass, 51,046 lbs.; the hay from this amounts to 17,866 lbs., and the nutritive matter is as much as $\frac{5}{64}$ths. At seed time the weight of grass is not perceptibly altered, nor the quantity of hay, but the nutritive matter is reduced to $\frac{3}{64}$ths. The after-math is unusually

luxuriant, amounting to 15,654 lbs., and rich with no less than $\frac{4}{64}$ths of nutritive matter. Such are the results of Mr. Sinclair's experiments, but it does not appear that the value of this grass has been tested on a large scale.

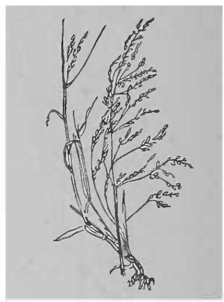
30. Meadow Soft Grass, fig. 221 (*Holcus lunatus*).—This is generally known by the name of Yorkshire Grass, or White. At the time of flowering, about July 14, it produced per acre 19,057 lbs. of grass, diminished by the process of drying to 6,661 lbs. and containing $\frac{4}{64}$ths of nutritive matter. Being left until the seeds became ripe, July 26, the weight of the grass was scarcely altered, but the quantity lost in the drying was strangely increased; out of 19,057 lbs. of grass, only 3,811 lbs. of hay were made, being a loss of four-fifths. The proportionate quantity of nutritive matter was also reduced to $2\frac{3}{4}$ parts in 64.

Fig. 221.



Meadow Soft Grass.

Fig. 222.



Fertile Meadow Grass.

This grass is common in meadows and pastures, and, as is evident, productive. It thrives best on moist soils, but may be grown almost anywhere. It should be closely fed, and principally with sheep. It agrees with horses, but cattle have been supposed not to fatten kindly upon it.

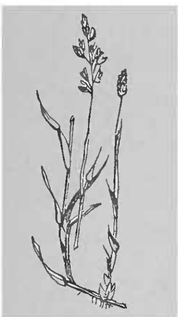
It is said occasionally to become a nuisance by the diffusion of its light seeds, which are afterwards with difficulty eradicated from the neighbouring soil. Mr. Curtis says, that it may rank with some of the best grasses; while Professor Low says of it, that 'its easy propagation is beneficial in so much as a pasture grass can be substituted for the inferior natural produce of the soil. It may be sown on the poorer class of peaty soils, but it ought to be excluded from those on which better kinds can be produced. Thaër by no means recommends it. Many of these questions require to be definitely settled.

31. Fertile Meadow Grass, fig. 222 (*Poa fertilis*).—The usual times of flowering and seeding are about the 14th and 28th of July. At the time of flowering 14,973 lbs. of grass would be

obtained from an acre of it, of which 7,861 lbs., or more than half, may be converted into hay. We have not been able to say this of any grass that has come under consideration. This immense quantity of hay would contain $4\frac{1}{2}$ parts out of 64 of nutritive matter. Sufficient experiments have not been made to test the real worth of this grass. Professor Low says of it, that 'it is a native of Germany, where it is esteemed one of the superior pasture grasses. It grows in wet situations, and near rivers, where it is said to perfect its seeds abundantly.'

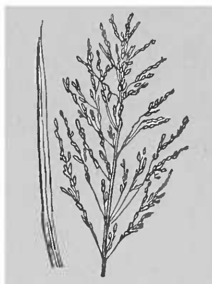
Thaër says of it, and various other varieties of Poa, 'these grasses afford the best of hay, and meadows on which they will grow are to be preferred to any other. But they ought not to be cultivated alone, on account of the difficulty of gathering their seed, and separating it from the woolly covering, which keeps it united in knots, and absolutely prevents it from spreading uniformly. The poa grasses require a rich meadow soil to ensure their thriving well.' [1]

FIG. 223.



CREEPING POA.

FIG. 224.



REED MEADOW GRASS.

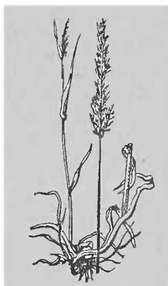
32. CREEPING POA, fig. 223 (*Poa compressa*).—This flowers at the same time with the *Fertilis*, in dry situations. Dr. Anderson deemed it the best and most valuable of all the poas. 'Its dark Saxon green leaves,' he says, 'are compact and succulent, and grow so firmly together as to form a pile of the richest pasture grass. It produces a fine turf in parks and lawns, and imparts a delicate flavour to the flesh of sheep and deer, to which animals it is peculiarly grateful.'

33. REED MEADOW GRASS, fig. 224 (*Poa aquatica*).—This flowers July 20, and ripens its seeds August 8. The produce per acre, according to Mr. Sinclair's experiment, is almost incredible—126,595 lbs., more than 56 tons; of this he supposes that 50,638 lbs. would be lost in the drying, and 75,957 lbs. made into hay. The proportion of nutritive matter he calculates at $2\frac{1}{2}$ parts in 64.

[1] Thaër's Principles of Agriculture.

From its strong stem and upright growth, it is calculated to remain unhurt by inundations, and is suited to those low places which are so liable to be flooded as to be unfit for the finer grasses. It has a powerful creeping root, and will admit of frequent mowing. It is particularly abundant in the Isle of Ely, where it attains the height of 6 feet, although it is usually cut when about 4 feet high. After it is dried, it is bound up in sheaves, and then formed into stacks, in which it undergoes a slight degree of fermentation that improves it. In this state it is provincially called *white lead*, from its acquiring a white surface when dry. The inhabitants of Ely also term it *fodder*, as expressive of its goodness—all other kinds of coarse hay being denominated *stover*.[1] It is excellent for milch cows, but it is not so much relished by horses. It may be converted into good winter provender by cutting it into chaff.[2] 'This plant, however, is too purely aquatic

FIG. 225.



YELLOW OAT GRASS.

in its habits to allow of any extension of its culture. It is well suited to swamps and fens, where it grows naturally, but it can scarcely be cultivated beyond them.'[3]

34. YELLOW OAT GRASS, fig. 225 (*Avena flavescens*).—Flowers about the last week in July, and the seeds are ripe in the middle of August. The produce of an acre of this from a clayey loam, at the flowering time, is 8,167 lbs., and the hay 2,858 lbs., containing $3\frac{3}{4}$ in 64 parts of nutriment; but when the seed is ripe the grass increases to 12,251 lbs., and the hay to 4,900 lbs., while the nutritive matter has decreased to $2\frac{1}{4}$ in 64 parts. The latter-math is inferior—4,083 lbs. only, and containing only $1\frac{1}{4}$ part of nutriment. This is a coarse grass, and is much inferior to the meadow and fescue grasses. Mr. Swayne, in his 'Gramina Pascua,' says, 'that it is one of the best grasses of this species for the use of the farmer;' and Mr. Curtis, in his work on grasses,

[1] Curtis's Flora Londinensis.
[2] Communications to the Board of Agriculture, vol. iii. page 437.
[3] Low's Agriculture, page 417.

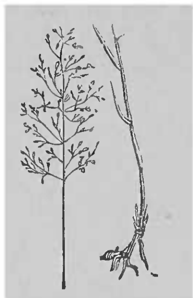
says that 'it promises to make good sheep pastures.' Mr. Sinclair says that 'this grass seems partial to dry soils and meadows, and appears to be eaten by sheep and oxen equally with the meadow barley, crested dog's-tail, and sweet-scented vernal grasses, which naturally grow in company with it. It is not, however, a grass of much value.'

35. CREEPING SOFT GRASS, fig. 226 (*Holcus mollis*).—The times of flowering, &c., the same as in No. 34. This is a more valuable grass. It yields, when cut at the flowering time, 34,031 lbs. of grass, which are converted into 13,612 lbs. of hay, possessing $4\frac{1}{2}$ parts of nutritive matter in the 64. If cut when the seed is ripe, there are 21,099 lbs. of grass, producing 8,439 lbs. of hay, and possessing $3\frac{1}{4}$ parts in 64. It is a grass well adapted for hay,

FIG. 226.

CREEPING SOFT GRASS.

FIG. 227.



BENT GRASS.

on account of the nutritive matter which it contains when in flower. Professor Low, however, calls it a troublesome and impoverishing weed, which it should be the study of the husbandman in every case to extirpate.

36. BENT GRASS, fig. 227 (*Bents*).—There are a variety of these grasses, and of very different value, depending on the time at which they get into good foliage and the proportion of nutritive matter which they contain.

The following table, extracted from Mr. Sinclair's excellent account of the grasses, will enable the reader to form some judgment respecting them:—

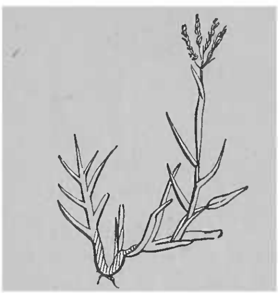
	The time when they get into foliage.	Their nutritive powers.
Agrostis vulgaris	middle of April	1·3
,, palustris	one week later	2·3
,, stolonifera	two ditto.	3·2
,, canina	do. do.	1·3
,, stricta	do. do.	1·2
,, nivea	three weeks later	2
,, littoralis	do. do.	3
,, repens	do. do.	3
,, mexicana	do. do.	2
,, fascicularis	do. do.	2

The *Vulgaris*, or Fine Bent Grass, is the earliest as well as the most common of these grasses. In this there is some advantage; but that is more than counterbalanced by the inferior quantity of nutritive matter which it contains.

The *Palustris*, or Marsh Bent Grass, yields 10,209 and 13,612 lbs. of grass in the two seasons, convertible into 4,594 and 5,445 lbs. of hay, and at each season containing 2¾ in 64 parts of nutritive matter.

The *Stolonifera*, or Creeping Bent, or Fiorin Grass, is the most celebrated and the best of these grasses. It abounds in moist fields and meadows, where, like the strawberry, it shoots out a great profusion of lateral strings (*stolones*) which are designed for the propagation of the grass. The root consists of numerous small fibres, not thicker than silk thread, nor more than an inch and a half in length, which do not penetrate deeply into the earth, but only take a slight hold of the soil. It has sometimes been confounded with the *quicken*, or knot-grass, a noxious and

Fig. 228.



CREEPING PANIC GRASS.

Fig. 229.

BLOOD-COLOURED PANIC GRASS.

exhausting grass of the worst quality, from the resemblance of their roots; but they may be easily distinguished, the root of the fiorin being slender and simple, while that of the quicken is long and tangled.

The qualities which this grass is stated to possess are as follows:—It grows luxuriantly in low and swampy grounds, peats, and mosses, which, but for its cultivation, would be of very little or no value. It is produced in very great quantities; and in the most favourable situations, which are irrigated meadows, has far exceeded the amount which is generally raised of any other grass.

Of the different varieties of the *Agrostis*, the *Canina* or awnless brown bent is the most productive, but is deficient in nutriment. An acre of it will produce 14,293 lbs. of grass; but there will not be more than 4,287 lbs. of hay—not quite two tons, and that containing only $1\frac{3}{4}$ in 64 parts of nutritive matter.

37. CREEPING PANIC GRASS, fig. 228 (*Panicum Dactylon*).—This grass is mentioned on account of the largeness of its produce, according to Mr. Sinclair. It flowers about the end of July; an acre of it may then produce 31,308 lbs. of grass, yielding 14,088 lbs., or nearly $6\frac{1}{2}$ tons of hay, each containing 2 out of 64 parts of nutritive matter. It has never been fairly tried.

38. BLOOD-COLOURED PANIC GRASS, fig. 229 (*Panicum sanguinale*).—This is not introduced as worthy of cultivation as a food for cattle, but merely as an illustration of the different characters and value of the same plant in different countries. The red panic grass is a native of Britain, but the quantity of grass is very small, and contains but $\frac{1}{64}$th part of nutritive matter. It is, therefore, and properly, considered as worthless. In Italy and in France it is much used as food for poultry and for other birds;

FIG. 230.

ANNUAL MEADOW GRASS.

FIG. 231.

TIMOTHY GRASS.

and in Poland and Lithuania, it forms a palatable food, and is boiled with milk, like sago, to which, indeed, it is generally preferred.

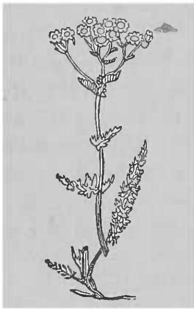
39. ANNUAL MEADOW GRASS, fig. 230 (*Poa annua*), is so called because it has but one annual root. It continues to flower through the greater part of the year, and is exceedingly prolific. It is found in great abundance in the county of Suffolk, and is sometimes called Suffolk grass. Cattle of every description are fond of it, and it is particularly useful for milch cows. Being, however, an annual plant, it is seldom sown except to obtain an occasional growth of herbage.

40. MEADOW CAT'S-TAIL OR TIMOTHY GRASS, fig. 231 (*Phleum pratense*).—This is a most valuable grass, flowering in the middle, and bearing seed at the latter end of July.

41. YARROW, fig. 232 (*Achillea millefolia*), is one of the most common and most valuable plants growing in this island. It is

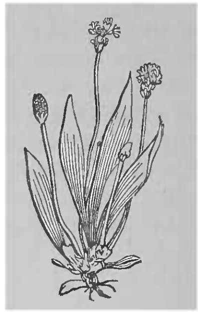
found on moist loams, and almost equally in dry, burning gravels, sands and chalks. It possesses the singular quality of resisting drought on the most arid soils; so that if a green spot appears in a burnt-up close-fed pasture, it may be almost certainly concluded to be covered with this plant. Yarrow is found in the best bullock pastures, where it is highly grateful to every description of

Fig. 232.



YARROW GRASS.

Fig. 233.



RIB GRASS.

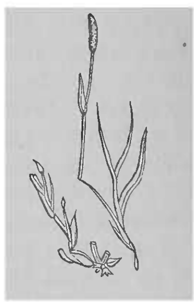
cattle, particularly to sheep, who bite it as fast as it grows; so that, on tolerably well-stocked pastures, it is rarely suffered to come into flower. It is suited to almost every soil, and flowers in June and July. It forms the principal herbage in many fine rich pastures; but where it is kept closely fed down, it is overlooked by the farmer.

42. Rib Grass, fig. 233 (*Plantago lanceolata*).—On rich sands and loams this plant produces considerable herbage, and on

Fig. 234.

WATER HAIR-GRASS.

Fig. 235.



FLOTE FOX-TAIL.

poorer and drier soils it answers well for sheep, although it is inferior to some other grasses.

43. The Water Hair-Grass, fig. 234 (*Aira aquatica*), is said to contribute much to the fine flavour of Cambridge butter.

This succulent and luxuriant grass deserves to be better known. It is generally found on the edges of pools and standing waters, whence has arisen the erroneous idea that it is only adapted to such localities. It flowers in June and July.

44. FLOTE FOX-TAIL, fig. 235 (*Alopecurus geniculatus*), grows in meadows on the banks of the Severn, in places so liable to inundation, that the other good grasses are expelled; and also in the moister parts of meadows, the hay of which is much esteemed for feeding cattle. It flowers in May and June, and promises to be a useful grass for newly-reclaimed morasses, or lands recovered from the sea. It is a creeping plant, never rising high, but growing from the centre in a position nearly horizontal, the lower joints always touching the ground. It may be propagated by slips. It is easily distinguished by its leading joints, light-coloured green leaves, and small round ear.

45. ITALIAN RYE GRASS (*Lolium Italicum*).—This grass is now much appreciated. It is extremely valuable on many accounts. It is early, very productive, exhausts the soil less than others while producing more food, and instead of spreading out its roots and foliage laterally, and forming tufts and smothering every other plant as the common rye grass does, the stems shoot up straight, and consequently allow plenty of room for whatever other plants are sown with it. It has likewise great power of resisting drought. It is greedy of liquid manure, for the use of which, indeed, it seems especially valuable. By using large quantities of liquid manure, as much as 60 to 90 tons per acre have been obtained in one season. See the pamphlet on Italian Rye Grass by Mr. Dickinson, published by Ridgway.

We cannot close the list of grasses without alluding to one discovered in the Falkland Islands, a sedgy grass of the genus *Carex*, we mean the 'TUSSAC GRASS' (*Dactylis Caespitus*). It will grow in rank wet peat bogs, or mosses, and thrives best where the sea spray drives over it; also in the clefts of rocks, in sand and shingle, on the coast down to the very edge of the water-mark, and on soils on which nothing else will live, this grass will thrive and flourish. It is sweet in flavour, tender, succulent, and highly nourishing, and cattle of all kinds eat it with the utmost avidity, and thrive upon it wonderfully. The blades grow to a height of six feet and each plant will bear from two to three hundred shoots; the roots are, for about three or four inches in depth, sweet, tasting somewhat like the kernel of a nut, crisp, and an agreeable food for man. Pigs also eat them greedily, and will grub up the plants to get at them. This grass does not come to maturity until the third year. No trial has as yet been made respecting the possibility of converting it into hay, but in the Falkland Islands it is employed as thatch, and then horses and cattle will tear it down and eat it in preference to the freshest grass. Lean cattle pastured on it become quite fat in two or three months, and worn-out ill-conditioned horses very soon pick up, and grow quite fresh again. Cattle brought to the island rapidly increase in size and condition when fed on it. It is found best not to graze it, but reap it or cut it into bundles, and then it quickly and luxuriantly shoots up again. A very good way of cultivating this grass is by dibbling in plants at distances of from 36 to 39 or 40 inches apart, in rows the same distance from each other (forming a series of *squares*), a little guano or other stimulating nitrogenous manure being dropped into each dibble hole before the plant is inserted. Planted this way a crop has been known to yield as much as 41 tons per acre. The season for planting extends from March to May.

Several experiments made with it prove that it will grow and thrive on ground before considered wholly worthless. There are records of pieces of peat and moss land having been enclosed and planted with Tussac grass, which came up and flourished luxuriantly; but it was only where these portions of barren ground thus submitted to cultivation lay within a short distance of the sea, that the experiments could be said to be entirely satisfactory.

CHAPTER II.

ON ARTIFICIAL GRASSES, OR GREEN FORAGE CROPS.

AMONG the best artificial grasses, and which demand the attention of the grazier, from their tendency to promote the thriving and fattening of cattle, are—

I. The CLOVERS, which have been the longest known to our agriculturists, and most extensively used both for hay and green food. There are four species of clover usually cultivated, each possessing peculiarly valuable properties, and all of them more or less useful in feeding cattle.

1. White or Dutch Clover (*Trifolium repens*) is a perennial. On wet or swampy land, or the poorer sorts of loamy or clayey soils, it does not answer; but on rich dry sandy loams it will thrive with great luxuriance. It is not so nutritive as the red, nor does it afford so broad a leaf; but it is preferred for sheep-walks, and when closely fed down is exceedingly valuable from the disposition which it has to send forth shoots, and the quickness

with which its leaves are reproduced. But the feeding must not be carried to excess, or the sheep will gnaw the stem down to the very roots, and even tear those up, and thus destroy it. It is usually sown with red clover and ray-grass, but it may be mixed with almost every kind of grass, and on dry soils purodces most excellent hay. It is found wild on waste lands where the soil is good, and it is not a bad criterion by which to judge of the fertility of a soil; it may almost be said to cleanse a soil, for it exterminates weeds by means of its roots, which thrust their way among them and push them out. It often, and somewhat unexpectedly and extensively, appears even after waste or long neglected lands have been broken up. There are numerous varieties of this plant, and it is seldom that it is found without some admixture.

2. Common Clover, or Trefoil (*T. pratense*), flourishes best on good loamy, or gravelly, or chalky soils, and is obtained by sowing seed, in the ratio of 10 or 15 lbs. per acre, at various intervals between February and May. Its root strikes deep into the soil, and affords a large produce of leaf and blossom, and closely covers and shades the land, while the crop remains upon it. It thus considerably ameliorates the soil, and prepares it for a succeeding corn crop, or it may be sown with any clean corn crop, of which oats is the best; but will do well with barley after turnips. When the land is to be used for pasturage for two or more years, a greater proportion of seed should be sown than when it is to be broken up in the following season. Clover crops, however, may be raised without being mixed with those of grain of any kind, and, in rich soils, this is often the most advantageous practice. It is frequently sown with ray-grass. If it is mown when the ray-grass is coming into blossom, the lower growth will be materially increased, and a very considerable quantity of excellent grass be obtained; besides which, the clover will be effectually sheltered by the ray-grass from the consequences of severe frosts. Thaër gives it as his opinion that the two crops most advantageous to clover are flax and buck-wheat; and when sown with the latter, it will even yield a luxuriant crop on land by no means adapted for it. The latter, however, is not a crop grown in this country, although a breadth of it should always be put down where bees are kept, and this apart from their honey, for, as Sir John Lubbock has very recently shown, these insects do great service in fertilising the clover themselves. We have yet a vast deal to learn in connection with farm crops. The common clover is in flower from May to September, and the ripeness of its seeds may be easily ascertained by the stalks and heads changing colour. There are three methods of disposing of clover. It is either mown for hay, or

cut occasionally as green food for different animals, or it is fed down with cattle, sheep, or other stock.

3. Red perennial Clover, or Cow Grass (*T. medium*), also known by the name of marl-grass, continues longer in the land than the broad clover, and is therefore more valuable when the lay is not intended to be broken up after the first year. It vegetates spontaneously on marly soil, and has been cultivated with success on sandy, loamy, and heavy clayey lands. It may be sown either with a proportion of perennial rye grass, or red or white clover, for cutting in a green state, or pasturing, or for a hay crop. It is an early grass. This kind, as well as the common clover, is sometimes sown with flax on very highly cultivated soils; and, as flax is a forward plant, it may in general be removed sufficiently early to allow the clover time for growing. Red perennial clover will grow on soil that is 'sick' of common clover, and this peculiarity it is which chiefly renders it valuable, although it does not yield so good a crop or so fine an after-math as the other.

4. Hop-clover, or Hop-trefoil, or Black-nonsuch (*T. procumbens*), grows naturally in dry meadows and pastures, and flowers in June and July. It has been recommended to the attention of agriculturists, as it will grow on soils 'sick' of other varieties. Cattle do not appear very partial to it when green, but seldom refuse hay made from it.

Other varieties of clover have been introduced into this country, such for example as the Bochara clover and the Alsike. The former was sent from Van Diemen's Land, where it grows luxuriantly, attaining a height of eight or ten feet: cattle and sheep are said to refuse it here, and horses will eat very little of it. But it does not appear that there are any authenticated experiments yet made known respecting its value for green or dry fodder. The latter species answers much better, and, what is peculiar to it, may be transplanted. It is very productive, one plant often covering a space of three or four feet. It somewhat resembles Dutch clover, but is much larger, and it is equally as productive as red clover, and shoots quickly and luxuriantly after cutting. Cattle eat it very freely.[1]

The advantage of top-dressing young clovers and mixed grass seeds is very great. The crops are increased fully one-third, and sometimes a half, and they are also ready for cutting much sooner. This, in a backward spring, is of immense advantage.

Powdered bones, gypsum, saltpetre, salt, and guano are all recommended as efficient top-dressings for clover, increasing the crop very materially. But if we would have good clover crops we must be careful how we sow them; we have no crop that

[1] Farmer's Magazine, vol. vii.

answers so well as a green summer crop, as it is equally adapted for strong soils which need rest, and loose exhausted land, which requires shelter and consolidation; therefore it behoves us diligently to seek out the causes of the frequent failures of this valuable one, and the best means of preventing or remedying the evil.

II. LUCERNE (*Medicago sativa*) is of French growth, but was introduced into British husbandry about the middle of the seventeenth century. It flourishes most luxuriantly in deep, rich, friable loams, but it will thrive in sound mellow soil of any kind, provided the substance of the lower strata be the same as that of the vegetable layer. Where such is not the case, and the substrata of the soil vary in quality and consistence, the growth of the roots will be checked, and the plants rendered poor and weakly, if not totally destroyed. It is useless to attempt its cultivation on wet, marshy, or clayey ground, for it will be injured, if not destroyed, by the stagnation of the water around it. Land in which it is sown must be kept as free as possible from weeds, otherwise the luxuriance of its growth will be greatly impeded. In order to clear the land for lucerne, two successive crops of turnips or carrots is recommended. It is a first principle with regard to the cultivation of this grass, that the soil should be brought into the finest condition of mould that is possible, and this is best effected by previous ploughing and harrowing, or the growth of those plants which tend most to render the soil fine and mellow. All kinds of weeds, too, should, as far as possible, be got rid of. Immediately before the sowing of the seed the soil should be well pulverised by ploughing and harrowing. The manure, which should consist of a rich and rotten compost, ought to be thoroughly incorporated with the soil before the sowing commences, otherwise it will occasion premature rankness in the early plants, which is not unfrequently followed by early decay. Top-dressings should be applied at different stages of its growth, and for this purpose gypsum, ashes, lime, and liquid manure composed of the drainage of the stable or dunghill, may be advantageously employed. Wherever the plants fail, their places should be supplied by transplanting. They should also be frequently hoed, so as to be preserved in the most perfect state of even garden cleanness. With due attention to all these points, lucerne will last during several years, and may be cut as often as three times in each season; but, if we would secure a prompt, vigorous and luxuriant after-crop, it should be mown before its flowers are developed.

Lucerne may be either broad-cast or drilled, or propagated by transplanting; all of which methods have been successfully practised. The proper season is towards the middle or end of March, or not later than April; because, like the turnip, lucerne is subject to the ravages of a fly, and by early sowing it will attain a sufficient degree of growth not to be affected by the devastations of the insect. Where considerable attention cannot be paid to the business of hoeing and keeping the crop clean, it may be sown broad-cast; but where the crop can be kept in a sufficiently clean condition by repeated hoe-culture, the drill is the most advisable method. The question with regard to the sowing of the plant by broad-cast or by drill may be thus briefly stated. When cultivated in rows, and carefully hoed, the lucerne is preserved for a long period in the ground; but when sown broad-cast, the grass rarely endures more than eight or nine years. If it is sown broad-cast, 20 lbs. of seed (which should, if possible, be *new*) will suffice for one acre; when drilled, 6 lbs. will be enough if the seed is deposited in equidistant rows of 2 feet. As soon as the grain is sown and harrowed, the lucerne should be sown, and a light harrow passed over it, whether drilled or broad-cast. Where lucerne is sown with a view of being transplanted, the seed should be deposited in the ground early in the spring, and carefully hand-hoed until August, when the sprouts will be sufficiently large to be transplanted; after which they will require but little attention until the following year, excepting that it will be advisable to hoe the transplanted crops once or twice during the intervening period. The value of the first lucerne crop will be greatly increased by sowing it with oats; but the subsequent crops are apt to suffer from the admixture.

III. Sainfoin (*Onobrychis sativa*) vegetates, with considerable luxuriance, on dry chalky soils, where it flowers in June and July; but its produce is far inferior in quality to the lucerne. It yields but 8,848 lbs., or about 4 tons per acre, but then little more than half of it is lost in drying, and it contains 2½-64ths of nutritive matter. It will flourish on light sandy soils, or on almost all soils of a mixed quality, provided there is a calcareous bottom to check the roots at the depth of a foot, otherwise they penetrate too deeply and exhaust themselves.

Sainfoin requires a clean soil. The seeds should be *fresh*, and sown towards the close of February, or early in March. The quantity varies from 4 to 5 bushels per acre, broad-cast, according to the nature of the land, although 4 bushels are, in general, fully sufficient. In the drill culture 3 bushels are enough. It is seldom, however, that the farmer takes the trouble to resort to the drill culture, but contents himself with the broad-cast. Sainfoin may be sown with barley; and as it does not attain its full growth until the second year, it is often mixed with trefoil, or yellow clover, in order both to increase the first crop and to check the growth of weeds until the sainfoin has taken deep root.

During the first year no cattle should be allowed to graze on it, as their feet will injure it; nor should it be fed down by sheep in the succeeding summer, as they are apt to bite the tops of the roots, the growth of which would be immediately checked; but in the following summer, a crop of hay may be made, and the aftermath fed down with cattle of any description. The period during which it is allowed to remain depends upon the quality and condition of the soil, and the care taken to keep it clean and to manure it; though upon the latter point, it may be observed, that except as mere top-dressing, manure has less effect upon sainfoin than upon any other grass, in consequence of the roots seeking their nourishment at a depth to which it cannot reach. It will generally last on the land for from seven to nine years; but in the meantime the natural grasses often spring up and choke it.

IV. BURNET (*Poterium sanguisorba*) is chiefly used for early sheep-feeding, although it may be cultivated with some advantage for soiling cattle. It is a very hardy perennial, chiefly met with on hilly and chalky soils, very little affected by the droughts of summer, and not much injured by the severe frosts of winter. If it be reserved for the purpose of making hay, it ought to be cut early, otherwise it will become coarse. In the culture of this plant, it is of great importance to have good seed, and that a proper spot should be selected for this purpose. As the seeds are shed when ripe, it should be cut in the morning while they are moist with the dew, and thrashed out on the same or on the following day. They who wish to save the seed should, according to Rocque, who first introduced the culture of burnet, feed the grass until May, otherwise it will be too rank, and lodge. Burnet flourishes best on dry soils, and may be sown in April, May, June, July, and August. For *sheep pastures* it should be broad-cast, or sown with the hand; for other purposes, it may be advantageously drilled. During the first year it will require to be kept very clear from weeds, which may be effected by harrowing; for, being a strong tap-rooted plant, the teeth of the harrow will not injure the roots. In the second year it will become sufficiently strong to choke all other grasses. The chief recommendation of burnet is its hardiness and early growth; but, although cattle will eat it at those seasons when there is no other green food, they are never fond of it. Some of our agricultural writers of thirty and forty years ago speak in strong terms of its supposed value, but it has never been much cultivated, and that value is now acknowledged to consist in two circumstances only, viz., its hardiness, and the inferior class of calcareous soils on which it can be cultivated. Neither in weight of produce nor quantity of nutriment can it ever be compared with the clovers or other leguminous plants.

V. CHICORY (*Cichorium intybus*), also called Common Wild

Succory, is a perennial vegetable, introduced by the late Mr. Young, and indigenous in this country. It grows on most soils of a loamy description, and even on some of the more light and brashy sorts of land. Almost every poor soil not too retentive of moisture will bear it; and it is very hardy, standing the severest cold. Its broad leaves cover the ground and shelter it, while its roots strike deep into the soil, and loosen it. Chicory is useful early in the spring, and may be cut for forage several times in the year. Some have recommended that it should be sown with burnet and cock's foot, and other grasses; but the manner in which it grows—like a lettuce—points out a different and more suitable mode of cultivation, namely, by itself, and in rows.

The best seed is undoubtedly that which is obtained by the farmer from his own plants; and as they produce seed in great abundance, it may be easily collected by hand; but the mode of sowing varies according to the intention with which it is raised. Thus, for feeding cattle, it is usually sown in conjunction with oats, or other spring corn, at the season the latter is usually deposited in the ground; but for soiling it is sown alone, from the second or third week in March until the close of summer—the earlier the better, on account of its hardy nature. The quantity usually sown is about ten pounds per acre; it will grow on any soil, but the crop is uncertain. As a forage plant it is best to grow it alone, not along with other plants. Chicory is much cultivated on the Continent as a forage plant.

For the first year one or two cuttings or mowings will be sufficient: which may, in subsequent seasons, be repeated three or even four times, beginning in April or May, and cutting every second month till October.[1]

VI. Spurrey (*Spergula arvensis*).—The common or corn spurrey is an indigenous vegetable, flourishing in corn fields and sandy situations, where it flowers from July to September. Its culture has hitherto been but little, if at all, practised in this country, though it is eaten with avidity by many animals, and particularly by sheep. Spurrey continues green until a late period in autumn, and often throughout the winter, on which account it has long been cultivated in Flanders, where it is sown immediately after wheat, by one ploughing of the stubble, and soon affords a tolerable pasture for cows; but it is said to communicate an unpleasant flavour to the butter. The generality of farmers regard it as little better than a weed, and it may perhaps have occasionally been confounded with the Wild Spurrey (*Spergula pentandra*), which is a weed, and closely resembles it in point of appearance. As it has been cultivated with great advantage on the Continent, and used both for green fodder and hay, it

[1] Annals of Agriculture, vol. xx.

would perhaps be worth while to give it a fair trial here. It may be sown by itself, or with clover or buck-wheat.

VII. TARES OR VETCHES (*Vicia*).—It is commonly said that there are two varieties of the common tare (*V. sativa*), called the *spring* and *winter* tares. They are, however, precisely the same species, but some having been sown in the autumn and some in the spring for a succession of years, they have acquired different habits of ripening, and will now only come to full perfection in the season to which they have been accustomed. The spring tare is usually sown in March, April, or early in May, and with a small quantity of oats or barley; and the winter tare in September (the earlier the better), in the proportion of from five to eight pecks per acre, and commonly intermixed with a bushel of rye. The winter tares are too often sown after one ploughing only. A second ploughing, so as thoroughly to prepare and mellow the ground, would have been serviceable. For the spring tares, also, the land should be ploughed once before winter, and again cross-ploughed in the spring, and after they are sown, the land should be rolled for the convenience of mowing. Whether winter or spring tares are to be cultivated, the land cannot be too clean. The tares should be cut when the pods are tolerably formed, but long before they ripen. Both these varieties are of very essential service in soiling cattle of every description; especially the winter tare, which comes into use just when the turnip crops fail, and affords a succulent food to ewes and lambs. They are both very nutritious, and supply a large quantity of fodder, of which all animals are fond. Hogs may be fattened upon them; the milk of the cow is enriched and increased by them, and they are extensively employed in the feeding of horses. They do not require a rich soil, but are always finest where the soil contains a fair quantity of nutritive matter; clays, provided they are not too wet, will bear them. A succession of sowings should be put down in order to have a like succession of cuttings for forage food in spring and early summer. Vetches are usually sown down with a little rye, which affords to the stalks supports to keep the vetches off the ground, which greatly adds to their produce.

In some countries the winter tare is cultivated as pasturage for horses, and is eaten off sufficiently early to admit of turnips being raised the same year. In Sussex, spring tares have been found to succeed after the winter tares have been got off, thus affording a succession of rich pasture from May to November. They produce abundance of seed, which the farmer will do well to collect, and keep perfectly separate, for, on account of the perfect resemblance which the seeds of the two varieties bear to each other, they are liable to be often mixed. Tares are never made into hay, and the great objection to them is, that they injure the land for a grain crop; this, however, is chiefly owing to their defective culture.

Furze (*Ulex Europæus*).—It is only within the last few years that the gorse, or furze, which used to be regarded simply as an article of fuel, or a temporary hedge, or a preserve for foxes, has been considered as an article of food for cattle.

The *ulex*, or furze, was first brought into notice by Sir Edward Mostyn and Mr. Wynn, who reared large studs of young horses, and fed them almost wholly during the winter on the clippings of their extensive gorse covers. The use of this plant was soon extended to cows and sheep, and always with good effect. There is not a case on record of injury resulting from the use of the furze. During the Peninsular war, and in the early part of the winter of 1813, the horses of the light cavalry subsisted for many weeks on gorse gathered by the men, and chopped fine with their sabres; and they not only continued in excellent condition for service, but got fat on the food.

To render it fit for fodder, the gorse, or furze, must necessarily undergo some process before it is given to the cattle. Its hard and fibrous stalks must be bruised and its prickles broken, so that the cattle shall have a little labour, and yet not be exposed to any inconvenience in the mastication of it. This was formerly effected by an iron-bound mallet, having a long handle, with which the furze was beaten on a rude flag-stone; subsequently the bruising process was performed by passing it between fluted iron rollers, worked by a fly-wheel; and then more complete mills, worked by little rills of water, were established in some parts of Wales. One of the latest improvements is a bruising machine, manufactured by Richmond and Chandler.

Furze is seldom made an object of direct cultivation in any part of our country, yet there can be no reason why it should not become so. It might be cultivated in light waste sandy soils by sowing its seed in February, March, or April, in the proportion of 6 lbs. to an acre. About October, or perhaps a little earlier in the following year, it may be first mown, and then may continue to be so at intervals until Christmas, or even until the middle of March. It will go on growing almost for ever. When used, a little salt should be added to it, and it should be mixed with chopped straw or hay in the proportion of one part to ten.[1]

Its effect on dairy cows has been put to the trial. In a dairy-farm of 100 cows near Birmingham, and which supplied that town

[1] Working horses do their work well when fed with it mixed with cut wheat straw, a quartern of oats per day, and a handful of salt, from the first of November to the end of March. Cows may likewise be maintained in good condition for the same period with a well-heaped peck of it in the morning and another at night, thoroughly bruised and mixed with an equal quantity of cut hay; the flavour of the butter yielded by them is particularly good.—*Farmer's Magazine*, vol. x. p. 63.

with milk, the land was poor, light, and dry, and such as, in the common mode of culture, would be insufficient for producing fodder for the stock of the occupier; he therefore sowed 100 acres of it with furze seed. He never let the plant rise into a shrub, but continually mowed it for his dairy cows. When bruised in the mill it was mixed with a certain portion of chaff, chopped hay or straw, wash and grains, but the furze formed the principal portion of their diet, and increased the quantity and improved the quality of the milk.[1] This is a very easy test comparatively; since then it has been tried repeatedly, and always with the same, or rather with increased and more striking results. Like the parsnip and the artichoke as roots, the furze as a forage plant for cutting as green food is deserving of great attention. At a time like the present it is impossible to be too particular as to supplies of food for stock.

There are on many farms pieces of waste land, the sloping sides of banks of rising ground, or on the margin of rivers, on which gorse, furze, or whin grow, for by these names the same plant or shrub is known in England, Ireland, and Scotland respectively. Now as a rule this plant, shrub, or bush is allowed simply to grow unheeded, or, if noticed at all, it is to be looked upon as a nuisance to be cut down, burned, or otherwise got rid of. To many, therefore, it will be somewhat novel to be informed that as a forage plant it possesses many valuable properties, and is not only much liked by dairy cows, but its use promotes the flow, and increases the richness of the milk, as stated above. Horses, too, as we have seen, are fond of, and thrive well upon it. Those who know its value go the length of specially cultivating it; it may be grown upon any soil—at least, a very wide range of soils will suit it, and after the plants have arrived at a certain stage of maturity they afford a succession of cuttings. These cuttings must, however, be passed through a gorse-bruising machine, or be well broken or crushed by hand mallet, in the case of small farms, in order to get rid of the sharp spikelets before they are given to the stock. The cuttings from the plants should be arranged in succession; those plants which have been cut last being those which are to be allowed to grow for the longest period before cuttings are taken from them again. A little consideration will enable the farmer to decide on the arrangement to secure the succession of cuttings in the most economical way. One great advantage possessed by the gorse is that it gives a good supply of green forage food during the winter months, being almost the only source from which such can be obtained during this period of the year; an advantage this which will or ought to be fully appreciated by the dairyman. We should by no means counsel the ruthless cutting down and getting rid of gorse trees or plants which may already occupy such plots of land as we have named above, but rather the careful going over the whole to see which of the plants are so old or otherwise have got so worthless that they may be got rid of, the soil occupied by them being grubbed up or dug, and well cleaned from weeds, and fresh plants transplanted or seed sown for a new crop. It would also repay the labour if the whole plot was gone over, moving the soil around and between the trees or shrubs, and, perhaps, if it can be spared, adding a little manure. But in any case the weeds, grass, and undergrowth of whatever kind, should be carefully removed, the gorse, like all other valuable crops, not doing well with weeds. Where the gorse is specially cultivated, the land should be well prepared; the seed is best sown in drills from 23 to 24 inches wide, the most favourable period being the end of March—the quantity of seed 8 to 10 lbs. the acre. The first regular cutting will be ready by the autumn of the year succeeding that of sowing. Sown in drills the seedlings will come up thick and close; a good many plants will, if removed, give free space for those remaining to grow in, and many of the plants taken out will be useful in filling up the spaces of waste land plots, where old gorse bushes have been taken out as named above.

There are plants other than those now named which might, with economical advantage, be grown for forage purposes. The most recently introduced, or rather that to which the attention of farmers has been most recently called, is the 'Caucasian prickly comfrey.' It resembles the Jerusalem artichoke in one respect, that the first cropping of the soil is the only one needed, as when once the plants are fairly established no extra labour is required, save in the weeding and occasional stoning of the soil between the drills or stools, these being placed at intervals say three feet apart, or about 4,800 to the acre. The general culture resembles that required for the potato. The comfrey does with a wide variety of soils, being specially and fortunately adapted for those which are apt to be dried up, for the plant is such a deep-rooted one, and will send the rootlets so far down, that in search of moisture it will flourish in soils and in seasons so dry, that other crops will be fairly scorched or greatly hindered in their growth. The prickly comfrey possesses also this advantage in common with other of our most valuable forage crops, that it is equally good when used in its green state as when dried for hay; and, further, no part of it is lost, as the branches and leaves, if also dried and tied up into bundles, will afford a good food for winter when other food is scarce or dear. But the most striking point connected with the comfrey here noticed is the extraordinary amount of produce which it yields; thus, while the most prolific of the artificial grasses, Italian rye, grass will yield on an average 50 to 60 tons per acre, lucerne 40, green cut vetches 20, and good grass from meadow or pasture land cut green only 8 tons to the acre, the Caucasian prickly comfrey will yield as much as from 80 up even to 120 tons per acre. The plant grows rapidly, and has a rich luxurious development of leaves and branches, and, as regards its feeding properties, it is liked by all varieties of stock, especially cattle; and for dairy cows it is peculiarly valuable, as it not only is greatly liked by them, but it is well calculated to increase the yield of milk. Altogether, the plant is worthy of having the attention of the dairy farmer, often greatly hindered in his work from lack of food for his cows. Further information, as well as the 'sets' or cuttings, can be obtained from Messrs. James Dickson and Sons, of Chester, the well-known seedsmen. We do not know whether this plant, valuable as it is, will add another to the somewhat long list of plants for forage purposes which have, from time to time, been introduced to the notice of the farmer, have attracted a great deal of attention, been much written and talked about, and then, after a season, have been quickly relegated to what figuratively is the 'last of all the Capulets,' to forgetfulness and neglect. Of these, perhaps none, during more recent times attracted greater notice than the Sorghem saccharatus, or North American sugar-cane. This was highly spoken of as a forage plant adapted for a wide variety of soils, such as could be worked to a deep tilth, and producing a large amount of food from a succession of cuttings. It may be cultivated either drill fashion from seed, or from transplanted plants from a seed-bed; if raised from seed the period of sowing is May; if from plants, the transplanting may be done as late as July, June, however, being the best month. It does best in a warm climate, and is not suited therefore for northern districts. As regards the fact above noticed, that its reputation has dwindled gradually away till it is rarely if ever spoken about, it may be here remarked—what, however, seems to be too readily forgotten—that if a plant is, or has been, proved at any time to be good, no amount of neglect which it may subsequently receive can alter this fact; it will be as good as ever, although less esteemed and less used. The neglect with which so many things are visited is easily enough accounted for, but the above should not be forgotten; and therefore we need not be deterred from trying a plant, for example, which has fallen into this category of forgotten things. By adopting in conjunction with this varied system of plant or forage-culture that of the 'stolen crop,' the farmer will be delighted to find that—whereas, under the old system, which in many districts has but one crop to depend upon (the grass), he would have been short of the food best adapted for his cows, and in every sense best liked by them—he will have ample supplies of some to make up the deficiencies of others.

CHAPTER III.

OF THE GRAIN AND PULSE COMMONLY CULTIVATED FOR THEIR SEEDS, STRAW, OR AS GREEN FORAGE.

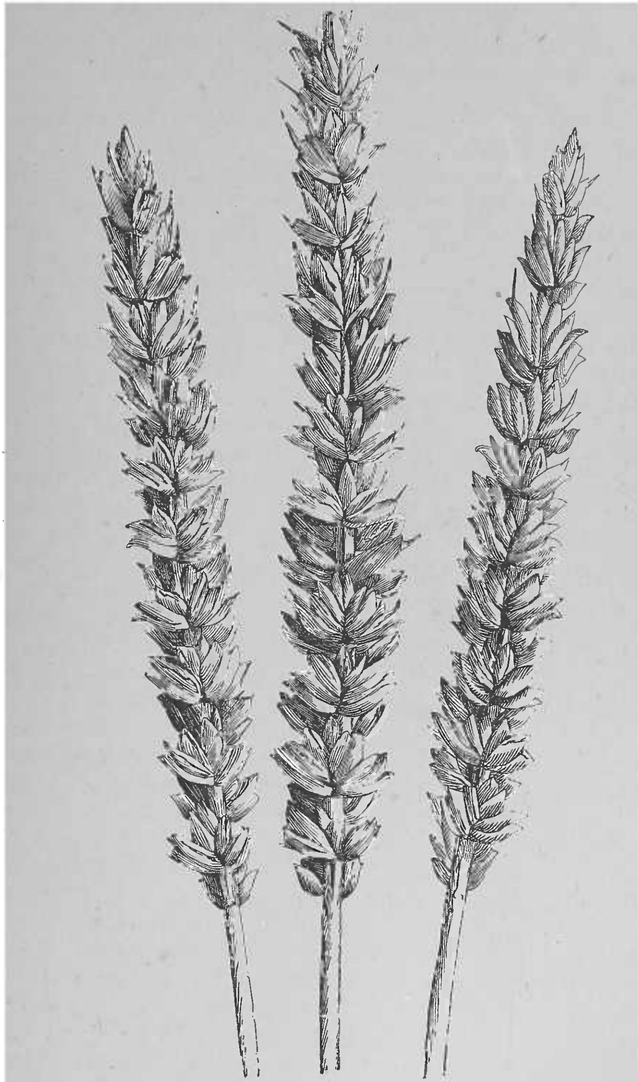
THE following are those generally cultivated in this country for stock-feeding purposes:—

WHEAT (*Triticum sativum*, fig. 236).—Although not generally cultivated for stock-feeding purposes, still, as forming part of a good rotation and as yielding a large supply of straw for folding, the crop should form a part of the well-ordered farm of a grazier. Wheat is divided into two great classes,—'winter' and 'spring;' and these again by their colour, as white and red. The best months for sowing the winter wheat are September, October, and November; unless indeed the month of December is very open and favourable, wheat should not be sown during this month. The latter end of February and the middle of March is the season for sowing spring wheat. The seed may be sown either broad-cast or in drills; the latter method is the best, as it enables the soil between the young plants to be hoed in early spring, well stoned, and kept free from weeds. The average quantity of seed sown may be six to seven pecks for the early, and from ten to twelve pecks for the later months; this is for the drill system. For the broad-cast, two bushels per acre may be put down as an average quantity. To prevent the disease called the 'smut' attacking the grain, it is the usual practice to steep the seed before sowing it. The steeps used are various. Stale urine is very generally employed; the seed is thrown into a quantity of this, the light seeds which swim being put aside as unfit for seed. After remaining a short time in the liquid, the seed is taken out, placed on the barn floor, a little lime thrown over it, and the whole allowed to dry. Nitrate of soda, arsenic, chloride of lime, sulphate of copper, and strong brine, are all recommended as steeps. It is advisable to have a frequent change of seed, care being taken to choose the seed raised in a locality where the soil is better and the climate earlier than in the place where it is intended to be grown.

BARLEY (*Hordeum*, fig. 237).—The varieties of barley are very numerous. The quantity usually sown is from two and a half to three bushels per acre; the time of sowing is March and April. Barley is usually cultivated for malting purposes; but Mr. Wilson, the distinguished author of 'British Husbandry' (A. and C. Black, Edinburgh), strongly recommends its more general cultivation for cattle-fattening purposes. The crop it usually follows is the turnip crop. The soil best adapted for barley is a warm free soil.

OATS (*Avena sativa*, fig. 238), of which there are many, thriving best, as all plants do, on good soils, but not unproductive

FIG. 236.



WHEAT.

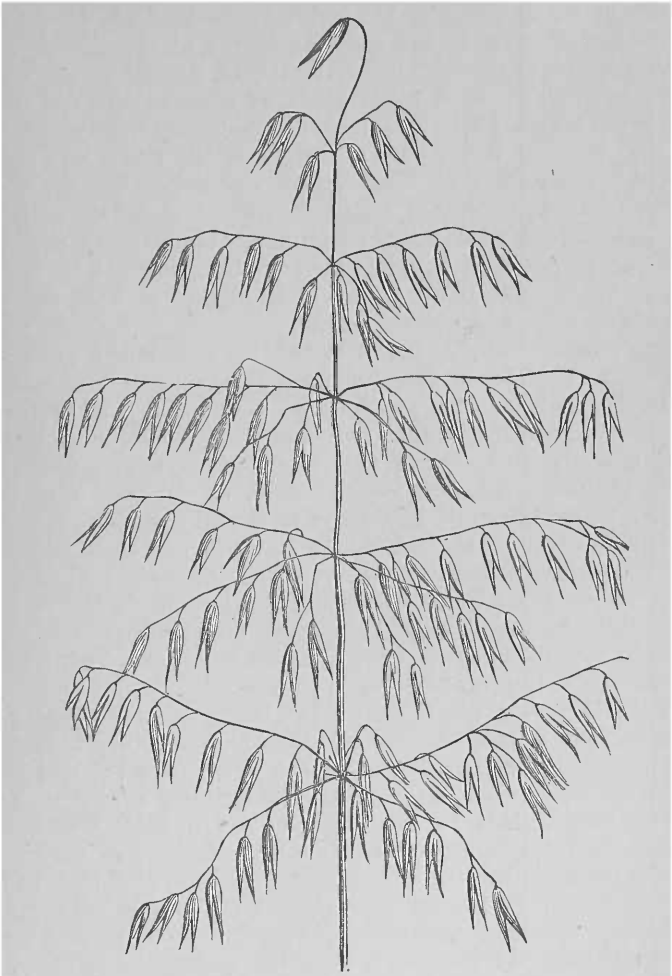
on those of an inferior quality. This grain is too well known to require much description. The proper season for sowing them is from the beginning of March to the commencement of May, but the earlier they can be got into the ground the better; the

Fig. 237.

BARLEY.

quantity per acre, if sown alone and drilled, is from two to six bushels, according to the variety used, to which, when a subsequent crop of artificial grasses is intended to be raised, are added one bushel of ray-grass, and twelve pounds of clover, just before the young plants appear above ground. This seed is

FIG. 238.



OATS.

harrowed in, and requires but little subsequent management. Grasses are, however, generally sown with the barley crop.

The goodness of the oat is judged of by its plumpness, its weight, and freedom from all musty or unpleasant smell or taste ;

and from such must the seed be chosen, if we would secure a good crop. A saving of at least one-fourth of the quantity of oats given to cattle generally, and particularly to the horse, is effected by submitting them to the action of a machine called an oat-bruiser; for when whole corn is given to the horse, a great quantity of it, by escaping his teeth, passes through the animal without contributing in the smallest degree to his nourishment. A wide field of experiment has of late been opened to the farmer by the account of some trials made of cutting oats and other grain while green. The results were satisfactory: the grain was fine and full, and thrashed out easily, and the straw was better adapted for manure than when yellow and drier; but the point to be ascertained is, the exact period at which each kind of grain crop can be cut with most advantage. Oat-hay, or oats cut green and prepared as hay, has been frequently stated to be not only an excellent food for horses, as it digests so well, but one of which they are particularly fond.

Rye (*Secale cereale*, L.) is suited to poor sandy soils, and is extensively grown in many of the German provinces, both as bread-corn, and for the purposes of distillation. It is there, also, very commonly given to post-horses, in the form of bread; being coarsely ground, and the bran not separated from the flour. In North America, too, the meal, strewn over chaff that has been previously wetted, is given to working cattle; and, used in this manner, it is said to keep the teams in very high condition. In this country, however, it is not cultivated to any extent, on account of its being liable to the depredations of an insect, that causes it to become horned or spurred, and produces the ergot of rye, in which state it is very pernicious to cattle. This disease prevails mostly in rainy seasons, or on a wet soil.

Of the common rye there are two hardy varieties—spring or white rye, and winter or black rye, the former of which may be sown from February to March, and the latter from the middle of September to the close of October. The quantity of seed per acre is from two bushels to two bushels and a half, Winchester measure, on poor, sandy, or dry limestone soils. Rye may likewise be harrowed in with a thin crop of turnips, and both be fed off with sheep. Either for pasturing or for soiling, rye supplies an excellent article of food to sheep as well as to horses and cows; the former may be fed off with it in the spring, the latter more towards the beginning of summer.

Buckwheat (*Polygonum fagopyrum*, L.) vegetates with great luxuriance in dry, loose, and sandy soils, that are open to the effects of the sun; though the variety known by the name of Siberian buckwheat, which is much heavier and more palatable in the grain, will thrive in the poorest soil, and is but little affected by cold. The best, and indeed the proper season for sowing it, is towards the end of May, or the commencement of June; and, in the course of a week, it generally appears above ground. The quantity is from one to three bushels per acre, if sown broad-cast, as it generally is, on account of the convenience of cutting it. In July it begins to flower, and it is usually fit for the scythe about the beginning of October. Three or four quarters per acre is a fair crop. Buckwheat requires little or no manure, and affords an excellent food, either for soiling or for winter store. Given to horses employed in slow draught, in conjunction with bran or chaff, it will get them into fine condition, but it is sometimes apt to produce swelled legs and cutaneous eruptions; if given to cows, in a recent or green state, it is said to increase the quantity of milk. It has been used for fattening poultry and swine; but the last-mentioned animals should not be permitted to feed entirely upon it, or they will be liable to be covered with scabby eruptions. The peculiarly fine flavour of the poultry in the South of France is said to be derived from this grain; but its fattening properties are not equal to those of the corn in common use. It is also good for pigeons, and is the favourite food of pheasants, whether wild or tame.

Peas.—Peas and beans contain a very great proportion of nutritive matter. Of the many varieties of peas cultivated, the principal sorts for field culture are very few.

The White Pea (*Pisum sativum*).—The proper season for sowing the white pea is from the end of February to the first or second week in March, in a light soil, with about 2½ bushels of seed for the large sort.

The Grey Pea (*Pisum arvense*), when raised for early podding and to be gathered while green, should be sown from the end of January to nearly the middle of March, on a strong soil, with about 2 bushels of seed per acre; but for general crops the usual time is from February to April. The drill husbandry is the best and most certain; and the seed should be put in double rows, about 15 inches asunder, with an interval of about 13 inches' distance between the double rows. The wide intervals should be cleaned with a small plough or cultivator, the narrow ones with a hand-hoe; when the plants are advanced, and before they begin to fall, by earthing up the rows a little they will lean towards each other, unite and form one row, and thus be supported, so as to blow and form their pods without falling on the ground. The distances here specified are calculated for the earlier and smaller sorts of peas; the larger kinds will require more room between the double rows. In many parts of Norfolk and Suffolk this crop is dibbled, but the practice does not answer so well as the drill. Peas should be sown in light soils from 5 to 7 inches below the surface, and in clay soils from 3 to 5, according to the consistence of each. Special care should always be taken to sow only good, sound seed, otherwise the crops will certainly be scanty and indifferent in quality, and liable to suffer from mildew, blight, and the worm. This kind of pulse may be sown after turnips or clover with one ploughing; but is best after a winter fallow, and the land in good tilth; it is, however, a very uncertain crop, and only succeeds on such soils as are not liable to suffer from excess of cold, wet, or drought. When the peas are cut, they should be laid in small heaps, and frequently turned with a fork, being very apt to be injured or to sprout if left on the ground neglected and unmoved. Great care, too, is necessary to prevent the pods from shedding. Top-dressings of dung, ashes, lime, guano, or nitrate of soda, are by some considered beneficial; but others are of opinion that these tend to make the haulm only strong, and deteriorate the crop generally.

Peas are chiefly used in fattening swine, and are better adapted for this purpose than the bean, but they should first be ground into meal. When bruised and given to cows, in conjunction with other succulent meal, they are said to give a flush of milk; pea-meal stirred in milk may likewise be given to calves with advantage. The haulm, if carefully gathered in a favourable season, affords a wholesome and valuable fodder for neat cattle, and is particularly relished by sheep; it is also usefully given, as rack-meat, to farm horses, but it should always be chopped. The stalks and leaves of peas being peculiarly succulent, it is difficult to harvest them properly in damp seasons.

Beans.—The only sort of bean usually cultivated for feeding domesticated animals is the Horse-bean (*Faba vulgaris*, L.), of which there are several varieties; the large ticks or negro beans, the small ticks, and the common sort. The horse-bean is taller than the tick-bean, but it is not so full of pods. They will all grow under the same system of culture, only requiring more or less room, according to their size. Beans are more hardy than peas, and also a more certain crop; but they require a stronger soil, and that it should be well manured for them. The best soils for the field bean, generally speaking, are the stiffer kinds of clay and strong loams. It is an exhausting crop, but a cleansing one, and often precedes the corn crop. The dung which is applied to the bean-crop may either be spread upon the stubble in autumn, or used when the drills are made: the first is the better practice, especially when wheat is to succeed, because it is immediately covered by the plough. Beans may be cultivated in the same manner as peas, and likewise on three-feet ridges, and thus they are easily kept perfectly clean with the horse-hoe and hand weeding; hoeing the ridges alternately. This is a better and cheaper way of cultivating beans than the common method upon the level ground. The quantity of seed is, about a bushel and a half of common beans upon an acre, which should be drilled about four inches deep, in the month of February or the beginning of March. Some farmers, however, adopt an earlier period, and sow them before Christmas, but then the bean must be of a very hardy kind, and thinned to about three inches' distance in the rows, leaving only the most promising plants. They may also be dibbled; in which case less seed is required, and the plants come up more regularly than when drilled. They should be frequently horse-hoed, and near to the plants; and the slips of earth left next to the rows by the hoe plough should be hand-hoed, and the rows hand-weeded. Thus great crops may be obtained from the common sort, and the land brought into fine order. There is a further advantage, in this way—that less manure is necessary to a crop of beans, thus cultivated, than if planted upon the level and hand-hoed. The sun and air are likewise more freely admitted among them; and as they do not grow so tall as when close planted, they blossom and produce pods almost down to the ground, whereas the tall close beans produce them only near the tops of the stalks. The close-planted are also infested with the dolphin fly, but not those which are drilled on ridges. It has latterly become customary, in some of the well-cultivated districts of the North, to drill beans with a small admixture of peas. They have been hitherto considered too valuable, as a seed crop, to be cut before they are ripe; but from experiments on their application as green food, it would appear that they might be profitably used for that purpose. When the bean is meant for seed, it should be suffered to ripen thoroughly, but not to be over ripe. The skin should have acquired a yellowish leather-like appearance. They are cut either with the sickle or the scythe. The average crop is uncertain, perhaps not more than from 25 to 35 bushels per acre, even under the most favourable circumstances. The bean-plant is subject to rust, mildew, and a kind of blight, which commences at the top and gradually proceeds downward. This is the work of one of the varieties of the *Aphis*. The only remedy is, to cut off the top of the plant as gently as possible, with a sharp knife, and carry it and burn it.

Beans are indispensable in coaching stables, but ought always to be ground or crushed before being given to the horse. Bean-straw, when properly harvested, and mixed with pea-straw, is considered to afford almost as much nutriment as hay of an ordinary quality.

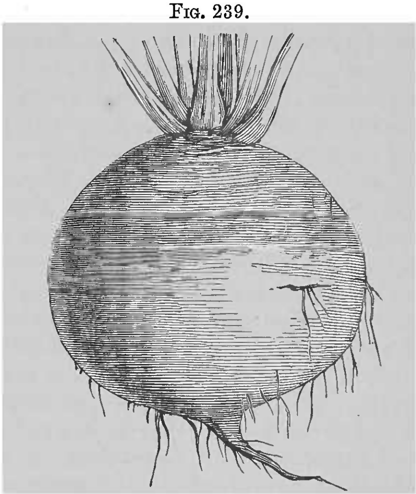
CHAPTER IV.

ON THE VEGETABLES OR ROOT CROPS BEST CALCULATED FOR ANIMAL FOOD.

HAVING pointed out the various modes of producing and consuming crops of grain and pulse, by way of fodder, we shall now briefly describe the culture of those vegetables which are peculiarly calculated to supply the farmer with food for his cattle stock during the trying season of the year; and, of all the roots which form the subject of this chapter, that which claims the most immediate attention, both from its general importance to the farmer and from its extensive use in the feeding of stock, is—

THE TURNIP.—The varieties of this root most cultivated for

FIG. 239.



SWEDE OR SWEDISH TURNIP.

feeding cattle are—the 'white Norfolk,' the 'yellow Aberdeen,' the 'purple-top,' the 'Swedish turnip,' and 'Dale's Hybrid,' which latter is a hardy succulent vegetable much relished by cattle, and in no respect injured by the severest winter. There is no vegetable within the whole range of agricultural produce which yields so valuable a portion of nutritious and wholesome food as the Swedish turnip (*Brassica campestris*, fig. 239). It is useful in the field, and it is valuable at home. It gives the best food in the greatest abundance for present use, it produces a plentiful supply of manure for future improvement, and it fertilises the soil. To this may be added, that it withstands the severities of the winter frost better than any; if properly stored up in dry weather it will retain its nutritive juices long after all other varieties have become withered and valueless; and it yields more nutriment to animals. It will also bear transplanting. Turnips are reared to most advantage on light soils, consisting of loam and sand mixed together; but the Swedes can be grown on much stronger land. They are sometimes sown broad-cast; but repeated experiments have proved that, wherever the land will admit of that method, it is far better to drill the seed, in which case from a pound and a half to two pounds of the seed will be sufficient per acre; the broad-cast method will require more. Wherever they are drilled, care must be taken to make the drills of a sufficient width.

The following is the usual preparation for sowing :—The land is ploughed about November, in order that it may be exposed to the action of the winter air and frosts; early in the spring it is again ploughed and cross-ploughed; and then, if it is free from weeds and sufficiently pulverised, from ten to twelve loads of farm-yard manure per acre is spread over the soil, and covered in. The time for sowing depends upon the state of the land; it should not, however, be earlier than the second week in May, or later than the third week in June. With the seed some artificial manure should be drilled in, as bones, peat-ashes, guano, &c. Swedes require more room than other turnips, and consequently should be drilled further apart by 6 or 8 inches, viz. other kinds from 14 to 18 inches apart, and Swedes from 20 to 24 inches apart. About three weeks or a month after the seed is sown the operation of hoeing should be commenced, and the plants thinned out to proper distances, viz. 8 or 10 inches apart; the land should then be kept free from weeds by repeated hand or horse-hoeing, as may be most convenient.

When sown too early, the crop comes to maturity before it is required for use, while the later they are sown the better are they enabled to stand the severity of winter, and the longer do they retain their nutritive juices;[1] although it must be confessed, that turnips sown later than the end of June never yield a plentiful crop. There is sometimes considerable difficulty in procuring good seed; for when different sorts are sown near each other, a bastard stock is found to be produced, which often disappoints expectation. Those who rear their own seed should, therefore, carefully separate the different species which they intend to propagate, and select from these the finest roots to be retained for seed. They are said to degenerate after the second year, and therefore an occasional cross from other soils may be advisable. The seeds should be thrown into water previously to being sown, and those which

[1] Farmer's Magazine, vol. xi.

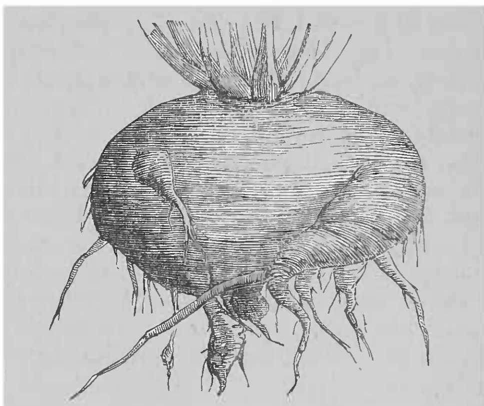
float rejected. The good seeds should then be dried, or nearly so, with sulphur, which is supposed to preserve them from vermin.

In general the turnip plants begin to appear above ground in ten days or a fortnight after they are sown; but sometimes nearly a month will have elapsed before they appear.

Occasionally it will happen that, although every attention may have been bestowed on the culture of turnips, several spots will remain barren and unproductive. To remedy this inconvenience, it is a good plan to set aside a small plot of well-manured ground for the purpose of growing a few plants to fill up blanks with. Plots may also be set aside for the cabbage, mangold, and rape crop, for all these will do well for transplanting.

Formerly, the manures employed in raising turnips were farm-yard dung and bone-dust, and, notwithstanding the wonderful

Fig. 240.



SWEDISH TURNIP AFFECTED WITH DISEASE—THE 'FINGER AND TOE.'

results attributed to some of the new fertilisers, many farmers still adhere to their old practice. The dung used should be well fermented, and thoroughly decomposed, and from 10 to 14 tons per acre is the average allowance. The quantity of bone-dust is about twelve bushels. The joint use of dung and bone-dust is very beneficial, the first being ploughed in, the latter being sown with one seed. Now, however, guano and superphosphate of lime are greatly used. Remarks on the various manures used for the green crops will be found in the section on manures.

Turnips, besides being subject to the usual depredations of insects, are exposed to several diseases, the chief of which are—

1. Canker of the root, known in some districts by the name of *anbury*. The leaves of the plant become flaccid and drooping. If the root is then examined, it will be found that, instead of

enlarging in its natural way and to its proper form, there is a singularly-formed excrescence, or more than one, attached to it. These excrescences become putrid and emit an offensive smell, and the whole of the root becomes acrid, and, towards winter, goes to perfect decay. On examination, a species of maggot is found in them, but of what insect it is the larva has not been determined. This is not at all a rare disease in the southern part of the kingdom, and the farmer gives the name of 'fingers and toes' (fig. 240) to these excrescences. Professor Low states, that 'it sometimes affects particular districts, and generally continues its ravages for many years in succession.' Several remedies for the disease have been recommended, one of which is to cease cultivating the turnip when it appears, and to substitute, for a time, some other species of crop; thus when turnips follow in regular rotation, at intervals of four or five years, to omit them once, and substitute a crop of potatoes. Lime has also been said to prevent the disease, or a solution of bone-dust in sulphuric acid, the bones being dissolved in one-third their weight of acid and an equal quantity of water, and afterwards the solution diluted to nearly half its strength.

'The remedies for finger and toe, or anbury, have,' says Mr. R. Russell in the 'Journal of Agriculture,' 'been so far indicated in discussing the causes. But to recapitulate. Lime is the most efficacious, and besides, it destroys many kinds of weeds, the healthy functions of whose roots are quite the opposite to those of the turnip. In those cases, however, in which it is not convenient to lime, the disease may be greatly mitigated by the application of suitable manures. Composts formed by earth, bones, ashes of wood, and small quantities of lime, are well worthy of a trial. It should not be distributed through the soil, but placed in handfuls as near the surface as possible, and the seed dropped upon it. By this means a young healthy plant would be obtained, and it would afterwards be enabled to push its roots through the soil. By applying rich farm-yard manure, and substituting the Swede for the common sorts of turnips, the disease in many districts has lost half its terrors.'

2. The *black canker* is a species of caterpillar, which commits very great devastations among turnips when the plants are in the state of growth termed *rough leaf*, that is, have formed considerable tops. One method of destroying these insects is, to turn a flock of ducks into the field infested with them. This expedient was successfully adopted in 1784, by Mr. Coke, of Holkham, who purchased 400 ducks and turned them on 33 acres of turnips, which they effectually cleared of the canker-caterpillar in the course of five days. Rolling has also been used with various success. As a preventive we know of no certain expedient, un-

less perhaps the sowing of turnip-seed on land so highly manured as to advance the growth of turnips into the state of rough leaf long before the insect makes its appearance.

3. The *fly*, a species of beetle—the *Haltica nemorum*—ravages the cotyledon leaves of young turnips on their first appearance, and, if not timely prevented, will completely destroy them. When the rough leaves appear, the root is safe from the attack of the beetle, and hence the anxiety for the rapid and vigorous vegetation of the plant. The sowing of turnip-seed between beans has been suggested as a preventive; as also the addition of one-fifth part of radish-seed rolled into the ground; likewise the drilling in of mustard-seed, which, when above ground, attracts the flies, and preserves the turnips;[1] but they are not in all cases effective. Another celebrated remedy, which was adopted by the late Lord Orford, is the steeping of the seed in train-oil the night before it is sown;[2] but, in this case, the seed should afterwards be drained from the oily fluid, and mixed with finely sifted sand or mould. By this treatment the root will not acquire any ill flavour; and seven gallons of oil will be enough to steep sufficient seed for 200 acres. It is probable that this steeping may prevent the attacks of the black canker-caterpillar. Sir H. Davy thinks that the mixture of soot and quick-lime, or urine and quick-lime, will be more likely to be efficacious, the volatile alkali given off by these mixtures being offensive to insects, and affording nourishment to the plant.[3] The burning of weeds, or of damp straw, has also been found efficacious in keeping off the fly. A few heaps lighted on the windward side of the field, so that the smoke may pass over it, have often been known to produce the desired effect. Quick-lime, finely powdered, and dusted over the seminal leaves of the turnips as soon as the fly begins to threaten them, has been found to be a preventive of the depredations of these voracious insects,[4] even where soot manure has failed. But that manure which most effectually promotes the growth of the plant will always be the best defence, as where-ever the growth is slowest, the ravages of the insect are most considerable; and for this purpose superphosphate of lime or bone-dust

[1] Farmer's Magazine, vol. xxx. p. 469.

[2] Annals of Agriculture, vol. xiv.

[3] Lectures on Agricultural Chemistry, p. 320. Sir H. D. records a successful experiment of Mr. Knight's, with a composition consisting of three quarters of soot with one part of lime slaked with urine: it was put into a small barrel with gimlet holes round it to permit a certain quantity, about four bushels per acre, to pass out, and to fall into the drills with the turnip seeds. Whether it was by affording highly-stimulating food to the plant, or giving some flavour which the flies did not like, Mr. Knight cannot state; but in the year 1811, the adjoining rows were eaten away, and those to which the composition was applied, as above described, were scarcely at all touched.

[4] Gorrie, in Transactions of the Caledonian Horticultural Society.

dissolved in sulphuric acid, and diluted with water, will be found beneficial.

4. Other insects, too, are not idle during the early growth of the turnip; the larvæ of one of the *tenthredines* or saw-flies and the wire-worm attack its roots, and are sometimes very destructive. Brushing the plant is recommended for these, also the application of saline matters; but a heavy shower of rain is, after all, the most effectual means of getting rid of them.

5. *Slugs* are likewise great depredators on turnips; for extirpating which some have recommended the rolling of the ground during the night, while these vermin are abroad; as also the strewing of lime in the evening or very early in the morning, at the rate of 15 bushels per acre. Geese and ducks may, as in the black canker, be advantageously turned into turnip-fields; but the most expeditious means of destroying these vermin is, the sprinkling of tar- or gas-water, by means of a watering-pot or other contrivance, on the land, before as well as after sowing, which will prevent their depredations; and which, if poured on them, will occasion instantaneous death. It may be made by pouring a sufficient quantity of tar into a barrel, and filling it with water, which, after standing two or three days, will become powerfully impregnated with the tar.[1]

Turnips should never be allowed to remain upon the land after they begin to sprout; for they not only exhaust the soil when allowed to perfect their seeds, but become sticky, lose their nutritive property, and are unpalatable to cattle. They are, however, of such importance to the grazier and breeder, that the most effectual mode of preserving them is an object of considerable moment; we shall, therefore, conclude this notice of their culture with a concise statement of the best means of keeping these roots. Where it is necessary that the roots should remain in the ground until the spring, they must be well earthed over, but in general they should be drawn in November or December, and their tops and tap-roots cut off (these may be advantageously given to sheep); if the weather is dry and open, they should be allowed to continue on the soil for a few days. A layer of straw should then be spread on the ground, and on this a bed of turnips placed, about two feet in thickness. These alternate strata may be carried up gradually to a point, in order to prevent the roots from rolling out. The whole should then be thatched with straw, one load of which will be sufficient for 40 tons of roots; and they will be effectually preserved for many months uninjured by frost or snow. In dry, porous, or sandy soils, pits or beds may be dug, about 2 feet in depth, and of a considerable breadth, wherein five or six layers of turnips may be put with a little fresh earth between each of them,

[1] Shank, in Bath Papers, vol. viii. The gas-water is obtained from gas-works.

and covered over with straw;[1] or they may be drawn, topped, and carted into a spot contiguous to the homestead, where they may be stacked against a low wall or in long narrow heaps, and thatched with straw securely enough to throw off all rain. Turnips, when a portion of their watery particles are exhausted by keeping, become rather improved than otherwise in quality, and are more relished by cattle.[2]

The following method has likewise been very successfully employed by Mr. Munning. Having observed that the drill-system alone could facilitate the protection of the turnips while on the land where they were grown, Mr. M. states that, in 1800, he effected this desirable object, *by removing the alternate rows for autumnal consumption;* thus leaving rows about one yard asunder, which he well moulded up by means of a one-horse plough. His land thus assumed the appearance of what is called *two-furrow work*, or perhaps, more properly, *tops and baulks*; each top embracing and defending a row of turnips, and the baulks being in the lines whence the turnips were removed. The whole were most completely moulded up, and seemed to bid defiance to a winter's severity. This plan has since been adopted with complete success for the preservation of Swedes, as we learn by a very intelligent account of their management in North Hants, published by the Society for the Diffusion of Useful Knowledge.[3]

The English Agricultural Society offered a prize for the best Essay on 'drawing turnips' with least injury to the land and to succeeding crops. Where the old broad-cast method is retained, no mode of drawing and carrying off can be suggested which will not be injurious to the land, be it light or heavy. The best method is, to draw the turnips from the half of two *lands*, from the furrow to the ridges, laying them in proper heaps on each side,

[1] Kent's Hints to Gentlemen of Landed Property, p. 121.

[2] The author of the Prize Essay of the Royal English Agricultural Society, on storing turnips, deprecates the use of pits, or piles, or anything which impedes a free circulation of air, as he says 'the turnips are liable to grow, and rot in them.' He thus describes a contrivance which, after repeated experiments, he found to answer better than any other:—'A piece of ground was selected, and two lines of stakes were driven into the ground about 2½ feet above the surface and 6 feet apart. These stakes were wattled on both sides and at one end, the other being left open for the purpose of backing the carts in to empty the turnips into their proper position; the roots were formed into a pile, the base occupying the whole space between the two rows of stakes, and the top terminating in a point. They were then thatched with straw and secured by ropes. Close alongside another enclosure was made and filled in a similar manner, and then as many more as were required, only leaving just room enough to pass between each. To prevent the water which runs off the roof from soaking underneath the piles, drains were cut between each which effectually carried it off.' When these were opened in the following spring, the turnips were found to be wonderfully perfect; there was but very little vegetation, and scarcely any rotten ones.—*Journal Royal English Agricultural Society*, vol. ii.

[3] See Mr. Munning's Account of some Experiments for Drilling and Protecting Turnips, &c., 8vo.; and 'Reports of Select Farms,' Farmer's Series, No. vii.

and taking a cart down the furrow for the purpose of carrying them off.

If, however, the ridges were made at 27 inches' distance, so as to admit the wheels of a cart in the spaces between two rows of plants, this would facilitate the drawing, and also that valuable invention, the horse-hoeing system. Wherever turnips are sown in ridges, the labour of hoeing will be materially diminished, and the evils of drawing and carting turnips almost entirely prevented.

There has been much discussion with regard to the comparative advantages of the removal of the turnips, or their consumption on the land. The whole turns on the question of manure. In which way is the dung of the animals most profitably employed? When turnips are consumed on the land there is no regular distribution of the dung, either of cattle or of sheep. In clay soils the land will generally be more injured by the feet of the animals, than any amount of dung voided by them on it can atone for. Hence, if these roots were carted home, and consumed by animals in the straw-yard, or the feeding shed, or the cowhouse, having been properly mixed and combined with other food, they would evidently be more economically employed. The actual quantity of manure would probably be the same, but at home it could be collected in a mass, and might then be divided with precision and effect. On light soils, on the other hand, the treading of the feet of animals is beneficial, not only by compressing the soil, but by kneading into it the excrement they void. The question, therefore, is whether the irregular distribution and partial evaporation of the manure is or is not compensated for by the saving in the labour and expense of carting home the turnips and carting out the manure. The following from the pages of the 'North British Agriculturist' on the cultivation of the turnip crop will appropriately conclude this section:—'Until the excess of moisture imbibed during winter and spring has been removed, the more argillaceous soils should, as a rule, not be stirred by the plough in spring—the grubber, harrow, and rolller being alone used to reduce the soil, and to bring to the surface the root-weeds. The same rule is applicable to light soils resting upon open porous subsoils. A fine mould is a condition favourable for the growth of the turnip crop—the seed germinating quickly and regularly while the after-growth of the plants is comparatively uniform. When the plough is used in place of the grubber, the furrow should be across the line of the previous one, and at a depth under that of the preceding furrow. The use of the plough in preparing land for a turnip crop is yearly becoming more restricted, and much less spring labour is being bestowed on turnip land than formerly. By this modern management the moisture is retained, and the germination of the seed is more certain. In Scotland and the north of England the common practice is to form drills. The manure deposited in the bottom of the drills is covered when the drills are re-formed, preparatory to sowing the seed. Where farm-yard manure is to be applied, ridging is necessary; but where portable manures are applied, it is advisable, particularly on all dry soils, to apply the manure broad-cast—the land being afterwards ridged and the seed deposited by the turnip-barrow. Under the condition of a dry climate, it is advisable to grow the crop on the flat; the manure and seed being deposited by a machine which performs both operations at the same time. Whether the land is raised into drills or kept flat, the line of the drills or seed rows should be across the ordinary line of the ridges. As a general rule, the distance between the seed rows of turnips should be 28 inches. When sowing takes place late in the season, the distance may be reduced to 20 inches, or even less; but when sown in May, and up to the last week in June, the distance should be 28 inches. The sowing of the Swedish variety may commence by the 8th of May, during the whole of the month. Two or more acres of white globe should be sown by the middle of the month to furnish succulent food for stock by the middle or end of September. If the breadth of turnip land is considerable for the number of horses and persons employed on the farm, it is important to commence sowing early, and to continue sowing steadily till the whole is finished. By the time that the sowing of Swedes is finished, that of yellows should commence, to be followed with the white variety. An extra breadth of Swedes should be sown, so that in the event of the turnip fly or caterpillar attacking a portion of the crop, re-sowing with the seed of some other variety may be proceeded with. By this precaution the ordinary breadth of Swedes may be secured. In purchasing seed for sowing, secure what is true as to variety and in good fresh condition. Of the Swedish varieties, select either Curwin's, Skirving's, common Purple Top, or Green Top. The latter variety is one of the best of all the Swedes, being hardy and producing full weights of roots. The quantity of seed necessary to sow an acre depends mainly upon the condition in which the surface has been reduced. Where the soil is finely reduced, 2 lbs. to the acre is an ample allowance; where the soil is rather rough, 4 to 5 lbs. should be sown. The seed should not be deposited beyond a depth of one inch; even one half-inch is generally sufficient to secure a regular braird. In sowing with the common turnip-barrows, the small rollers behind the seed spouts may be removed. By this method more healthy plants are generally secured. There is some objection on the ground that the singling out of plants cannot be so expeditiously executed as when the surface has been smoothed with a roller, but this objection does not always hold good; besides, the increased vigour of the plants repays any extra outlay for wages in singling the plants.'

II. Rape (*Brassica napus*) is inferior, in point of produce, to turnips, although in nutritive properties it is hardly equalled by any other vegetable; the culture is similar to that of turnips, and it will support about the same number of animals per acre. It may be sown later than turnips, therefore, where it is an object to obtain two green crops in the year, a longer time is afforded for eating off a previous crop of winter tares, and it will succeed even after an early crop. If sown for seed, it requires a rich soil; but large quantities are grown with advantage, for feed only, on very poor land in many parts of England, particularly on ground newly broken up.

The herbage of the rape is used as food for cattle and sheep, and an oil is expressed from its seed. The masses of seed-husks after the oil has been expressed—or rape cake—and the loose dry husks, are used as a top-dressing for various crops, after having been reduced to powder. Rape would occupy the same place in a regular rotation of crops which is given to turnips and potatoes, and, like them, it would answer as a first crop on newly-reclaimed ground. When it is sown to be eaten off by sheep, it may be either broad-cast or drilled; but where it is to be cut for the purpose of feeding cows or other cattle in the stall, the drill system is preferable.

It will bear transplanting where the land is dry, and a green crop is to succeed. We cannot, however, then expect so luxuriant a crop as if it were sown in a proper season, and the growth not checked by transplanting.

The crop may be cut down and given to cattle in the stalls, and then a second cutting will be produced; but the best mode of consumption is to eat it down occasionally with sheep on the land. It is generally fed off at intervals, from the beginning of November to the middle of April, being valuable at the former period for fattening ewes, and at the latter for supporting ewes and lambs.[1]

The following notes on the cultivation of rape we gave in the 'Journal of Agriculture,' and reproduce them here:—

'An expeditious mode of planting rape is used in Flanders. A spade, ten inches wide, is pushed vertically into the ground, and by drawing the handle towards his body, the labourer makes a wedge-like opening; a woman inserts a plant in each side of this opening, and when the man removes the spade, the earth falls back against the plants. The woman puts her foot between the two plants, and they are then fixed in their places. In this

[1] Farmer's Magazine, vii. 178.

operation the man moves backwards, and the woman who puts in the plants forwards. Instead of the spade, an instrument is sometimes used called a *plantoir*. It consists of two sharp-pointed stakes, a foot or more apart, connected by a cross handle at top, and a bar at about eight or ten inches from the points. The instrument is pressed into the ground by the handle, assisted by the foot placed on the lower bar, and makes two holes, a foot apart, into which the plants are placed, and earthed round as before. This is done when the land has not been laid up into high ridges.' In some parts of Flanders the plough is used for transplanting; a deep furrow is made by it, in which the plants are placed by a woman who follows it, and are earthed up by the return furrow, the earth being pressed round the plants by the foot of the woman following. No crop will repay the labours of weeding, hoeing, and cleaning, so readily as the rape crop—a difference of fifty per cent. will result in the yield, according as these operations have been well or ill attended to. Artificial manures may be applied to the crop during its growth with great advantage; guano, bone-dust or rape-cake being amongst the best. In Flanders the favourite manure for the colza, a plant requiring the same fertilising materials as the rape, is a mixture known as the *en grois flamand*, composed of urine, oil-cake, human excreta, and of columbine.

As regards the value of the rape for a spring feeding crop, the following remarks from an acknowledged authority, Mr. Rham, will form a useful conclusion to the 'Notes':—'If the crop is very forward, it may be slightly fed off; but in general it is best to let it remain untouched till spring. In the end of March and the beginning of April it will be a great help to the ewes and lambs. It will produce excellent food till it begins to be in flower, when it should immediately be ploughed up. The ground will be found greatly recruited by this crop, which has taken nothing from it, and has added much by the dung and urine of the sheep. Whatever be the succeeding crop, it cannot fail to be productive; and if the land is not clean, the farmer must have neglected the double opportunity of destroying weeds in the preceding summer and in the early part of spring. If the rape is fed off in time, it may be succeeded by barley or oats, with clover or grass seeds, or potatoes, if the soil is not too wet. Thus no crop will be lost, and the rape will have been a clear addition to the produce of the land. Any crop which is taken off the land in a green state, especially if it be fed off with sheep, may be repeated without risk of failure, provided the land be properly tilled; but where cole or rape have produced seed, they cannot be profitably sown in less than five or six years after on the same land. The cultivation of rape or cole for spring food cannot be too strongly recommended to the farmers of heavy clay soils.'

III. The POTATO (*Solanum tuberosum*, L).—There are several varieties of this root raised solely for culinary purposes, and others which are cultivated solely with a view to feeding cattle; almost all of which flourish in light, loamy, sandy soils, and will grow in any tolerable land. The following was the ordinary preparation for the potato crop:—The ground was ploughed twice or thrice, and, just before the last ploughing, which ought to be accomplished by the end of March, from fifteen to twenty loads of stable manure were spread over the land and ploughed in when the weather proved open and mild, or if not, suffered to lie for a week or ten days. After the last ploughing the ground was levelled, and furrows drawn in it about 3 feet asunder and 7 or 8 inches in depth. In the centre of these furrows the seeds, roots, eyes, or slips were placed, and covered with earth. A little before the young plants appeared, a light harrow was passed over the whole, in order to remove all weeds and hindrances to the growth of the haulm. As the plants grew, they were earthed up two or three times with the horse-hoe, and hand-hoes were requisite to eradicate the weeds.

Since the 'disease' has attacked the potato, however, some experienced growers have found it advisable not to manure before the last ploughing, but to deposit the seeds in the furrow, cover them with a thin layer of soil, and *then* spread the manure above that; for it has been observed, that where the seeds have been placed in immediate contact with stable or farm-yard manure, the tubers have been watery and unfit for keeping, and predisposed to take the disease.

Much care should be taken in the selection of the seed potatoes, and healthy, vigorous tubers always chosen; for, besides the quality, the largest will generally be found to produce the strongest roots. About twenty bushels, when the eyes are cut, are sufficient for an acre.

Mr. Howden, of Lawhead, East Lothian, instituted a course of experiments on no fewer than sixty-two varieties of early potatoes—indeed, on every variety that he could get.

It may be interesting to record the names of the six most productive, and the six most unproductive of those varieties:—

	Produce per Acre.	Starch.			
White Seedling .	493 bush.	Not tried	Mealy	White	Not liable to disease.
Sanderson's London .	416 „	2758 lbs.	Dry	Do.	Do.
Long Red Kidney	374 „	2247 „	Do.	Red	Do.
Biscuit .	372 „	2222 „	Mealy	Pink	Do.
Round white .	362 „	1897 „	Dry	White	Do.
Witchfield .	351 „	2861 „	Do.	Red	Do.

We add one more, because it is the same as the last in the number of bushels, and yet differs so materially in quantity of starch:—

Dickson's White .	351 bush.	1814 lbs.	Dry	White	Not liable to disease.

The following are the six least productive:—

Sawyer's White Kidney	165 bush.	Mealy	White	Liable to disease.
Dodd's Seedling	115 „	Waxy	Do.	Do.
White's Kidney	105 „	Dry	Do.	Do.
Aberdeen Kidney	101 „	Waxy	Do.	Do.
Tyrolese Kidney	90 „	Do.	Do.	Not liable.
Red-nosed Kidney	77 „	Do.	Do.	Liable.

Various manures have been applied to potatoes. The 'Journal of the Royal Agricultural Society,' vol. iv., gives the following experiment, made by Mr. Clowes, of Norfolk, on a free loamy soil, substratum brick earth and clay:—

	POTATOES.	
	Tons.	Cwts.
Soil simple	5	13
12 tons of fresh horse-dung	12	7
15 „ bullock-yard dung	9	12
50 bushels of sprats	9	11
15 tons of fish and earth	9	3
20 bushels of bones	10	3
3½ cwt. guano	12	2
10 „ rape-cake	8	18
20 sacks malt screenings	9	0

There are numerous experiments recorded with regard to guano which seem to prove that its effects on potatoes are very beneficial. Nitrate of soda is also found considerably to increase the crop in many localities. Salt combined with charcoal, charred peat, or soot, in the proportions of one part salt to three parts of either of the other matters, has not only been found to produce great increase in the crop, but, by the anti-putrescent qualities of these manures, to act as a preservative against disease. In all cases, however, the success of the manure depends chiefly upon its chemical affinity for the soil with which it is incorporated.

Potatoes are subject to injuries from insects, as well as to various diseases, of which none is more fatal than that which appeared in this country in 1845 and 1846, and devastated the crops throughout almost the whole of Great Britain. Agriculturists and scientific men are by no means agreed as to the cause of it; by some it is ascribed to atmospheric influences, by others to the ravages of an insect denominated the *Aphis devastator*; humidity, blight, defective or erroneous cultivation, have also been asserted to have separately and collectively tended to produce it. Liebig attributes it to the same cause which in spring and summer excites influenza, viz. 'a disturbance of the natural evaporation producing a check on that motion of the fluids which is one of the conditions of life.' It has likewise been attributed to shallow tillage, the disuse of spade husbandry, the prevalence of drill culture, and a superabundance of active manures.

The remedies prescribed have been as various as the causes ascribed: unfortunately none seem to be entirely to be depended upon. Attention to tillage, to the selection of healthy sound seeds, to the removal of extraneous causes, and to the storing of seed potatoes, has done something, and may do more, towards eradicating the disease. To give even the briefest résumé of the various remedies which have been suggested to prevent the ravages of this disease, or of the theories upon which their use is based, would occupy the space of a moderately sized volume. Where so many therefore claim attention, and where space is so limited as ours, we must refrain from entering at all into the subject; nor need we much regret our inability to take it up, as many, we might say the great majority of the remedies proposed and theories propounded, have left the question as to the true cause of the disease very much, if not precisely where it was years ago, when first it broke out. To it, perhaps, the saying was never more applicable, 'all that we know is that we know nothing.'

The proper time for digging up potatoes is in autumn, when their stems and foliage are beginning to decay. This operation should be performed in fine weather; after which the roots may either be piled up in a dry place in elongated heaps resembling the roof of a barn, thatched with a layer of straw 6 inches thick, and then slightly covered with mould, well beaten down with a spade, to render it firm; or they may be pitted in a similar way to turnips; but where this is done, the pit must be dug on an elevated spot, well drained, and in a dry soil, and each root must be carefully examined, and all bearing the least appearance of unsoundness rejected. The pit may be covered with dry clean straw, and then with mould. As potatoes are liable to heat and sweat, means of carrying off the vapour thus engendered must be provided, by leaving ventilators or partial openings in the heap or pit. These must, however, be closed when there is any sign of frost, or the roots will be injured. It has been recommended, as a better plan still, to absorb this damp or sweat by throwing in dry earth or sawdust among the potatoes when they are being pitted or stacked, and laying a good bed of this beneath them.

If the potatoes are stacked under cover and in a close place, it should not be forgotten that, as soon as their decay commences, a poisonous vapour begins to proceed from them. Our best potatoes contain certain poisonous properties, which are only expelled by heat in the process of preparing them for human food. A poor family had a heap of potatoes in their only room. The children were one day told to pick the good potatoes, which they did by stirring up the heap with sticks. Five persons inhabiting the room were seized with giddiness, headache, and vomiting. They first attributed this to their glimmering fire; the window was opened, and the patients soon recovered. On the following day, the fire not being lighted, the task of picking the potatoes was recommenced, and again the symptoms of the preceding day appeared, and relief was again obtained by opening the window and ventilating the room. The cause of illness was now plain enough. The evidence that there is this poisonous principle in the raw potato sufficiently demonstrates the importance of feeding cattle with the boiled or steamed root only. For thus it becomes better prepared to be acted upon by the digestive powers, and that which would impede digestion, or gradually produce a prejudicial effect on the constitution, is got rid of; besides, the horse does his work better, and the ox fattens sooner, when fed on cooked roots than when fed on raw.

IV. The COMMON WHITE BEET (*Beta hortensis*, L.), though chiefly cultivated in gardens for culinary purposes, is, according to Rocque, a most excellent fodder for cows; the best way of feeding them being, to mow the plant, and to give the leaves to them during the summer. It is raised from seed, which should be sown in the beginning of March, on an open spot of rich ground, in a low situation, and it should be occasionally watered. Its utility in the feeding of cattle has, hitherto, been too much undervalued.

MANGOLD WURZEL (*Beta vulgaris*).—The introduction of the cultivation of this root into Great Britain, which took place in 1786, formed almost a new era in British husbandry. There is but one other root that can compare with it, namely, the Swedish turnip; they do not, however, interfere with one another, but are both excellent for different purposes. In a former part of this work, the value of each, and the precise points in which the one may occasionally be preferable to the other, have been stated. For stall-feeding until spring nothing can exceed the turnip; but the turnips then begin to lose a portion of their nutritive property, and by that time the mangold-wurzel, having lost much of its watery particles by keeping, begins to be preferable to the Swede.

There is no doubt of one important fact—that, after the mangold-wurzel has superseded the Swedish turnip, whether from change of food, or the superior nutritive power of the beet, or probably from both causes, the beast does accumulate flesh and fat much more rapidly than he did before. For ewes lambing at the time that it comes in, it is particularly excellent, giving more and better milk than the turnips did at an earlier period. There is not an animal that has become accustomed to the taste of it who does not prefer it to all the other species of winter provender.

This plant will grow on almost any tolerably moist soil which contains a fair proportion of nutritive matter, or on retentive clays, or peaty land; but rich clayey loams are those which produce the best crops.

The land intended to bear mangold-wurzel should be either manured expressly for this crop or for the preceding one, and must be clean and in good condition if we would ensure success; it should be cleansed and ploughed before the winter has set in, and afterwards subsoiled, and then again ploughed as early in the spring as the weather and the other labours of the field will allow. To this should succeed a harrowing, to collect all the weeds, and it is then rolled and formed into drills. About the latter end of April, or early in May, is the best time for sowing; and if the weather be favourable, the operation should then be commenced by ploughing in a dressing of decomposed farmyard dung, and then drilling in the seed, and subsequently rolling the ground. At the proper time it should be hoed, a space of about 14 inches being left between each plant; any deficiency must be made up by good and strong plants, and an inch or more of the top part of the root left out of the ground. The top of the ridge should be made fine with the end of a small rake, in order that the plant, which is at first very feeble, may get its head above ground. The grubs will soon begin to attack it on account of its sweetness; but, by filling up the failing ridges with transplanted roots, which should be kept at the first hoeing, the ridges may be kept tolerably full, and thus it may be preserved until it sets the grub at defiance.

Guano, applied as a manure to mangold-wurzel, has been said to increase the crop to three and even four-fold the quantity yielded by the simple soil.

Of the different species of mangold-wurzel, the marble kind will produce the greatest weight; but the red possesses more nutriment, and the yellow is the most nutritious of all.

The Germans, who cultivate this root extensively, prefer the red for feeding cattle, and the yellow for the purposes of distilling or manufacturing sugar.

As the autumn advances, a supply of food for a considerable number of cattle may be obtained by cutting off the leaves, but these should not be given to sheep without the admixture of other fodder, as they are apt to produce purging. The mangold wurzel should be taken out of the ground in October, or early in November, as, if frosts occur, it will be very seriously injured. Care should be taken not to wound or bruise the root in drawing or storing it; the leaves should be all cut off, and ploughed into the soil, or used for immediate food. The roots may be stored in pyramidical heaps, and thatched with straw, and then a coating of earth overlaid. Small chimneys or ventilators should be contrived in the heap to obviate the danger of heating, and as mild spring weather approaches the coating of earth should be removed from the surface.

This root may be sown on a stiffer soil than the turnip, but it requires a somewhat more favourable climate.

Mangold-wurzel has several advantages; it is not liable to disease, it is comparatively free from the attacks of vermin, and it may be kept perfectly sound for four, six, or even eight months; cows are very fond of it, and yield a great quantity of milk when fed on it, and the milk is never tainted by the bad flavour which turnips too frequently communicate.[1]

V. Cabbage (*Brassica oleracea,* L.).—Of this valuable plant there are several species cultivated in Britain; the sorts most deserving of notice are:—

1. The *drum-headed cabbage*, also a variety of the common cabbage. Perhaps there is little difference between it and the Scotch and the Yorkshire; they all have large leaves, which, as the plant advances, collapse, and form a dense head. Its seed is deposited in beds, either about the end of February or early in March, or sometimes in August. In the latter case, the plants are set out in November, and transplanted in July. This kind is much relished by cows, calves, and ewes, and they are rapidly fattened by it. The heart only should be given to cows, because the leaves (which may without injury be given to other stock) impart an unpleasant flavour to the milk, cream, and butter of the cows which are fed upon them; should any of the leaves have been accidentally given to the cows, the addition of one gallon of boiling water to six times that quantity of milk, when exposed in the leads or other shallow vessels, will in a great degree remove the disagreeable taste.

2. The *green Scotch cabbage* is likewise a very hardy variety, introduced from North Britain, where it is an article of prime

[1] The following account of an experiment on the qualities of mangold-wurzel, as food for milch kine, is extracted from a pamphlet published by Thos. Newby, who introduced the cultivation of this root into Cambridgeshire in 1812:—

Two milch cows, who had calved in spring, were in October turned out into an over-eaten pasture, and fed morning and evening on hay only. In one week they yielded

Milk	101 quarts.
Cream	$5\frac{1}{2}$ „
Butter	$4\frac{1}{2}$ lbs.

They remained on the same pasture another week, and were then fed with mangold-wurzel and hay, each cow having half a bushel of the root sliced and given to her, morning and evening: the result was—

Milk	130 quarts.
Cream	$8\frac{1}{2}$ „
Butter	$6\frac{3}{4}$ lbs.

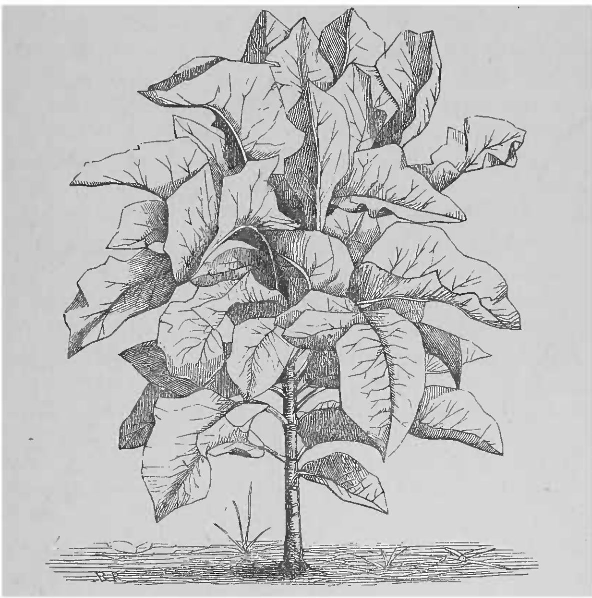
Yet another week they were kept on the same pasture, and during that had only hay morning and evening, as at first: this produced—

Milk	87 quarts.
Cream	$4\frac{3}{4}$ „
Butter	$3\frac{1}{2}$ lbs.

importance for cattle feeding. It possesses this singular advantage, that it will grow on moorlands; and, if it is cut a short time before the winter frosts set in, it is particularly grateful to cattle.

The spring season for transplanting cabbages that were sown in the previous autumn, extends from February to May, and to August for those sown in the spring. The earlier they are set out the better, as their growth is materially affected by drought. The best distance for a full crop is in squares of three feet, which will allow of the operation of the horse-hoe crosswise, after which the hand-hoe should be unsparingly employed. From four to

FIG. 241.



TREE CABBAGE.

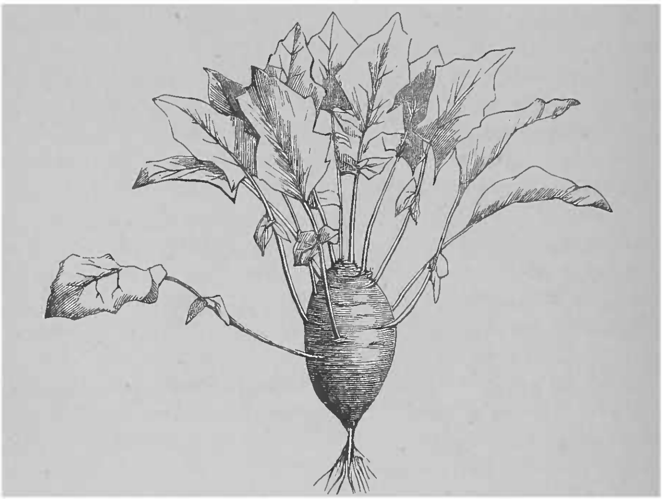
five months are requisite to bring the plant to maturity. For spring sowing the seed should, if possible, be got into the beds in February, and the plants should be set out towards the middle of April.

3. The *tree or thousand-headed cabbage* (fig. 241) is a hardy plant, which promises to be of some service to the grazier, as its leaves may be cut without impeding its growth, and it will, in the course of five or six weeks, produce a new crop, while the severest frosts do not affect it. Its culture corresponds with that of the cabbage.

Cabbages will not bear storing like the Swedish turnip, and therefore must be used nearly as soon as they are pulled. They are, however, more nutritive than the turnip: one ton of drum-head cabbage will yield 75 lbs. of gluten, while a ton of Swede turnips will only yield 33 lbs., and consequently they will feed a greater number of animals from the same extent of ground. Any rich land will bear cabbages with success, but a strong loam or clayey soil is best adapted for this vegetable.

The opinion here expressed as to the cabbage not being capable of being stored like the turnip is however very fortunately met by a peculiarity of the plant when left in the ground; for there it is so hardy, being capable of withstanding any degree of cold we have in this country, that practically it may be and is in many

Fig. 242.



KOHL-RABI—OBLONG VARIETY.

cases left out all the winter, the only effect of severe frosts being that the outer leaves are slightly damaged, but the interior is left perfectly sound and sweet. This is an example of how long a fact remains unnoticed. Thus, for example, in the garden cabbage the sprouts which form from cabbage stalks left from summer cuttings, from time we may say immemorial, have been left exposed to all the vicissitudes of winter frosts. Yet no one ever thought of applying the plan to farm produce. We have again and again so applied it and with marked economical effect. We are also inclined to doubt the fact as stated below, that cabbages are not valuable as food for fattening cattle. We decidedly think they are, the best mode of giving them being raw. This, however, may be modified in winter, when they may be given as part of the evening's mash.

Although the cabbage is comparatively little used for the fattening of stock, still its use is greatly recommended by the rest modern authorities for dairy cattle. It is greatly relished by them, adds to the quantity of the milk, and does not taint it like turnips. The turnip, the mangold-wurzel, the carrot, and the potato have nevertheless almost superseded it, except where particular situations and circumstances call for its cultivation. Long habit and the prejudice which is entertained against the cabbage may have something to do with this.

The *Kohl-rabi* (fig. 242), commonly known as the turnip-rooted cabbage, is a healthy plant now much esteemed for stock. The seed may be sown in March in seed beds, and the plants transplanted in May, or it may be sown early in May on the drills. Much of what has been said as to the culture of turnips applies to this crop.

VI. The CARROT (*Daucus carota*, L.) is raised from seeds, which ought to be previously well rubbed in the hands, to divest them of their beards, and mixed with dry sand, ashes, or bran, or powdered charcoal; which latter, as it influences the vegetation of the seed, is to be preferred, where it can be easily obtained. This is done to prevent them from adhering together, or to the drill, and coming up in patches. These roots flourish best in light sandy loams, which should be well loosened by frequent deep ploughing, or subsoiling and harrowing, in order to admit of the long tap-roots penetrating to the necessary depth; from a successful experiment made in the north of Scotland there is, however, reason to believe that carrots will flourish equally well in peaty soil.[1] They were formerly not considered to answer so well when drilled as when broad-cast; yet the first-mentioned method is decidedly most advantageous; for, being sown at wider intervals, the roots will not require to be thinned out, neither will they need so much hoeing in order to facilitate their growth; in short, the broad-cast sowing is fast falling into disuse, and is a far more expensive mode of cultivation.

Carrots are a most valuable substitute for the potato; they are equally, nay, more nutritious, for feeding cattle; they will grow on inferior soils; they do not impoverish land so much; and they loosen it far more; for, penetrating to a greater depth, their roots derive the chief of their sustenance from matters below the reach of other crops, or of the potato; thus, abstracting but little of the goodness of the surface soil, they leave the land better adapted to bear a good grain crop. Cows, pigs, horses, and colts thrive on them, and relish them.

[1] Sir John Sinclair on Scottish Husbandry, vol. i. p. 303.

The white Belgium carrot, which has only been introduced into this country within the last ten or twelve years, is of more rapid growth than the red variety, and therefore in unfavourable seasons answers better. It is equally agreeable to live stock. Mr. Pusey states, that white carrots generally yield on an average eight or nine tons per acre more than red ones. Mr. Morton, of Chester Hill, states that a crop of white carrots sown on a deep sandy loam, without manure, yielded at the rate of 26 tons 3 cwt. per acre. Many persons consider this crop equal to any of the roots usually given to cattle.

Carrots require careful cultivation, and should not be sown on foul land; clean wheat or barley stubbles are best for them. The sowing should take place at the end of April, or during the first or second week in May, and previous to this the land should have been prepared by a manuring of farm-yard dung ploughed in some five or six months previously, and subsequently to that by deep ploughing, subsoiling, and harrowing, with intermediate rollings. The seed should be drilled, and not broad-cast, and then the ground rolled. About three or four weeks afterwards the hoeing must commence. The carrots will be ready to take up about six months from the time of sowing, and should never be left in the ground later than November. A good soil, well cultivated, will yield about 16 to 20 tons per acre.

For storing carrots about the latter end of autumn and during dry weather, let the roots be dug up, and piled upon an earthen bank (raised about six inches above the level of the soil, and adapted to the quantity of carrots intended to be stored), on which has been spread a thin layer of dry straw, and on this the carrots are to be placed, two or three deep, with successive intervening strata of straw; the tops being turned outwards, and their ends folding one over another, while the smaller roots are *topt* and thrown into the centre. The storing may be continued to the height of about four feet, when the whole is to be covered with a little straw and a few inches of dry earth. Another line may then be commenced in the same manner, leaving room for a person to pass between, and the interval filled up with dry straw, and the outside defended with bundles of straw staked down or fastened with hurdles. Thus arranged, carrots will be effectually secured from frost, and afford a regular supply of wholesome fodder, at a time when almost every other vegetable is destroyed.[1]

As carrots will grow without the assistance of manure, and as good crops have been thus obtained, an opinion very generally prevails that the application of manure is injurious to them. It

[1] Annals of Agriculture, vol. xi. See also an interesting paper on the cultivation of carrots, in Communications to the Board of Agriculture, vol. vii., part I., and Jour. Roy. Ag. Soc., vol. viii.

is true that raw manure, ploughed in shortly before the sowing, very frequently occasions the plant to become *forked*, and thus spoils its appearance for the market; but manure which has been incorporated with the soil sufficiently long to have become decomposed, will always be found to increase the produce. Salt dug into the ground has been known to increase the crop one-half; salt and soot is also a very beneficial manure for this crop. Rape-dust and bone-dust have been recommended.

Carrots form a palatable and nutritious food for almost every species of stock. They may be given unboiled. Mixed with cut straw, there are few things that will better support the horse, and colts are brought into excellent condition when fed with them. To the cow they afford a wholesome food, and colour and flavour the butter much more agreeably than turnips. The hog eats them ravenously, and thrives upon them; and if the veterinary surgeon were to state his opinion, it would be that the carrot is one of the most valuable medicines which he has at his command. In the form of poultice, it will give a healthy character to foul ulcers, and it will heal some of the varieties of 'grease,' where everything else fails. When colts, and young horses, too, are recovering from distemper, or catarrh, or strangles, or when it is doubtful what turn the disease will take, there is nothing so likely to recall the appetite and to turn the scale in favour of life. Carrots will occasionally have a similar, although not so decided, an effect on cattle; they are, indeed, invaluable in these respects. If the sick animal can be induced to eat them, good will in all probability result, and in no case will they do harm. The carrot crop is subject to the attacks of various insects, some of which, as the aphides or plant-lice, attack the leaf, and others the root of the plant. The *rust* is one of the worst diseases to which this crop is liable; the seat of the evil is here in the root, and the cause a small mite or maggot, supposed to be the larva of the *Psila rosæ*. A top-dressing of cow, or pigeons' dung, or sand saturated with spirits of tar, or quick-lime, spread over the ground immediately before the sowing, or drilled in with the seed, are the remedies prescribed for the rust; a decoction of tobacco, or some potent fumigation, are the only means of getting rid of the plant-lice.

VII. The Parsnip (*Pastinaca sativa*).—This root has hitherto been little used for the food of cattle in this country, although in some parts of France it is highly valued, and in Jersey and Guernsey it is cultivated upon the most extensive scale. It gives a flavour and richness to the milk of cows which is scarcely exceeded by the carrot and the mangold wurzel; swine are fond of and readily fattened by it, and cattle may be fattened by it in much less time than can be accomplished by the potato; indeed, since the frequent failures of the potato crop, considerable attention has been directed to the parsnip. Its cultivation is very similar to that of the carrot, and it can be grown on all deep turnip soils, and, with proper care, on heavy or light, wet or cold lands.

It has of late become a serious question what crop is to be substituted for the potato, and carrots and parsnips present themselves as being the cheapest, the most nutritive, the most remunerative, and the most beneficial to the land; they, too, like the potato, are well adapted for affording food to both man and beast; in fact, as regards cattle, they are far more nutritious than the potato. The parsnip, from vegetating more rapidly during the first few weeks of its growth, is less subject to the attacks of insects than the carrot; nevertheless, on inferior lands it seldom yields so abundant a crop as the last-named root; and the chief objection to it is, that it occupies the soil too long, parsnips being generally considered to keep better in the ground than when drawn and stored. There is little doubt, however, that this inconvenience might be remedied by careful storing, and we cannot but recommend this root to the attention of the agriculturist. The parsnip however keeps so remarkably well in the ground, that if the space can be spared, they may be left in it all the winter; if it cannot, they can be safely stored in an outhouse or general store, all that is necessary being to cover them up with dry and sweet—not musty—straw, which will be all the better if it be moved from time to time. There is scarcely any of our cultivated roots which keeps so long and so well and is so easily stored as the parsnip. From these and other circumstances connected with it, we are surprised that it is not better known and more grown.

The JERUSALEM ARTICHOKE (*Helianthus tuberosus*).—This vegetable has been recommended as a substitute for, or at any rate an auxiliary to, the potato crop. It is one of the hardiest roots we have, as well as one of the most productive; it will grow on almost any soil, and in almost any situation, and with little or no manure, and is comparatively free from disease. It is propagated much in the same way as potatoes, from 'sets' or eyes. The great objection to it is the difficulty of getting rid of it from land in which it has once been sown. It is a root far less highly valued than it deserves to be. It is relished by all our live stock, especially when cooked; for pig feeding it is particularly valuable, and for milch cows, it has a capital effect upon the milk production, and if—like turnips—given after, not *before* the milking, gives no unpleasant flavour to the milk. Moreover the flavour is vastly more pleasant than that of the Swede turnip. In brief, the artichoke should be much more extensively used than it is.

As it will flourish on almost any soil, and its culture is by no means difficult, it might be profitably raised on reclaimed unoccupied and barren spots of light poor land. No precaution appears to be necessary for preserving its roots during winter but trenching around the plants to prevent the water from injuring them. If this is done they will resist the frost, but they may be stored or pitted in the same way as turnips and potatoes.

Few trials have as yet been made as to their value in feeding cattle; but from the chemical resemblance between the composition of the Jerusalem artichoke and the potato, there is reasonable ground to infer that it would at least be as useful as that root, and on the Continent the stems and leaves are eaten and relished by cattle. At any rate the matter is well worthy of trial.

CHAPTER V.

THE QUALITIES AND COMPARATIVE VALUE OF SOME GRASSES AND ROOTS, AS FOOD FOR CATTLE.

MANY experiments have been made to discover the relative value of different kinds of food for cattle, by feeding the various species of stock with a given quantity of each, and weighing the animals, in order to ascertain the increase of flesh gained by each during a certain period. The result, however, of all such experiments depends so much on the breed, age, and constitution of the animals, as well as upon hidden peculiarities in the digestive process, that they have been generally found inconclusive; and thus have arisen the numberless contradictory statments that have been published.[2]

With the view of establishing a system, on the correctness of which some reliance might be placed, a series of experiments was undertaken at Woburn by the late Duke of Bedford, and conducted under the able superintendence of his principal gardener, Mr. George Sinclair, who subsequently communicated the results to the public in a volume entitled 'Hortus Gramineus Woburnensis,' which cannot be too strongly recommended to the attention of every farmer.

[1] Farmer's Magazine, vol. vii. p. 421.

[2] Thaër, in his Principles of Agriculture, gives a proportional scale as to the relative fattening powers of the under-mentioned roots and grasses:—

103 lbs. of hay are equal in point of nutriment to 200 lbs. of potatoes—460 lbs. of beetroot—350 lbs. of ruta baga—525 lbs. of radishes—266 lbs. of carrots—260 lbs. white cabbage—90 lbs. young clover—90 lbs. dry vetches—90 lbs. dry lucerne—90 lbs. dry sainfoin.

The various grasses were cultivated separately, in little plots of equal sizes, and thus the quantity of fodder produced by each upon an acre could be ascertained. An equal portion of the produce of each was then subjected to a scientific process, by means of which the qualities of each were obtained with perfect accuracy. Equal quantities of the dry grasses or vegetable substances were then acted upon by hot water, until all their soluble or nutritive parts were dissolved; the solution was then evaporated to dryness by a gentle heat, and the matter obtained carefully weighed. The difference between the weight of this and that of the whole parcel before the experiment began would express the quantity of nutritive matter with sufficient accuracy, at least for every purpose of agricultural investigation.

It was found that vegetable matter is chiefly composed of gluten, mucilage, saccharine matter or sugar, and bitter extract. It was upon the several proportions of these, exclusive of the woody fibre which forms their basis, that the nutritive value was judged to depend.

The researches of Mr. Sinclair, and the results to which they led, however valuable they were, have given place to more recent ones, founded upon and deduced from the theory of Liebig.

The principles of cattle feeding, as now generally received, owe their discovery and elucidation to the genius of this celebrated Continental chemist, whose researches have done so much to raise agriculture high in the rank of sciences.

All food consists, according to Liebig, of two parts—the *organic*, or the parts which are capable of being burnt or consumed, and the *inorganic*, or those which cannot be consumed, and are therefore termed the *ash* of food. The ash is made up of insoluble earthy matters, chiefly phosphate of lime and magnesia, which act as bone-formers; also, of soluble saline substances, as the chloride of potassium and sodium, the sulphates of soda and potash; all these supply the blood and the juices of the animal with their mineral constituents.

The organic portions of food—as albumen, gluten, casein, starch, gum, pectine, sugar, oil, and fibrine or fibre—are divisible into two great classes: the 'nitrogenous' group and the 'non-nitrogenous' group. The *nitrogenous* group is composed of vegetable albumen, vegetable casein, and vegetable fibrine. In all these the four elements, carbon, oxygen, hydrogen, and nitrogen, are present; hence the name nitrogenous compounds of food, by which they are distinguished. The use of the nitrogenous portions of food is to add to the flesh of the animal to which they are given, and repair the waste of the tissues which is perpetually taking place. From this they are generally described as 'flesh-formers;' and, moreover, as the eminent chemist Mulder considered the albuminous constituents of food to be compounds of protein, they are also sometimes designated 'protein,' and sometimes amylaceous compounds of food. The names, then, 'nitrogenous' and 'albuminous' flesh-formers, 'protein' and 'amylaceous' compounds, are often indiscriminately used. Flesh-forming substances are obtainable from both animal and vegetable foods: thus, albumen is obtained from the white of an egg, and from the juice of cabbage; fibrine from fresh-drawn blood and from wheat—when obtained from wheat it is called gluten; casein, from milk and from peas and beans. All these substances must be present in food, otherwise it is of no utility in building up the body of the animal, and in repairing the waste of the tissues which is continually going on.

The *non-nitrogenous* group of food-substances are so called from the element nitrogen being *absent* from their composition: the other three elements, carbon, hydrogen, and oxygen, being alone present. The non-nitrogenous substances of food are represented by gum, sugar, starch, fat and pectine; and their office in the animal economy is to promote respiration and maintain the animal heat. Hence, they are sometimes termed 'heat givers' and 'respiratory compounds.' Of all these substances, the fat goes to produce fat in the animal, and to promote heat; while the starch, gum, and sugar, go merely to promote respiration. In some respects, the heat-producing and respiration-supporting substances of the non-nitrogenous portions of food may be said to be identical, one often supplying the place of the other. Thus, the heat claims of the animal must first be met—that is, the animal must have its due supply of heat before fat can be produced; but if the substances are present in such quantity as to be more than requisite to maintain the heat, they are made to produce fat. We thus see the importance of maintaining the warmth of a fattening animal, so that none of the food will be wasted unnecessarily in maintaining heat, but as much of it as possible given to lay up a store of fat.

When the food theory was first propounded by Liebig and for some time after, it was believed that food was nutritious in proportion to its richness in the nitrogenous compounds. Recent researches have, however, made it abundantly evident that before a food can be in the full sense of the term a nutritive one it must be a combination of *both* the nitrogenous and the non-nitrogenous substances. On this point also Professor Tanner, in a recent article 'On the comparative Value of different kinds of Food,' has the following summary of the facts which have been ascertained:—

'That the proportion of nitrogenised matter in a food does not solely regulate the increase of meat.

'That the proportion of non-nitrogenised matter in a food does not regulate the increase of meat.

'That the addition of these two component parts does not represent the meat-producing power of a food.

'That the *combined* use of a fat-producing food with a flesh-producing food produces almost double the quantity of meat which would result from their use when separated from each other.'

The following summary of the uses of the various constituents of food are given by Dr. Voelckner in his well-known and valuable paper the 'Chemistry of Food,' published in the Journal of the Bath and West of England Society:—

1. 'The earthy substances contained in food, consisting chiefly of phosphate of lime and magnesia, present the animal with the materials of which the bony skeleton of its body principally consists. They may be called, therefore, bone materials.

2. 'The saline substances, chloride of sodium and potassium, sulphate and phosphate of potash and soda, and some other mineral matters occurring in food, supply the blood, juice of flesh, and various animal juices, with the necessary mineral constituents.

3. 'Albumen, gluten, legumin, and other nitrogen-containing principles of food, furnish the animal with the materials required for the formation of blood and flesh; they are therefore called flesh-forming substances.

4. 'Fats and oily matters of the food are employed to lay on fat, or to support respiration and animal heat.

5. 'Starch, sugar, gum, and a few other non-nitrogenised substances, consisting of carbon, hydrogen, and oxygen, are used to support respiration (hence they are called elements of respiration), as they produce fat when given in excess.

6. 'Starch, sugar, and the other elements of respiration alone, cannot sustain the animal body.

7. 'Albumen, gluten, or any other albuminous matter alone, does not support the life of herbivorous animals.

8. 'Animals fed upon food deficient in earthy phosphates or bone-producing principles grow sickly, and remain weak in the bone.

9. 'The healthy state of an animal can only be preserved by a mixed food, which contains flesh-forming constituents as well as heat-giving principles, and earthy and saline mineral substances in proportion, determined by experience, and adapted to the different kinds of animals, or to the purposes for which they are kept.'

Composition. Proved value and percentage of different foods.—The following table, by Professor Tanner, in the Bath and West of England Society's Journal, will be useful. The column headed 'as proved' shows that by the consumption of 6 lbs. of barley, under favourable circumstances, 1 lb. of meat should be obtained, by the consumption of 150 lbs. of mangold the same, and so on.

Material	Composition			Feeding value	
	Non-nitrogenised matter per cent.	Nitrogenised matter per cent.	Water per cent.	As proved	Per cent.
				lbs.	
Barley	56	13	14·83	6 to 1	16·7
Oats	55·5	13·6	12·8	7 to 1	14·3
Beans	48·5	23·3	14·8	8 to 1	12·5
Peas	50	23·3	14·1	8 to 1	12·5
Linseed-cake	13·52	28·56	8·6	5 or 6 to 1	16·7
Linseed-cake and Peas, equal parts	31·76	25·93	11·3	4½ to 1	22·2
Rape-cake	11·3	33·7	6·8	6 to 1	16·7
Cotton-cake	30·4	42·9	7·9	6 to 1	16·7
Clover-hay	40	9·3	14·0	12 to 1	8·3
Swedes	8·474	1·44	89	150 to 1	·66
Mangolds	8·19	1·81	86	150 to 1	·66
Carrots	10	1·5	85	160 to 1	·66

It is the practice with some authorities to estimate the value of cattle food by the quantity of water it contains.[1]

Dr. Lankester in his Guide to the Food Museum at Kensington gives the following table, showing the weight of water in various foods. It is questionable, however, we may state here, how far this view of the inutility of water in a food is a correct one. For some speculations on this very interesting point, we may be permitted to refer the reader to vol. ii. of 'Outlines of Modern Farming,' which forms one of the series of Rudimentary Treatises issued by the publishers of the present volume. The following is Dr. Lankester's table referred to, showing the weight of water in each 100 lbs. of the various substances in their natural condition:—

	lbs.		lbs.
Potatoes	75	Indian meal	14
Carrots	86	Rye	13
Turnips	87	Peas	14
Parsnips	79	Rice	13
Mangold-wurzel	85	Beans	14
Cabbage	92	Bread	44
Flour	14	Cocoa	5
Barley-meal	14	Lentils	14
Oatmeal	13	Buckwheat	14

The feeding materials at command of the farmer may be divided

[1] 'There is little danger,' says Professor Tanner (Journal of the Bath and West of England Society, vol. viii. part 2, new series), 'of there being a deficiency of the sup-

into two classes: those produced on the farm, *first*, grasses, clovers, hay, straw, turnips, mangolds, kohl-rabi, rape, cabbage, wheat, oats, barley, rye, beans and peas; and, *second*, those obtained from foreign or other sources extraneous to the farm, as oil-cake (linseed), rape-cake, cotton-seed cake, rice meal, Indian corn, and the various kinds of condimental foods. We shall take these substances in the order here given.

But before giving these analyses it will be well to notice—what indeed has not often been noticed, but what has nevertheless an important bearing on the subject now under discussion—namely, that the nutritive value of farm produce of the same kind is not always similar, or rather of equal value in all cases. Thus, a turnip of the same kind grown in one part of a field may be of very different nutritive value from a turnip grown in another part of the same field. The difference may be still more remarkable between turnips grown in totally different districts. It will be unsafe then to determine that the analyses which we are about to give, or which may have been made from time to time, give accurate results applicable to all samples of the same produce. Nor need this be wondered at when we consider the diversities of soil, climate, manure, and the way in which this manure is applied, all bringing into existence a very complex condition of circumstances tending to bring about a material difference in the composition of the produce. Thus—not to go deeply into the matter—which space indeed prevents us at present from doing—we can very readily suppose that a root grown in hard baked soil, under dry and cloudless weather, will be very different in composition or nutritive value from a root grown in friable soil with genial alternations of gentle showers and cheerful sunshine. A very eminent authority points out the importance of this very clearly when he says: 'We are too much in the habit of speaking of cake, turnip, mangold, or hay, as if these complex mixtures of substances were simple chemical combinations; whereas the differences in two samples of the same produce are often very great. Anyone who has tried practically the nutritive effect of good and badly made hay, or of turnips grown on good land and on peaty land, knows well that there is a vast difference between hay and hay, or a turnip and a turnip!' There is, however, to be said in this studying the analyses of farm produce, that they give data from which their *relative* value may be estimated. Thus we can tell generally the difference there is between the *feeding* value of a turnip and a carrot, between wheat and barley, and so on.

NATURAL GRASSES.—Since the researches of Liebig into the

plies of mineral matter, because of the stores formed in all vegetable produce. It is to the due and proper supply of the other classes of food that attention should be especially directed.'

Table showing Nutritive and Mineral Constituents of different Grasses.

Botanical and Common Names of the Grasses.	Water	Albuminous or Flesh-forming Principle	Fatty Matters	Respiratory Principles: Starch, Gum, and Sugar	Woody Fibre	Mineral Matter or Ash	Date of Collection
Anthoxanthum odoratum—Sweet-scented vernal grass (1)	80·35	2·00	0·67	8·54	7·15	1·24	May 25
Alopecurus pratensis—Meadow fox-tail grass (2)	80·20	2·44	0·52	8·59	6·70	1·55	June 1
Arrhenatherum avenaceum—Common oat-like grass (3)	72·65	3·54	0·87	11·21	9·37	2·36	July 17
Avena flavescens—Yellow oat-like grass (4)	60·40	2·96	1·04	18·66	14·22	2·72	June 29
„ pubescens—Downy oat-grass (5)	61·50	3·07	0·92	19·16	13·34	2·01	July 11
Briza media—Common quaking-grass (6)	51·85	2·93	1·45	22·60	17·00	4·17	June 29
Bromus erectus—Upright brome grass (7)	59·57	3·78	1·35	33·19		2·11	„ 23
„ mollis — Soft „ „ (8)	76·62	4·05	0·47	9·04	8·46	1·36	May 8
Cynosurus cristatus—Crested wagtail grass (9)	62·73	4·13	1·32	19·64	9·80	2·78	June 21
Dactylis glomerata—Cock's-foot grass (10)	70·00	4·06	0·94	13·30	10·11	1·54	„ 13
„ „ seeds ripe (11)	52·57	10·93	0·74	12·61	20·54	2·61	July 19
Festuca duriuscula—Hard fescue grass (12)	69·33	3·70	1·02	12·46	11·83	1·66	June 13
Holcus lanatus—Soft meadow grass (13)	69·70	3·49	1·02	11·52	11·94	1·93	„ 29
Hordeum pratense—Meadow barley (14)	58·85	4·59	0·94	20·05	13·03	2·54	July 11
Lolium perenne—Darnel grass (15)	71·43	3·37	0·91	12·08	10·06	2·15	June 8
„ italicum—Italian rye-grass (16)	75·61	2·45	0·80	14·11	4·82	2·21	„ 13
Phleum pratense—Meadow cat's-tail grass (17)	57·21	4·86	1·50	22·85	11·32	2·26	„ 13
Poa annua—Annual meadow grass (18)	79·14	2·47	0·71	10·79	6·30	0·59	May 28
„ pratensis—Smooth-stalked meadow grass (19)	67·14	3·41	0·86	14·15	12·49	1·95	June 11
„ trivialis — Rough-stalked „ (20)	73·60	2·58	0·97	10·54	10·11	2·20	„ 18
Grass from water-meadow (21)	87·58	3·22	0·81	3·98	3·13	1·28	April 30
„ second crop (22)	74·53	2·78	0·52	11·17	8·76	2·24	June 26
Annual rye-grass (23)	69·00	2·96	0·69	12·89	12·47	1·99	„ 8

chemistry of food, most elaborate analyses of grass, showing the constituents according to his classification, have been made. The above table, from Dr. Voelcker's paper on the 'Chemistry of Food,' shows the value of the natural grasses in a fresh state.

Dr. Voelcker groups the grasses in the following order, as indicative of their feeding value; these grasses, however, are not, he says, separated from each other by definite lines of demarcation. The figures within parentheses after the name of each grass denote the number of the line in previous table, in which the analysis and common names of the grass will be found.

Grasses of superior quality.—Lolium italicum (16), Poa annua (18), Hordeum pratense (14), Cynosurus cristatus (9), Dactylis glomerata (10), Bromus mollis (8), Phleum pratense (17); the second class, or grasses of medium quality, being—Anthoxanthum odoratum (1), Alopecurus pratensis (2), Arrhenatherum avenaceum (3), Lolium perenne (15), Poa pratensis (19), Poa trivialis (20); the third class, or grasses of inferior quality, being—Avena flavescens (4), Avena pubescens (5), Briza media (6), Bromus erectus (7), Festuca duriuscula (12), and Holcus lanatus (13).

Grasses of medium quality.—Anthoxanthum odoratum (1), Alopecurus pratensis (2), Arrhenatherum avenaceum (3), Lolium perenne (15), Poa pratensis (19), Poa trivialis (20).

Grasses of inferior quality.—Avena flavescens (4), Avena

Nutritive Properties	Red Clover	White Clover	Yellow Clover	Alsike Clover	Bokhara Clover	Lucerne	Sainfoin	Vetch	Plantain
Water . .	80·64	83·65	77·57	76·67	81·30	73·41	77·320	82·16	80·79
Flesh-forming substances .	3·60	4·52	4·48	4·82	3·28	4·40	3·512	3·56	2·48
Heat and fat-producing substances	13·78	10·26	15·94	16·44	13·52	19·11	17·43	12·74	14·89
Ash .	1·97	1·57	2·00	2·06	1·89	3·08	73	1·54	1·83

HAY.

Nutritive Properties	Superior Meadow Hay	Inferior Meadow Hay	Mean of 25 samples of Hay	Aftermath or second crop of Hay	Clover Hay
Water .	16·94	16·54	14·61	13·06	16·84
Flesh-formers .	10·69	6·16	8·44	10·75	13·52
Heat producers .	40·17	69·89	43·63	49·74	64·43
Ash .	5·04	7·41	6·16	7·46	5·51

pubescens (5), Briza media (6), Bromus erectus (7), Festuca duriuscula (12), Holcus lanatus (13).

Artificial Grasses.—The preceding table shows the nutritive value of clovers, &c., as determined by the experiments of Dr. Voelcker.

The following are statements of the percentage of flesh-formers, heat-givers, and water, in various feeding materials. We take them from Mr. Pringle's admirably practical Tract on 'Cattle Management' (Messrs. A. Fullarton & Co., Edinburgh and London).

FLESH FORMERS *in Cereals and Straws.*—In the 100 parts of the grain of wheat there are 11·64; oats, 11·85; barley, 10·84, 13, 8, 8, 6; Indian corn, 12·0; beans, 23·3; peas, 23·4; lentils, 24 parts. In the STRAW of wheat, 1·79; straw of fats, 1·63; straw of barley, 1·63; straw of rye, 2·29; straw of common Scotch bean, 8·25; straw of winter bean, 6·79; straw of peas, 12·55 parts.

FLESH FORMERS *in clover hay*, 13·52; *common meadow hay*, 8·44; *aftermath*, 10·75.

FLESH FORMERS *in the Green and Leaf Crops.*—Turnips, 1·14; Swede, 1·73; mangold, 1·54; kohl-rabi, 2·75; cabbages, 1·75; parsnips, 1·280; white Belgium carrots, 0·667.

FLESH FORMERS *in the Grasses, &c.*—Red clover, 3·60; white clover, 4·52; yellow clover, 4·48; alsike clover, 4·82; lucerne, 4·40; sainfoin, 3·51; vetches, 3·56; Italian rye-grass, 8·66; perennial rye-grass, 10·16; green rye, 2·705; green rape, 3·13.

FLESH FORMERS *in Oil Cakes.*—Linseed, 24·44; linseed or oil cake, 27·65; rape cake, 29·53; cotton-seed cake (decorticated), 41·25.

FLESH FORMERS *in Miscellaneous Substances.*— Carob or locust bean, 7·72; lupine, 34·0; malt-combs, 23·87; bran, 13·80; oat-dust, 6·92; barley-dust, 8·46; malt-dust, 6·69; rice-meal, 6·68.

HEAT GIVERS *in the Cereals and Straws of the Cereals.*—In 100 parts of the *grain* of wheat there are of heat-givers, 68·74; oats, 63·34; barley, 68·31; Indian corn, 67·48; buckwheat, 51·0; beans, 38·0; peas, 39·0; lentils, 37·0; *straw* of wheat, 31·06; oats, 37·86; barley, 39·98; rye, 37·15; common Scotch bean, 65·85; winter bean, 65·96; peas, 21·93.

HEAT GIVERS *in Hay.*—Clover hay, 64·43; common meadow hay, 43·63; aftermath, 49·74.

HEAT GIVERS *in Green and Leaf Crops.*—Turnips, 4·436; Swedes, 5·932; mangolds, 8·60; parsnips, 15·738; white Belgium carrots, 11·250; kohl-rabi, 8·62; cabbages, 4·05.

HEAT GIVERS *in the Grasses, &c.*—Red clover, 13·78; white clover, 10·26; yellow clover, 15·94; alsike clover, 13·52; lucerne, 19·11; sainfoin, 17·43; vetches, 12·74; Italian rye-grass, 52·36; perennial rye-grass, 38·92; green rye, 10·026; green rape, 4·649.

Heat Givers *in Oil Cakes.*—Linseed, 30·73; linseed cake or oil cake, 40·95; rape cake, 40·90; cotton-seed cake (decorticated) 17·44.

Heat Givers *in Miscellaneous Substances.*—Carob or locust bean, 17·41; lupine, 32·37; malt-combs, 45·94; bran, 55·73; oat-dust, 76·07; malt-dust, 59·44; barley-dust, 69·73; rice-meal, 31·13.

Water in the Cereals.—Wheat, 12·26; barley, 13·65; oats, 13·09; Indian corn, 14·96; beans, 14·1; peas, 14·8; lentils, 12·5.

Water in the Green and Leaf Crops.—Mangold, 87·78; Swedes, 89·460; white globe, 90·430; Aberdeen yellow, 90·578; Norfolk bell, 89·460; cabbage, 86·28; kohl-rabi, 86·020; carrots, 87·338; parsnips, 82·050; rape, 87,050.

Water in the Grasses.—Red clover, 80·64; white do., 83·65; yellow clover, 77·57; alsike clover, 76·67; lucerne, 73·41; sanfoin, 77·320; vetch, 82·16; meadow-hay, 14·61 (first crop); do. aftermath, 13·06.

Water in Oil Cakes, Linseed, &c.—Linseed cake, 12·44; lin-*seed*, 7·50; rape cake, 10·68; cotton-seed cake, 11·19.

Water in Miscellaneous Substances.—Rice meal, 12·019; carob or locust bean, 14·22; malt-combs, 3·21; lupine, 14; bran, 12·86; barley-dust, 11·03.

Water in the Straws.—Wheat straw, 12·26; oat straw, 13·09; barley, 14·65; Indian corn, 14·96.

Such are the approximate estimates of feeding value of various foods; but there are many modifying circumstances which affect the nutritive value of cattle foods which should be remembered. The following remarks, which the editor of the present edition contributed to the pages of the 'Scottish Farmer,' may be suggestive on this point:—

'That chemistry has rendered valuable services to the practical feeder there is little doubt; but at the same time it must, we think, be admitted that some danger arises from taking as guides—safe under all circumstances of soil, locality, and animal peculiarities—the results of those analyses of foods and classification of the effects which their constituents are presumed to produce, which have of late years been so widely circulated. An analysis of any product of the farm may be given, and certain feeding effects predicated from its use; but it by no means follows that this analysis will represent correctly the feeding value of the same kind of product grown in a locality where the soil or climate may be of a very different character. The chances are all in the opposite direction; and the probability is that the material—same in name and variety—may be of high in the one, and of low feeding value in the other locality. True, this difference is not to be put to the discredit of the chemist who may have made the first analysis; it arises rather from the mistaken notion of the feeder, who takes it for granted that the analysis of any material grown in one place will represent precisely the value of the same material grown in another. For instance, the nutritive value of oats grown in Scotland is higher than when they are grown in England, the case being the reverse as regards barley. The highest authority on such matters states that this fact has been well established by several analyses. Again, it is but a short time ago that Mr. Ruston showed that while mangolds grew luxuriantly in his soil, they possessed no very high nutritive value; while turnips are not worth the growing as regards feeding value. How misled one under such circumstances would be if he took for a guide in practice the analyses of the same feeding materials, grown in another locality, as given by some chemist. But we do not require to take, by way of example, the products of localities separated by wide intervals of country; for the practical man has often abundant evidence of the different feeding value possessed by produce grown not only on two contiguous farms, but even on different parts of his own farm. The value of the produce must be and is influenced by the modes of treatment, as well as the nature of the soil. It would open up, for instance, a very interesting enquiry, if we could institute rigid experiments as to the feeding value of produce grown on precisely the same soil, but under different treatment, application of manure, &c., &c. Produce grown on a poor exhausted soil cannot possess the same qualities, be they good or bad, as that grown on carefully-prepared and highly-manured soil. The season, too—the absence of rain, or the superabundance of it—will also influence, in a more or less marked degree, the qualities of produce; and even the period at which it may be harvested will have its influence too.

'The period for which produce is kept before being used also exercises an influence on its feeding value. This we know, that mangolds are much more nutritious, or, at all events, more wholesome—and in the feeding sense the two terms may be deemed synonymous—when given to stock in December or the spring, than when taken newly up. Weeds, too, exercise a baneful influence on the quality of produce; and often a mysterious, at least unknown, peculiarity of soil or herbage will make the one side of a valley a very Golgotha for sheep, while the other side may be a Paradise. The different effect of the same food on different animals is a point also worthy of consideration; but to this we will refer in process of time, and fully, as its importance, indeed, deserves.

'Chemists themselves have directed special attention to the danger of supposing, as many do suppose, that chemical analysis alone determines the value of a feeding material. On this point

Dr. Voelcker has some remarks pregnant with meaning. "We are too much in the habit of speaking of cake," he remarks, "turnips, mangold, or hay, as if these complex mixtures of substances were simple chemical combinations; whereas the differences in two samples of the same produce are often very great. Anyone who has tried practically the nutritive effect of good and badly made hay, or of turnips grown on good turnip land, and on peaty land, knows well that there is a vast difference between hay and hay, or a turnip and a turnip. In speaking of the nutritive value of any article of food, too precise a language is out of place; and it is simply absurd to draw nice general conclusions from small differences which the analysis of different feeding materials may have yielded. Unless the differences are strongly marked and constantly observed in a great number of cases, it is unsafe and irrational to attach a precise nutritive value to different articles of food, especially if the opinion is founded solely upon analytical data, and not corroborated by actual experimental trial."

'The nutritive or feeding value of a food is greatly influenced by certain conditions frequently connected with it. Thus, as Dr. Voelcker points out, the prejudicial substances which it may contain—the mechanical effect which it exercises—the physical condition of the food—the flavour which it imparts to the flesh or milk—are all circumstances influencing the value of a food. Thus rape or oil cake may contain a large percentage of mustard, and the sweepings of food-stores may have had material mixed up with them; in that case, the food is not only innutritious, but absolutely poisonous. Again, bran, for instance, although in reality, so far as chemical analysis shows, more nutritious than the whole grain, exercises such a mechanical effect in passing through the system, that it not only induces relaxing effects, but passes through, to a certain extent, undigested altogether. The effects of musty or a bad condition of food, as hay, are too well known to be much dwelt upon here.

'The observations we have here made may be taken as a few suggestive notes on a subject, the importance of which is sometimes overlooked; but there are other points which are full of interest, and which exercise no small influence in modifying the feeding value of farm produce. The consideration of these points brings us more closely in connection with the science of physiology than with that of chemistry. And on this point, connected with what may be called the peculiarities of *inner* life, we may state at the outset, that comparatively little is known which may be taken as correct and trustworthy. As yet, conjecture is nearly all that we can indulge in, and although facts are certainly being brought forward repeatedly which will ultimately tend to place the science of life on a more secure and better understood basis, at present these facts—so called—are so scanty, and some of them are so open to be disputed as being facts at all, that little can be predicated with certainty from them. Indeed we may, with the philosopher, paradoxically affirm that, as regards life and its wondrous secrets, what we know shows us that we know nothing. Yet the observations which we have made are full of suggestive interest. That the peculiarities, temper, disposition, and age of the animal we feed exercise a modifying influence upon the feeding value of the materials employed is well known. One likes straw, another hay; roots are eagerly devoured by some, which are eaten as if with palled appetites, if not turned from with disgust, by others. The milk of cows will increase and diminish, will assume a variety of conditions of the most diverse character, and these succeeding each other sometimes with singular rapidity, and as singular an uncertainty. The food relished by them to-day will be turned from with disgust to-morrow, and while one breed does well with one kind of produce, another breed cannot thrive upon it at all. The same food, too, with the same animals will produce precisely opposite effects one day from those brought out upon another, according, apparently, to the condition of the animals, whether they are quiet and gently treated, or disturbed by fear or ill-usage. The weather, doubtless, too, acts as singularly upon some animals as it does upon the human frame, bringing with it fits of depression, or, on the other hand, a flow of animal spirits, and influencing, it may be reasonably conjectured, their physical condition accordingly. Dr. Voelcker very clearly points out a variety of circumstances connected with the condition of the animals as modifying the value of the food with which they are supplied. Of these points we here present a *résumé*, which we have elsewhere given:—

'"1. *The age of the animal.*—For young animals, food rich in nitrogenised, and poor in woody fibrous matter, is required; bone-forming materials are also required.

'"2. *The various kinds of animals.*—The food fitted for horses is not the best for cows and sheep.

'"3. *The natural disposition or temper of the animals.*—While a short-horn rapidly, a Kerry or a Welsh cow rarely, fattens.

'"4. *The purposes for which animals are kept.*—The difference between fattening store cattle and keeping milch cows in good condition is obvious enough. Again, horses working hard in spring and summer scarcely keep up on the same food which will fatten them easy in the stable in winter."

'Again, although we may reason with some degree of probability on the faith of analyses, as to the feeding properties of food, it should not be lost sight of that these may be greatly modified by the animal organism of the animal fed upon them. Hence arises the importance of attending to the *digestibility of food.* Unfortunately, comparatively little is known about this important process, so that nothing can be predicated with certainty about it. But a few of the conditions on which the digestibility of food depends are stated by Dr. Voelcker, of which the following is a brief *résumé*:—

'"1. *On the kinds of animals.*—Thus cows more readily assimilate the nutriment in cut straw than horses; while sheep do not so readily digest chaff as cattle.

'"2. *On the amount and character of the woody fibre contained in food.*—As a rule, woody fibre is less easily digested than other constituents of food. Its condition also affects the nutritive value of food in which it is present. The soft fibre of plants is readily transformed into fattening substances; while the hard fibre of old or fully-ripened plants passes almost entirely through the animal.

'"3. *On the amount of flesh-forming substances.*—Food rich in these should be given sparingly to cattle; while for horses subjected to rapid waste of muscle it is well adapted.

'"4. *On the bulk of the food.*—The bulk of food contributes to the healthy action of the digestive organs; the bulk is, however, subject to differences, according to the animal; thus, horses require less bulk than cattle.

'"5. *On the form in which food is presented to the animal.*—While food in one form possesses little value, by preparing it in another its value is increased. Straw cut into chaff is better than the straw in bulk; steamed, well mixed with sliced roots, better still. Oats and barley, beans and oil cake, are all improved in feeding worth by being bruised. The steaming of hay and the boiling of roots render them also more readily assimilable by the animals to which they are supplied, and consequently more palatable.

'"6. *On small proportions of substances with which we may not even be acquainted.*—The researches of Professor Liebig on the juices of flesh showed the existence of certain substances greatly influencing its digestibility. Now, as the total compounds which play an important part in the digestibility of meat are but small in amount, and if the digestibility is influenced by small quantities of substances such as Liebig discovered—"is it not likely," asks Dr. Voelcker, "that vegetable food may contain small quantities of compounds which exercise a similar influence?"

'On glancing over, then, such notes as we have here presented, some idea may be derived of the complex nature of the problem which the successful feeder has to solve, and the difficulties which he has to encounter; a problem, the solution and difficulties, the overcoming of which, demand from him the exercise of a high degree of skill and continued observation, and a freedom from those prejudices of place and opinion which mar effectually all true progress.'

The more intimate the acquaintance of the farmer with these things, the more interesting will the science of agriculture be to him; and he will often be enabled by such knowledge to avail himself of immense advantages, which otherwise would be unperceived and lost. Every farmer should make himself acquainted with the quality and the kind of the nutriment contained in the respective roots and grasses, and its effects upon different animals, before he devotes his time or capital to the feeding and grazing of cattle. For it has been justly observed by Mr. Sinclair that, 'without the means of distinguishing with certainty the different species of grasses, the cultivator must have recourse to other men's experience and assistance before he can make any certain or just experiment of his own, or any consequent improvement. The farmer who cannot distinguish the seed of the most valuable species of grasses from those that are worthless or pernicious must be subject to the serious losses and disappointments occasioned by every accident which may place in his hands the seeds of inferior or pernicious plants, instead of those grasses adapted to his soil, and possessing productive and nourishing properties; and should he be unable to distinguish the plants produced from those grass seeds which he may sow under such circumstances, he must wait until the non-advancement in condition of his stock informs him of his loss.'

The whole subject of the chemistry and physiology of cattle-food and feeding has been closely investigated of late; yet there is, nevertheless, much in connection with it obscure and unsatisfactory. Of what men have thought and are now thinking about it, the reader will find a rapid *résumé* in 'Historical Outlines of Farming and Farming Economy,' published in the rudimentary series of the publishers of this work.

BOOK THE TENTH.

ON MANURES IN GENERAL, AND THEIR APPLICATION TO GRASS LAND AND CROPS.

CHAPTER I.

VEGETABLE MANURES.

THE whole aim and intention of cultivation is to raise from land larger and finer crops than it could by possibility yield if simply left to natural influences. With this view we plough, harrow, and pulverise the soil, in order, by bringing its constituent parts as much as possible in contact with the atmosphere, and subjecting them to its agencies, to effect the solution or decomposition of such particles as are best calculated to exercise a beneficial influence on the vegetation of the crop we would raise. But tillage alone will rarely effect our object satisfactorily; we must, therefore, have recourse to manuring, or communicating to the soil such fertilising matters as are most likely to ameliorate it, to supply its deficiencies, and to afford to the plants sown thereon exactly those substances which they require.

It has been well said that 'manures are to farming what blood is to the animal frame,' viz., the vital principle, without which the whole system languishes. The practice of manuring land has existed from remote ages. If we recur to the works of Cato, Pliny, Columella, Varro, and Virgil, we shall find that we have only been following in the steps, and endeavouring to improve on the practice, of the ancient Romans, who evidently made this important branch of agriculture an object of careful attention. The writings of the above-named old authors contain repeated directions concerning the choice, application, and preservation of various kinds of manures, both liquid and solid.

Under the term *manure* is included every substance that is calculated to afford nourishment to and ameliorate the soil, whether by remedying or improving its natural poverty, calling into action its latent powers, or correcting its defects.

The great principle of *manuring* is, so to study the qualities and deficiencies of the soils, and the wants and constituents of the plants, as to be able to apply to each soil and each crop that particular manure which is best adapted for it, and most likely to repay the expense and labour bestowed. This, however, is not to be learned by intuition; observation, experiment, practice, and science must combine their lights, ere the agriculturist will arrive at such knowledge as will enable him to cultivate his land in the best, cheapest, and most advantageous manner.

Manures may be divided into five classes, *vegetable*, *animal*, *fossil* and *mineral*, *liquid*, and *artificial*, each of which will form a distinct object of consideration; and we shall conclude by annexing some remarks on the best modes of collecting and preserving manures, and applying them to the land.

VEGETABLE MANURES, which claim our first attention, are either entire plants which are turned in by the plough while growing, or vegetables in a state of decomposition, either through putrefaction or from having been burned.

1. *Vegetable Ashes* are, in general, an effectual application for manuring cold, marshy, boggy, moist, and uncultivated soils; and on all cold, clayey, or tenacious loamy soils, wood ashes may be used with very good effect, in the quantity of about forty bushels[1] per acre; but care must always be taken to spread them thinly and evenly over the land, if we would have them productive of benefit. In many farms where wood, vegetables, and other matters are burned, the ashes are thrown on the dunghill; this is a bad practice, for they there become collected in masses, and are then very likely to destroy all vegetation they come in contact with. In some parts of Germany ashes are almost the only dressing applied to grass land. They have been found very effective in this country in promoting the growth of clover. But of the various kinds of ashes in use, those of peat are the most valuable.

A valuable manure, and absorbent and deodorizer of manures, is peat charcoal. As a top-dressing for grass land or potatoes, or swedes, it is most efficacious, and is said in a very great measure to check the disease in potatoes and impede the ravages of the fly in turnips. It absorbs the fertilising and ammoniacal principles of liquid manure, and, as it were, converts them into a solid form, incorporating them with itself, thus rendering them capable

[1] The strike bushel is invariably to be understood, unless a contrary standard is specified.

of being applied to land at times and in modes which otherwise would be impracticable. A knowledge of this property of peat charcoal will enable farmers to effect a considerable saving in that portion of their manure which too often drains away and is lost. Its deodorising powers may also make it valuable to the farmer in his stables, his cattle-stalls or sheds, his piggeries, and his farm generally; for those gases, pernicious to animal health, which it absorbs will become beneficial to vegetable growth when applied in the form of manure or top-dressings to grapes, cereals, and root crops.

The usual time of applying peat ashes is in March or April; the quantity varies from 12 to 20 Winchester bushels per acre, according to the nature of the soil or the kind of crop raised. From 15 to 20 bushels per acre may be bestowed on meadow land with advantage. Peat ashes applied to turnip crops are said to prevent the ravages of the fly; they are also stated to protect carrot and potato crops from injury, and increase the growth of cabbages.

The quantity per acre of *peat ashes* is stated by Mr. Malcolm[1] to be as follows:—'On strong retentive lands for *pasture*, 12 bushels top-dressed; on *lighter loams*, 10 bushels, and on *sandy* or *chalky loams*, for pasture or seeds, 8 bushels; to be laid on in autumn.' Dr. Anderson has recently investigated the composition and action of peat ashes or charcoal, and he has arrived at the conclusion that peat merely dried acts as rapidly and efficiently as a deodoriser or absorber of manurial matter as peat charcoal. This very much simplifies the preparation and use of peat as a manure.

The justly-celebrated *Dutch Ashes*, which have been used with so much success in Belgium, and highly commended by some of our best agriculturists, differ materially in their chemical composition from peat ashes, containing a large proportion of the carbonate and phosphate of lime and but little charcoal; this may, however, arise from their having been burnt instead of simply charred.

Sir J. Sinclair[2] gives the following account of their beneficial application:—He states that when for a number of years the crops of clover had been gradually becoming more and more deficient, and the crops of wheat sown after the clover had frequently failed, it was supposed that, from too frequent repetition, the ground had become tired of clover, and therefore the same success in cultivating it could no longer be expected. The subsequent failure of the wheat crop, too, added to the loss, and to the disappointment and depression. 'I was much gratified, therefore,

[1] Compendium of Modern Husbandry, vol. ii.
[2] Hints regarding the Agricultural State of the Netherlands, 1815.

to find,' he continues, 'that in Flanders there were no complaints of the failure of the clover crop (except in one district, where a plant called the *orobanche* infested the ground), and that the crop of wheat, after clover, was reckoned among the surest of any. It was still more satisfactory to ascertain that the means of obtaining similar results were distinctly known, were not expensive, and could easily be procured in England, being nothing but the application of Dutch ashes.

'There were two sorts of turf, or peat, in Holland. The first is found on rising grounds, and in a sandy soil, at from 3 to 12 feet from the surface, the strata varying from 18 inches to 3 or 4 feet in depth. This sort is principally found in Friesland. It is cut and prepared in the same manner as the peat of Scotland and Ireland, burns quickly and cheerfully, gives a good heat, but leaves only a very light ash, of little value. The other sort of peat, which is more generally used in Holland, is extracted from the marshes, which are constantly covered, during the winter season, with water of a *brackish* nature; after this peat is reduced to a pulp it is spread upon the ground, and when it has acquired a certain consistency it is cut and dried in the same manner as the former. It burns less clearly, and gives less heat than the other peat, but it lasts longer, and leaves a much heavier ash, full of saline matter, insomuch that it is sometimes used as a substitute for soda, in the manufacture of green glass. This can only be accounted for by the effects of the water with which it is covered, which not only deposits a muddy substance, whence the richer part of the ashes is derived, but being itself of a brackish quality, it impregnates the peat with salts.

'These ashes were analysed about seventy years ago, when it appeared that from one-ninth to one-twelfth part consisted of glauber and marine salts.[1] In a more recent analysis by Professor Brande, of the Royal Institution, the contents of the specimen given him were as follows:—

Silicious earth	32
Sulphate of lime	12
Sulphate and muriate of soda	6
Carbonate of lime	40
Oxide of iron	3
	93
Impurities and loss	7
	100

'In such an article, however, the variety of substances to be found in it must be very great, and the proportions different.

[1] See Mémoires de l'Academie de Bruxelles, tome ciii. p. 47, where there is a paper written by the Abbé Marci, on the subject of artificial manures, in which the advantage of using these Dutch ashes is spoken of as being then well known.

'In every part of the interior of Flanders these Dutch ashes are used as a top-dressing for clover, and with a success hardly to be credited. They are brought to Brussels by canal, and thence are conveyed, by *land carriage*, to the distance of from 50 to even 100 miles. Wherever they are used there is no complaint of any deficiency either in the crop of clover or that of wheat afterwards. The following are some instances of their successful application:—

'Mr. Mosselman, a great farmer at Chenoi, near Waver, assured me that without the ashes of Holland he should neither have a crop of clover nor of wheat afterwards; and that wheat after clover, *manured with Dutch ashes*, was the most certain crop of any.

'Mr. Hanelot, near Fleurus, declares that he sows upon clover 25 cuvelles of Dutch ashes per hectare (about 19 bushels per English acre); that no manure, though it were to be given in greater quantities, and at more expense, would equal it in strength; that after sowing these Dutch ashes they always have two great crops of clover, besides pasturage afterwards; and that the next crop of wheat is not more injured by insects than the other crops of that grain.

'Mr. Vandoorslair, in the Pays de Waes, informs me that this manure is used with great benefit where clover is kept for a second year, whether for cutting or pasture; hence its advantage, where that practice is adopted, would be incalculable, as the second year's crop is of little value at present.

'Eighty-three practical farmers, in the neighbourhood of Fleurus, joined in a public declaration to the following effect:— "All our farmers know by experience, that when clover is not manured at the rate of 25 cuvelles of Dutch ashes per bonnier, the following crop (of wheat) is invariably bad, notwithstanding any culture that may be given to the soil; whereas there is always an excellent crop of wheat after clover, and doubtless in proportion to the quantity of the manure above mentioned, which is used." The farmers who subscribed this declaration must have been deeply impressed with the importance of these ashes; for in general they brought them from 40 to 50 miles, by land carriage, from wharfs on the canal of Brussels.'

The advantages of Dutch ashes had long been known on the Continent; and though it was as easy to import them into England or Scotland as into Flanders, it did not appear to have been ever thought of, or tried. On his return to England, upon enquiring the price of these ashes, and the quantity applied to the land, Sir J. Sinclair found that the expense of manuring with them at the rate of 18 or 19 bushels per acre would come to about 10*s.* or 15*s.* per acre, freight included.

Nor is clover the only crop to which Dutch ashes are applied with advantage; some farmers spread them on the ground where they have sown turnips or carrots, passing a harrow over the surface, and thus destroying the insects which injure those plants. These ashes are likewise sown on rye in October; on wheat and pasture lands, as well as on clover, in April; and on oats and beans in May. They accelerate the growth of peas; but they render the grain harder and more difficult to boil. In gardens they are used with much advantage, scattered over the surface, after the land is sown and raked. They are also good for hops, a handful being given to each heap. When applied to grain they promote its early growth, but are principally useful by increasing the quantity. They may be drilled or sown by hand, like grain; but care must be taken to leave no part of the surface without its just proportion. A still hazy morning is to be preferred for this operation, lest the wind should blow them away, and prevent their fixing on the soil and plants in the manner intended. The change which these ashes cause on the clover is perceptible in the course of a week. Among the other advantages they afford, it is said that they not only bring with them the principles of fertility, but that they are also well calculated to hinder the multiplication of all sorts of worms and insects; to destroy the mosses and lichens, which injure our pasture lands; and to protect the wheat from several maladies to which it is exposed, in particular the *nielle* or mildew; the exemption of Flanders in so great a degree from these maladies may be partly owing to the abundant use of these ashes.

2. *Wood Ashes* have been applied to some soils with benefit, but as they have seldom been used alone, but generally combined with various matters, their positive effects are not evident. Burnt or charred sawdust, too, might doubtless be made efficacious in consolidating or absorbing the valuable particles of liquid manure, and would also be valuable as a manure by itself, but for the difficulty of consuming it economically.

Ashes of Kelp, or *sea-weed.*—Col. Le Couteur gives the following testimony in favour of this as a manure when applied to wheat crops:—

'It attracts moisture from the atmosphere; it materially increases the value of the grain and fineness of the sample, but does not add to the weight of the straw, though rendering it whiter and more nourishing to cattle. It causes the wheat to assume a rich healthy appearance, and is an excellent application after a crop of potatoes or parsnips, both of which require to be richly dressed with stable or other strong manures, and has not the effect of decomposing them as lime does.

'It is also destructive to insects and their eggs, which lie in the soil or turf. It forces the earth-worms and wire-worms to come from their lurking-places to the surface and die, particularly when laid on in considerable quantities. Farmers who can obtain it without much difficulty are in the habit of using it lavishly, but, I believe, without producing proportionately larger crops from inferior land, though it has been asserted that the effect of such copious dressings is very permanent, being especially apparent on the succeeding clover crops.

'Kelp ashes should lie on the surface of the soil a month or two previous to sowing time, in order to weaken their caustic power, or they are otherwise apt to burn the tender shoots of the corn, as well as the larvæ of the insects; but by lying a certain length of time on the surface, exposed to the action of the atmosphere, or what would be better practice, merely lightly turned into the soil, they become eminently beneficial.

'I am inclined to believe,' he adds, 'that paring and burning an old lay will produce an almost equally good effect where the land is suited for it, for although the ashes may not be of that superior quality, or possessed of all those virtues peculiar to kelp ashes, those which can be spread by these means perhaps make up in quantity for what they want in quality.

'An additional circumstance in favour of paring and burning is, that all the seeds of weeds, or eggs of insects, that lie concealed in the turf are more effectually destroyed than by repeated manurings. I am so partial to the use of ashes that I should recommend those who have large woods or forests to employ women and children to collect the dry and broken boughs and underwood, in order that it may be burned for the sake of the ashes. That which is now wasted or neglected would then be converted into a valuable and permanent manure, perfectly free from weeds, and destructive to insects and worms.'

3. *Sea-weeds*, if cut down in their most succulent condition and shortly before they flower, may be used as manure, for they are then not only most disposed to putrescence, but also the injury that would otherwise result from the germination of their seeds will be effectually avoided. It is a wasteful practice heedlessly to burn weeds or throw them into the highway; they are but little known, or farmers would not so often permit the heaps of weeds washed up by one tide to be floated away again by the next, and wasted and lost as they are on too many of our sea-coasts.

4. *River or pond weeds* are capable of a similar application, and with great benefit, on loose sandy soils intended for turnips; but they have no effect on wet springy lands, or on those which are liable to be inundated.

5. *Sawdust, shavings, and chips of wood*, when in a state of

decomposition, are useful manures. Their effect when applied to the soil, without any other admixture, is scarcely perceptible in the first and second years; in the third year it begins to be apparent, and in the fourth acts most beneficially. Mixed with dung, or with lime, or made into a compost and suffered to stand for two or three years, they become, however, most valuable manures, especially for vegetable crops.

6. *Rape or cole-seed cake* reduced to a coarse powder, after all the oily particles have been expressed from the seeds, is a powerful and useful manure as a top-dressing for turnips, produces excellent crops when ploughed in with wheat, and may be beneficially applied to grass land. It is considered poisonous to various grubs, and especially to the wire-worm. It was usually scattered by the hand, and harrowed in with the seed of the intended crop, but by pulverising and drilling it in with the seed, one half the quantity may be saved; it attracts the moisture of the soil and is readily decomposed. It should be used in a fresh state, and is particularly useful in moist seasons. The quantity employed should be about half a ton per acre. It is best suited to stiff clayey and moist lands. Its benefit never extends beyond the second, generally not beyond the first crop. The great objection to it is its expense.

Mr. Hannam, of North Deighton, in his prize essay, thus sums up the effects of this substance as a manure:—

'1. That rape-dust being so beneficial to the growth of grain, is in general most marked in its effects on thin poor soils.

'2. That it does not operate so well in a dry season as in a moist one.

'3. That it is most *certain* in its effects upon the winter-sown wheat crops; but in *favourable seasons* most remunerative on the spring crops.

'4. That it answers best on strong soils for the wheat crop.

'5. That it is not judicious to apply too large a quantity at one time.

'6. That it is necessary, after using rape-dust for several rotations, to apply a dressing of saline and earthy manures.'[1] Rape or oil cake (linseed) is much used in Flanders to mix with the contents of the liquid manure tanks, more especially when this is required for the flax crop.

'7. *Malt-dust* possesses similar properties, and should be used in the same way, but it is now generally superseded by other and better manures.

'8. The *Tanner's waste*, or *oak-bark*, from which the greater part of its astringent principle has been extracted, may be kept in small heaps, and mixed with lime and a sufficient quantity of

[1] Journal of the Royal Agricultural Society, vol. iv. p. 177.

water to keep it moist, and promote its decomposition and putrefaction. It is a good manure for cold stiff soils, whether arable or grass land; but, for the latter, it should be made to approach as nearly as possible the state of vegetable mould. The best time for spreading it on grass lands is shortly after Michaelmas, that the winter rains may wash it into the ground; for, if applied in the spring, it will burn the grass, and exhaust rather than improve the soil for that season. It is chiefly valuable as a substratum for compost heaps, and then, when impregnated with the moisture and essence of the other manures, becomes exceedingly efficacious. Mr. Martin, secretary of the Cottage Improvement Society, has recently shown how efficacious charred tanners' bark is as a deodoriser of night soil, liquid manure, &c.

'9. *Wood soot* is a very beneficial top-dressing for cold clayey soils, whether in pasture or in a state of tillage. When used it must be laid on early in the spring, in order that the substance of the manure may be carried down to the roots of the grass at the period of vegetation, and also that all the noxious effluvia may be evaporated before cattle are turned upon the land. The quantity commonly employed varies from 20 to 40 bushels per acre.

'The *soot* from coal is a very powerful manure, and one that is very much employed in many parts of England; although considerable diversity of opinion exists amongst scientific agriculturists as to the value of coal in any form as a manure. From 10 to 16 bushels per acre, and occasionally more, may be applied; and the crops of grain and wheat thus raised are wonderfully luxuriant. It is also equally beneficial when applied to grass lands. An admixture of soot and salt has been found exceedingly beneficial, especially for carrots and parsnips; it has also been applied to wheat with success; from 7 to 8 bushels is about the usual quantity, which is ploughed in.

'Some agriculturists have advised that the soot shall be dissolved in water, before being applied to the soil, as they consider that then there is no loss of any of its component parts. Its effects do not endure more than one or two years.

'Soot answers best on light, dry, chalky soils, and its effects are most apparent when applied in a wet season. On heavy, clayey, wet land, it is comparatively inert; its action, however, on such soils is aided by the addition of common salt.

'10. The practice of *ploughing under green crops as manure* is better suited to those warm countries where vegetation is very rapid than to our variable climate; and, even there, it is a question whether this be the best and most expeditious way of producing *decomposed matter* for manures. "When we are able to raise green food of any kind," says an eminent practical man, "it is better that we apply it, in the first place, to the feeding of animals, for then it not only yields manure, but performs another and more important purpose."[1]

'Tares, rape, vetches, buckwheat, spurrey, clover, and other succulent vegetables, are chiefly used for this purpose, for they readily undergo decomposition, and yield a rich manure; that from rape is considered particularly good. The best period for the operation is when the plants are beginning to flower, as they then contain the greatest quantity of easily-soluble and nutritive matter, and the warmth of the weather will also very materially promote the decomposition. We should, however, recommend that some substances tending to promote decomposition were always ploughed in at the same time, as the earlier fermentation of vegetable matter is generally sour, and the whole process is often slow, and liable to be retarded by various accidents. The ploughing in of green crops, as a dressing for turnips, ought to be done at least three weeks before the sowing, when the seed should be lightly harrowed in. Turnips themselves, when, through any unforeseen accident, they have been injured by frost, may be treated in this manner, with great benefit to the succeeding crop; they are stated to prevent the germination of the seeds of weeds found in dung, as, when stirred among the latter, the turnips accelerate their putrefaction.

'*Brewers' trimmings* or cummins, as the dried rootlets or germinating points of malt are called, are said to be extremely valuable as a manure, especially for heavy soils. A contemporary has recently published the results of some trials of this material, which are satisfactory.

'When old pastures are broken up and made arable, not only is the soil enriched by the decay and decomposition of those plants which have left soluble matters in it, but the leaves and roots of the grasses living at the time, and occupying so large a part of the surface, afford saccharine, mucilaginous, and extractive matters, which become the food of the succeeding crop, and, by their gradual decomposition, afford a supply for successive years. But they are too good—if fresh and sweet—and far too valuable as a feeding material to be used in the first instance as manure. Let them be passed through the animal machine first, and then a twofold benefit is obtained.'

[1] Low's Agriculture, p. 50.

CHAPTER II.

ON ANIMAL MANURES.

ANIMAL substances, on account of their rapid tendency to putrefaction, when divested of the vital principle, have been found to afford the most ready and abundant nutriment to vegetables. The first we shall mention is —

1. *Dung*, of which that dropped by fattening cattle possesses more fertilising properties than the dung of lean cattle. The dung of those fed with rape, linseed, or other oleaginous seeds, is the richest; that of animals supplied with oil-cake, or those seeds of which the oily matter has been expressed, is next in the order of fructifying power; then the dung of cattle fed on roots; next, that of such as are supplied with hay, varying according to the goodness of their keep; that of straw-fed cattle, especially lean beasts, is the poorest of all.[1]

With regard to the relative powers of animal dung, it may be observed that *horse-dung*, when not too new, is admirably calculated for cold, sterile, and poor ground, the faults of which it corrects, while that of neat cattle is better adapted to hotter soils; but both, when combined together, or with earth or mud, form a useful manure for almost every soil. The effect, however, is but transient, excepting on moist tenacious soils, and even there it produces no very permanent amelioration. When dung is thus used by itself on moist clayey soils, it should be carried and turned in as soon as its first stage of fermentation has commenced; but when it is intended to be used on warm light soils, it will be best to mix it with succulent vegetable substances, or earth or turf.[2]

The *dung of swine* is of a fatter and richer nature than that of any other animal, and is supposed to be particularly excellent for grass lands and for cold clays. Sprengel, however, says: 'It is the slowest to undergo decomposition, developes in its putrefaction little if any heat, and yields scarcely any ammonia. Esculent

[1] See Book i. chap. xi.
[2] Thaër's Principles of Agriculture, vol. i.

roots manured with pigs' dung acquire a disagreeable flavour, arising, probably, from a peculiar volatile substance emitted by the dung, or rather the urine, of pigs.'[1]

Professor Johnson describes it as being 'soft and cold, like that of the cow, and containing, like it, at least 75 per cent. of water.' He considers it to be 'one of the richest and most valuable manures that can be applied to land.'[2]

There can be no doubt but that, without preparation, it is not well to apply it to land. Incorporated with the manure heap, mixed with that of cattle, and there allowed to ferment and decompose, it becomes valuable. Mr. Pocock, of Thoulstone, states that, knowing the excellence of pig manure, he has erected a large dry shed, in which, first of all, he puts a layer of dry coal ashes, about a foot deep and 4 feet wide, to which he has all the deposits of the pigs, both fluid and solid, carried; as soon as it begins to ooze out, he adds more ashes, until the heap is about 4 feet high. A fresh layer is then commenced, and treated in the same way. After lying some time, it is turned twice or thrice, and is then fit for drilling. He tried it for turnips, and found the result equal to the effects of guano, and far superior to bone-dust. The droppings of three pigs, if carefully thus preserved, he considers an ample dressing for 2 acres of land.[3]

Mr. Cuthbert Johnson observes that ashes for mixing with pig manure should be as dry as possible, and have as much charcoal in them as may be. He advises farmers to *char*, not burn, any vegetable or other refuse they may have, expressly for this purpose; and adds, that 'thus a home-made drill manure for turnips may be easily and cheaply prepared.'[4]

The pulverised *dung of deer and sheep* (the properties of which do not materially vary) is, in the judgment of agriculturists, best calculated for cold clays; the quantity per acre is from four to five loads, to be thinly scattered over the autumnal or vernal crops, in the same manner as ashes. The common mode, however, of applying sheep's dung is by *folding*, the utility of which practice has been already discussed; the benefit thus obtained is said to be derived from the consolidation of the land, effected by their treading, and from their urine, to which may, perhaps, be added, the perspirable matter exuded from their fleeces while lying upon the ground. But we question whether the volatile and some of the most vital principles of the manure are not evolved under this system, and given off into the air. To secure real benefit from folding, it has been recommended that, as the fold is shifted, the

[1] Journal of the Royal Agricultural Society, vol. i. p. 491.
[2] Elements of Agricultural Chemistry, p. 168.
[3] Farmer's Magazine, vol. xxx. p. 144.
[4] Ibid., vol. xxxi. p. 102.

land it has occupied should be immediately breast-ploughed, in order to cover in the manure, and condense its ammoniacal gases within the soil.

The dung obtained from folding of sheep upon turnips is of a twofold nature, the upper stratum being dry, hard, and undecomposed, the lower moist, solid, and adhesive. These, unless well mingled together, must not on any account be spread over the same field; for the upper part will prove injurious to warm, dry, elevated lands, and the lower one will lay the corn on any land, unless spread very thinly over it.

The *dung of poultry*, particularly of pigeons, is very rich in manurial ingredients, provided that it is carefully and minutely divided. It should be merely spread over the soil, and not covered or buried.[1] That of geese is asserted to contribute to the fattening of sheep in a very material degree, those animals being most partial to, and thriving best on, pastures that have been manured with goose dung; but, as common manure, it is not considered rich, and other animals have an aversion to grass by which it has been tainted. It should be laid on as fresh as possible, spread upon the surface of the land, and lightly covered. The dung of birds, however, is usually obtained in quantities too small to render it an object of much importance, and is generally saved to be added to compost heaps for the garden. We treat of each of these matters, first of all, separately; but not because we advocate the application of the dung of any animal, or class of animals, separately to the ground, unless voided while the stock are grazing or feeding, or being folded there. All kinds of *dung* can be far more efficaciously and economically used in combination with each other, and with urine and litter and other matters, as we shall presently have to show, than when applied by themselves. This does not, of course, apply to what are called the 'portable' or artificial manures, amongst which the most important—next, indeed, in value to farm-yard manure—is guano, now about to be described.

Dr. Voelcker, Consulting Chemist to the Royal Agricultural Society of England, has devoted much time to the investigation of the subject of farm-yard manure, or *dung*, as it is more generally designated. The following are his analyses of it, in its fresh and in its rotten state:—

[1] Sir H. Davy is of opinion, that as the soil in woods where great flocks of wood-pigeons roost, is often highly impregnated with their dung, it would form a valuable manure.—*Lectures*, p. 299.

FRESH STATE (14 DAYS OLD).

Water		66·17
Soluble organic matter [1]		2·48
Soluble inorganic matter (ash):—		
Soluble silica	·237	
Phosphate of lime	·299	
Lime	·066	
Magnesia	·011	
Potash	·573	
Soda	·051	
Chloride of sodium	·030	
Sulphuric acid	·055	
Carbonic acid and loss	·218	1·54
Insoluble organic matter [2]		25·76
Insoluble inorganic matter (ash):—		
Soluble silica	·967	
Insoluble silica	·561	
Oxide of iron, alumina, with phosphates	·596	
Containing phosphoric acid	(·178)	
Equal to bone earth	(·386)	
Lime	1·120	
Magnesia	·143	
Potash	·099	
Soda	·019	
Sulphuric acid	·061	
Carbonic acid and loss	·484	4·05
		100.00

IN ITS ROTTEN STATE.

Water	75·42
Soluble organic matter [3]	3·71
Soluble inorganic matter	1·47
Insoluble organic matter [4]	12·82
Insoluble inorganic matter	6·58
	100·00

The Professor, in giving these analyses, thus explains some of the leading features of dung as a manure:—'Chemically, it must be considered as a perfect and universal manure. It is a universal manure, because it contains *all* the constituents which our cultivated crops require to come to perfection, and is suited for almost every description of agricultural produce. As far as the inorganic

[1] Containing nitrogen . . . ·149
Equal to ammonia . . . ·181

[2] Containing nitrogen . . . ·494
Equal to ammonia . . . ·599
Whole manure contains:
Ammonia in free state . . . ·034
„ form of salts . . . ·088

[3] Containing nitrogen . . . ·297
Equal to ammonia . . . ·360

[4] Containing nitrogen . . . ·309
Equal to ammonia . . . ·375
Total amount of nitrogen . . . ·606
Equal to ammonia . . . ·735

fertilising substances are concerned, we find in farm-yard manure potash, soda, lime, magnesia, oxide of iron, silica, phosphoric acid, sulphuric acid, hydrochloric and carbonic acid: in short, all the minerals, not one excepted, that are found in the ashes of agricultural crops. Of organic fertilising substances, we find in farm-yard manure some which are readily soluble in water, and contain a large proportion of nitrogen, and others insoluble in water, and containing, comparatively speaking, a small proportion of nitrogen. The former readily yield ammonia, the latter principally give rise to the formation of humic acids, and similar organic compounds. These organic acids constitute the mass of the brown vegetable substances, or rather mixture of substances, which, practically speaking, pass under the name of humus.

'Farm-yard manure is a perfect manure, because experience, as well as chemical analysis, shows that the fertilising constituents are present in dung in states of combination which appear to be especially favourable to the luxuriant growth of our crops. Since the number of the various chemical compounds in farm-yard manure is exceedingly great, and many, no doubt, exist in a different state of combination from that in which they are obtained in analysing farm-yard manure—in our present state of knowledge it is impossible artificially to produce a concentrated, universal, and perfect manure, which might entirely supersede home-made dung. I do not refer to the mechanical effect which farm-yard manure is capable of producing. This mechanical effect, especially important in reference to heavy clay soils, ought to be duly regarded in estimating the value of common dung; but for the present it may suffice to draw attention to the fact that even fresh dung contains a great variety of both organic and inorganic compounds of various degrees of solubility. Thus, for instance, we find in fresh manure volatile and ammoniacal compounds, salts of ammonia, soluble nitrogenised organic matter, and insoluble nitrogenised organic substance, or no less than four different states in which the one element, nitrogen, occurs in fresh manure. In well rotted dung, the same element, nitrogen, probably is found in several other forms. This complexity of composition—difficult, if not impossible, to imitate by art—is one of the reasons which render farm-yard manure a perfect as well as a universal manure.'

In estimating the value of farm-yard manure, which is generally put down at prices varying from 4*s.* 6*d.* to 6*s.* per ton, it is the practice to assume that a certain proportion of the food which the cattle consume remains in the manure; so that either the manure is to be credited with a part of the food, and hence more valuable, or the food is to be reduced in cost, or reckoned cheaper, as the manure is so much the more valuable.

Dr. Anderson has on this point, as showing its fallacy, the following suggestive remarks:—'I must confess,' he says, 'I have always been of opinion that there is no way in which a farmer is more likely to deceive himself; the proportion of the food which is thus to be referred to the manure-heap being mere guess work, unsubstantiated by experiment, and generally overrated; as, for instance, when we hear of one-third of the price of oil-cake being debited to the manure. It would be much wiser to ascertain the expenses of feeding, irrespective of the manure-heap, and then, of course, if there is a profit upon it, the manure is got without cost, and nothing but the expense of application is to be estimated. If, on the other hand, there is a loss, that loss is the cost of the production of the manure; and it must be the object of the farmer to see that it does not exceed the price at which farm-yard or artificial manures can be purchased.'

Guano, pronounced 'gwano' not *gu-ano*, the Spanish name for manure, consists of the excrements of the sea-fowl deposited on the rocky coasts of the Pacific Ocean, in strata of several feet in thickness. This substance has been known and used by the Peruvian agriculturists for ages, but only began to be used in this country, in any quantity, in 1841. In Peru, it is considered as one of God's most valuable gifts to man, as, with its assistance, the inhabitants are enabled to raise food for man and beast on the barren sea-coast, and on the sides of rocky mountains.

Guano is no less esteemed now in this country. It is one of the richest fertilizers we have, 'nearly every one of its constituents being a material highly valuable for promoting the growth of plants.'

Guano is by no means uniform in quality or appearance; that obtained from some parts is a very fine powder, almost like the sands of the desert, while from other places it is procured in rocky fragments; some kinds contain little or no sand, others as much as 30 per cent.; some are devoid of ammonia, others contain from 7 to 17 per cent. of it; some contain 18 or 19 per cent. of earthy phosphates, others as much as 30 or even 35; the quantity of water likewise varies considerably. There is great variation in the composition of this substance, as is evident from the differences in the results of several analyses, undertaken by eminent foreign as well as native chemists.

Professor Voelcker, the eminent agricultural chemist, in a paper on the 'Value of Artificial Manures,' in the 'Journal of the Bath and West of England Society,' gives the following analysis of a *good* sample of guano:—

Water	12·402
Organic matter and ammoniacal salts [1]	52·980
Phosphates of lime and magnesia (bone earth).	25·065
Alkaline salts, chiefly chlorides of potassium and sodium	8·262
Insoluble silicious matter (sand)	1·507
	100·216

The same authority gives the following analysis of an inferior guano:—

Water	11·32
Organic matter and ammoniacal salts[2]	53·94
Phosphates of lime and magnesia (bone earth)	30·98
Alkaline salts, chiefly chlorides of potassium and sodium	6·62
Insoluble silicious matter (sand)	14·50
	117·36

A good guano should not yield less than 16 per cent. of ammonia; and no guano should be purchased without a guaranteed analysis, and this analysis should state explicitly the percentage of ammonia contained in the guano.

The guano comes to us in a state of fine powder, of a brown or fawn colour, and giving out a strong marine odour. Mr. Towers says, 'Peruvian guano is of the colour of Scotch snuff, with a tinge of pale red, and is full of whitish particles, which are doubtless saline concretions: its smell is slightly urinous; while the Saldanha guano is drier than the Peruvian, not so highly coloured, somewhat of a greyish hue, and has a faint smell, resembling that of heated vegetable matter.'[3]

Guano is, without doubt, the best fertilizer and nourisher of soils, and the most powerful manure ever yet discovered; its very composition is of itself sufficient to indicate this fact.

Dr. Von Martius states the manuring powers of guano to be four times greater than those of pigeon's dung, one of our most stimulating manures; and Liebig observes that the importation of 1 cwt. of guano is equivalent to the importation of 8 cwts. of wheat. There is, in fact, no manure which contains so many fertilising qualities in a small compass as guano. It appears to be peculiarly adapted to our humid atmosphere, as well as to the climate and soil of Ireland, for it brings the crops forward early, a great advantage in our variable climate; its chemical and ammoniacal particles and properties enable it to feed the vegetation faster than any other manure, and bring the crop earlier to maturity.

Guano loses a great deal of its ammoniacal particles from

[1] Yielding ammonia, 17·215.
[2] Yielding ammonia, 11·80.
[3] Farmer's Magazine, vol. ix. p. 391.

exposure to the air; and, therefore, the sooner the farmer uses it after it comes into his possession, the more benefit the land is likely to derive from it. Mr. Jackson recommends the following cheap and effective mode of preserving guano from deterioration for almost any length of time:—'For each ton of guano get 30 lbs. of oil of vitriol, dissolve it in double its weight of water, and then mix it thoroughly with the guano.'[1] Several methods have been introduced with varying success to fix the volatile constituents of guano—these need not be named here, as they are widely advertised in all the agricultural papers, and we do not wish to appear invidious in naming one or two only where space prevents us from naming them all.

From $2\frac{1}{2}$ to 5 cwts. per acre appear to be the most advantageous proportions in which it can be applied to the soil; less is productive of little if any sensible effect, and more than this qnantity is apt to render the crops rank, or lay them. Great caution must be observed in the use of this manure, if we would ensure its success. Pure guano should never be applied superficially to young crops, or mixed with the seeds, as is too often done; but it should be deposited in the soil at a greater depth than the seed, so that a layer of soil may come between the seed and the manure beneath it, for its chief component parts—salts of ammonia, potassa, and soda, besides the urea it contains—are calculated to arrest vegetation, and burn up or destroy the vitality of the plants or seeds.

Many agriculturists have recommended the application of it as a liquid manure, but it must be sufficiently diluted; the best way, however, to use it is in a finely pulverized condition, mixed with fine soil or with coal ashes. Mr. Gardner, Renfrewshire, recommends that it should be thus used:—'Take any quantity of animal charcoal or burnt bones you may require; dissolve these in a tub, with half their weight of muriatic acid, first adding to the charcoal as much boiling water as will bring it to the consistence of thin gruel: let it stand and dissolve in the tub for about twenty-four hours, stirring it up occasionally. For every 112 lbs. of animal charcoal or burnt bones thus dissolved, take 56 lbs. of carbonate or sulphate of magnesia, 112 lbs. of carbonate of soda or common salt, and 56 lbs. of potash; mix them well together, and pour them into the tub amongst the dissolved charcoal, stirring it all the time, and then let it stand again for ten or twelve hours. If this mixture is used by itself, add sawdust, dry peat, or any other absorbent, to take up the moisture; but otherwise add guano, which will absorb it.' He gives the following experiments, made on a soil of medium loam, on which turnips after an oat crop were sown:—

[1] British Farmer's Magazine, 1844, p. 142.

1. The soil dressed with 30 tons of farm-yard manure, costing 10*l.* 10*s.*, produced 34 tons 5 cwt. of bulbs.

2. The soil dressed with

	cwt.
Farm-yard dung	15
Peruvian guano	3
Animal charcoal	2
Sulphuric acid	1
Carbonate of magnesia	1
Sulphate of soda	1
Muriate of ammonia	1
Common salt	1
Horn dust	3

Costing in all 9*l.* 3*s.* 4*d.*, produced 46 tons 5 cwt. of bulbs.

3. The soil dressed with

	cwt.
Farm-yard dung	15
Peruvian guano	3
Animal charcoal	2
Muriatic acid	1
Carbonate of magnesia	1
Sulphate of soda	1
Sulphate of ammonia	1
Horn dust	3
Common salt	1

Costing in all 9*l.* 5*s.* 4*d.*, produced 46 tons 17 cwts.

4. The soil dressed with

	cwt.
Farm-yard manure	15
Peruvian guano.	3
Horn dust	4
Common salt	2
Sulphate of soda	2

Costing together 7*l.* 15*s.*, produced 37 tons 2 cwt. of bulbs.[1]

It is a bad practice to mix guano with the compost heaps, for, although the compost will be slightly enriched, the guano will be considerably impoverished by giving off its volatile and ammoniacal salts in the fermentation that succeeds.

All the experiments yet made tend to prove that guano, in conjunction with farm-yard dung, is one of the best, if not the very best manure, that can be used; the proportions are, about 10 or 12 tons of farm-yard dung to 2½ cwt. of guano per acre; the dung ridged and the guano spread over it, and both turned in.

The Peruvians use a small quantity of guano, and abundance of water; their manurings with this substance are always immediately succeeded by an irrigation. Drought is unfavourable to this manure; but where heavy rains have followed the application of guano, the crops are always finer. It appears to be a most excellent manure for grass and meadow land, producing extraordinarily luxuriant crops of rich grass, which cattle prefer to any other, and sometimes as many as three good crops in one season; but on turnips its success is very great; it also benefits potatoes, mangold wurzel, and carrots, and appears applicable to wheat and other grain crops. Flowers of all kinds increase in beauty and luxuriance, when watered with a solution of guano in water; the same may be observed with regard to strawberries and young trees and shrubs. It has been remarked that the worse the land is the better does guano answer.

There is in the market much spurious guano, as well as much

[1] Transactions of the Highland Society, 1847, p. 16.

that is adulterated; and it behoves the purchaser to be always on his guard against imposition. Many of the failures that have attended the use of guano are attributable to an inferior, or *home-made*, article having been substituted for genuine guano.

Guano is often adulterated with 25 per cent., or even more, of yellow sand, gypsum, or yellow clay, and also with umber, in the proportion of from 15 cwts. of this latter to 5 cwts. of guano. A composition, very similar in colour and consistence, is made of umber and gypsum, and sold for guano. Cinders, coated with lime, clay, or sand, and stinking oatmeal which had become damaged by salt water, have also been used to represent guano.

The loam of the Essex flats, too, which much resembles guano in appearance, is packed in bags such as guano is sold in, and great quantities of it carried to the different ports of England for some mysterious purpose. Colour has been considered as a criterion; but, as exposure to the atmosphere will alter the hue of guano, this is not to be depended upon. The smell, too, may be influenced by so many causes that no dependance can be placed upon it; as a general rule, it may be stated that the driest and best has usually the least perceptible odour. Weight is a better test, but still not a conclusive one. Professor Way states that 'the weight of a bushel of good Peruvian guano should be about 68 lbs., but it sometimes weighs as much as 73 lbs., and at others not more than 61 lbs., according as the guano is more or less lumpy;' all adulterations of 40 per cent. would materially increase this weight. He gives the following simple and easy tests for the general use of farmers, but advises all who are about to purchase largely in guano to have recourse to that unerring test—analysis by some good chemist:—

'When pure guano is burnt in a shovel until the blackening has gone off, the ash ought to be white, and almost wholly soluble in muriatic acid; where the ash is yellow or brown, and where much residue is left in the solution, clay or coprolite has been used to adulterate the guano.

'Burn 100 grains of guano with twice its weight of powdered nitre, and when the mass has ceased to swell up, dissolve the nitre in water. If the guano was pure, the white phosphate of lime will easily float off in the water, when decanted; should there be a mass of heavy yellow or black stuff at the bottom of the glass, it implies adulteration.'

The following modes of detecting adulteration in guano we translate from a foreign journal:—

1. *Colour of Guano.*—The colour of coffee with milk is ordinarily that of good guano. If the colour is too grey it is because the guano is earthy. When it is browner there is a considerable quantity of water in it.

2. *Taste.*—The stronger the flavour of the guano—as salt, piquant, and caustic—the richer it is in ammoniacal salts.

3. *Smell.*—The smell of guano can scarcely serve as a means of comparison, for it varies with the degree of dryness or moisture. However, a smell of ammonia is a good sign.

4. *Consistence.*—Good guano is ordinarily oily to the touch. It is in small grains, but sometimes in large pieces. If the guano be rich in urates, the pieces, when broken, appear shining and crystallised. When the guano is of inferior quality it is full of earth; it is bad if it contains many stones and gravel.

5. *Flame.*—A small piece of good guano put on a thin blade of platinum, and held over the flame of a spirit lamp, will blaze up, burn with a long flame, and leave a residue of charcoal ashes. Guanos poor in organic matter give out less charcoal.

6. *Testing it with Quicklime.*—A piece of guano rubbed with a piece of quicklime emits a strong smell of ammonia.

Many specimens offered for sale contain an amazing quantity of sand; the presence of this may be detected by weighing a small portion of the guano, and then stirring it for some time in a vessel of water, and, after it has stood a minute or two, not more, to permit the heavy substance to subside, pouring off the water, when the sand will remain at the bottom. The proportion of it may then easily be ascertained by drying and weighing it, and comparing the weight with that of the portion of guano submitted to the experiment.

The admixture of cream of quicklime with genuine guano will cause the evolving of ammoniacal fumes almost too powerful to be inhaled.[1] As a general rule, it may be observed that, where the ammoniacal odour produced by the application of lime or alkali to guano is strong, and where there is a strong saline taste in any solution of guano and water, the article may be regarded as tolerably pure. The farmer will best guard himself against imposition by always procuring it from the large and well-established dealers, and never suffering himself to be tempted by cheap guano, which must be in some way an inferior article, as the importers, who have the exclusive agency of the Peruvian guano, have never sold any sound and good under 9*l.* 5*s.* per ton.

When guano is moist, it should be regarded with suspicion; for, to be good, it must be brought from some climate where no rain falls. Cargoes imported from the coast of Chili, where rain is frequent, having been sold for Chincha and Boliva guano, have injured the character of that manure. Professor Johnston states, 'that it is the dryness of the climate which has permitted guano to accumulate on these coasts. When we reach a region in which, from local causes, the dews are heavier, and the rains more fre-

[1] Journal of the Royal Agricultural Society, vol. v. part 1.

quent, the accumulation ceases. A single day of English rain would dissolve and carry into the sea a considerable portion of one of the largest accumulations, and a single year of English weather would cause many of them to disappear.'[1]

We now come to describe *night-soil*, or excrementitious matter of *privies*, which is believed to excel every other species of manure, for the first year of its application. In the second, Mr. Middleton states,[2] that its beneficial effects are less evident; and, in the third, they nearly, if not altogether, disappear. Arthur Young says: 'The effects of night-soil are prodigious; it just trebles the produce;' he also states that it is a vulgar error to imagine that it communicates an unpleasant flavour to plants grown on land manured with it. He gives three waggon-loads, or from 240 to 300 bushels, as the proper quantity for an acre of grass land, on which it answers best.[3] The proportion for land in good condition is estimated by Mr. Middleton to be about two loads per acre annually, and which, he thinks, will permanently preserve its fertility. He adds, that exhausted land may be perfectly restored by the application of four or five loads of night-soil on each acre for the first year, after which two loads annually will be sufficient to retain the land in a high state of cultivation; and that the herbage produced by land thus manured is capable of fattening the largest cattle in a smaller compass of time than any other. On account of the generally fluid state in which the excrementitious matter of privies is usually found, it is advisable to combine it with some peaty or earthy substance, as this will absorb the volatile gases evolved by the decomposition of the ordure, and be itself reduced to the requisite degree of solubility for facilitating the growth of plants; thus, much benefit will be derived, both in the quantity and quality of the manure.[4] It has also been found highly fertilising when mixed with water, and thrown over the land in a liquid state. Thaër advises its being made into a compost, by mixing it with turf and other substances, and adding a small quantity of burnt lime; and he says, 'Thus the superfluous energies are reduced to the proper standard, and the effect extended over a greater space without anything being lost by the diffusion. The compost must be well mixed and stirred together before being used.'[5]

The disagreeable smell of night-soil may be destroyed by mixing it with peat, charcoal, or quicklime; or exposing it to the atmosphere in thin layers, strewed over with quicklime, by which

[1] Journal of the Royal Agricultural Society, vol. v. p. 315.

[2] Transactions of the Society for the Encouragement of Arts, &c.

[3] Annals of Agriculture, vol. xxxiii. p. 602.

[4] See the Earl of Dundonald's Treatise on the connection of Agriculture with Chemistry, 4to.; a work deserving the attention of every intelligent agriculturist.

[5] Thaër's Principles of Agriculture, vol. i. p. 425.

means, in fine weather, it speedily dries, is easily pulverised, and in this state may be used in the same manner as rape-cake. The Chinese method of mixing night-soil with one-third of its weight of fat marl is worthy of a trial. Made into cakes, and dried by exposure to the sun, it forms a usual article of commerce in that vast empire.[1] We know of no substance equal to dried earth or clay, as recommended by the Rev. Mr. Moule, for mixing with night-soil. By its means, an excellent home-made guano can easily be made and at a cheap rate. The researches, however, of Dr. Voelcker into the composition of this manure lately made, would go far to show that it does not possess the high manurial value which has been claimed for it. Seeing that it consists almost entirely of night-soil, which beyond doubt is highly valuable, the only way of accounting—we venture to conjecture—for the results of Dr. Voelcker's experiments is, that the clay does not fix the ammoniacal vapours, which therefore pass off.

In the neighbourhood of Paris there is an establishment in which is manufactured a very active manure of night-soil, called *Poudrette*, 240 lbs. of which are said to produce an effect equal to that of eight loads of stable manure.

In Flanders, the night-soil is carefully preserved; at Nice it sells for a very high price; it is the same in most of the towns of Germany; the inhabitants of Belgium make great use of it; and in the towns of England it is not so much wasted as formerly.

2. *Urine*, or the liquor of farmyards, is a fluid capable of being employed with great benefit on meadows. All urine contains the essential elements of vegetables in a state of solution. The dung of the horse is considered more fertilising than that of the cow, and the urine of the cow more fertilising than that of the horse. The effect of the urine of the horse in forcing and stimulating the growth of Italian and other grasses, and hastening the vegetation of plants, is greater, however, where it has been judiciously applied, than is generally imagined. Pigs, in consequence of the large amount of liquid food they obtain, discharge a larger quantity of urine than any other animal. Sprengel states that the urine of the pig contains less water, and one and a half per cent. more urea, than that of cattle; hence it must undergo putrefaction before being applied to growing plants, or it will injure them by its caustic ammoniacal properties; but, before suffering it to putrefy, it should be considerably diluted with water, in order to prevent the escape of that ammonia which is in itself so valuable and essential to the growth of plants.[2] Sprengel

[1] Sir H. Davy's Lectures, p. 298.

[2] Sir H. Davy and Sir J. Sinclair confirm this statement. See also Scottish Husbandry, vol. i. p. 81, note. The subject is likewise treated at considerable length in No. IX. of the British Husbandry.

advises that the urine of the cow should likewise be suffered to putrefy before it is made use of, in order 'that the urea may be decomposed, and the caustic ammonia converted into the state of carbonate, humate, or acetate of ammonia.' He also advises that it should always be mixed with water, stating that this mixture is far more beneficial to vegetation than the pure urine would be, from the chemical alterations and combinations which then take place, especially when the liquid is suffered to stand five or six weeks before it is used.[1] When applied to meadows, the best time for *sprinkling* urine is during the winter, when the rains will wash the fertilising saline particles into the soil; or the land may be sprinkled early in the spring, when it is laid up for hay, because no cattle will touch the grass so long as the salt adheres to the blade. Another circumstance necessary to be attended to, in order to make the most of this valuable manure, is, that it be carried to the meadow or pasture intended to be watered in dry weather, as the farm-yard fluid in the reservoirs is at that time strongly impregnated with salts, which may be known by its deep brown tinge. The reservoirs appropriated for its reception should be constantly kept in a state of readiness for that purpose; and thus the land may be watered or sprinkled as often as the operation may be thought necessary. In too many farms, the urine is allowed to run from the yard and stables into the horse-pond. This is an extravagant and reprehensible practice, without any assignable reason to recommend it; still, where it is persevered in, it may yet be turned to some account, by employing such pond-water as a sprinkling or top-dressing for meadows, but no animal should be allowed to drink from the pond. Mr. Gyde, in a paper sent to the Highland Society of Scotland, calculates 'that, for every 10,000 lbs. of the urine of the horse that is allowed to escape, the farmer loses 600 lbs. of dry matter, of a highly fertilising nature; and that for every 10,000 lbs. of the urine of the cow wasted, the loss is 700 lbs. of dry matter.' In Flanders, where urine is highly valued as a manure, that of each cow is estimated at 2*l.* per annum. It has also been calculated that a cow voids between 2,000 and 3,000 gallons of urine in a year. These things have been too little thought of; the farmer only sees the mere dribbling away of this valuable fluid, and forgets to calculate how, day by day, it would accumulate, if reservoirs were provided, and the saving and benefit he might derive from such accumulations, if properly conducted, and the tanks or reservoirs were so arranged as to prevent the evaporation of the ammonia and other fertilising gases.

Many interesting accounts of economical modes of collecting and applying the urine of cattle as a manure to land have been

[1] Journal of the Royal Agricultural Society, vol. i. p. 469.

communicated: we select one, which appeared in the 'Farmer's Magazine,' given by an intelligent farmer in the vicinity of Peebles. His farm buildings were so disposed that the urine of all the stalls was conveyed by drains to a dung-pit; and the dung laid in a place appropriated to that purpose, instead of being thrown in the middle of the yard, according to the usual practice. The dung-pit was 12 yards square, and 4 feet deep, and filled with mould previously carted into it, for the purpose of being impregnated with the urine and moisture from the dung. This pit produced about 288 cart-loads, forty of which were sufficient for an acre. The expense of filling the pit is calculated at about 6*l.*; so that the advantage of the method is too obvious to be mistaken. An excellent paper on the saving and application of the liquid manure of a farm will also be found from the pen of Mr. Kinnimonth of Invertiel, near Kirkaldy, in the 'Transactions of the Highland and Agricultural Society.'

In Belgium, rape-cake is thrown into the tanks of urine and water, and allowed to putrefy with those fluids; as also are vegetable matters, as weeds from fields and gardens, &c.

The addition of mineral substances also increases the manuring properties of urine: gypsum, common salt, bone-dust, saltpetre, alum, wood ashes, potashes, &c., are adapted for the purpose.

Urine is always more efficient on light soils than on clays and strong loams; the former it renders in some degree consistent, while on the latter much of its carbonate of ammonia is evolved before it can penetrate into them.

In the application of urine, great care must be taken not to apply too much to the land, especially where the soil is poor.

In every 100 lbs. of *cows' urine* there are 65 lbs. of water, 5 lbs. of urea, 5 lbs. of phosphate of lime, 12 lbs. of sal-ammoniac and muriate of potash, and 10 lbs. of carbonate of potash and ammonia. While the solid excrements obtained from one cow are estimated to manure half an acre of land, the liquid excreta are estimated to manure three times the amount. It is therefore of the utmost importance to have tanks applied to every farm building in which to collect the liquid excreta of farm stock.

A German professor, M. Schubler, instituted a variety of experiments on the comparative value of different species of dung:—

3 times the quantity of seed sown will be produced, if no manure is employed.
5 times, if the ground is dressed with old herbage or grass, or leaves.
7 times, with cow-dung.
9 times, with pigeons' dung.
12 times, with human urine.

12 times, with sheep's dung, and
14 times, with human dung, or bullocks' blood.

3. Where *greaves*, or the refuse of tallow-chandlers after the work of making candles, the clippings or waste of curriers, fell-mongers' clippings, shreds of shoemakers and furriers, or the waste or refuse of glue-makers or wool shockers, can be obtained in sufficient quantities, they afford uncommonly useful manures.

4. *Fish*, such as pilchards, sprats, herrings, mackerel, mussels, and others, afford a useful species of animal manure, to which purpose they are applied in those parts of Britain where such fish are found in abundance. To these may be added, the refuse blubber of the whale remaining after the oil is boiled out; the offal of large fish, great quantities of which may be sometimes procured in populous cities or maritime districts; and the stickle-backs, a common fish in all rivers and ditches, of which (in some parts of the county of Cambridge) 20 bushels are strewed over an acre of land. The use of fish manure is, of course, limited to particular districts, and rendered less to be relied upon by the uncertainty of the supplies. Another drawback is, the necessity of using it at the time it is obtained, and some particular kind of fish, as herrings or sprats, may happen to be very plentiful just at the moment when it is inconvenient to the farmer to fetch them and apply them to the ground. The remains of fish, however, constitute such an economical and powerful manure, that experiments should be made relative to preserving it in the form of compost, or in some other way. In Cornwall and Devonshire, pilchards are successfully used when mixed with sand, soil, or sea-weed, and their effects continue for several years.

Professor Way has recommended that sprats should be reduced to a dry mass, by expressing the oil they contain, much in the same way as the oil is expressed from linseed, and he states that the dry residue would contain nearly 12 per cent. of nitrogen, a quantity greater than any known manure, with the exception of guano. The manure would then be portable, capable of being kept for any length of time, and adapted for use with drills.[1] Establishments have been instituted for the purpose of making a manure from the remains of fish, at some of the leading fishery stations. Report speaks favourably of the value of the manure produced.

5. *Bones*, broken small, or reduced to the size of a coarse powder, form an excellent manure, especially on sand, poor clays, and peat. They may also be laid on grass with most valuable effect, and on arable lands in fallow for turnips, or for any of the subsequent crops. Bone manure is used to a considerable extent in the west of Yorkshire, in Holderness, and in Lincolnshire, on cold

[1] Journal of the Royal Agricultural Society, vol. xx. p. 613.

and light sandy soils. The usual quantity is 40 bushels per acre; but when mixed with ashes, 30 bushels per acre. It is applied in the same way and at the same periods as other manure, and the duration of its effects is according to the size of the bones; they are, however, in their results, more evident, and more beneficial, especially upon grass lands, in the second year than in the first. On the most sterile clays it rapidly effects a decided change; mosses, and all the tribe of scanty vegetation, disappear before its fertilising influence, and a luxuriant crop of herbage takes their place.

The pastures of Cheshire have undergone an almost inconceivable amelioration from the application of bone manure. The average quantity applied to poor clay there, is about a ton and a half per acre. It is worthy of note, however, that in other districts, bones are not so beneficial: why, it is difficult to say. Before, therefore, expending large sums on the bone-dusting of lands, a portion ought to be tried first to test its capabilities.

It is now some thirty or forty years since this manure was first introduced, and, although it has occasionally fallen into disrepute from being applied to soils to which it was not suited, and used on damp ill-drained land, it has, on the whole, retained, if not increased, its original reputation; and at the present day, the practice of manuring with bones has become so universally adopted, that they form a very considerable article of commerce. They are imported from Belgium, Holland, and Germany, in immense quantities.

Many large farmers have machines to crush the bones, which they save or buy from some neighbouring kennel or elsewhere; but there are regular merchants from whom they can be obtained, in the proper state to lay upon the ground. They may be procured in different forms; either broken into pieces of about an inch or half an inch in length, or in the form of coarse powder. In this latter state, they produce immediate and incalculable benefit, when they are unadulterated; but the demand for bone-dust has induced fraudulent dealers to adulterate it very considerably. Many failures may arise from the farmer having had a spurious article foisted on him. Hence he should avoid, in this, and indeed in all cases, dealing with any but known and respectable manure merchants. The fraud can sometimes be detected by burning a small quantity, when the peculiar smell will inform the purchaser whether he has been imposed upon. Where the adulteration consists of oyster-shells and limestone, effervescence will be produced if muriatic acid be poured on a little of the powder.

Boiled bones have been found nearly as efficient and durable as fresh, and doubtless are so on some kinds of soils; thus, those thrown aside by the glue-boilers have been sought and used.

Their effect on the land is not so prompt as that of fresh bones, probably from their having been divested of most of their animal, or oily and gelatinous principle; but they are rendered more porous by boiling, and more capable of absorbing and concentrating moisture, gases, and other evaporations which constitute the food of plants; and besides, they retain that which is considered by eminent scientific agriculturists to be their chief fertilising principle—the phosphate of lime, and this is, by the act of boiling, brought more easily in contact with the plants whose food it is to become. Indeed fossil bone, or phosphate of lime, which exists in immense beds in many countries of Europe, and in some districts of England, is now used in very large quantities for the manufacture of 'superphosphate.' (See remarks below.)

Formerly bones were more used in inch and half-inch pieces than they now are—half-inch bones profit the land but little during the first year, but their effect will gradually increase during the first three years, and they will not be worn out of the ground in five years: inch bones will continue to act on the land for seven or eight years, but their influence is not felt for the first twelve or eighteen months.

Superphosphate.—Another and still more efficient and economical way of applying bones to land is, to dissolve them in sulphuric or muriatic acid. The effect thus produced on the soil will be prompt and highly beneficial, though not so durable as the old system; but then it will be cheaper, and where the object is to raise a root crop, as turnips, the crop will be valuable in itself, and do its work on the soil. The proportions for mixing are, about a bushel of bones to a stone of sulphuric acid; one-fourth of the quantity of bones applied to an acre of land in the old way will suffice, when they are dissolved; hence a saving of more than half the expense, and an actual increase of fertility, in most cases.

A good sample of superphosphate of lime prepared from bones should contain from six to eight per cent. of soluble or bi-phosphate of lime, and double that amount of insoluble or bone phosphate. Dr. Voelcker, in the paper already alluded to, on the value of artificial manures, gives the following analysis of a good sample of superphosphate of lime:—

Water	19·26
Organic matter[1]	16·12
Soluble phosphate of lime	6·38
Equal to bone phosphate	9·94
Insoluble bone phosphate	22·16
Hydrated sulphate of lime (gypsum)	25·10
Alkaline salts	5·12
Sand	5·82
	109·90

[1] Percentage of nitrogen . . 1·66
Equal to ammonia . . . 2·01

The following is an analysis of an inferior sample :—

Water	14·40
Organic matter [1]	8·93
Soluble or bi-phosphate of lime	3·60
Equal to bone earth	5·61
Insoluble or bone phosphate	6·83
Gypsum	44·20
Alkaline salts	2·52
Insoluble siliceous matter (principally quartz sand)	19·50
	105·59

The following, from a paper on the 'Home Manufacture of Portable Manures' by Mr. Maxwell, in the Journal of the Royal Agricultural Society of England, vol. 23, will be useful as showing an easy method of making superphosphate of lime :—

'Having dug out a space large enough for one pit 10 ft. long, 6 ft. wide, and 2½ ft. deep, inside measurement, level the bottom and lay down 3 inches of *millwrought* puddle, upon which place fire-brick flue-covers to form the sole of the pit; build the sides and the ends with common bricks (a brick and a half thick) using *no* cement or plaster; puddle outside and puck with fine sand. After the pit has been once used for dissolving, the interstices between the bricks will be filled up.

'A pit of this size is capable of holding two tons of ground bones. Pits may, of course, be made of similar dimensions if preferred. Strong wooden vats or tubs will suit equally as well. In preparing superphosphate, first throw into the pit the substance it is intended to dissolve; pour over this one-fourth its weight of water, stirring and mixing well, with a wooden rake or pole; then add sulphuric acid, which may be twice the weight of the water, or half the weight of the substance to dissolve: stir and mix the mass as before. Take, for example, two tons of bone ash, containing 75 per cent. of phosphates, 10 cwt., or 112 gallons of water, 1 ton of sulphuric acid,[2] and allow them to remain forty-eight hours in the pit; the above would yield 46 per cent. of phosphates, of which there would be 24 per cent. soluble, at an average cost of 5*l.* 5*s.* to 5*l.* 10*s.* per ton.'

The soiled or damaged *locks of wool*, or trimmings of sheep,

[1] Nitrogen . . . . 1·44
Equal to ammonia . . . . 1·75

[2] Dissolved bones are best prepared by passing the common bone-dust through a wheat-sieve, and throwing the powder into an iron vessel with half its weight of sulphuric acid and the same quantity of water; after standing for a day it may be transferred to a wooden vessel and more water added, and then allowed to macerate until all the larger pieces of bone are soft. The mixture can either be diluted with water and applied to the land from a water-cart, or mixed with moss or mould and sown over the land in a state of superphospate of lime. When applied in this state it should be put in along with the seed. It answers well thus for old pastures, and its effects are very rapid, but it is not so well adapted for a top-dressing for white crops. —*Farmer's Magazine*, vol. xxii. p. 304.

and, generally speaking, *woollen rags*, afford excellent dressings for light dry and chalky soils, in which they are useful rather by their retaining moisture than as manure. The former are used chiefly in the county of Surrey, the latter in Kent, in the hop-gardens, in the proportion of from 8 to 12 cwt. per acre; they are also applicable to wheat crops, but not to roots or quick-growing plants. They should be reduced into shreds not larger than a five-shilling-piece, then spread as evenly as possible by hand upon the ground, and ploughed in about three months before the intended crop is sown. The beneficial effects of this manure are found to extend to the second year. Woollen rags have several advantages: they will keep any length of time, the carriage of them is light, the expense not great, and they may be easily and cleanly applied to the soil. Sir Humphrey Davy says that in Italy and the South of France, all remains of woollen stuff are carefully collected, that they may be placed round the roots of the olive trees.

The supply of woollen rags, properly so called, has, however, decreased of late years, much that was formerly sold to the farmers being now reconverted into cloth; the quantity is, however, made up by the admixture of rags of other kinds, and the value and quality thus greatly deteriorated.

'All the vermin caught on the farm of the Rev. Mr. Huxtable are thrown into sulphuric acid, by which they are soon converted into a manure as valuable as bone-dust, and thus the very pests and scourges of the farmer are converted to his advantage.'[1]

Dead horses have also been reduced to manure by steeping them in sulphuric acid; in fact, there is scarcely any refuse animal matter that may not thus be renderered valuable and available. For much useful information on the utilisation and preparation of a variety of waste substances as manure, see the paper already alluded to by Mr. Maxwell, on the 'Home Manufacture of Portable Manures.'

CHAPTER III.

ON FOSSIL AND MINERAL MANURES.

UNDER this division are comprised various kinds of earth, lime, marl, clay, &c., which vary in their effects, and all of which contribute in a greater or less degree to improve the land, according to the nature of the soils, and the proportions in which

[1] *Sherborne Journal.*

the fossil manures are applied, and the various articles or substances of which they are composed.

1. A very useful manure of this class is the *shelly* or *calcareous* sand deposited in strata on different parts of the British coasts. From the quantity of fine calcareous matter produced by the friction of marine shells, and similar substances, as well as the animal matters combined with it, this sand is exceedingly valuable, especially as it retains a portion of sea-salt, which greatly promotes the decay and putrefaction of vegetable and animal substances. This kind of manure is best calculated for cold, clayey, or loamy soils, on which it will produce most abundant and luxuriant crops; the quantity per acre is from 18 to 20 tons, though the peculiar nature and other circumstances of the soil or situation, as well as the greater or less portion of calcareous matter it contains, will necessarily cause a difference in this respect. A considerably less quantity of calcareous matter, when finely attenuated, as in this case, will produce more decided effect than when applied in the state of earthy marl, being spread more equally upon the land, and more intimately blended with the soil. When laid on land in grass, it speedily and most decidedly improves it. The finer the grain of the sand the more speedy are its effects, and the shorter the period of their duration.

2. The *Ashes of Clay*, after it has been burned, ameliorate wet, cold, and sandy soils, and stiff clayey lands. This species of manure has been used in the North Riding of the county of York, where the ground is so sandy as to yield, with the application of other manures, only rye; while, with burnt clay, such land produces abundant and luxuriant crops of wheat. The quantity per acre varies from ten to twelve loads, and some have used as many as thirty; the qualities of this manure are said to be so lasting as to render a repetition of *claying* unnecessary for many years. The heavy land of Suffolk, and the flats of Essex, have likewise benefited by clay-burning; it has been found to answer in Hampshire, and Mr. Pusey has tried it with success on stiff clay land in Oxfordshire. It has been extensively used in the North of Ireland, and has been found eminently serviceable where the land has afterwards been judiciously cropped.

The good effects of this manure, if such we may term it, are, however, to be attributed rather to the mechanical alterations which it produces in the soil than to any peculiarly chemically fertilising properties inherent in the clay we burn; and yet it will always be well, where the land may consist of one or two varieties of clay, as is often the case, to select that which experiment or analysis leads us to imagine will, when burnt, prove most ameliorating. Clods intended for burning should be pulverised with the clod-crusher before being collected into heaps; furze, whin, and bean straw, are the best fuel for that purpose. The fire should smoulder and char rather than actually burn, for, as we have before stated, charcoal of any kind is preferable to ashes, from its porous and absorbent qualities; therefore a steady and sufficiently strong heat should be kept up, without its ever being suffered to burst into flame; the external air must be carefully excluded.[1]

The ashes of clay may be advantageously used as a manure for turnips, at the rate of 50 tons per acre. They also form a most valuable top-dressing for pastures and meadow land. They have been used with decided success for wheat crops, grown on a clay soil, and also for barley. Burnt clay is a capital absorbent of liquid manure.

3. *Chalk.*—Of this fossil there are two sorts: the one soft and unctuous, which supplies the best manure, in its natural state, for lands; the other hard, firm, and dry, which is best adapted for the purpose of burning into lime. Either kind, however, affords an excellent manure for compact clayey soils, into the pores of which it insinuates itself, and thus exposes the clay to the action of the sun, air, rain, and frost, so that its two cohesive particles become loose, and it is reduced to a state of pulverisation. The Kentish chalk does not, however, produce these effects on the clays that are situated near the pits, though it may be advantageously mingled with other clays; probably on account of the Kentish clays being of a chalky nature, and already containing a sufficiency of that substance, or from the chalk applied being too similar to the soil. Chalk may also be usefully employed on sandy grounds, which it often renders sufficiently compact for the purposes of vegetation; while it totally extirpates the pernicious yellow ox-eye or common marigold, a noxious weed, which peculiarly infests lands of the last-mentioned description. In laying chalk on grass lands, care should be taken to reduce the lumps, for it may be long before the weather will pulverise them sufficiently to enable them to become incorporated with the soil; and if left on the ground they will impede the scythe. The quantity per acre varies from 10 to 30 tons according to the nature of the soil to which it is applied, rich land not requiring so large a quantity as poor or light lands do. The effects of this manure are by no means immediate, one or two years often elapsing before they become apparent, but on soils to which it is suited it is a very permanent amelioration. Lime is more generally applied to grass and pasture lands than chalk, but when employed in considerable quantities, and pulverised, beneficial effects have been experienced from the latter, especially where the land is light and sandy.

[1] There are several long and minute accounts of various methods of conducting this operation to be found in that excellent work, 'On Fertilizers,' by C. W. Johnson.

4. *Lime* is of extensive utility for manuring lands; it is best in the 'slaked' condition. Its effects vary considerably, according to the nature and quality of the substances with which it is combined. Where magnesia is united with the calcareous matter, as in the counties of Derby, Northumberland, and Nottingham, its beneficial effects are not so great in fertilising the soil, and promoting vegetation, as where such combination does not exist, particularly when the *same* quantities are spread on land.[1]

After the lime has been perfectly calcined, it receives the appellation of quicklime; and ought to be spread as expeditiously as possible, in order that it may be duly slaked and blended with the soil. This fossil is calculated for almost every soil, but more especially for boggy, peaty, heathy, and mountainous situations; for waste lands which are overrun with fern, broom, bushes, furze, rushes, or other coarse vegetable matter that has contracted an acidity unfavourable to vegetation; and for tenacious clays, which, being thereby loosened and rendered friable, are more easily worked, and more readily penetrated by the fibres of plants. On old sheep-walks and commons, and on low, rich, and drained meadows, which have formerly been marshes, and which contain a very considerable quantity of vegetable matter, it is also of singular benefit; for the lime, in all these cases, entering into chemical combination with the soil, accelerates putrefaction, and dissolves or removes everything that is noxious or hurtful to vegetation.

The quantity of lime usually spread on land varies considerably; much depends upon the goodness of the lime, and still more upon the nature of the soil to which it is applied. The general allowance, in the estimation of experienced farmers, should be from 100 to 400 bushels an acre, particularly where the land has for a long time been in a neglected and uncultivated state, and has become sour; in which case, one good application of lime proves more beneficial than many frequent and repeated scatterings of small quantities. Professor Johnson states the average quantities to be from 50 to 200 bushels per acre. For common soils which are not impregnated with acids, or do not abound in putrescible matters, 160 bushels may be sufficient for one acre; but that quantity should be increased in a double or treble proportion in the case of strong and stiff clays. This, however, is only when the lime is intended to be incorporated with the land; for where it is merely used as a top-dressing, with a view to the improvement of the pasture, a much smaller quantity will answer the intended purpose. When the object is to apply calccareos

[1] See an able essay on this subject, by S. Tennant, Esq., in the Philosophical Transactions of the Royal Society for 1799.

matter to a soil in which it is deficient, the lime may be applied in its caustic or mild state; and in this state it can be spread more equally over the surface of the ground, and thus is more likely to become intimately mingled with the soil.

The caustic properties of lime have the effect of dissolving and bringing into immediate action the inert vegetable matters contained in the soil. Great crops have often been produced by its *first application*, and farmers have been led into the error of repeating the operation without the addition of other manure, whereby the land has become exhausted, instead of fertilised. A *second liming* should, therefore, not be undertaken without great caution. 'Caustic lime,' says a celebrated writer, 'unites with the half-decomposed fibres of vegetable matter, as straw, heath, and the like: it helps their decomposition and accelerates it. By its means the dead fibres of vegetable roots which remain in the earth when the plant is removed become soluble, and their elements entering into new combinations supply the materials for the various vegetables which are produced. *So long as there is a store of organic matter in the soil, lime will be an excellent manure.* Clayey soils are better able to bear repeated limings than those of a more sandy nature, for the lime tends to loosen the texture of the former, while it often hardens the latter to such a degree as frequently to form large clots of mortar. On damp wet ground its effects are scarcely perceptible. An excellent mode of preparing it is, to form small heaps, and cover these with earth. When the lime is slackened by the moisture of the soil, the piles or heaps are to be opened, and as much dung deposited in each as the earth will cover. Its too caustic properties may be also corrected by mixing it with earth and weeds or stable litter. At the end of three months the mass should be thoroughly stirred; and, by this method, the seeds of the weeds will be effectually destroyed, while the increased fermentation thereby produced will more speedily excite the fertilising qualities of the dung.' [1]

In mixing lime with dung, or any animal manures in which the process of fermentation has commenced, it must be borne in mind that it tends to liberate their ammoniacal particles, and consequently to deteriorate them very materially. This is one of those

[1] Professor Low explains this in the following manner:—'Lime forms insoluble compounds with almost all the soft animal and vegetable substances with which it can combine; but these compounds, exposed to the combined action of the air and water, are altered in time—the lime gradually becomes a carbonate—the animal or vegetable matters are by degrees decomposed, and furnish new compounds capable of nourishing plants, so that lime, in performing two functions seemingly opposed to each other, really promotes the fertility of the soil, and the growth of plants. It first disposes certain substances insoluble in water to become soluble, while, by combining in part with substances that are soluble, it prolongs the nutritive action of soft vegetable and animal substances beyond the time in which they would have acted, if they had not entered into a combination with lime.'—*Elements of Practical Agriculture*, p. 61.

numerous errors in every branch of agriculture which a knowledge of chemistry will enable the farmer to guard against.

Hence it is that lime and farm-yard manure should never be used at the same time: 'indeed it is advisable,' says an authority, 'to put off the application of other manures as long as possible to land that has been recently limed.'

Of the mixture of lime and salt, and its efficacy as a manure, we shall speak when we come to *Salt*. Lime must always be thoroughly incorporated with the soil, so that every particle of the one shall act on some particle of the other; without strict attention to this, the ameliorating effects of this substance will be but imperfect. The land should be fallowed previously to the application of lime to it, and then carefully and thoroughly tilled.[1]

Phosphate of Lime, many extensive beds of which are found in England, and especially in Suffolk, Surrey, and Cornwall, was, we believe, first pointed out to the notice of agriculturists by Cuthbert Johnson, who has, by his researches and science, added so much to our knowledge of manures, and their component parts, and the chemical relations or combinations by which they act on certain soils. He states the *apatite*, a mineral substance found in the tin mines of Cornwall, to be composed of phosphate of lime, also 'the coprolite of the Suffolk craig formation,' and coprolites generally; it is likewise found in some of the lower chalk formations, and in some marls, dug out at Farnham, in Surrey. Its application to turnips, barley, and wheat has been attended with success.[2] These substances are now largely used in the manufacture of superphosphate: Lawes' superphosphate, for instance, is made in large quantities from these fossil remains.

Sir Humphrey Davy says:—'Phosphoric acid and lime, in the ratio of one proportion of each, form *phosphate of lime*. It constitutes a chief ingredient in calcined bones. It exists in most excrementitious substances; and is found both in the straw and grain of wheat, barley, oats, and rye, and likewise in peas, beans, and tares. It is rarely found in a native state, and then only in small quantities. Phosphate of lime is generally conveyed to the land in the composition of other manure, and it is probably necessary to corn and other white crops.'[3]

5. *Coal Ashes*, when properly preserved, supply a good top-dressing for clover, lucerne, or saïnfoin, on dry chalky soils, in the quantity of fifty or sixty bushels per acre, scattered immediately over the land after the hay harvest; and are equally beneficial on grass lands, on which they are spread either during the winter or in the course of the following spring; they likewise materially benefit this

[1] Thaër's Principles of Agriculture, vol. i.
[2] Farmer's Magazine, vol. xxix. p. 81.
[3] Sir H. Davy's Lectures, p. 336.

crop when it is raised on sandy soils. Lord Albemarle found no manure formed a more beneficial top-dressing for sainfoin, and, indeed, for clover, lucerne, and other grasses, than coal ashes. The quality of coal ashes may be much improved, by covering up in every cart-load of ashes one bushel of lime, in its hottest state, for about ten or twelve hours, when the lime will be entirely fallen. The whole is then to be well mixed together, and turned over two or three times, when the cinders, or half-burned pieces of coal, which would otherwise be of no use, will be reduced to as fine a powder as the lime itself. It should, however, be remarked, that, in order to obtain this benefit from coal ashes, they ought to be kept perfectly dry; and, when thus prepared, they are stated to improve swampy moorish soils very materially, and in a very short time. Incorporated with night-soil, they will give it firmness and also absorb its effluvia, but they must be dry and fresh or their efficacy will be diminished. Mr. Prideaux recommends that the coal ashes, as they are taken from the grate, should always be thrown into the privy, as by this means its contents will be kept free from unpleasant smell, concentrated as it were, and ready to cart away for manure at any time.[1]

6. *Leached or Soap-boilers' Ashes* are considered by some persons to be possessed of great fertilising properties; but there is much difference of opinion upon this point. They are recommended as particularly useful for swampy cold soils, on which they effectually destroy rushes and other aquatic weeds. There are few soils, however, to which they may not be beneficially applied.

The quantity per acre varies from 100 to 160 bushels, according to the quality of the ashes. The soapers' waste of London consists wholly of the refuse of kelp and barilla. It yields about 91 parts out of 100 of calcareous matter; and may be advantageously applied wherever such manure is wanted in lands, and will serve the purpose of liming. The small quantities of alkaline salt and gypsum which it contains, also, render it much superior to common calcareous matter, as a top-dressing for every kind of grass. In Lancashire it has been found very good and durable on dry pastures. It is better for pasture than for arable ground, and crops of clover-hay have been more than doubled by it. Mixed with vegetable refuse, earth, as scrapings of ditches, &c., and sawdust, it makes a valuable compost, suitable for a top-dressing to old pastures, and for some of our grain crops. 'One good effect of this manure is, that it *destroys slugs and vermin of every description*.'[2]

[1] Farmer's Magazine, vol. xxix. p. 81.

[2] Communications to the Board of Agriculture, vol. vi. part ii. See also a valuable little Essay on the utility of Soap Ashes as a manure, 12mo., London, 1812.

7. *Bleachers' Refuse*, mixed with earth, or vegetable refuse, or with sawdust, constitutes an efficient manure for old grass lands, promoting the growth of the grasses very materially; it has been applied to some of our grain crops with tolerable success, and especially to oats. It is fittest for light friable soils.

8. *Gypsum* is a native combination of calcareous earth with sulphuric acid, and is reduced to powder by a moderate heat, though as difficult of fusion as limestone. It abounds in various parts of England, and its uncommonly fertilising properties render it valuable. Exhausted sandy uplands, that have been abandoned, are restored to fertility by its use, but it appears best calculated for chalky, sandy, hot, dry calcareous soils; heavy and damp lands are not at all benefited by it. The vegetable crops that appear to be most improved by this manure are, red clover, grass, lucerne, and sanfoin; it has been applied to turnips and potatoes, but with little success; and it is of little or no use to grain crops. In order to apply the gypsum with effect, it must be previously pulverised, and strewed over the land, either broad-cast, by the drill, or by hand, at any period of the year, in the proportion of two, four, or six bushels per acre; the best time for performing this operation is when there is little wind, and previously to the falling of gentle showers, as these latter materially promote the efficacy of the gypsum. It is the active principle in our animal and vegetable manures, and the peat ashes owe their efficacy entirely to the presence of this salt; therefore, wherever peat ashes prove beneficial, gypsum may be applied with decided advantage.

It cannot be denied that the results of some experiments on the value of gypsum as a manure are far from satisfactory; but this has arisen from its having been applied to soils and crops for which it is unsuited. Some land naturally contains a sufficient quantity of gypsum, and to such, of course, it is superfluous and injurious. Some crops contain no portion of it in their composition; to such, therefore, it will prove innutritious. Clover, lucerne, and sainfoin, as well as several other grasses, absorb it in large quantities, every fair crop carrying away three or four bushels of gypsum per acre; for these crops, therefore, it is most advantageous; and when a field which formerly yielded them luxuriantly begins to fall off, the farmer may be assured that a dressing of from two to three bushels per acre of gypsum will be productive of the best results.[1]

9. *Marl* is calcareous earth, found in different parts of this island in various forms, and blended with various substances; according to which it is respectively called *stone-marl*, *argillaceous* or *clay-marl*, and *shell-marl*. The first is so denominated from

[1] Johnson 'On Fertilizers.'

its being of a harder consistence than the other sorts, on account of the greater or less quantity of sandy particles it contains. Of the second kind, clay is a principal ingredient; it is of a gray brown or reddish-brown tinge, sometimes intermixed with blue and yellow. In shell-marl, the chief component is a decomposition of shells, effected in a long course of years, and blended with a small portion of earthy matter. All these varieties of *genuine* marl agree in effervescing with acids—the best test for examining them—sinking in water, crackling in fire, like salt, and becoming pulverised on exposure to the atmosphere.

The best season for applying this manure to land is in the months of January and February; the quantity varying according to the nature of the soil. For sandy light lands the argillaceous marl is preferable, as it renders them more firm and tenacious; the stone and shell-marls are, on the other hand, best calculated for stiff, clayey, and loamy soils. The average allowance for sandy ground is about fifty or sixty cubic yards per acre, although in some parts of Cheshire as much as 128 cubic yards are applied; on loose wet loams (which are greatly benefited and rendered more friable by the use of marl) it should be spread to the quantity of 100 yards. Much attention, however, is requisite in this respect; for should too large a proportion be spread at one time, there will be a difficulty in removing it; whereas, whenever too little appears to have been used, the deficiency may be easily remedied by resorting to frequent light dressings.

This mode of manuring is best calculated for land which has been laid down with clover, rye-grass, and trefoil, in the spring, twelve months before the application of the marl, and which will remain so six months afterwards. It will then have time to sink gradually into the soil before it is ploughed up, and will become in some measure incorporated with it. In many parts of Scotland it is suffered to remain exposed to the frost of two or three winters before being ploughed in. Great care should also be taken to break all the lumps, and get it fine by repeated harrowings and rollings and to have all the stones picked and carried away, in order that the grass may shoot up as soon as possible, and stock be grazing upon it. The long exposure of the marl to the influence of the atmosphere is a circumstance of very considerable importance; and this is, perhaps, best effected by laying it on the surface of the land when in grass. So permanent are the fertilising properties of marl, that, if it is properly spread, its effects will be visible on arable land for twelve or fourteen years, and on pasture during a much longer term.

Where no marl pits exist, or this fossil cannot be procured except at an expense by no means commensurate with the benefits that would be derived from it, a good artificial marl may be formed by mixing equal parts of lime and pure clay in alternate strata, so as to form a heap, which is to be exposed to the winter frost. This compost is well calculated for light lands, and but little inferior to the genuine marl; for strong and heavy soils, however, it will be necessary to mix loam and sand with the lime, in lieu of clay.

10. *Salt.*—There are few manures with regard to which there have been such contrary and erroneous opinions. As a condiment for cattle of every description its value is no longer disputed. It is essential to their thriving, and it is one of the most useful therapeutical agents that we possess. Doubts with regard to its connection with vegetable life, however, continue to be entertained. This may arise from injudicious applications of it, or its use in considerable quantities, when it is evidently destructive to the increase, and even the life of plants. Its existence in its common state is dangerous and even destructive; our sea shores bear abundant evidence of that, and yet some of our salt marshes yield highly nutritious and wholesome, and even medicinal herbage,[1] which is eaten with avidity by all kinds of cattle.

There are two questions about this manure; first, as to its quantity. It is probably as necessary to the life of the plant as of the animal; and nature has, almost in every situation, embued the soil with a certain portion of it, which, however, may in many cases have been gradually abstracted by the crops. Next, as to its composition. In the state of common salt, it may be successfully used to destroy a host of vermin, which would otherwise infest the soil and destroy the young plants; mingling with the soil, and in our marshes, and in the little plots which we sometimes sow with it, in cases of the rot in sheep—mingling thus with the soil, and in certain proportions, it gives to the herbage a medicinal character. It assists in the decomposition of animal and vegetable matter; it adds to the fertilising properties of certain composts, but it is by its own decomposition that it does so; it promotes the decomposition of animal and vegetable remains; destroys and converts into manure vermin and weeds; and preserves vegetation from the injuries arising from sudden transitions of temperature, salted soils always freezing more slowly than any

[1] Sir H. Davy thinks it not unlikely that the same causes influence the effects of salt as those which act in modifying the operation of gypsum. Most lands in this island, particularly those near the sea, probably contain a sufficient quantity of salt for all the purposes of vegetation; and in such cases the supply of it to the soil will not only be useless, but may be injurious. In great storms, the spray of the sea has been carried more than fifty miles from the shore; so that, from this source, salt must often be applied to the soil. He has found it in all the sandstone rocks which he has examined, and says that it must exist in the soil derived from these rocks. It is a constituent, likewise, of almost every kind of animal and vegetable manure.—*Lectures*, p. 339.

others. The application of salt likewise renders land more capable of absorbing moisture from the atmosphere, a fact which constitutes by no means the least of its advantages.

It is not certain that the best way to use salt is to use it alone. We incline to the opinion that it should always be mixed with other substances, as guano, nitrate of soda, lime, soot, coal ashes, &c., &c.

Mr. Sinclair says, 'Salt seems to lessen the quantity of straw, but to increase the weight of grain.' The following table contains the result of his experiments, made at Woburn in 1818–19, on a sandy soil; the plots were each thirty-six feet square, and the wheat drilled in in November, and reaped August 2nd. (*See table on next page.*)

Salt is better calculated for light, sandy, well-drained soils than for clays and heavy, wet, cold lands; and the quantity used is, from eight bushels per acre to as much as twenty, or even forty, which latter quantity has been used, and with advantage, for cleansing fallows, destroying coarse herbage, rushes, &c., and killing weeds. Salt has been applied to wheat, oats, and barley both as a top-dressing and incorporated with the soil; also to potatoes, turnips, and mangold wurzel with manifest advantage, increasing both the amount and the quality of the produce; it likewise benefits clover and grass lands, whether irrigated or not. As much as 30 cwts. per acre has been applied to meadow land with success, but 10 or 12 cwts. is the average quantity. All light soils are benefited by it, especially if they contain vegetable matter; cold heavy land, on the contrary, is rather injured by the application of salt.

Dissolved in water, salt is an excellent preventive against smut, mildew, rust, blight, and all kinds of vermin.

An excellent manure may be made by taking equal portions of salt and lime, where they can be conveniently procured, and placing them in many successive layers, one over the other, those of salt being watered to incorporate them with the lime, and suffering them to remain undisturbed for a week, after which they should frequently be well incorporated with each other, by stirring and turning, and kept damp, but not wet. Some, however, recommend that the mixture should be kept perfectly dry, while others assert that if kept dry the lime and salt might as well be strewn separately on the soil; at any rate, the heaps must be protected from rain, as much wet will wash away the salt. They should not be used for two or three months, for if applied to the soil before decomposition has taken place, a process which usually goes on but very slowly, this manure will be injurious rather than beneficial.

Equal parts of salt and soot may also be advantageously mixed together as a manure for root crops, and have been found exceedingly advantageous to potatoes, parsnips, and carrots, and also

Kind of Manure and Mode of Applying it	Manures, omitting fractions Quantity per acre				Produce of wheat per acre	
	Dung in tons	Salt in bushels	Lime in bushels	Oil-cake in bushels	Bushels	Weight of a bushel
						lbs.
Spit manure applied before sowing seed .	45	...	...	...	49	$57\frac{3}{4}$
Salt and spit manure dug in, salt mixed with the seed .	45	44	...	...	75	58
Salt mixed with the soil, four inches deep, before sowing	...	44	...	...	91	59
Salt ditto ditto . . .	...	$5\frac{1}{2}$	...	...	77	59
Salt sown with the seed. . .	...	$5\frac{1}{2}$	...	...	73	57
Salt combined with manure dug in four inches deep .	45	$5\frac{1}{2}$	...	...	75	$52\frac{1}{2}$
Salt and manure, salt sown with seed, manure dug in . . .	45	$5\frac{1}{2}$	...	...	95	59
Salt and manure, salt applied to surface.	45	$5\frac{1}{2}$	...	...	82	$57\frac{1}{2}$
Salt simply applied to surface . .	...	$5\frac{1}{2}$	...	...	60	55
Salt and manure, salt applied to surface. .	45	44	...	...	55	$53\frac{3}{4}$
Salt simply applied to surface . .	...	44	...	...	77	56
Salt and lime mixed and applied with seed	...	$5\frac{1}{2}$	121	...	66	$56\frac{1}{2}$
Salt and lime mixed and applied before sowing	...	$5\frac{1}{2}$	120	...	68	$56\frac{3}{4}$
Salt and lime mixed and applied on surface	...	$5\frac{1}{2}$	120	...	64	56
Lime applied with the seed .	...	...	120	...	53	$52\frac{1}{2}$
Lime applied to the surface .	...	...	120	...	57	$54\frac{1}{2}$
Salt, lime, and dung mixed, and applied as manure . .	90	$5\frac{1}{2}$	120	...	62	$56\frac{1}{2}$
Long dung dug in as manure. .	41	...	...	...	71	$56\frac{1}{2}$
Salt and long dung mixed and applied as manure	41	22	...	...	71	$56\frac{3}{4}$
Lime and long dung ditto ditto .	41	...	120	...	54	57
Salt and long dung ditto ditto .	41	44	...	...	...	56
Oil-cake mixed and applied with seed . .	...	...	...	$5\frac{1}{2}$	48	56
Oil-cake applied as common manure .	...	...	...	$5\frac{1}{2}$	73	60
Oil-cake and lime applied as common manure	...	...	120	$5\frac{1}{2}$	$74\frac{1}{4}$	$56\frac{3}{4}$
Salt and oil-cake mixed, and sown with the seed	...	$5\frac{1}{2}$	...	$5\frac{1}{2}$	$60\frac{1}{4}$	52
Salt and oil-cake mixed, and applied as manure . .	...	$5\frac{1}{2}$	...	$5\frac{1}{2}$	$74\frac{1}{2}$	58
Salt, oil-cake, and manure, applied as manure	90	$5\frac{1}{2}$	...	$5\frac{1}{2}$	$74\frac{1}{2}$	58
Salt, oil-cake, and manure, the salt and oil-cake sown with the seed, the manure previously dug in	90	$5\frac{1}{2}$	...	$5\frac{1}{2}$	$55\frac{1}{2}$	$55\frac{1}{2}$
Salt, oil-cake, and lime applied as manure	...	$5\frac{1}{2}$	120	$5\frac{1}{2}$	71	$51\frac{1}{4}$
Salt, oil-cake, and lime sown with the seed	...	$5\frac{1}{2}$	120	$5\frac{1}{2}$	$55\frac{1}{4}$	$55\frac{1}{2}$
Salt, oil-cake, and lime applied to the surface	...	$5\frac{1}{2}$	120	$5\frac{1}{2}$	66	58
Salt applied to the soil in the preceding spring	...	62	...	...	$44\frac{1}{4}$	$57\frac{1}{2}$
Salt applied to the soil in the preceding spring	...	31	...	...	$26\frac{1}{2}$	$47\frac{1}{2}$

for wheat. About twelve or fourteen bushels of this mixture, ploughed in, is the ordinary quantity applied.

11. *Saltpetre*, or *nitrate of potash*, has been much recommended as a manure for wheat, barley, oats, turnips, tares, clover, and grass. It appears to be most valuable on light arable soils, but has been used with considerable advantage on gravels and sands. The quantity applied rarely exceeds one cwt. per acre, or one and a quarter. As a top dressing for wheat and grass crops it is very beneficial, and should be applied as early in the spring as possible, especially to grain crops, as it is destructive to vermin. Prof. Johnson, in his scientific and valuable work,[1] which should be in the hands of every practical agriculturist, says, 'In warm dry seasons saltpetre may be readily and economically generated by a very simple process; viz., merely by mixing in earth heaps decomposing vegetable matters, as weeds, fern, turf, peat, &c., with a moderate proportion of calcareous earth, as lime, chalk, or marl, &c., and allowing the whole to remain in a dry state during the summer months. By this means saltpetre is gradually formed, especially if the mixture is protected from rain, and the process will be much promoted if access to the atmospheric air is assisted by turning the mass over occasionally, and forking the surface of the heap.'

12. *Nitrate of Soda* is a manure which has only of late years come into notice, but is now *most* extensively used. The chief part of that which comes to our market is imported from Peru.

Nitrate of soda appears to have been used on almost every variety of soil, and with various degrees of success. For some crops it is superior to saltpetre; of these are carrots and barley. For the oat crops it seems to be specially valuable. On light, dry, hilly land, and often on gravelly soils, it has produced very good effects; to clays and heavy lands it does not appear so applicable. There is much yet to be learned with regard to the proper application of it. The quantities hitherto used have been from 1 to 2 cwt. per acre, but there is little doubt that less than this would, if incorporated with other fertilising matters, be productive of equal benefit. Its surprising effects on grass lands are generally acknowledged. It is a good plan to mix it for such lands with salt, soot, and coal ashes.

[1] 'On Fertilizers.'

CHAPTER IV.

ON LIQUID OR FLUID MANURES.

FLUID manures may be said to comprise *water*, *mud*, *urine*, and, in fact, all those liquid matters which are or may be profitably employed in the manuring of land.

The best methods of employing *water* for this purpose have been stated in a former part of this work, as well as the advantages resulting from *warping* land. Here, however, we would observe, that *flax* and *hemp water* promise to be useful fluid manures. It is noticed in Yorkshire that the grass grows doubly where flax is grassed, which shows that all the putrid water of the pits should be used as manure. Indeed, all putrescent fluids, as well as animal substances, are found to possess fertilising properties; and, therefore, wherever convenient ponds or reservoirs are on a farm, one at least should be half filled in summer with green weeds, for the sake of the putrid water which would soon be the result.

The water flowing from gas-works, or *gas*-water, as it is sometimes called, if mixed with an equal quantity of pure water, has been found to be an efficient fertiliser of pasture land; it must not, however, be used undiluted, or it blights the sward.

With regard to *mud* (which term includes the sweepings of streets and roads) rendered fluid by rains, and the miry sediment found at the bottom of ponds, ditches, &c., all these, and especially pond mud, if there is a stream running into the water, will never fail of proving good manure, when used with judgment. The best mode of employing it is as follows:—

As soon as the mud is dry and sufficiently hard to split, it should be turned over; and at the end of three or four weeks an equal quantity of chalk or marl should be mixed with it; the chalk being either carried to the mud, or the reverse, as convenience or other circumstances may require. If lime can be had at a cheap rate, the addition of one-fourth part of it to the mud will prove of great benefit. The whole should be well incorporated, and allowed to rest from June (the usual season for this work) until September, when it should be again turned over, and spread upon pasture or meadow land in October.

The best mud for agricultural purposes is that taken from ponds which have received the draining of farm-yards; to which may be added the scourings of old ditches, that chiefly consist of decayed vegetable matter, and the sweepings of the London streets; both of these, however, require to be mixed with horse-dung, in order to promote fermentation, before being spread upon the land. Thus prepared, mud forms a good top-dressing for grass lands; but it should on no account be spread in too great quantities, or too thickly at one time; otherwise it will retard the growth of grass, and consequently prove detrimental, rather than of service, to the ensuing crop. As much as ten or twelve loads per acre, however, are said to have been carted on lands with the most beneficial effects. This species of manure is much inferior to well-rotted dung—the produce of the farm-yard—and may often be mingled and incorporated with this latter into a kind of compost with considerable advantage. It forms an excellent bottom for manure pits or urine tanks, absorbing and retaining the moisture and gases. Mixed with lime, too, it has been found efficacious.

We have already adverted to the liquid manure which is wasted in most farm-yards—the urine of the various animals, the juices which ooze out, or are washed out by rain during the process of fermentation in the dung-heap, or which filtrate through the litter in the fold, and are suffered to run off into ditches or drains and be lost. What is fermentation but the process of breaking down and rendering soluble the fibres and integuments of vegetable matters, in order to bring them into a proper state to afford food to plants? Does it not, then, stand to reason that no single particle of manure in which this process is going on should be suffered to drain away, or be washed out of the mass; nay, that even the gaseous particles should be as much concentrated as possible? And is this done? Do we not see the manure exposed to air, rain, and dews in the yards? do we not see it then carted to some convenient spot by the roadside and again exposed, and its richest juices trickling away into some neighbouring ditch? While fertilising treasures are thus wasted, the farmer spends his money on foreign or artificial manures, unobservant of the loss and deterioration taking place under his very eyes.

Town Sewage.—The agitation which has been for some years carried on as to the use of the liquid drainage or sewage fluid for agricultural purposes is doubtless familiar to many of our readers. There can be no doubt of this, that this liquid sewage does contain fertilising materials of no small value; but, on the other hand, it is also true that these are mixed with such large quantities of water—in the normal usual condition of the sewage—that very great difficulties are thrown in the way for the economical application of it to agricultural lands. So great, indeed, are these difficulties that, with only one or two isolated cases here to be noticed, the utilisation of town sewage has not yet been carried out on the extensive scale that some authorities maintain it should be. As neither the scope nor the space of this work permits of the subject being gone into in detail, we may be permitted to refer to a work in which we consider its whole bearings, entitled 'The Utilisation of Town Sewage, Irrigation, and the Reclamation of Waste Land,' forming one of the Rudimentary Treatises issued by the publishers of this work. Meanwhile, we glance but briefly at some of its leading features. As to the composition and value of town sewage as a manure, there have been many estimates sent forth of late years; some of these are considered too high, others too low, according to the opinions held by the various authorities promulgating them, as to the 'town sewage question,' *pro* or *con*. The fertilising value of sewage arises chiefly from the human urine it contains, and the excreta of the population, which are assuredly of themselves very valuable, and may be set down at 20*s*. value per annum per head of the population.[1] But, then, all this fertilising material is diluted with such enormous quantities of water—the product of our modern town tubular drainage system—that its value is very much reduced. Twopence or 1¾*d*. per ton may, however, be set down as the value of town sewage, while the value of Peruvian guano, with which it is always compared, is some 12*l*. 10*s*. or 13*l*. 'But the value of a manure,' as we have elsewhere remarked, 'is, however, regulated by other considerations, of which the most important is the degree of its concentration. This, indeed, decides the value of a manure to the farmer; for the more fertilising substances in a given bulk of manure, the cheaper is it conveyed from the depôt of its sale to the farm where it is used. A manure, for instance, costing 10*l*. per ton can be conveyed into the country at a cost of one-tenth of its value; but the cost of conveying a manure costing 1*l*. per ton is raised to 100 per cent. of its value, that is, the carriage would cost as much as the material. It is clear, therefore, that the more concentrated a manure is, the cheaper it is to the farmer. But when we consider that it takes 1,500 tons of town sewage to give fertilising matter equal to that afforded by the use of one ton of Peruvian guano, it will be evident that a most important element in the solution of the problem of how best to utilise our town sewage comes thus into play, and an element most difficult of solution. Indeed, it may be truly said that the whole subject turns upon this point; on all hands it is agreed that town sewage does possess a certain value, although that may be set down as considerably less than the exaggerated estimates promulgated by some, as, for instance, 1*l*. per head of the population per annum; but the difficulty to be got rid of is, whether it can be conveyed to the land where it is to be used at a cost which will repay the outlay. Mr. Chadwick, the great advocate of the liquid distribution system by means of pipes, estimates

[1] Dr. Voelcker, however, estimates them at 6*s*. only per head.

the cost of conveying sewage to a distance of from ten to fifteen miles, and to a height of 150 feet above the level of the sewer from which it is taken, to be $2\frac{1}{2}d.$ per ton. The same authority puts it in another way: thus, if a ton of any solid manure cost 15*s.* to convey it to a certain distance, then 72 tons of liquid sewage can be conveyed the same distance for the same money. Much, however, depends upon the manurial value of the 72 tons of the sewage; for it is quite possible that the fertilising matter of the 72 tons might not be equal to more than half the value of the one ton of solid manure; so that 150 tons nearly of the liquid would be required—a very important difference in the calculation. Mr. Lawes thus disposes of the difficulty here raised:—"If the 72 tons of sewage so delivered to him for 15*s.* were to be in the state of dilution which existing facts led him to think it probably would be, it would contain only about seven-eighths of the average annual excrement of one person, which, allowing liberally, he had valued in the solid form at 6*s.* . . . the extra cost of 9*s.* or 10*s.* would be paying rather dear for the solution of 5*s.* to 6*s.* worth of the manure." There can be no doubt of this, that if liquid sewage could be conveyed to the land at the rate at which Mr. Chadwick states that it can be conveyed, and that it is of so high a fertilising value as he states it to be, so that he could supply, at the rate of $2\frac{1}{2}d.$ per ton, sewage in 12 gallons of which there would be fertilising matter equal to the excretion of one individual of the population, there would be no difficulty in getting it rapidly disposed of. But this cannot be done; at least, that it has not yet been done, we think all experience goes to prove.' As to the future prospects of the *general* utilisation of town sewage, the following, from the pen of a well-known writer, may perhaps afford some index:—'The true way to obtain a full profit from sewage is to apply it to light and free soils, which can be had for about nothing; to soils, moreover, which present sloping surfaces, over which the stuff may pour, and, possibly, also to apply it in a putrid state, containing its elements in a condition in which they are at once ready to feed both the roots and leaves of the plants among which it flows.'

The modes of applying liquid town sewage hitherto adopted resolve themselves into two: *first*, application by open channels, irrigation fashion, the water flowing along these channels discharged by them over sloping surfaces by natural gravitation; and, *second*, by having pipes laid under the soil at intervals on the land, into which the liquid is forced, either by steam power or by pressure from a high-level reservoir, and from which the liquid is taken and distributed over the land by hose and jet. The most celebrated example of the first mode is that at Craigentinny meadows, near Edinburgh, of which the following is a description, taken from the 'Agricultural Gazette,' and furnished, as we believe, to its pages by its able editor, Mr. J. Chalmers Morton, who has paid much attention to the whole subject:—

'The streams which wash out Edinburgh are used for the irrigation of grass lands at Craigentinny, Lochend, Grange, besides certain meadows west of the town.

'The meadows at Craigentinny lie to the NE. of Edinburgh, at the foot of the valley which drains two-thirds of the ground on which the town stands. They are 190 acres in extent, of which 40 acres or thereabouts lie close along the shore, a narrow strip between it and the coast railway. The land is for the most part a free soil—next the sea it is a light sand—in places inland it is stiffer. It is a fan-shaped plot; the water enters at the handle, and, travelling along the outsides, is diverted to one or other of the "panes" between the outward artificial channels and the old watercourse. It is let in pieces varying from a rood to an acre in extent, and has this spring fetched prices varying from 20*l.* up to 41*l.* 10*s.* per imperial acre.

'The sandy piece next the sea lets for 20*l.* to 25*l.* per acre, the inferior produce here being due partly perhaps to an original inferiority of soil, but chiefly, we imagine, to the fact that the water which pours over it has been used, all of it once, some of it twice before. At least half of the meadow is thus irrigated with tail water, and indeed it may be said that all of it is to some extent thus watered; for the Lochend meadows lie higher up the stream, and a quarter of the "Foul Burn" is diverted for use there, rejoining the main stream after having left much of its fertilising contents behind.

'The lighter portions of the land yield the earliest swathe and come quickest to the scythe again. We saw a swathe cutting, on April 23, which must have weighed at least 10 tons per acre. There is, we believe, nothing elsewhere like it known to English agriculture. This great quantity is the result, not of a very tall, but of a very thick growth. The blades of grass are not more than 12 or 14 inches long, but they stand so thick, and the stem of each is so soft and succulent and large, that the lower part of each is blanched, and the stubble left is white.

'In a day or two, or immediately after the whole grass of any plot is taken away, the water is let on. The whole, as to arrangement, is a rough specimen of the ordinary ridge and furrow plan of irrigation, and the supply seemed to be ample according to the practice of the ordinary water meadow—forming a thin skin of flowing water, visible everywhere on the surface of the land. A stream 2 feet wide and 1 foot deep, running at the rate of a mile an hour, was in one place supplying what we judged to be an acre of the land. This corresponds to 10,000 cubic feet per hour, and as the supply is kept on for about five hours at a time, it is equal to 1,200 to 1,400 tons per acre for a dressing. Such a dressing is generally all that the plot receives until the next cutting; but as during the season of growth all the stream is kept in use, excepting at flood times,[1] and all is watered in rotation, it may happen that another dose is available for the same land during the four to six weeks' interval which elapses before the swathe is again ready for the scythe. If there should be an opportunity of giving it a second dressing within three weeks, or at least a fortnight of that time, the opportunity is taken.

'From three to five cuttings are taken during the year—the first is not the heaviest, and indeed the cow-feeders who hire the plots are tempted to take the earliest earlier than they should, both for the sake of an early bite of grass, and in order that a fifth swathe may be taken in October. Putting four cuttings as the average, and remembering the water is laid on to some extent during the winter season, it is not too much to estimate that every acre of the Craigentinny meadow receives 10,000 tons of sewage during the year. For this an average produce of at least 25*l.*, or six-tenths of a penny per ton, may be obtained; and as this (half the meadow being watered with tail water) is obtained a second time, the whole worth extracted from the Edinburgh sewage here is rather more than $1\frac{1}{4}$*d.* per ton. As an additional illustration of the experience here, it may be supposed that the waste of 80,000 persons, probably imperfectly gathered, however, is here utilised, and as the Lochend and Craigentinny lands amount to about 230 acres, that is at the rate of more than 300 persons per acre!

'As to the cost of the operation—taken in one view it is hardly anything; the sewage is obtained for nothing, the work of management does not cost more than 20*s.* a week at Lochend, and at Craigentinny it is managed by two men, and probably costs under 100*l.* a year. But if any company or new proprietary proposed to undertake the work, they could not purchase the apparatus (the estate) under 500*l.*, perhaps 600*l.* per acre, which is 2*s.* or more for every ton of the swill which is turned to account upon the land.'

An important exemplification of the underground pipe system, is to be seen at the farm of Mr. Alderman Mechi at Tiptree, who is a most enthusiastic advocate of the use of liquid sewage.

Mr. Mechi collects it in tanks, and, by means of a force-pump worked by steam, sends it through clay pipes to the fields. There

[1] One man manages the distribution of the water, but he has an assistant, so that between them a watch night and day is kept, especially for the diversion of a sudden flood, which is at once turned to waste; others are employed at busy times, and especially in cleaning out the water-carriers.

are other examples of pipe irrigation, for an account of some of which, see those works already alluded to.

The following from 'British Husbandry,' by Mr. J. Wilson, as to the liquid sewage question, will be valuable, as putting its agricultural merits before the reader—all the more valuable, coming, as it does, from the pen of so well-known a practical authority:—

'The entire annual cost of applying manure in this manner is stated to amount to from 10*s.* to 14*s.* per acre for the whole extent of the farm; now this would suffice to provide annually from 1 to 1½ cwt. of Peruvian guano (even at its present high price) for every acre of the farm, or from 2 to 3 cwt. per acre, if applied, as the liquid is, to the portion under green crop only. The stated application of such a dressing of guano, in separate portions, and during showery weather, will be found to yield results little inferior to those obtained by the use of liquid manure. To do this requires no costly apparatus, or permanent sinking of capital, and its application can be desisted from at any time when found unremunerative. The adoption of this plan of applying the liquid manure of the farm necessarily demands that the whole system of management be accommodated to it. In order to furnish this liquid manure, the whole of the green crops must, summer and winter, be conveyed to the homestead, and there consumed in such a manner that the urine and dung of the animals fed upon it may be scoured into the tanks. It is no such easy matter to replenish these tanks as some persons seem to think. When cattle are housed in boxes or properly protected yards, the whole of the urine is absorbed by the litter, and goes to the field in the dung-cart. This is certainly, then, a more expensive way of conveying it to the field than by pipes. But then, as in the new system, the urine, &c., is diluted with at least three times its volume of water, there are four tons of manure to convey on the one plan for one on the other. Even where pipes are used, all the litter, and a portion at least of the dung, has still to be carted out, so that no claim of a saving of carriage can validly be put forward on behalf of this system; but the merits must be grounded solely on the superior efficacy of manure, when applied in a liquid instead of a solid form.

'In the case of dry and loose soils, the consuming of the turnip crop by folding sheep upon it, has hitherto been regarded as at once the cheapest way in which it can be converted into wool and mutton, and the land consolidated and enriched, so as to fit it for producing grain and other crops. On tenacious soils, and in a moist climate, which is quite the case at Myremill, it is certainly impracticable to pursue this system in winter. It is perhaps also the case that sheep are healthier, fatten more rapidly, and yield more wool, when fed under cover than when folded on the open turnip field. Admitting all this, however, we are disposed to think that these benefits are better secured by Mr. Randell, of Chadbury's, plan of littering the pens with burnt clay, which keeps the sheep clean, and their feet in good order, and, when mingled with their urine and dung, forms a most valuable manure for any kind of land. Were this carried out by means of moveable pens, which could be erected and easily shifted from place to place in the turnip field, the carriage of the turnips and manure would be greatly reduced, especially if accomplished by means of the portable railway.

'In the case of dairies near towns, where the cows are largely fed on brewery or distillery offal, and other purchased food, the circumstances are totally different from those of ordinary farms depending solely on their own resources. The liquid manure that would otherwise run to waste, when thus applied, is so much clear gain, in so far as the value of the increased produce exceeds the cost of application. It may form a wholesome caution to some persons to mention here that, notwithstanding all that has been written about the success of the spirited operations at Port Dundas, we were told by Mr. Harvey, that so dubious is he still about it, that if the thing were to do again, he would rather keep his money in his pocket, and let the urine run into the sand as formerly. If there is doubt, even in such a case, how much more when the manure must virtually be purchased? And this leads us to remark, that we have better hopes of the ultimate success of this plan of manuring, when it is restricted to the application of the surplus liquid manure of the homestead to some piece of meadow near at hand, supplementing this supply, when necessary, by dissolving guano in water, and sending it through the pipes. These remarks apply even more strongly to the sewage from towns. The liquid, in this case, is highly charged with fertilising ingredients of the most valuable kind, seeing that it consists largely of night-soil from a population consuming much animal food. With few exceptions, this valuable liquid, which flows in such quantities from all our towns, is not only utterly lost, but is a grievous nuisance by polluting our streams and generating disease. In applying it as manure, the expense lies entirely in providing and working the necessary apparatus. In such cases, then, with an unfailing supply of highly fertilising liquid, costing nothing to begin with, there is every inducement to put into operation any plan by which it can be economically applied to field crops. The enhanced value of green forage in the vicinity of towns is an additional motive for attempting this. The profitable disposal of town sewage in a way neither injurious to the health nor offensive to the senses of the community, is, however, a problem yet remaining to be solved.

'The ingenuity and enterprise displayed by Mr. Kennedy and others, in their endeavours to cheapen by this means the cost of farm produce, and the promptness and untiring patience with which they have shown and explained their proceedings to the unceasing stream of visitors which the novelty of the operations has attracted from all parts of the kingdom, and even from foreign countries, are altogether so admirable and praiseworthy, that it requires no slight effort to speak of them otherwise than approvingly. The confidence with which various influential parties are proclaiming the complete success of this scheme of irrigation, and recommending it for general adoption, seems, however, to require that those who have examined it, and arrived at an opposite conclusion, should publicly say so.

'It is unreasonable to expect that private parties are to divulge their whole business affairs, and yet, without a full Dr. and Cr. account for some ordinary arable farm treated on this system, it is impossible to arrive at a sound judgment on its merits. Until this can be done, it would be better to abstain from publishing partial statements, which tend only to mislead the public mind. We offer these remarks in no spirit of hostility to this new system of farming; we shall rejoice unfeignedly to find that our opinion of it is erroneous, and that it really warrants the sanguine expectations which some parties entertain respecting it. We simply maintain that as yet the case is "not proven," and our counsel to those who are disposed to try it is, not to embark in it to an extent that would embarrass them, if, as we fear, it should prove a failure.'

We should not dismiss the subject of town sewage without adverting to the plans proposed by which its *solid* portions have been attempted to be taken from it, so as to form a solid manure, to be applied to the land like other manures. This has been attempted in a variety of ways, the general principle being to treat the liquid with some foreign material to act as a deodoriser, and a fixer of the ammonia in a solid portion of the sewage. The substances proposed and employed have been very numerous; charcoal, lime, salts of ammonia, superphosphate of magnesia, and the persalts of iron have all been tried, of which the latter, we believe, is the most successful. The mode, however, of using the solid portions of sewage has not been successful, nor is it likely to be when we know that five-sixths of the fertilising substances of sewage are dissolved in it, held in a state of suspension, and cannot, by any method yet discovered, be precipitated along with the solid flocculent portion of the sewage. For a full account of the best known of these, such, for example, as the now somewhat celebrated 'A B C' process, we may be permitted to refer to our work, 'Sanitary Science,' published by Collins, Sons, and Co., Glasgow and London.

CHAPTER V.

ON COMPOSTS.

NOT many years have elapsed since those manures which result from combinations of different materials or substances have become known to the agricultural world, under the names of *composts*. Of their utility no doubt can exist, for it has been demonstrated by experience that the mixture of such matters as are calculated mutually to act upon and chemically to combine with each other, and are adapted to the different kinds and states of the land, and the requirements of the crop, are eminently useful in increasing the fertility of the soil, as well as accelerating the growth of vegetables.

'The absolute value of a compost,' says Mr. Foot, in his Prize Essay on Manures, 'depends on the amount of food it is capable of furnishing to plants, its value in relation to a particular soil, and also on the measure in which it is calculated to affect the texture of that soil. The question of profit in making composts at all depends upon whether, by their means, the farmer can incorporate any valuable animal, vegetable, or mineral substances with his soil, which he might not otherwise be able to appropriate to his crops with equal benefit and at the same expense.[1]'

The best composts are those which are made from a mixture of animal substances with earth. Formerly it was the practice to make composts in *layers*, by which means much of the strength of the manure was necessarily wasted before it could be spread on the land. It is, however, a more economical method first to mark and dig out the spot or yard, next to cover its *concave* bottom four or five inches deep with very tough clay, and then to line this stratum with strong gravel, well beaten in, in order to prevent its removal when the manure is taken out. Into this spot should be conveyed a quantity of earth, taken either from the top or under surface, and of a quality adapted to the land to be manured. For compact, stiff, clayey soils, it should be *sand*; and for open, porous, sandy ground, *clay*. All the weeds about the farm should be cut down before they seed, and these, together with all the succulent plants which grow in ditches, or by watercourses, and the deciduous leaves of trees, should be gathered into the yard, where the putrefactive process may be completed by the aid of lime, in the manner already mentioned. After thoroughly breaking the several materials, such as sawdust, offal, bones, waste or refuse fodder, and, in the cider counties, the refuse of apples and pears after making cider and perry, they may be laid in heaps

[1] Farmer's Calendar, p. 98.

around the space marked out for the compost heap, a man being placed between each two heaps to throw the manure upon that space. Thus the compost heap will be shortly raised to the requisite height; and the various ingredients being thoroughly mixed, the whole will ferment, and in the course of two months will incorporate as fully as the same manures disposed in layers in the common method. It is to be observed, that although autumn is stated as a proper season for making composts, on account of the weeds and leaves, yet this business may be carried on at other times in the year. Composts thus prepared ought not to be kept too long before they are spread upon the land, as they will waste considerably, and the most fertilising particles be evaporated.

For composts thus made, one thorough mixing or turning will be fully sufficient; for frequent turnings weaken them as a manure by checking the fermentation of the mass. Should, however, such fermentation subside too early, holes may be made in the heaps with a pole, from the top nearly to the bottom, into which may be thrown urine, or the fluid drainage of the farm-yard; and, as the water drains from the heaps, it should be carefully collected by means of wooden troughs, or gutters well paved with finely-sifted gravel, or with lime and gravel mixed with boiling hot lime-wash, and spread with a trowel; and by means of these conveyed to a tight barrel, or hogshead, sunk in the ground, or a tank, whence it may be again thrown upon the heap at a leisure time. In this way, also, the fertilising liquor will be prevented from losing its properties by evaporation.

Ashes and muck, in the proportions of 4 to 5 bushels of the former to a common load of the latter, are said to make a very valuable compost. There is a series of experiments narrated in vol. xxi. of the 'New England Farmer,' which demonstrates the almost incredible benefits of this mixture. Where the muck is fine and powdery, the matters may be mixed together and applied to the soil at once; but if the muck is strong and fibrous, some time must be allowed for decomposition—the latter term being in America employed to designate the mud of long-established ponds, fish ponds, &c.; the term in this country meaning common farmyard dung or manure. In America 'muck' is the mud of ponds, &c.

Peat prepared with lime only, forms an excellent compost manure for wheat crops, when applied judiciously.

Salt and lime, in the proportion of 2 bushels of lime to 1 of salt, or in equal portions, is a very powerful mixture. It should be applied broadcast in March and April, at the rate of from 40 to 60 bushels per acre. As a dressing for spring corn it is most efficient.

Pond mud, ditch scrapings, road scrapings, &c., mixed with salt and lime, in the proportion of a bushel of each of the latter to a cubic yard of earth, form another enriching compost.

The use of manure manufactured by means of compost heaps is much recommended on strong retentive or clayey soils.

Mr. Dixon, in the October number of the Journal of the English Agricultural Society for 1839, gives the following account of his method of constructing one of the heaps. He laid out a space of considerable size, and about three feet deep, in the middle of his farmyard, and on this he put a considerable quantity of peat and sawdust, in the proportion of three parts of the former to two of the latter, and to this he regularly conveyed the dung of the cattle sheds, while the urine also was conducted through channels to wells for its reception, one on each side of the compost heap. Every second day, the urine so collected was thrown over the whole mass with a scoop. This was continued for a week.

Another layer, 9 inches or a foot thick, and also composed of peat and sawdust, was added, and on which was thrown, once in every week, from 25 to 50 cwts. of nightsoil and urine. It is better if the peat is exposed to the alternations of the weather for some months before it is brought to the heap, for by these means it loses much of its moisture; charring is a still better preparation. Recently-dug peat possesses a certain acid, which is injurious to vegetation; but that which has been charred or kept and exposed, improves the texture and increases the produce of stiff heavy clays, to an extent that experience alone will determine. Compost, to be ready for the spring crops, should be made up before January; in the summer it takes eight or ten weeks; but the addition of lime, ashes, or matters of a similar nature will always expedite the decomposition. Compost heaps may be raised on different parts of a farm, but are best in the farmyard, where all the urine from the cattle stalls can be employed with the greatest economy; it should, however, never be forgotten, that the urine from animals is, in given weights, far more powerful than their solid excrements.

It matters little how heterogeneous the materials brought together in composing the heap, so that they will chemically combine, and not nullify or dissipate, or set any of the component parts of each other; animal, vegetable, and mineral substances, may be united to lend their aid in fertilising the soil; and the more various the matters, the more rapid and perfect will be the decomposition. The compost should always be sheltered from the rain, otherwise much of its goodness will be washed away.

Another circumstance should be recollected — all manures resulting from putrefying substances should be covered over with the soil as they are carried on to the field, or, in the course of a very few days, the wind and the sun will dissipate a considerable portion of the most valuable ingredients.

Bones dissolved in sulphuric acid to the consistence of cream, and the mixture poured upon the compost heap, will convert all kinds of refuse into a most efficient and powerful mass of fertilising matter.[1]

Finely-pulverised clay may often be substituted for lime with advantage in compost heaps, and there is no substance, unless it may be charcoal, which becomes so valuable when saturated by the drainage of the dung-heap, or by urine.

Mr. Bowley, of Sidington, Gloucester, used gas-tar, and the ammoniacal liquor of gasworks, in compost heaps, thus:—'My usual practice is,' he says, 'to form out my compost heap with long dung three feet thick, to pour the gas-tar regularly over it, and put on another layer of dung or turf, and to throw lime on the top, and allow it to remain in this state two or three months before being turned or touched.'[2]

Gas-tar mixed with fine clay or earth, or with the mud scrapings of roads or ditches, has been recommended as an excellent preparatory manure for the wheat crop; it must be spread evenly over and ploughed into the ground at least six months before the wheat is sown.

The mixture of salt with compost heaps, whether dung, or refuse, or vegetable matters, has been found very advantageous, as it tends rapidly to decompose these matters, and also benefits the land to which it is afterwards applied.

We recommend, as a general rule, that compost heaps should be sheltered from the rain, and likewise covered with a layer of earth, or in some other way kept as much as possible from contact with the atmosphere. Likewise that, in forming them, regard should be had to the nature of the soils and crops for which they are destined, and also to the chemical effects of the substances on each other.

It is impossible, within the limits of this work, to notice the different varieties of manufactured manures, of which there are now many offered to the public.

[1] Gardener's and Farmer's Journal.
[2] Farmer's Magazine, vol. ix. p. 197.

CHAPTER VI.

ON THE PRESERVATION OF MANURES.

AS manures are of such indispensable necessity to the farmer, and dung is in general so important a manure, every possible method should be taken, not only to prevent it from being wasted, but also to improve it both in quality and quantity. It cannot be too often repeated, that in no way are manures more wasted than by constant exposure to the sun, air, and rains; hence various expedients have been resorted to in order to prevent this loss. Among these are—the mixing it with dry earth, pulverised or burnt clay, charcoal, dry or charred peat, or other absorbent substances, which will, in a great measure, prevent this inconvenience; the erection of sheds over dung-heaps; the covering of these heaps with turf sods (the *grassy side* being *downwards*), when the dung is to be kept until it is old; and the formation of tanks or reservoirs.

The farmyard has been generally considered the most convenient place for forming *dung-steads*, *dung-sluices*, *dung-pits*, or *dung-meers*, or *mixen*, as the repositories for this useful article are variously termed. This, however, has arisen rather from indolence than expedience, for not only is the mound thus raised, often in view of the dwelling-house, unsightly and offensive, but it is inconvenient from the space which it occupies when cattle are foddered in the yard, as well as prejudicial to their health. Dung-heaps should be formed on some waste spot out of the yard, but as near to it as possible, when it is not deemed advisable to place them in the fields on which the manure is intended to be laid. For middle-sized farms one heap may suffice for the proper management of dung, but two are always preferable, and on larger holdings even more will be necessary.

Mr. Prideaux recommends: 'a staunch pit, rather deep than wide, being made to receive the drainings, a bed of humous earth may be first laid down inclining towards the pit. Upon this spread hard stalks, &c., which are slow to decay, then a layer of dung mixed from the cow-houses, stables, and sties, sprinkled with salt; next a layer of vegetable matter, as weeds, roots harrowed up, hedge clippings, fallen leaves, and other recent herbage, of the same thickness, dusted with slaked lime; upon this a four-inch layer of peat, bark, sawdust, sods, ditch or pond scourings, scrapings of the roads, or ashes; then beginning again with the salted dung, and adding the vegetable and humous layers until the heap is four or five feet high, always keeping the lime from coming in contact with the dung. Then pour over it the liquid drainage until all is soaked through, and continue to repeat the layers, pouring the drainage upon every four feet of thickness. As the fluid passes through, it will dissolve the salt and lime, and carry the juices throughout. Slope the top of the heap, and cover it with straw to throw off rain. Have gutters to carry off the fluid to the liquid manure tank, and in six months the heap will be ready for use.'

A slight shed thrown over the dung-stead will prevent too much exposure to the sun and air, as well as the rain, and thus effectually prevent any of its valuable particles from being dissipated.

It is right, however, to say that this point of covered dung-sheds is by no means a settled one with agriculturists. The necessity for keeping the manure in a moist condition urges some to avoid placing a roof over the shed. While it is necessary for the economisation of farmyard manure, to save it from the washing influences of rain, exposed in heaps as it too often is, it is also equally essential that it shall not be kept *without* moisture—a condition of matters which gives us volatile, not soluble products, which is what we require.

The augmentation of manure or increase of its supply necessarily depends upon the nature and the application of the food given to animals. We have already pointed out the various articles of the vegetable kingdom, as well as the artificial foods, that are best calculated for feeding and fattening cattle; and have endeavoured to evince the superiority of *soiling*, both as respects the economical consumption of food, and also the production of manure. The quantity of manure afforded by a farm may likewise be materially increased by having *standing sheep-folds*. For this purpose, in Flanders, the ground is marked out, and spread with dry sand, four or five inches thick; on this are erected slight sheds, in which the sheep are housed at night, a small quantity of fresh sand (for which dry peat, or any of the earthy materials already mentioned, may be substituted) being laid on every evening. This is cleared out once a week, and carried to a dunghill or spread upon the soil. The manure thus procured is well calculated for fertilising almost every kind of ground, and makes an excellent dressing for cold and stiff soils. Dry stable litter, from which the dung has been shaken out, may also be very advantageously used in folds.

It was the opinion of one eminent agriculturist that the most effectual method of obtaining a supply of manure for land situated at a distance from great towns, consisted in raising green crops for the purpose of feeding sheep, bullocks, or other animals *on the* *land.* This he considered to be the only method by which the loss of nearly all their urine and dung could be prevented. He deemed that, under ordinary management, three parts of this manure was lost; but in the soiling of tares, turnips, cole, clover, &c., in the fields, there was no loss, the whole being immediately applied, without the cost of carriage, to the enriching of the soil. It is, however, obvious that much of the fertilising elements contained in these manures must necessarily be wasted by evaporation, and their ameliorating power materially diminished; so that, although the soiling of sheep with turnips may be carried on, and with some advantage, on light lands, on account of the benefit derivable from the treading of the ground, which, on such soils, is of importance to the succeeding grain-crop, yet, after the fullest consideration of the subject, we are decidedly convinced that, if properly managed, stall or stable feeding of cattle and horses is the most effectual mode of obtaining the largest possible quantity of animal manure. Mr. Brown, of Markle, is of opinion that 'if the clover-break were regularly cut with a scythe and consumed at home, perhaps every farmer would manure one-sixth more ground annually than what he is at present capable of doing.' He also states 'that a field of clover and rye grass will feed one-half more beasts when cut than when depastured.'

The following remarks from a paper in the Transactions of the Highland and Agricultural Society of Scotland, by Professor Tanner, on 'The Manure of our Farms,' will be useful in connection with the point now under consideration:—

'All our farm produce may be divided into two classes—viz., corn crops and green crops; and practice has shown that a judicious rotation of these crops favours the productive powers of the land, and it is equally successful in increasing the quantity of our manure; the corn crops yield the bedding for stock, and the green crops their food; both are necessary, and their combined rise is desirable. Presuming, as I shall do for the present, that the object is to produce a large quantity of manure, it is evident that this will be best done by the consumption of roots and hay at the homestead, and the liberal use of straw as litter. Not that, as a rule, you would alter the rotation, provided you have a fair and suitable intermixture of corn and green crops; but whilst the roots grown will to a great degree regulate the quantity of manure made during the *winter* months, by the introduction of such crops as vetches, rape, and clovers, for cutting as fodder for stock in summer, any surplus portion of straw may be converted into manure. Under this system, well carried out, the farm increases in fertility, and thus from its own resources we have the means of improving the quality and general productiveness of the land. When the straw of a farm is abundant, it is often necessary to continue its conversion into manure beyond the period when the roots are consumed; and the use of fodder crops in such a case is very desirable. Should local circumstances render it undesirable to carry out this system, the use of linseed cake, or some similar artificial food, with a smaller proportion of roots, will enable more stock to be wintered, thereby more straw made into manure, and its quality improved; whilst the additional expense for artificial food will be repaid by the stock, if used judiciously. This consideration of the production of farmyard manure, the reader must remember, is totally distinct from an investigation of the question whether or not the roots should be drawn to the homestead or consumed upon the land. I have here simply to consider the best course of procedure when it is decided that manure shall be made at the homestead.

'The reader is doubtless aware that, in the removal of our crops from the land, we take away certain materials which the plant has accumulated during its growth, and thereby diminish its fertility. A part of the organic matter of the crop, and, no doubt, a large part, has been drawn from the air; whilst the residue of the organic matter, and the whole of the mineral matter, has been yielded by the soil. Under a judicious course of farming, the chief portion finds its way back again to the land; but under a bad system the return is not sufficient, and the soil deteriorates in quality. The sale of hay, straw, root crops, &c., and the careless management of dung, are practices which have a tendency to injure the land. The former practices are seldom allowed, unless compensated for by the purchase of manure; but the latter cause of loss is totally unsatisfactory, for, whilst it is a loss to the farm, there is no remuneration for it. If it is desired to raise the fertility of a farm, there is no system more generally calculated to accomplish this result than to establish a rule never to sell stock until fully fattened, nor any other produce except corn, and of this corn to reserve a portion for fattening the stock, or else to purchase food of equivalent value for this purpose. This system, combined with a suitable rotation of well-cultivated crops, and careful management of the manure made in the farm, cannot fail to be productive of a rapid increase in the fertility of the land. As I before said, local circumstances may prevent an entire adoption of this system, but all may derive advantage from it in a greater or less degree.'

Dung-steads may be tended, and the respective manure-heaps augmented at different times, when no other business of greater moment stands in the way. They should be guarded from being torn or spread about by the scratching of poultry or by swine, and therefore, when in or near the farmyard, should be surrounded by pens made of broad deals or hurdles. If the heaps do not ferment, or decomposition does not go on so expeditiously as could be wished, the admission of air will promote it. The admission of air to the dung-heap has been well termed the stimulating of a slow fire, which, if not judiciously controlled by due supplies of moisture, will result in passing into the air a large quantity of fertilising gases.

It frequently happens, however, that fermentation proceeds too rapidly for the purpose of the farmer, and thus some of the most valuable properties of the manure are lost, and the quantity also becomes seriously reduced. In such case the heaps should be immediately turned and mixed with a considerable quantity of mould; and this operation should be repeated often enough to prevent the fermenting process from ever proceeding further than may be necessary for the destruction of the seeds of weeds, and the decomposition of the woody fibre of the vegetable matter contained in them. The better way, however, to check undue fermentation is by pumping on it the contents of the liquid manure tank, which contains the excretions of the stock. This, indeed, is said by good authorities to be the best way of using the liquid excretions of the farm. Where 'fresh' manure, as it is called, or unfermented dung, is required, the more it is compressed in the heap—if 'rotten,' the lighter and more open—the better. How to get these two conditions we have already shown.

The following method of making dunghills, as practised in Middlesex, we give from Mr. Middleton's interesting Survey of that county; and from its judicious arrangement, it has a just claim to the attention of agriculturists. In the first place, all the scrapings of roads, mud of ditches and ponds, and the top-mould of gravel-pits, are spread in the most convenient spots, as bottoms for dunghills. On to these layers is carted all the dung produced on the farm, together with the whole of what can be obtained from London and the various inns on the road, and to these things are occasionally added chalk, ashes, soap-boilers' waste, bricklayers' rubbish, &c. In this state the mass or heap continues until within one month of the time for manuring the land; the whole is then turned and thoroughly mixed together, the larger clods being broken into small pieces, and the drier parts thrown into the middle. In consequence of this management, the mass becomes more intimately blended, and the putrefactive process is completely finished, while the different substances remain in a heap. At the same time, by this method of forming the basis of dunghills, the fertilising liquor which distils during the fermentation and heat that necessarily ensue, is effectually preserved, and greatly contributes to ameliorate the soil. Mr. Thompson, of Kirby Hall, recommends 'to have a pit dug in the earth into which to throw manures; the bottom of the pit is water-tight, and has a slope towards the centre, where a tank is placed, so as to receive the drainings from the manure, which drainage is frequently poured over the manure, in order to keep up a regular but not excessive fermentation.' He has all the vegetable refuse of the farm collected and spread over the bottom of the pit in a layer of six or eight inches thick, and on to this the manure or dung is carted. When the manure is wanted for immediate use, it should be lightly thrown together, and after being well soaked with the tank-liquor, be covered with a thin layer of the soil, to absorb the volatile gases. If it is to be kept six months or more, it should be compressed, and thickly covered with soil or charred peat, so as almost entirely to exclude air.[1]

The most proper situations for dunghills are contiguous to the stables and ox-stalls, to which another may be added near the house and piggery. They may be tended and augmented at odd times, when no other business requiring particular attention stands in the way. The *dung-meer* adjacent to the house, especially, may be easily composed of various rich and fertilising ingredients besides dung. Thus, the scrapings of the yard after rain has fallen may be advantageously thrown in, as also may some of the nearest earth, swamp mud, straw, weeds, the dung of fowls, soot and ashes, shells, lime, and bones, the sweepings of the kitchen, oil dregs, and any fatty matters, woollen rags, bloody water in which meat or fish has been washed, greasy water, suds, ashes, even when the lye has been extracted from them, old useless brine, urine, and in short, any animal or vegetable substance that does not contain too much acid, though even acids may be employed if their properties are counteracted or overbalanced by a sufficient quantity of alkaline substances.

The dung-heap contiguous to the barn or cow-houses may be augmented with some of the nearest soil, mud, weeds, &c.; in every case, however, it will be proper that those ingredients should predominate in each heap which are not only best calculated to ameliorate the land on which it is to be laid, but which will also ferment and decompose, as nearly as possible, at the same time; for otherwise one portion may be losing its most valuable qualities, while another is only slowly proceeding towards decomposition, or the whole process may be improperly checked. Hence it will be necessary to acquire a knowledge of the nature of the various manures, as well as the soils and crops to which they are to be applied; but as this subject has been already discussed, we will not again enter on it. The process of fermentation, however, will not take place so evenly and rapidly as it ought, unless the heaps are shovelled over once or twice in the course of the summer, in order that the various ingredients may

[1] Journal of the Yorkshire Agricultural Society, No. 6.

become more intimately mixed and mellowed, and consequently the sooner fit for use.

It is, lastly, of great importance to have either a pavement or good road all round the farmyard and dung-pit; as farmers suffer more than is commonly imagined by having their carts and cattle straggling through piles of straw, in farmyards where this is neglected. It is also desirable to have two reservoirs for urine, where cattle are stall-fed in any number; as soon as one of these is full, it should be suffered to remain in that state until it becomes putrid, and the other may in the meantime be filling.

'The situation of the heap at the homestead is of much importance, as it is to be used for the same purpose from year to year. It is not, perhaps, advisable that it should be greatly hollowed, unless arrangements are made for conveying any excess of fluid matters to a proper place for their reception. Without a due supply of moisture, a proper degree of fermentation will not take place in the manure; yet, in the case of animals fed on nutritive food, a sufficient supply is always present. In the process of fermentation, too, much of the liquid portion is separated from the stock of manure, which should be conveyed from it, to be otherwise disposed of and to prevent its going to water. Placing the manure heap on an elevation is, however, still more injudicious, as the most valuable parts of it then escape, in all directions, creating a nuisance all around, and being utterly lost and wasted. For the preservation of the liquid matters, then, it is advisable that the surface should be slightly hollowed, and that the soil should be perfectly impervious to moisture, otherwise considerable loss will be sustained by absorption. In the lowest part a grating should be placed, communicating with a pipe or sewer for the conveyance of the urine to the reservoir or liquid manure tank; and, in the event of moisture being at any time required in the heap to facilitate fermentation, it can be easily carried from the reservoir, and distributed over the mass in such quantities as may be required.

'In the management of farmyard manure, it is important to guard against its being much exposed to the weather. The heap should be kept closely together, and the daily additions from the houses regularly placed on it, taking care, as before remarked, that the different kinds of manure shall be adapted to each other, and thoroughly incorporated together, to secure an equable degree of fermentation taking place throughout. Should no further addition be made to the heap for any considerable time before the application of the manure to the land, it will be well to have the whole covered up with earth, in which state it may be kept for a length of time without sustaining injury. But although exposure to the atmosphere is injurious, the access of water from the roofs of the farm-buildings, or other sources, is still more so, as directly carrying away portions of the most important ingredients in the heap. The retention of the fluid matters afterwards but slightly atones for the injurious effects of superfluous moisture being admitted to the heap; there can be no good reason alleged why a portion of the fertilising matters of the manure, and those the most valuable, are to be carried away to be separately applied, even could that be done without any waste being sustained, which certainly is not the case.

'When the manure is stored in the fields, the same precautions are to be observed to guard against exposure to the atmosphere. The successive layers, as brought out, are therefore to be regularly spread over the heap; and after the whole is finished, a covering of earth from the adjacent head-land should be put on it. The size of the heap will, of course, depend on the quantity of manure on the farm, and the extent of the fields to which it is to be applied; but the heap should be only increased in length, the other dimensions being stationary, and regulated by the circumstances of the farm: the height should rarely exceed 5 or 6 feet.

'The presence of air and moisture being essential in the fermentation of manures, it is fortunate that the regulation of the supply of them is within the reach of the farmer, so that he can hasten or retard the process as occasion may require. An excess of moisture is, however, not less injurious than an insufficient supply. When a mass of manure, however rich it may be, has remained for any length of time saturated with moisture, it undergoes such a change that, afterwards, no management whatever can induce the slightest degree of fermentation without fresh dung from the stables being added; and, even when this has been done, the manure will be found to have materially suffered, and to have lost much of its fertilising properties. The management must have been grossly defective, especially as regards the arrangements for economising the liquid portion of the manure, when such an excess of moisture is suffered to be present. Where a proper outlet is provided for the egress of superfluous fluid from the heap, this will never occur; and in every case it will be found to result more from the introduction of extraneous moisture than from any excess of the liquid portion of the manure itself.

'Where manure is stored together in any considerable quantity, a sort of incipient degree of fermentation will take place, even should a sufficiency of moisture not be present; this, however, will speedily exhaust itself. The extent and rapidity with which this will take place is regulated chiefly by the supply of stable dung present in the heap, as it is well known that that rapidly heats even when the moisture contained in it is but little. This kind of fermentation is always injurious to the manure, and is attended by the further disadvantage, that after it has subsided it is extremely difficult to induce it again to take place without the addition of a large portion of fresh dung. The best remedy is, obviously, to add a further supply of moisture—liquid manure, if it can be obtained, or the mixture already spoken of, bones dissolved in sulphuric acid, and add it gradually to the heap, so that it may be absorbed as applied, which should be done while the manure is being turned over.

'Fermentation being further regulated by the facility of access of the atmosphere to the mass, this may easily be regulated by compressing the materials, or placing them loosely together, and adopting whichever course is best suited to circumstances. Heaps formed in the autumn or early part of winter, and not intended for application until the spring, may be advantageously compressed by discharging the loads from the carts on the heap itself. This is effected by keeping one end of the heap low, and gradually sloping; and the compression of the manure by this means prevents the horses' feet or cart-wheels from sinking in the heap, the unloading on it being attended with much less difficulty than could be imagined by those accustomed to the work. This, of course, only has reference to single-horse carts, which are generally considered to be the best for carting through fields; and also only to moderate loads, which, it is also conceived, in such cases are better calculated to effect the object in view than any other—namely, that of the conveyance of the greatest quantity of material with the least injury to the animals of draught. The degree of compression should be regulated by the quantity of the manure itself, and the length of time which it is intended to remain before being applied to the land. When it is not intended to remain long in the heap, no compression should be applied, for obvious reasons, but the mass placed as loosely together as possible.' [1]

In all cases, and under all systems, the objects to be kept in view are, that no refuse, be it fluid or solid, animal, vegetable, or mineral, shall be wasted; that the fertilising properties of the manure shall be as much concentrated and retained as possible; that the manure shall be so made that it may be preserved as long or as short a time as is requisite, and so combined and managed that, when applied, it shall be of that nature, and in that condition, which will best ameliorate the soil and promote the vegetation of the crop to which it is destined. Covered or roofed-in dung-sluices are now being introduced in all good farms. The sides of these are left open—the flooring water-tight, and sloping from the corners to the centre of the floor—at which point there is a grating leading to a liquid manure tank, which thus receives

[1] Farmer's Magazine, vol. xxi. p. 61.

the drainings of the manure. A pipe also leads the liquid manure to the tank from the various buildings or stables, and by a simple arrangement of a secondary but small tank, called a 'settling tank,' the solid matters are arrested and retained in this, while by a pipe properly arranged, the contents of the tank can be pumped up as desired. There are various other ways of arranging the relationship of the tank and the upper dung sluice, but the above indicates the general principle. The dung is retained by low walls—with gates at convenient points—and the roof is supported by vertical uprights.

CHAPTER VII.

ON THE APPLICATION OF MANURES.

AS manure is essentially necessary to the improvement of land and to the promotion of the growth of plants, while its fermentation and warmth dispose the soil for the more easy admission of moisture from the atmosphere, and thus ultimately contribute to the support of human existence, the mode of applying it to the greatest advantage must be a subject every way deserving of attention. In the preceding discussion of the various articles capable of being employed for this purpose, some hints as to their general application have necessarily occurred; but, beside these, there are other circumstances to be regarded—viz., the crop, whether tillage or grass, the nature of the land whereon the manure is to be spread, and the state of such manure at the time it is to be employed.

With regard to the *state* in which manures are to be spread on the land, it appears that those soils which are intended for the production of crops that speedily attain their full growth, derive the greatest benefit from the application of such manures as are thoroughly reduced by the completion of the putrefactive process; while other crops, which are longer, both in point of duration and also before they arrive at maturity, are benefited by those kinds of dung, or manure, which have undergone the least change or decomposition. Long dung is said to suit stiff land, and pastures, and potato crops best, although its operation is slower than the spit dung, which, from being in a more soluble state, is best for green crops; half as much of the latter will do, but it should be applied oftener than the former, as its effects, though more speedy, are less durable.

'Much diversity of opinion exists among farmers as to the state in which farmyard manure should be applied to the land; but it is evident that this can only be ascertained with precision by bearing in mind the peculiar purposes for which such application takes place. Adhesive soils generally are most benefited by manures slightly fermented: the increased bulk of the manure in such cases, serving to keep soils of this class more open, which effect is still further increased by the decomposition of the manure being ultimately completed in the soil itself. The lighter class of soils, on the contrary, require consolidation, and are more benefited by the application of well-fermented manures, which have a greater tendency to impart that texture. But the question of the state in which the manure should be applied ought to have greater reference to the crop than the soil, the attention of the farmer being chiefly directed to obtain the earliest results; and in most cases the application of unfermented manure will not effect this object. * * * * * * * * *

'The chief application of farmyard manure is to the raising of green crops, in which cases it is deposited in the drills, and covered up by the plough. It is also applied to fallows intended for wheat, being then equally distributed over the surface, and covered by a light ploughing immediately before sowing the seed; but the more general introduction of green crops and other improvements in agriculture having rendered this expensive preparation for wheat less necessary than formerly, its application for this purpose is becoming annually more limited. Its effects as a top-dressing to meadow-lands are also well known, though, being usually deficient in quantity for other purposes, its application for this purpose, unless in the vicinity of large towns, is not very extensive. As already remarked, this manure is suited for all soils and all crops. When it is limited in quantity, and the portable manures are employed as auxiliaries, it should be applied to the heavier soils of the farm, the effects of the latter being greater on light soils, and the farmyard manure in the former case not only contributing to the growth of the crops, but also mechanically improving the texture of the soil. It may also be advantageously used in combination with the portable manures, and this is perhaps the preferable practice. It differs from them in one important particular—its not being adapted for the drill, or application to the growing crops, for which purposes the portable manures are eminently suited, and from this circumstance in many cases derive much of their value.

'The usual mode of applying manure to green crops is to deposit it in the drills immediately under the seeds, but it is also occasionally spread over the surface of the ground before the first ploughing in the preparation of the land in the autumn or beginning of winter. In this case it becomes thoroughly incorporated with the soil during the preparation which it undergoes for the crop. It is no slight advantage to have the labour of the application of the manure over in the spring, when the operations of the farm are necessarily hurried, however perfect the arrangements may be for this performance, and adequate the force employed for the purpose. The perfection of cultivation consists in the high degree of pulverisation attained as a preparation for the various crops included under the denomination of green crops, and the maintenance of this highly-pulverised state is not less necessary than its production, in order that the resources of the soil may be developed to their fullest extent; but every farmer is aware how much this is interfered with by the cartage of the manure in the spring, which is of course avoided by the method of application under notice. Its effects on the crop have also been proved to be as great in this case as in the more common method of application in the spring, especially on the better class of soils. It is, no doubt, a disadvantage that the manure is not immediately available, in any considerable quantity, for the support of the young plants in the first stages of their growth, although, after having made some progress, the rootlets spread in all directions, and every portion of the manure becomes available. A combination with some of the portable manures will here be of service, as the application of them in small quantities at the time of sowing the crop will push forward the young plants until the manure incorporated with the soil becomes available.

'On all the better class of soils, therefore, especially when thorough draining has been employed to remove all superfluous moisture, this method of applying farmyard manure has many advantages. The practice must, however, be altogether confined to such soils, it being entirely unsuited to any other. Little consideration is necessary to see the impropriety of applying manure to wet soils before winter; and in the case of poor soils of every description, it is better that the manure should be applied in the largest available quantity immediately to the growing crops. It is, also, only where a superior system of tillage is practised that the value of this method of applying manure can be appreciated, as, when a high degree of pulverisation is not effected, the evils resulting from after consolidation cannot be felt.

'The quantity of farmyard manure which should be applied depends on the state of the soil and the crop for which it is intended. Under our still defective system of cultivation it is believed that its effects are not fully developed, and a quantity larger in proportion must be applied. Twenty tons to the acre are considered an ample allowance throughout the best cultivated districts of the country, while in others more than twice the quantity is applied. The intervals of time at which the application takes place should be taken into account in ascertaining the quantity to be applied, but more frequent applications, and in smaller quantities, would probably be found to answer the intended purpose, better than the system so generally followed. The object of the farmer should undoubtedly be directed to the production of early rather than prospective results; and it having been satisfactorily ascertained, in the case of some of the portable manures, that an increase in quantity beyond a certain amount is productive of no beneficial effects to the immediate crop, it is worth consideration how far the same holds good as regards farmyard manure, and whether it would not be desirable to regulate the quantity applied to the wants of the earlier crops, and repeat the application at shorter intervals, as occasion might require. This is the system pursued in Flanders, where the management of manures is so well understood and so economically carried on.'[1]

The proper *time* for manuring land, and the best mode of applying the manure, is a point which is less understood than could be wished; the convenience of the agriculturist, the condition of the land, and the state of the weather, must always influence this operation more or less. In general, however, the application of manure may be regulated in a great measure by the following rules:—

1. The land should in general be dry, in order that it may be fit for the reception and retention of the unctuous parts of the manure which is to be ploughed in and thus incorporated with it. In the case of grass or meadow-lands, which require the manure only to be strewed or spread *on the surface* of the soil as a top-dressing, it will be best to apply it a short time before the grass shoots upwards from the ground. On the contrary, where it is deposited *in* the earth, the most proper time will be immediately before sowing the seeds for whose nutriment the manure is destined to serve; because the atmospheric air that is buried with the dung gradually evolves a genial warmth, which materially accelerates vegetation. These remarks must not be understood to apply to drill manures.

2. The dung or compost should be spread without delay (in fact, as soon as possible after it has been carried to the field), and dispersed as equally as may be. For this purpose, the labourers and implements should be ready on the spot. The loads should be regularly arranged in *lengths* or rows, and the manure immediately turned in, as it more readily dissolves in the ground when newly covered, and its whole strength is thus secured to the soil.

3. The manure being speedily mixed with the earth, should be buried at a proper depth, lest the gaseous, oily, and nutritious particles should evolve and become dissipated. On the coarser

[1] Farmer's Magazine, vol. xxi. p. 61.

soils from three to four inches will be a sufficient depth, but the manure may be set much deeper in the more porous and friable sorts of land.

4. In order to prevent any undue evaporation from taking place in hot, windy, or dry weather, care should be taken not to cart out more from the dung-stead than can be properly dispersed shortly afterwards, neither must it be shovelled about more than is absolutely necessary. When this business is performed in calm or in cloudy weather, the volatile parts of the manure will not be liable to evaporate in any considerable degree. Further, when the farmer has carted away his dung-heaps from his yards, he should take up an inch or two of the surface ground beneath, unless it is rendered impenetrable to moisture; because, ordinarily, much of the strength of the dung and urine has passed into it, and made it a good manure.

5. The quantity of manure should be invariably proportioned to the nature of the soil, and to the time which has elapsed since the last manuring; because, if too much dung is laid on a warm and light soil, it imparts to the latter a still greater degree of heat, and partially burns up the grass; while on strong soils, too large a quantity will make the plants shoot up with a degree of luxuriance rarely compatible with perfect maturity.

It is right to state that opinions are various and apparently very contradictory as to the advantages or disadvantages of allowing manure to remain in the field exposed to atmospheric influences before it is ploughed in. The majority of authorities are, however, of opinion that the sooner manure is ploughed in the better, when applied in an unfermented or fresh state. When used as a top-dressing for pastures in a *well-fermented* condition, the case is different; for in this condition the ammonia is combined with the organic acids, forming compounds which are not volatile. Hence the value of rotten manure to pastures. As regards the time of application of manure, the most approved practice seems to be that in light soils the manure should be carted out and applied to the soil as near as possible to the time of putting in the seed; while in clays, loams, and marls, the manure may be carted out, applied, and ploughed into the land in autumn or early winter with advantage. This early application not only economises the labour of the farm, but, as has been proved both by theory and in practice, economises also the fertilising properties of the manure.

We have already discussed the various natures of the different sorts of manures, together with the soils to which they are most applicable, so that little remains to be added on this head. In order, however, that manures may be duly proportioned to the soil, it may not be useless briefly to recapitulate :—

1. That the wetter and colder the lands are, the more dung they require; because their cold nature should be corrected by the warmth of the dung.

2. On the contrary, a less proportion of dung will be sufficient for drier soils, as too great heat may burn up the plants.

3. For cold, stiff, loamy clays, which are liable to become too solid and impenetrable to the fibres of vegetables, the manure should be employed before it is perfectly decomposed, and in large quantities, as it will thus prevent the surface from becoming too solid and firm. Notwithstanding that this unfermented manure works slower in the ground, the fertilising substances will, in the course of two or three years, totally decay, and afford a gradual supply of nutriment to the crops, and a more permanent amelioration to the soil.

4. Vegetable earth, or mould, being generally of a drier nature than the preceding kind of soil, does not require so large a quantity of dung.

5. Sandy lands, being naturally hot, and superficially covered with a still hotter layer or stratum, require dung that is perfectly decomposed and putrified. If manures in an imperfect state of decomposition are applied, they must only be laid on in smaller quantities at each time, and applied oftener. Such soils are greatly improved by folding; but the dung should always be mixed and covered with the soil as soon as possible, or its ammonical and fertilising particles will evaporate.

The proper season for applying those manures which are spread on the surface of grass land, or applied to crops as top-dressings, as coal ashes, soot, wood and peat ashes, bone dust, rape dust, malt dust, guano, saltpetre, sulphate of ammonia, &c., is from February to April; for, in general, these substances are spread in too small proportions to require a whole winter's rain in order to wash them into the soil; whereas, by dispersing them over the soil in a state of coarse powder, or in small lumps that cohere very slightly, the spring showers will wash them into the soil, so that the roots and stems of young grass, or the shoots of the plants or vegetables, are at once benefited by them. Where a second harvest of hay is to be made, and the weather is not too hot, a second top-dressing of perfectly-reduced manure may be applied with considerable benefit to the crop. It has also been found advantageous to apply a top-dressing twice, with the interval of a fortnight or three weeks between them: when this is done, only half the proper quantity is given at first, and then the remaining half.

Grass lands may be much ameliorated, both as regards the improvement of the herbage, and also the amount of the produce, by laying on the manure after the operation of scarifying:[1] it thus

[1] See book viii. chap. iii.

sinks into the incisions, and acts more advantageously than manure applied without cutting.

After the grass is mown, some farmers give the land a dressing of dung, usually in September, and this operation should not be deferred beyond October. Where composts are used, the end of September is perhaps the best season for applying them. The usual quantity is about 15 or 20 cubic yards per acre every fourth year, unless the land is very rich; but it has been suggested that a smaller quantity given oftener would be productive of better effect. It is a good practice to mix a pound of common salt with each cubic yard of compost when it is turned over.

The practice of ploughing in manures on arable land a short time before grasses or the seeds of other vegetables are deposited in the ground, has been already mentioned as calculated to promote their respective growth. There is, however, another advantage resulting from this mode of manuring land—viz., that as the whole is thus made to nourish the vegetables in an immediate and direct manner, a *smaller quantity* will be fully adequate for the purpose; and as the collecting, preserving, and augmenting of manure is necessarily attended with considerable expense, it certainly behoves every intelligent agriculturist to employ it in the most economical way. The economy of manures is in a very great measure attainable by adopting the drill husbandry, one principal advantage of which consists in depositing the manure in *drills*. Mr. Parkinson[1] observes that such drills should be made two feet asunder, each being six inches wide at the bottom; he sows peas, beans, &c., in this way; and from the result of this method he asserts that in consequence of the manure being kept closely together, and the seeds placed immediately upon it, four loads will effect, in the drill husbandry, as fully and as beneficially, what would have required *sixteen* loads in the usual way of spreading it over the land.

We shall conclude this branch of our subject with the Rev. Mr. Close's table for manuring land, which will enable the farmer at one view to calculate with accuracy the number of loads per acre which it will in general be necessary to employ in manuring a field, at the distances therein specified.

Explanation of the First two Rows of Figures in the following Table.

The number of heaps, consisting of one load each, laid at five yards' distance, is 193 to cover one acre; at *two* heaps to a load, 96; at *three* heaps, 64; at *four*, 48; and so to the end. Each of the following rows is to be taken in a similar manner.

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[1] Experienced Farmer.

	Number of Loads per acre							
Number of heaps in a load	1	2	3	4	5	6	7	8
At five yards' distance	193	96	64	48	38	32	27	24
At five yards and a half distance	160	80	53	40	32	26	23	20
At six yards' distance	134	67	44	33	26	22	19	16
At six yards and a half distance	114	57	38	28	22	19	16	14
At seven yards' distance	98	49	32	24	19	16	14	12
At seven yards and a half distance	86	43	28	21	17	14	12	10
At eight yards' distance	75	37	25	18	15	12	10	9

Artificial or Portable Manures are now so largely used that the best modes to be adopted in their application to land is a matter of the utmost importance to the farmer. The following instructions, from the pen of the well-known agriculturist Mr. J. B. Lawes, will be worthy of the best attention of the reader:—

'*Wheat.*—On the heavier descriptions of land, 2 to 3 cwts. per acre of Peruvian guano is the best manure for this crop. It should be sown broadcast before the seed and harrowed in. It is sometimes mixed with twice its weight of common salt, by which, as well as by ashes or other matters, a more equal distribution through the soil is attained.'

In the last number of the Journal of the Royal Agricultural Society, an able paper on 'Experiments on the growth of Wheat,' is given by Mr. Lawes and Dr. Gilbert, of which the following is the conclusion:—

'Ammonia salts are generally neither so cheap a source of nitrogen, nor are they, when used alone, so good a manure for corn crops as Peruvian guano, which contains a large proportion of phosphates as well as nitrogen. Rape-cake, though a recognised manure in the market for wheat, acts somewhat more slowly for the amount of nitrogen it contains than guano. It will be well, for the sake of comparison, to show the cost of the manure and value of the increase of the three manures—rape-cake, ammonia salts, and Peruvian guano. This is done in the following table

'Reckoning the value of the increase against the cost of the manures, there is a considerable margin in favour both of the ammonia salts and the guano, but particularly of the guano. The evidence further goes to show that these active nitrogenous manures are by no means fully exhausted in the first year of their application. The quantity of guano used—nearly 5 cwt. to the acre—was however much more than is usually applied; indeed, much more than it is desirable to apply in ordinary practice. Nor should it be inferred from the plan and results of these experiments that the practice of growing a series of corn crops by means of artificial manures is to be recommended. But when these results are considered by the side of those obtained at Rothamstead, Holkham, and elsewhere, and with the light of the common experience of almost every arable district of the country, the practical conclusion undoubtedly is that highly nitrogenous manures much increase the produce of grain crops under the circumstances in which these are generally grown in our rotations.

Manure applied per acre in four years			Increase obtained per acre in six years						
			Corn		Straw				
Description	Quantities	Price per ton	Bushels	Price per bushel	Cwts.	Price per cwt.	Cost of manure	Value of increase	Difference
	lbs.	£ s.		s. d.		s. d.	£ s. d.	£ s. d.	£ s. d.
Rape-cake	8000	5 10	46$\frac{3}{4}$	7 0	75$\frac{1}{4}$	1 3	19 12 10	21 1 4	1 8 6
Sulphate of ammonia	800	15 0	36	7 0	69$\frac{3}{4}$	1 3	12 10 0	16 19 2	4 9 2
Muriate of ammonia	800	20 0							
Peruvian guano	2100	12 10	45$\frac{1}{2}$	7 0	91$\frac{3}{4}$	1 3	12 1 1	21 13 2	9 12 1

'Peruvian guano, which contains a large quantity of phosphates, as well as nitrogen-yielding matter, is one of the best artificial manures for wheat; and 2 to 3 cwts. per acre, sown broadcast before the seed, and harrowed into the land, will generally be sufficient. When ammonia salts are used, about 2 cwts. per acre may be employed, and 1 to 2 cwts. of superphosphate of lime should at the same time be applied. The above quantities are such as should generally be employed when the grain crop is grown in the ordinary course of rotation, and the land is considered to be not highly enough manured to carry as heavy a crop as the average of seasons will well ripen.

'But another great advantage to the farmer of the nitrogenous and phosphatic manures now in such general use is that, provided the land be well dunged once in the course of the rotation, he may, without injury to it, by these means frequently take an extra grain crop in the course; for example, barley or oats after wheat, as the description and condition of the soil and the locality may indicate. In such cases, one-and-a-half times or twice as much of the artificial manure should be used as when the crop is grown in the ordinary rotation.'

Barley and Oats.—'When either of these crops follows a root crop which has been partially or wholly removed from the land, a mixture of equal parts Peruvian guano, or nitrate of soda, or sulphate of ammonia and superphosphate of lime, may be used with advantage. The selection of one or other of the three nitrogenous manures mentioned should depend in some measure upon the comparative cost of each at the time. About 1 cwt. of the guano, nitrate or sulphate, and 1 cwt. of superphosphate of lime, will generally be sufficient for an acre. The manure should be sown before the seed, as recommended for wheat. When one corn crop follows another, as oats after wheat, about twice as much of the artificial mixture should be used as under ordinary circumstances. When corn crops require to be top-dressed late in the spring, nitrate of soda is the best manure to employ; 1 to $1\frac{1}{2}$ cwt. per acre being used.'

Meadow Hay.—'To grass land mown for hay, from 8 to 10 tons of rotten dung should be applied once in about every four or five years, in the month of November. The artificial manures most suitable for grass land are, Peruvian guano, salts of ammonia, and nitrate of soda. When either of these manures is used alone, the following quantities may be applied:—

Peruvian guano .	2 to $2\frac{1}{2}$ cwt. per acre
Salts of ammonia . . .	1 to $1\frac{1}{4}$,,
Nitrate of soda	1 to $1\frac{1}{2}$,,

'One cwt. of nitrate of soda, mixed with 1 cwt. of superphosphate of lime, is also a very good manure; or a mixture of equal parts of Peruvian guano, ammonia of salts, nitrate of soda, and superphosphate of lime, applied at the rate of 2 cwts. per acre, is perhaps the most generally useful. In deciding upon the exact combination to be employed, some regard should be had to the relative cost of the several substances at the time, as it varies considerably from season to season.'

'The best time to apply the artificial manures is from the end of January to the middle of February; if the application is delayed much later than this, nitrate of soda is the best manure to employ.'

Mangold Wurzel.—'This crop requires to be very liberally manured. The best dung at command should be employed; 10, 15, or even 20 tons per acre being spread after the land is drawn in ridges, and previous to their being split; and 2 to 3 cwts. of Peruvian guano, mixed with twice its weight of common salt, should be strewed by hand on the top of the dung. Common salt appears to act more beneficially as a manure for mangolds than for any other crop of the farm; it also produces marked effects upon the growth of asparagus in our gardens. Both plants are, in fact, indigenous to the sea coast.'

Turnips.—'When swedes or common turnips follow a corn crop which has been manured by farmyard dung, the roots may be grown by artificial manures alone. From $2\frac{1}{2}$ to 3 cwts. of superphosphate of lime should be drilled with the seed, and in the case of swedes (excepting when sown late, or the land is considered in good condition), from 2 to 3 cwts. of Peruvian guano may be used in addition. If the preceding crop has not been manured by dung, 7 to 10 tons per acre should be applied, 2½ cwts. of superphosphate of lime being drilled with the seed; and if the dung used be poor, 2 cwts. of Peruvian guano may be strewed over it in the drills; or where no manure-drill is employed, the superphosphate of lime may be sown broadcast after the dung is spread, either alone or mixed with guano, as the case may require. These manures do not react injuriously upon each other when mixed together; but the guano is liable to be injurious to the young turnip plant if brought in close contact with it. Hence, when guano and superphosphate of lime are mixed together and sown by the drill, two or three inches of soil should intervene between the manure and the seed.'

'Local peculiarities,' says a well-known authority on artificial manures, 'of the farm or district will, in a considerable degree, regulate the system and extent of the application of artificial manures; such as the access to the field, distance from the steading, supply of farmyard manure, quality of land, whether light or heavy, if to be eaten on by sheep, or drawn from the land, &c., all of which are necessary considerations. Should the field be at some distance, hilly, and to be eaten on by sheep, then it would be advisable to apply only artificial manures, and reserve the dung for a shorter and more easy transport; but perhaps this may apply more to the South of England, where the dung is usually carted to the field in winter, and either thrown up into a heap or ploughed in. To what extent the farmer is justified in the universal employment of farmyard manure is for himself to judge, according to the circumstances of his case; but now that artificial manures can be had at a moderate price, as auxiliaries to the use of dung, it becomes a grave question to decide how, when, and where to apply it to the greatest advantage. On light soils I have a strong idea that it would be best used if applied to seeds during winter, and on such soils grow the turnip crop with a judicious mixture of artificials, and eat it off with sheep. If the farmer would but bear in mind the fact that 3 or 4 cwt. of an artificial manure will produce as good a crop of turnips as 20 tons of farmyard dung (of course assuming a sufficiency of carbonaceous matter to be present in the soil), he might, in many cases, save the enormous expense of the cartage and spreading of a heavy, bulky, and watery mass, by the economical substitution of a more concentrated and equally efficient substance.'

At the same time it should be remembered that these artificial manures are only auxiliary to farmyard manure, which ever must be the 'mainstay' of the farmer in fertilising his fields.

CHAPTER VIII.

ON THE FLEMISH SYSTEM OF MANURING.

THE deservedly high reputation for improvement in agriculture which the Netherlands have long attained renders every part of their system of husbandry so peculiarly interesting that no apology will be necessary for presenting another extract from Sir John Sinclair's sketch of the agricultural state of that country, already so often alluded to in the course of this work.

'The Flemish farmers are peculiarly distinguished by their great attention to manure. It is a principle with them that the fertility of the soil entirely depends on the riches you give it, and that a farmer cannot be too attentive to the collection and application of this source of wealth. The more opulent farmers likewise pave and line with bricks the receptacles for their dung, which is thus kept constantly plunged in a mass of liquid matter. The fibrous parts of the vegetables are in this way completely decomposed, and four tons of such manure go as far as five collected and kept with less precaution.'[1]

The following is a list of the manures made use of in the neighbourhood of Lisle:—

'1. The dung of cattle and horses with the straw.

'2. Ashes.

'3. Lime.

'4. The urine of animals, collected with care in brick cisterns.

'5. The cakes of rape and hemp seed,[2] reduced to powder in a mill, and which is sometimes thrown into the urine cisterns. This last sort of manure, on account of its strength, is scattered about in small quantities fifteen days before the seed is sown, that it may not prove injurious to the plant.

'6. The sour water obtained by washing the tubs of starch-makers. This is considered to be a very weak manure.

'7. The urine of cattle fattened at the distilleries.

'8. The dung of pigeons.

'9. That of sheep and cattle, gathered by young children along the sides of the roads.

'10. Street dung.

'11. Marl.

'12. The refuse of horns; a manure as effectual the second as the first year.

'13. Nightsoil purchased from scavengers. A waggon-load of this matter, drawn by three horses, costs only 12 francs, or

[1] Communications to the Board of Agriculture, vol. i. p. 238.

[2] Cakes of flax-seed are destined for feeding cattle and sheep.

10*s*. sterling. The town of Lisle, however, alone produces as much of this sort of manure as would sell for about 4,200*l*. a year. The nightsoil of a hospital there, containing 1,800 souls, is let for 3,300 francs, or 137*l*. 10*s*. per annum.

'In order to increase the quantity of manure, not only horses, but cattle, and even sheep, are kept in stables during almost the whole year; and that nothing may be lost, the stables and cow-houses are washed with water, which is conveyed into cisterns, or thrown into the dunghill.

'Great attention is also paid to cover the dung. When it is spread on the surface of a field to be ploughed, after a furrow is made, a person with a fork, or rake, goes before the plough, and throws from the surface into the furrow the manure upon as much soil as the plough is likely to turn over, which is thus effectually covered, and prevented from being exposed to the atmosphere. This should be done *in all cases*, and not restricted to the potato crop, as in this country.

'The Baron de Serret has ascertained that powdered rape-cake, strewed over the surface of the ground, destroys *la taupe grillon* (Gryllotalpa), so injurious to kitchen gardens: and he is persuaded that every insect of that species may be destroyed by the same means.[1]

'But the great improvement that has taken place in regard to manure is its being applied in a liquid state. For that purpose the urine of cattle and horses is regularly collected into cisterns, that none of it may be lost. Mr. Mondez has five cisterns at Frasnes, fit to contain 230 metres (about 250 English yards in capacity), for receiving the urine of 68 cattle of different ages, and 32 horses, young and old. This quantity of urine manures 16 French hectares, or about 40 English acres. Many other farmers adopt the same system.

'It is proper to state, that several intelligent practical farmers object to this plan, alleging that the dung of the farm-yard loses as much as is gained by the cistern system; but those who were appointed to examine Mr. Mondez's practice declare that, owing to the judicious concavity of the farm-yard, there was as much moisture as was necessary to ferment the straw, which may be effected by water alone, and repeated, as gardeners know well; and it is now ascertained, by the experience of the Swiss, that liquid manure is the most efficacious of any, and produces a third

[1] The use of oil in vegetation is also very great. When the cuttings of gooseberries are planted, it should be done in a lump of clay mixed with cow-dung, and a few drops of train oil; and when young thorns are planted in a poor or sandy soil they will thrive better if their roots are dipped in oil. Near the first turnpike going to Mile End, an artificial manure was sold, supposed to be the sweepings of the drysalters in Thames Street, mixed with the refuse of those places where the blubber of whales is boiled, one bushel of which was said to equal twenty-eight of common manure.

more effect than what is spread on the surface. Hence, after the dung is fermented, they dilute it in water, and the liquid alone is carried to the field and scattered over it. The earth immediately imbibes this fluid, which soon reaches the roots of the plants, and causes a rapid vegetation, whereas it is a long time before dung in a solid state fertilises the soil. The straw that remains of the dung thus washed is applied as manure for potatoes.

'The experience of Mr. Harley, who keeps a great dairy near Garlow, corroborates this doctrine. He says that the advantages of irrigating grass lands with cows' urine almost exceeds belief. Last season some small fields were cut six times, averaging 15 inches in length at each cutting, and the sward very thick. The soap-suds of a neighbouring wash-house are applied to the same purpose with considerable advantage.

'The great argument for separating the urine from the dung is, that it is always at the command of the farmer, and can be applied in any manner he thinks most advantageous. It is peculiarly useful in spring, when the application of liquid manure gives a new fillip to the plant, and makes its growth more vigorous. The urine is much improved by powdered rape-cakes, which are frequently thrown into the cisterns.

'The management of manures regulates not only the whole, but every individual part of the economy of a Flemish farm. The first object and great aim of a Flemish farmer is to make or get manure; and to carry this into effect, nothing that can contribute in the least to increasing a dunghill is thrown away. He cultivates food for cattle, and ties them up all the year round, that he may not lose any of the manure. He sows rape, and allows it to blossom and ripen, that he may obtain the seed for manure. His ashes-cart and urine-barrels traverse every street in the town, every by-way in the country, to collect this important necessary for his farm. It is in their management here that the farmers of Belgium so much excel, and are enabled to extract more from the land than any other body of farmers. They act up, in short, to the true old adage, that "Muck is the mither o' the meal kist." The principal manures used are the farmyard dung, urine or liquid manure, rape-cake, and ashes. The comparatively great number of animals kept by the Flemish farmers on their few acres has been before alluded to. This they do principally for the purpose of making manure, to enable them to carry out their system of farming. On a farm of sixty-three acres, three horses and sixteen milch cows, and several heifers for supplying the stock, were kept throughout the year, besides six cows and a few calves being fattened yearly. In another, of seventy-seven acres extent, four horses and twenty cows, with a requisite number of heifers, were kept, besides from twenty to thirty calves being fattened off yearly; and in a third, of eighty-eight acres, five horses and twenty cows, besides heifers and calves, were kept. These farms were all arable, and were situated in one of the finest districts in Belgium. Mostly every crop receives some of their farmyard dung, which is always well rotted before being applied. As we have before stated, one of the peculiarities of the Flemish system is the extensive and various uses they make of the urine from the animals kept on their farms. Everyone has heard of the urine-tanks of Flanders, which are to be found all over the country, at home and in the fields. They are built in a most substantial manner, and so far underground that, when they are covered in, the farmer is enabled to cultivate the soil over them. Contracts are generally entered into between the farmers and those in towns who have much of this at command, such as brewers, distillers, &c., who fatten animals from the refuse of their works. Two pounds are commonly given for the urine of one animal for a year. The farmer, at stated periods, conveys, by means of barrel-carts, what is collected in towns to those subterraneous receptacles at the corners of the fields, to be ready for the seed-time. The crop to which it is principally applied is flax; and then they dissolve in it rape-cake, which renders it a most powerful manure. After the flax-seed has been sown and covered in and rolled, so that the surface is made quite smooth, they proceed to apply this mixture. It is applied in the following manner:—Five men are employed altogether, two to pump, two to scatter it, and one to drive it. A rectangular piece of ground, thirty yards in breadth, is measured off across the ridge; this is subdivided into six portions of five yards each. The field is laid off in ridges of ten yards. Six wooden vessels are filled and placed in the middle of a ridge at the distance of five yards from one another, so that the contents of each vessel, which is about the size of a potato firlot, is the allowance for every fifty square yards. There is nothing in which they manifest so much economy as in the saving of this material, which they prize as a most valuable assistant to their labours. Rape-cape, besides being applied as mentioned above, with the liquid manure, is also used in a dry state. The rape is cultivated principally as a manure, and is used extensively where the cropping is very severe. Ashes are never used but as a top-dressing to clover; but the traffic which is carried on in them between Holland and Belgium is sufficient to form a distinct trade with a certain class of merchants in Belgium. The farmers in Belgium set a high value on them, and place so much dependence on them for the success of their clover-crop, that there is a current saying among them that "He who buys ashes for his clover-crop pays nothing; but he that does it not pays double."'[1]

[1] Quarterly Journal of Agriculture.

CHAPTER IX.

FARM ACCOUNTS.

THE advantages of clear accounts are obvious in every other pursuit of life; yet, strange as it may appear, the making of a few rough memoranda or figures, to yield a *gross* account of the general receipts and expenditure, usually constitutes the utmost efforts which are made by the majority of farmers who profess to keep accounts. Not unfrequently do men engage in agriculture without much previous education, or even study and enquiry; and they conduct large concerns in it without those accounts which are justly reckoned essential in every other business. To this unaccountable omission may be traced much of that uncertainty as to the real state of their affairs with which industrious farmers are often perplexed, as well as of that loss which they often sustain. In order to supply this very material deficiency, the following outline of farming accounts is offered to the attention of farmers and graziers, from which they may select such as are best adapted to their several purposes:—

JOURNAL from

State of Weather.

	Barom.	Therm.	Wind	Rain	
Mon.					
Tues.					
Wed.					
Thurs.					
Friday					
Sat.					

Weekly Account of Labour, &c., from

Names of Labourers and Work performed	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	No. of Days	Per Day	£ s. d.
Farm Servants									
Daily Labourers									
Task Work									
								Total .	

Date	DAILY JOURNAL OF TRANSACTIONS	Remarks

MONTHLY ACCOUNT OF CASH.

Date	Sum Received			Of whom Received, and to whom Paid	Sum Paid		
	£	s.	d.		£	s.	d.
Total				Balance to next Month's Account			

WEEKLY DAIRY ACCOUNT from

		Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Amount	
		qts.	qts.	qts.	qts.	qts.	qts.	qts.	galls. qts.	
Milk	Quantity milked . .									Total
	Made into butter . .									
	——do. cheese . .									
	Sold									
	Consumed . . .									
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	cwt. qrs. lbs.	
Butter	Made . . .									Total
	Sold . . .									
	Consumed . .									
		lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	cwt. qrs. lbs.	
Cheese	Made									Total
	Sold									
	Consumed .									

CURRENT ACCOUNT OF CORN CROPS.

Date	Description	Sown	Thrashed		Consumed		Sold		And to whom	Price		
		bush.	qrs.	bush.	qrs.	bush.	qrs.	bush.		£	s.	d.

CURRENT ACCOUNT OF HAY CROPS.

Date	Description	No. of acres stacked	Quantity cut	Consumed	Sold, and to whom	Price		
						£	s.	d.

MONTHLY ACCOUNT OF LIVE STOCK.

Description of	No.	Increase by		Decrease by			No.	Total remaining in Stock, and Remarks
		Purchase	Birth	Sale	Accident	Consumption		
Horses								
Cattle								
Sheep								
Swine								

A TABLE

For calculating the Expense of Dibbling, Hoeing, Sowing, Reaping, Mowing, &c., &c., by 10, 15, 20, 30 Poles, the Rood, and Acre, from Two Shillings to Two Pounds; cast up to the Fraction of a Farthing.

Total Sum per Acre				Ten Perches or Poles		Fifteen Poles		Twenty Poles		Thirty Poles		Rood	
	£	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.	s.	d.
At	—	2	0	—	1½,000	—	2¼,000	—	3 ,000	—	4½,000	—	6
	—	2	6	—	1¾,500	—	2¾,250	—	3¾,000	—	5½,500	—	7½
	—	3	0	—	2¼,000	—	3¼,500	—	4½,000	—	6¾,000	—	9
	—	3	6	—	2½,500	—	3¾,750	—	5¼,000	—	7¾,500	—	10½
	—	4	0	—	3 ,000	—	4½,000	—	6 ,000	—	9 ,000	1	0
	—	4	6	—	3¼,500	—	5 ,250	—	6¾,000	—	10 ,500	1	1½
	—	5	0	—	3¾,000	—	5½,500	—	7½,000	—	11¼,000	1	3
	—	5	6	—	4 ,500	—	6 ,750	—	8¼,000	1	0¼,500	1	4½
	—	6	0	—	4½,000	—	6¾,000	—	9 ,000	1	1½,000	1	6
	—	6	6	—	4¾,500	—	7¼,250	—	9¾,000	1	2½ 500	1	7½
	—	7	0	—	5¼,000	—	7¾,500	—	10½,000	1	3¾,000	1	9
	—	7	6	—	5½,500	—	8¼,750	—	11¼,000	1	4¾,500	1	10½
	—	8	0	—	6 ,000	—	9 ,000	1	0 ,000	1	6 ,000	2	0
	—	8	6	—	6¼,500	—	9½,250	1	0¾,000	1	7 ,500	2	1½
	—	9	0	—	6¾,000	—	10 ,500	1	1½,000	1	8¼,000	2	3
	—	9	6	—	7 ,500	—	10½,750	1	2¼,000	1	9¼,500	2	4½
	—	10	0	—	7½,000	—	11¼,000	1	3 ,000	1	10½,000	2	6
	—	15	0	—	11¼,000	1	4¾,500	1	10½,000	2	9¾,000	3	9
	1	0	0	1	3 ,000	1	10½,000	2	6 ,000	3	9 ,000	5	0
	1	5	0	1	6¾,500	2	4¼,250	3	1½,000	4	8¼,000	6	3
	1	10	0	1	10½,000	2	9¾,000	3	9 ,000	5	7½,000	7	6
	1	15	0	2	2¼,000	3	3¾,500	4	4½,000	6	6¾,000	8	9
	2	0	0	2	6 ,000	3	9 ,000	5	0 ,000	7	6 ,000	10	0

TABLE TO CAST UP WAGES BY THE DAY, WEEK, MONTH, AND YEAR.

By the Day		By the Week			By the Month			By the Year		
s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
0	1	0	0	7	0	2	4	1	10	5
0	2	0	1	2	0	4	8	3	0	0
0	3	0	1	9	0	7	0	4	11	3
0	4	0	2	4	0	9	4	6	1	8
0	5	0	2	11	0	11	8	7	12	1
0	6	0	3	6	0	14	0	9	2	6
0	7	0	4	1	0	16	4	10	12	11
0	8	0	4	8	0	18	8	12	3	4
0	9	0	5	3	1	1	0	13	13	9
0	10	0	5	10	1	3	4	15	4	2
0	11	0	6	5	1	5	8	16	14	7
1	0	0	7	0	1	8	0	18	5	0
2	0	0	14	0	2	16	0	36	10	0
3	0	1	1	0	4	4	0	54	15	0
4	0	1	8	0	5	12	0	73	0	0
5	0	1	15	0	7	0	0	91	5	0
6	0	2	2	0	8	8	0	109	10	0
7	0	2	9	0	9	16	0	127	15	0
8	0	2	16	0	11	4	0	146	0	0
9	0	3	3	0	12	12	0	164	5	0
10	0	3	10	0	14	0	0	182	10	0
11	0	3	17	0	15	8	0	200	15	0
12	0	4	4	0	16	16	0	219	0	0
13	0	4	11	0	18	4	0	237	5	0
14	0	4	18	0	19	12	0	255	10	0
15	0	5	5	0	21	0	0	273	15	0
16	0	5	12	0	22	8	0	291	4	0
17	0	5	19	0	23	16	0	310	5	0
18	0	6	6	0	25	4	0	328	10	0
19	0	6	13	0	26	12	0	346	15	0
20	0	7	0	0	28	0	0	365	0	0

BOOK THE ELEVENTH.

MONTHLY CALENDARS OF FARM WORK IN ITS VARIOUS DEPARTMENTS THROUGHOUT THE YEAR.

CHAPTER I.

CALENDAR OF WORK IN CONNECTION WITH YOUNG STOCK, STORE CATTLE, AND FATTENING BEASTS.

OCTOBER.[1]

YOUNG STOCK should be brought in from the outlying fields in which they may be pastured, at night, and housed either in stalls or yards with sheltered sheds, as the night air is now often cold and damp. If the weather be wet and stormy during the day they will be all the better if not put out to pasture. Give good and nutritious food when housed, and, if wet when brought in, rub them well down with dry straw. As pastures by this time are poor and afford but a scanty bite, supply them, if kept out at grass, with a full allowance of such cut green forage food as may still be had, or white or yellow turnips. These will be most economically used if given in racks or in the cribs of the sheltered sheds, if these, as they ought to be, are supplied to pasture fields in which stock are intended to be wintered. To the turnips straw should be added—and the turnips should always be sliced or pulped—the straw cut into chaff, and the whole well mixed together. An occasional feed of oil-cake, or good artificial food, or home-grown grains or beans ground into meal, mixed with the turnips and straw, will be beneficial. Attend to the condition of their bowels. (For appropriate and safe medicines for this *see* Text.)

Store Stock are, as a rule, fed wholly upon turnips and straw forage, given in their crude or natural condition; but they will be more readily assimilated by the animals, as well as much more economically consumed, if the turnips are given in

[1] As the farmer's year, from custom, and in most instances from convenience, generally commences from Michaelmas, the following calendars have been drawn up with reference to that circumstance.

the sliced or pulped form and the straw cut into what is called chaff, the two being well mixed together. Those beasts which are approaching the period of being ready for fattening off, say within three to four months from now, should have occasional, if not daily, feeds of oil-cake or other good artificial food, to the weight of from two to six pounds daily; the weight being gradually increased as they increase in bulk and fatten. The white turnips should be fed off first, next the yellow, by which time the swedes will come in. Potatoes may be substituted for turnips if these be scarce, though the value of potatoes for store stock is doubtful. If parsnips be given they will be better in every way.

Fattening Cattle.—Bring steadily forward the fattening of those beasts set aside to be exhibited or sold at the Christmas fat cattle shows by careful attention to the kind and quality of their food, the regular times at which it is given them, the general condition of their health, and the cleanliness of all connected with them. Aim more at producing a uniform quality of moderately fat but sound, firm, and solid flesh, with that due and finely adjusted proportion of fat and lean which is now much more and justly appreciated by the consumer than the high state of obesity which was the fashion some years ago, and which some feeders still aim at producing. See to the quality of the water, which is of prime importance in good feeding. The eye is a bad judge of the quality, as the clearest-looking water is not always the purest; it will pay to have it analysed; and if good, supply it *ad libitum*, the animals will take no more than they wish for. The allowance of oil-cake must be increased gradually as the beasts fatten; and it will best be given mixed with sliced roots and cut straw. For the beasts less advanced, feed on the food recommended by Mr. Jonas Webb (*see* Text), and with only a moderate allowance of oil-cake, for which some of the meal of home-grown produce may be substituted. If there be, as there should be with a proper system of arable culture (*see* Text), a variety of foods, give frequent changes of food to the stock of all kinds; these will be found highly beneficial.

NOVEMBER.

Young Stock.—As this month begins what may be called the severe and trying months of the year for live stock of all kinds, take up young stock from outlying pasture fields and house them at the steading. The best method is perhaps that of the 'Hammel,' for which *see* Text. Give clean and sweet bedding both in shed and yard, and whitewash the walls of both inside and out. By doing away with the system of 'wintering' the young beasts in the pasture fields, saving in more ways than one is effected, the pastures are improved, the health and condition of the stock greatly advanced, and the utmost economy in feeding secured. See to the condition of the bowels of the animals, and be careful to keep their bodies clean and free from matted dung, &c.

Store Cattle should also be brought in from outlying pastures —where they are too apt to be neglected, if from nothing else, from the distance alone at which they are from the steading—and put up in fields near the latter. Where pastured in outlying fields, provide shelter sheds as an imperative necessity, in which supplies of food should be stored up to provide for emergencies in stormy weather when the grass is snow-covered or frost-bound. Should weather of this kind occur, make daily visits to see after condition of stock; these should be made, indeed, in all weather. If additions be made to store stock in order to make up for those shifted to fattening beasts, keep them separate for some time from the others if they have been bought in open market, in order to avoid all chance of disease—as foot-and-mouth—being imported into the farm. Give beasts approaching the fattening period a daily allowance of oil-cake or home-made meals, the quantity increasing from two to six and eight pounds daily in proportion as they fatten. Slice roots and cut all straw fed to them, and see to the general state of their health, the condition and supply of water, and the cleanliness of bedding in shelter sheds, and also of the bodies and coats of the animals.

Fattening Stock.—Give as great a variety of foods as the stock in hand will admit of, as home-made meals, beans, peas, seeds of tares or vetches, oats, &c., &c., and of bought or foreign produce, as lentils, carobs, or locust beans, and of roots, turnips, parsnips, and occasionally Jerusalem artichokes. In severe frosty weather give at least one warm mash daily; this will be best if given before making up for the night. Keep roots in the house for some time to raise their temperature before giving them to stock; cold frozen or half-frozen roots affect fattening stock prejudicially. Cut, slice, or pulp them, and cut the straw, mixing the whole before feeding. Rub down daily, morning and evening, with clean dry straw all the animals so as to free their coats from adhering dung, and currycomb at least twice a week to free their skins from dust (*see* Text). Keep all feeding vessels scrupulously clean, and bed with cut, not long, straw.

DECEMBER.

Young Stock.—As the severity of the weather increases, increase the attention paid to condition of animals. See to the soundness of their food, the quality of the water, and the sweet condition of the bedding alike in sheds and yards if Hammel-fed, or of stalls if stall-fed. Give occasional—some feeders give daily—allowances of oil-cake, or of home-made meals of beans, peas, lentils, and carrots, oats, &c., &c., the great object being to keep the young animals in a regularly progressive and improving condition, never allowing them to go back, to which change of food greatly conduces. See to state of bowels, as young stock have always a greater or less tendency to constipation.

Store Cattle.—*See* remarks made last month. If pastured in outlying fields, make daily visits to them, and see that they be supplied with abundance of food, and that the ponds or troughs, if ice-bound, be broken up.

Fattening Stock.—This being the great month of the year for fat beast sales and shows, the few days at its beginning should be taken advantage of to prepare those animals which are to be sent to them—not in the way of 'doctoring' them in some of the illegitimate methods known to, and practised by, some—but in the legitimate way of 'polishing them off' by good feeding and attention to their health, in which much may be done in a short time if the previous periods have been duly taken advantage of. See well to the state of the skin and coats of the animals; rub them down daily with clean straw, and currycomb or brush them at least three times weekly. (*See* Text as to the important functions performed by the skin.) This will add greatly to their appearance as well as their health. Those animals which are ready should be carefully gone over with a view to choose the best; and should there be a doubt as to the points or condition of any one, the doubt should be given to the keeping back of the animal, to be sold off at the earliest opportunity. For if the feeder 'goes in' for prizes at shows, and aims at a reputation for breeding fine stock, this should not be risked by carelessness in sending out doubtful animals. The hint here given is worth attending to. Those animals not designed for the shows or sales of this month, but which are nearly ready for the butcher next or thereabouts, should be pushed on rapidly, the best food being given and in liberal quantities, the allowance of oil-cake now reaching its maximum of six or eight pounds daily; some stock which 'take kindly' to food making greater progress on a smaller allowance than others on a larger. It is by attention to these 'fine points' that the stock-keeper shows best the knowledge he has of his business, and makes money where others lose it.

Store Cattle getting on for fattening should be well fed, allowances of nutritious food being given them in addition to their usual food of turnips and straw, this being the chief if not only food of those animals which are to be grazed during the approaching summer. Give those which are making poor progress occasional, or, if necessary, daily extra allowances of oil-cake or home-made meals. Rape-cake is as nutritious as oil-cake (linseed), and its acrid qualities can be easily got rid of by boiling it in a turnip and straw mash, or by pouring boiling water over it.

JANUARY.

All stock without exception will test the patience and try the skill of the feeder this month, if its characteristics are those of the kind which may be reasonably expected. If any are 'wintered' in outlying pasture fields, and especially if so wintered as unfortunately in many districts is the rule, where the poor beasts have to make the best of the worst circumstances as regards food and shelter under which they can be placed, the stock-keeper will have abundant opportunities—if he looks at all after them, not always the case—to see the folly of the system, as one ill calculated to advance their condition. Give, then, to those which are so sub-pastured rich supplies of food additional to that which they may manage or not manage to pick up through snow-covered or ice-bound herbage, poor and innutritious as at the best it is. See also to the condition of the water-troughs or drinking-ponds.

Young Stock, housed as they should be at the steading, must be carefully attended to as regards supplies of food, clean bedding, and water. See to the state of their general health, giving special attention to that of the bowels—the best indication of the former.

Store Cattle.—*See* last month as to general directions.

Fattening Cattle.—Much, if not all, of what was recommended to be done last, should be done this month. Give as frequent changes of food as the stock in hand will admit of. In no case in severe weather give large feeds of cold or half-frozen roots; but, before feeding with them, keep them under cover for a day or two, and with clean—not musty—straw strewed over them. Slice and mix them with straw-chaff, oat-straw being the most nutritious. By way of change, pea-haulm may be given in place of straw; or, when mashes are administered, bean-straw may be cut and mixed with the turnips and allowance of oil-cake. Some feeders prefer—and there is much in the plan to recommend it as it gives zest to the otherwise dry and somewhat tasteless food—to give the oil-cake, or other substitutes for it, as meals, &c., along with the sliced roots and cut straw in their dry state. In all cases a modicum of salt should be given with the food.

FEBRUARY.

Young Stock should be kept going on each week, so to say, making a further stage in their improvement as compared with the last, for if through neglect they are allowed to 'go back,' what was made previously may never again be made up. This care is specially demanded during the present month—perhaps of all the spring months the most trying to the health and condition of all classes of stock, as the winds are generally high, and bitterly cold and searching. See then to the proper bedding of the animals, using dry and sweet straw. As this article will now or will soon be getting scarce, economise it by substituting fern-leaves, if they can be had, ordinary leaves, or sawdust, which last makes very good bedding. In all cases where straw is used cut it by the machine into short lengths; this alone will effect a large saving, and render the cleaning a much more easy task. To what was said last month of *Fattening Stock*, little requires to be added this month; let, however, the caution just given as to the weather be attended to, as it is specially applicable to beasts getting ready for the butcher. Cold, damp, and what is known as 'muggy' weather does more injury to cattle well advanced to the sale period, and which are, therefore, more liable to sudden changes and bad weather than at earlier periods, than positively frosty sharp weather. But against the effects of both, fat cattle must be specially guarded. Give the best and most nutritious food most fitted to them; see that the bedding be clean, dry, and sweet, the water good, and the feeding-vessels in a state of the most scrupulous cleanliness. Pay special attention to the state of the bowels, for if these be constipated the best food will fail of its effect. The sulphur and nitre dose is the safest and the best; many valuable cattle have owed their health, indeed their lives, to its use (*see* Text).

MARCH.

If February was a trying month for stock, March, with its proverbially blustering, keen, and cutting winds, and its too often damp and searching air, is still more so, and tries to the utmost as a rule all the cares of the stock-feeder to protect his in many cases all too delicate animals from its effects. But keeping as a rule to the recommendations we have given for the last month or two, he may consider that he has done all that may be reasonably demanded of him. He cannot expect—and we should be wrong if we led him to do so—that the results will be satisfactory in any sense, as far as true progress of the animals is concerned, if he has persisted, in spite of all that has been briefly hinted at in this calendar, and fully explained in the text, in exposing his *Young* and *Store Stock* to wintering in outlying pasture fields, with their poor supply of herbage, with their exposure to all kinds of weather, without shelter of any kind being afforded them. Where this is, however, persisted in, see to daily visits being paid, that food of good quality and in abundant quantity be supplied them, and the water supply attended to. As regards *Store Cattle*, the remarks as to the economy of straw apply to them equally as to young cattle, and the wasteful use—if the word be allowable—of it which goes on in some feeding-yards should never be tolerated in well-regulated farms. The recommendations given already as to cutting it both for bedding, where the animals be housed in yards and sheltered sheds, and for feeding should be attended to with still more scrupulous care as the season advances and the supply gets scarcer. The same remark applies to roots, which should never be given to the animals whole but always sliced or pulped. (For relative advantages of pulping and slicing *see* Text.)

Fattening Cattle.—Those within three or four weeks of being ready for the butcher should be polished off by regular allowances of sliced or pulped roots, cut straw—oat is the best, and pea-haulms equally good, if not better—with the full allowance—six to seven pounds daily—of oil-cake or home-made meals. The more varied in kind these latter are, the better. Beans, peas, lentils, carobs, or locust-beans, maize or Indian corn or rice, all mixed together in due proportions (*see* Text for feeding value of each), will be highly beneficial to the animals. Those further off the selling period will have a less allowance of these stimulative foods according to their condition; but in all cases no whole roots—except a few as a *bonne-bouche*—should be given. Attend to the quality of the water as an essential, to the bedding if stall-fed, and to the general and scrupulous cleanliness of the food-vessels, and of the animals themselves. Do not neglect the currycomb as well as the clean straw for rubbing them down, nor the condition of their bowels.

APRIL

Begins the 'genial' months of the year, and if the arable part of the farm has been duly attended to (*see* text and Calendar of General Farm Work) the pastures will be fast approaching that period when much of the in-door labour of the stock-keeper will be saved. One word of caution—and it is much required as a rule—must be given here: do not send the stock to the pastures at too early a period. A vast deal of loss is sustained by doing this; the early grasses have not time to gain their full nutrition; by being eaten down the protection afforded by the older grasses to the tender shoots of the younger ones against the early frosts is lost; while the whole is greatly deteriorated by the trampling of the animals over the wet and unconsolidated condition of the surface. Where pastures are ready it is the better plan to cut the grass as forage food, taking it to the stock in the stalls or yards, where none is wasted if judiciously used. (*See* Text on Soiling of Cattle and Stall Feeding.)

Store Cattle which have been winter-fed in sheltered fields near steading, or in yards and sheds at same, may be turned out to outlying pastures if these be in a good enough condition, and the weather be good and likely to continue settled; but in settled bad weather delay doing so till improvement takes place. It is much the safer way to turn them out permanently at a later period of the year. If the fields are small, which is the best arrangement for pasturing, decide upon the order in which changes from one field should be made, modified according to circumstances of condition of grass, &c., of same. (For advantages of change of food or 'bite' of grass *see* Text.)

For *Store* and *Fattening Cattle* the remarks of last will apply pretty generally to this month; this only being added, that much more might be made of the home-made artificial foods than is as a rule made now, and with a decided saving. In this, as in many other departments of cattle-feeding economy, the money of the stock-keeper might be saved, as assuredly the well-being of his stock secured, by a little timely attention being given.

In the case of fattening cattle approaching the period of being ready for the salesman, as turnips will be becoming scarce, mangold-wurtzel may be given if they are in stock; failing these, parsnips and Jerusalem artichokes, both of which are much liked by stock, especially the former, and the value of which as a cattle-feeding root is by no means appreciated as it ought to be; so also may be said of the artichokes, which as a rule, however, should be given cooked. Potatoes as a feeding material for fattening cattle are much spoken against by some feeders, as highly of by others, but generally they are considered more applicable to store cattle. If given to fattening cattle they should be mixed with the roots and with oil-cake or home-made meals, to which salt should invariably be added. See to the general condition of the health of the stock, special attention being paid to what has been called the 'sheet anchor' of this—the bowels.

MAY.

The first good supplies of pasture grasses may be looked for this month, but for the precautions to be taken on putting stock in pasture fields *see* Text. Stock which have hitherto been fed on winter food are changed to green pasture grasses; the change must be made gradually from food which has been generally dry to that more or less succulent. The safest and the most economical plan will be to cut a portion of grass from the pastures, and stall or yard feed on the grass as forage food. After a while as the pastures improve, the *Young Stock* and *Store Cattle* should be let into them by day, bringing them home—at least in the case of the young stock—at night. In no case over-stock the pastures so that the grass will be too much fed down (*see* Text).

Fattening Cattle.—Those beasts from the store cattle which have been gradually getting ready are now to be drafted off to supply the place of the animals which are despatched to market. Of these store animals select the best, and those most likely to be got ready quickest for the midsummer sales. To the pasture food to which towards the latter end of the month those selected animals will be shortly put—excepting in the case of those reserved for the soiling or stall-feeding systems—add a gradually increasing allowance of oil-cake or home-made meals. Fattening beasts nearly ready for the butcher should be finished off with their maximum allowance of those nutritious foods, not exceeding, however, in the case even of the heaviest beasts, eight pounds daily. Give in all cases and to all classes of stock a modicum of salt, and pay particular attention to the state of their bowels, using under ordinary circumstances the sulphur and nitre mixture. Fattening beasts put to pasture must be gradually accustomed to the change in their food.

JUNE.

Young as well as *Store Cattle* are now put out to pasture. Those of the latter approaching the period when they will be drafted off to supply the place of fattening beasts sold off, should have an allowance of oil-cake given them, beginning with the minimum of two pounds, or even less, daily, according to their condition. Those of the young stock which are backward and making but slow progress should have the same. Change the pasture fields in the cases of both classes from time to time; a fortnight to three weeks at the most being a fair period for any one field being occupied. The same applies to *Fattening Stock* out at grass, which should in all cases have their allowance of oil-cake or meal. Where they are *stall fed*, the grass cut for a portion of their food should be cut in small portions at a time only, so that it be fresh and sweet. The green forage food, as vetches, &c., &c., will now be in good condition. Those with the grass should be so given that as frequent and complete changes in the food be given as possible; add salt in all cases, and those stall-fed should have a lump of rock-salt in their feeding-mangers. See that the drinking-ponds and troughs in the fields are clean, well supplied, and in good order. For stall-fed beasts, have all the feeding-vessels in the highest condition of cleanliness, as also the animals themselves (*see* a preceding month and the text for the important ends these serve). The fattening beasts should have been so managed that as complete a clearance of the whole should be made this month for the usual shows and sales which take place during the next month; all store cattle ready to take their place, or be bought in; which practice (see text for reasons) should, however, be avoided if at all possible.

JULY.

Store cattle and young stock may have such last supplies of swede turnips as may be left over from the winter stock in addition to their pasture grasses, or they may be given to the store cattle alone which are likely to be ready for being fattened up in a period of about three months from now or so; this will push them on, to aid which also an allowance of oil-cake may be given them in gradually increasing quantity, the minimum two pounds daily. To fattening cattle at pasture mangold wurtzel, parsnips, and other roots left should also be given, with occasional supplies of green cut forage food, as vetches or the like, in order to give them the benefit of change of food; for which useful end, also, change the pasture fields (see last month). All cut food and their allowance of oil-cake should be given them in feeding racks, never thrown or strewn upon the surface of the grass, a practice which results in half at least of the produce being wasted by being trampled, breathed, and 'voided' upon. When stall-fed, fattening cattle should have their cut food given in small portions at a time, fresh and sweet, and with frequent changes as to kind. Keep the houses well aired, but the animals out of draughts. See to the supply of water, abundant in quantity and pure in quality, and to the thorough cleanliness of all the food vessels. Keep the animals free from all dried dung on their coats, and their skins pure and free from dust and of a healthy delicate red colour, to which end use the currycomb or hard brush and dry clean straw regularly. See to the healthy secretions of the animals, carefully avoiding all approaches to constipation or irregularity in their liquid voidings. Those and other points (for which see text) being attended to, stall-fed fattening stock will be as healthy as those pastured out. Keep stock of all classes pastured, free from the attacks of flies and insects, for injurious effects of which on health and condition see detailed remarks in text.

AUGUST.

Pastures becoming now in many districts short of grass, from being overstocked, or from being dried and parched through lack of rain, the short supplies must be supplemented by those obtained from the breadths of land which the judicious and prudent cultivator will have devoted to the growing of forage foods. The greater the variety of these, the more likely will be the success of the crops as a whole, and the wider the changes which may be made in feeding. These immense advantages will be perhaps more felt and better appreciated in the case of stall-fed or soiled *fattening cattle* than in that of stock pastured in outlying fields, although in these they will often in certain seasons be found of great value. In pasture fields give the cut food in racks or in the cribs of the shelter sheds, which should be provided to all of them without exception, whatever be their extent. Keep changing the fields. For remarks on this and on all other points connected with the feeding of all classes of stock pastured out, and fattening cattle stall-fed, see remarks in last two months.

SEPTEMBER,

In its occasional nights of 'nipping and eager air,' gives warning of the approach of the dreary months now near at hand, and of the necessity with the prudent stock-keeper to bring *young stock* and *fattening cattle* out at pasture to the shelter of the yards and houses at night. Do this every night rather than run the risk of the animals getting injury through exposure. In the case of *store stock* not yet brought in to in-lying pasture fields near the steading, or designed to be wintered in out-lying ones, see to the shelter-sheds being well cleaned out, and bedded down with clean sweet straw. Pastures being now poor, grass must be supplemented for all classes of stock pastured out, by cut forage food, and by white or stubble turnips, which ought to be ready by, indeed before, this time. They should be sliced and mixed with the cut green food, or with the straw of the season's cereal crops cut into short lengths. Those stock getting supplies of oil-cake, &c., should have this also mixed with the other food, all of which should be given in the racks or shed cribs or mangers. Clean out this month all drinking ponds, and make good their sides and bottoms, repair water troughs, and see that their supply pipes are in good working order. Repair and make good the roofs and walls of shelter-sheds, clean out the floors of same of all dung; repair cribs and mangers, and have the fittings of the lock-up provision boxes, &c., in working order. Prepare all, in short, for the coming winter months, during which no work of this kind should have to be, and for which opportunities are not often offered in which it can be done.

CHAPTER II.

DAIRY COW CALENDAR.

OCTOBER.

THOSE cows still kept out at pasture should have the poor feed of grass which they now yield supplemented by such cut forage food as may yet be in stock, this being given to them in the field racks, or the feeding cribs of the shelter sheds. If cut and mixed with the straw of the new cereal crops of the season, together with the allowance of oil-cake or home-made meals, the food will not only be more economical, but more nutritious. Take the cows into the house at nights, as the night air at this season is cold, and raw and early frosts may set in. (Better results in every way will be obtained by giving up the system of pasturing, and housing the cows wholly.) Should the weather turn out thoroughly wet during the day, the animals even then should be housed, well rubbed down with dry straw, and have a warm mash given them. Do this also when taken in at night under the like circumstances. Feed the cows which are stall-fed or soiled with regularity, carefully avoiding long intervals between feeding times. Clean out and keep scrupulously clean all feeding vessels. Whitewash the walls, previously brushing them down to free them from dust, cobwebs, &c., &c. Take advantage of the animals having their daily turn in yard or paddock, to thoroughly clean out the whole interior of house; wash down all the woodwork, and make all neat and tidy for the winter feeding.

NOVEMBER.

The work to be done this is very similar in its general character to that of last month. Cows out at pasture, however, should now be brought into the house for the winter season. In very damp weather with low temperature give a warm mash in the middle of the day, and keep them wholly in the house, omitting even the daily short run in the yard or paddock. Pay particular attention to the cows selected to be sent to the forthcoming cattle shows, to see that their general health be good. Give them food calculated to increase the flow of milk. Be careful to currycomb them regularly. Keep their coats free from all soiled matter. Select calves from those calved in spring to breed from. Weed out those which give the best signs of being fattening rather than milking beasts. Keep a regular diary of the 'doings' of all the stock, meat they consume, milk they yield, &c., &c. Clean out all stalls, and whitewash the parts which appear to be getting soiled.

DECEMBER.

As the cold increases, add to the bedding of the cows, and let the food be mainly given as warm mashes. Pay particular attention to the bowels. To those much constipated give an increased allowance of oil-cake, and if this be not effective in getting rid of the complaint, give at first a slight purgative. Let this have ample time to act on the bowels; do not force action by increasing the dose. Give rape cake to those cows in milk, the yield of which seems to be falling off, in a mash of moderate warmth, but of thinner or more fluid consistency than usual. Decrease the number of and reduce the thinness of the mashes of cows about to be or now being dried off for calving. Do this gradually, and note the effect upon the bowels. Give food of moderate richness only, to cows near calving, and pay particular attention to their health.

JANUARY.

To cows in full milk give ample supplies of nutritious food, those substances being chosen which are known or found to increase the flow of milk, rather than those which have a tendency to fatten. If the recommendations in the text have been followed, add to the other foods cabbage. Give changes of food from time to time. Give rape cake, as of the oleaginous foods it is best adapted to this purpose. Where quantity rather than quality of milk is desired, give good feeds of thin liquid mashes; if near a town, use liberally grains or distillers' wash. Avoid giving heavy meals of raw cold roots to cows near their calving, slicing or pulping them, and mixing them with other foods. To cows within two or three weeks of calving begin to give daily an allowance of three to four pounds of the best oil-cake. See particularly to the state of their bowels, which keep gently and freely open. Cows 'noted' to calve about the middle or end of March should be begun to be dried off. Do this carefully at first, gradually decreasing the quantity of milk taken. When the udder gets hard and with a slight tendency to inflame, rub it gently several times a day and with a simple cooling unguent; camphor pomatum or oil is the best. Rub only with the hand if no tendency to inflammation shows itself. Keep cows near calving housed. Bed all the animals with sweet straw, and clean out carefully all the stalls and gutters.

FEBRUARY.

Be careful as to exposing cows in calf, and especially those near their time, to cold weather, and damp and rain. Should they get by chance wet, house them quickly, and rub them well down with dry straw. Give them dry bedding and a warm mash. Give cows in full milk as juicy and succulent food as can be got; slice or pulp the roots, cut the straw into chaff, and make the whole into a mash, not too warm but thinnish in consistency. Keep giving changes of food, substitute occasionally for the ordinary swede the mangold or the parsnip. Add also meals of home-grown greens, and if to be had at a moderate rate, keep giving feeds of brewers' or distillers' wash, to promote flow of milk. Give drying cows a modicum of hay daily, and to those near the time of calving four to five or six pounds daily of oil-cake. Keep the temperature of the house comfortably warm, but not close. Study the way in which the winds blow, and open and close the fresh air ventilators accordingly. Towards the end of the month all the animals will be the better if a portion of sulphur is added to their food, say every other day, for a week. Keep the stalls, woodwork, and gutters thoroughly clean. Currycomb all the animals at least twice a week, thoroughly but yet not roughly—there is great art in currycombing properly—and rub them down with dry straw each time they are cleaned and bedded up. The gentle friction caused by this, especially at bedding up for the night, reduces restlessness, and predisposes them to sleep and quietness.

MARCH.

Exercise caution in exposing the animals, especially those which have recently calved, to the somewhat tempting yet withal treacherously cold and bitter winds of the early part of this month. If let out for an airing, the yard will do better than the paddock, as the sheds will afford shelter when required. See caution given last month as to cows getting wet. See to the condition of cows about to calve as regards their bowels, and do not omit their daily allowance of oil-cake. Remove them to a loose box or roomy double stall; the first is best. Much danger is to be apprehended from the really cruel system of allowing cows to calve when tied up. Give cows which have calved warm drinks, avoiding the giving of large draughts of cold water. The food should be at first thin but moderately nourishing, increasing the nutrition gradually. Rich food given suddenly is apt to induce milk fever. Draw off the milk frequently, yet gently. Keep down all distension of the udder, and look carefully for all appearances of inflammation in the same. The gentle rubbing of the udder by the dairymaid will be peculiarly grateful at this time to the animal. This process has often been found preventive of bad attacks. Remove frequently the old bedding, and renew it with clean sweet short-cut straw. Give a handful of good hay occasionally, and keep a lump of rock salt in the manger for the animal to lick at.

APRIL.

Cows soiled should have to their other and ordinary food, cuttings from the tares and winter rye, breadths of which were sown the autumn previous. Take care not to cut this food unless sufficiently advanced, which may be the case if the season has been backward; by cutting too early much of the crop may be lost, while the food is not so good for the cows. Gradually accustom the cows to this green food. Bring in cows turned out to pasture at nights, and keep them housed on such cold, wet and raw days as happen during this month. Keep cows in full milk housed, as they will yield more when not exposed to the cold of the pastures; if rape, or vetches and rape, has been sown the winter previous and it be sufficiently ripe, give to these, cuttings twice a day; this will promote the flow of milk considerably. For other treatment as to food, &c., &c., see previous months.

MAY.

Cows which have recently calved and are in full milk should now be yielding the largest profit. Much will, however, depend upon the feeding and general treatment. As green food ought now to be had in abundance, feed the cows liberally upon it, taking care to accustom them gradually to it. Give as frequent changes of food as possible, and if soiled—as this will pay best—turn them out to the yard or paddock daily. Clean and curry-comb the cows regularly, and well ventilate the byres or cow-houses. Pastures should now be at their best, the grass being sweet, succulent, and plentiful. Turn out cows designed to be pastured; but especially in the case of those in full milk, it will pay best to house them at night regularly. In thoroughly rainy days keep them also housed.

JUNE.

Keep changing the fields for those cows at pasture, so as to afford them the advantages of change of 'bite,' as well as to give the grass an opportunity to grow. Avoid the overstocking of pastures, as both they and the cows feeding off them will suffer. Cows soiled in the house and court should have cut grass given them as change from the other green forage now in abundance, the various succession of crops coming in regularly to keep up the supply. House cows at night which are pastured. Attend to the health of all, especially those about to calve; to these give for the last fourteen days a full allowance of the best oil-cake. Give to cows brought in at nights from pastures a 'handful' of good hay and a little oil-cake: increase the allowance of this, and the varieties of food, to those which appear falling off in their milk.

JULY.

The remarks of last month will apply to this nearly wholly; but if shelter sheds be not provided in the fields, take special care to house the cows during the hours when the 'fly' is doing its worst wherever it can. Cows near calving or far advanced in calf should, indeed, be housed during the very hot weather, as great injury may be done them by being 'gadded.' Under rather than overstock pastures, and see to the supply of water that it be abundant and good. Keep changing pastures.

AUGUST.

Look at the state of the pastures, as they begin to fail in the dry weather which this month is so often prevalent. In such cases, reduce the number of the cows pastured, or change them to a better grassed field. But with failing pastures it will pay better to soil the cows in the house or in the sheds and courts. Attend to the general health of cows; give all in milk a regular supply of oil-cake. House pastured cows during very hot days, or at least during the hours when the fly plague is at its worst, and house them regularly at nights.

SEPTEMBER.

Failing and failed pasture fields being now pretty universally the rule, give to cows kept regularly out proper supplies of other food, as cut green forage food, rape, mustard, tares, &c., &c., and on housing them at night a bit of hay and a modicum of oil-cake. It will be advantageous to cows in milk to give them towards the end of the month cooked food at least once a day, the last meal at night being the best time. Cows regularly soiled, if green forage food be yet moderately abundant, need not have this cooked mess till further on in the season, or unless they begin to fail in milk. See to the health and general condition of the cattle, and begin preparations for the coming winter season.

CHAPTER III.

SHEEP AND LAMB CALENDAR.

OCTOBER.

THE lambing of ewes varies with the varying localities and their climatic conditions, going on in what may be called an unbroken succession from January—which may be called the earliest month of the earliest or southern district—until April, and even up to the middle of the month, which may be called the latest month of the latest, or upland, hilly, or mountainous districts. So in like proportion does the time vary for the ewes being put with the tups or rams. Thus in early districts ewes may be removed this month, and they should be pastured in a good fresh field, in order that the date may be known at which each ewe is served; the ram should be smeared or marked on the breast with red keel, as a portion of this will be transferred to the hind quarters of the ewe, and the shepherd going his nightly round of his flock will be able to see and take 'note' of the date of each ewe. In arranging to serve the ewes, care must be taken in accordance with the known average peculiarities of the district; to arrange so that the lambing will take place at a period when the flush of early sweet grass is coming in. Sheep put up for fattening should have an allowance daily of oil-cake, the pastures beginning now to fail and yield but poor bites; the weight of cake will vary according to that of the animal, from three-fourths of a pound to a pound. The cake will best be given along with cut hay, and both be put in the sheep racks. Meals may be allowed in addition, Indian corn meal being good and liked by the animals; there are also several good artificial foods in the market which have a very decided effect in fattening. Sheep folded upon turnips should have an allowance of hay daily, this being placed in the racks. Where lambs are set aside to be fattened in spring or the late winter months, they should have an allowance of sliced turnips daily; if the pasture grass is not 'hashed' and muddy, these may be thrown and spread over the surface, but it will be much more economical if these and all other kinds of cut or separate food be fed from the racks. Prepare—no matter how roughly, so that they be moderately 'snug'—sheltered sheds in the fields in which sheep are to be wintered. In those in which they are to be 'folded' on the turnips, by taking advantage of convenient parts of the fences, &c., comfortable rough shelter may be secured for the sheep from the rough, wet, and stormy weather now to be looked for. Dip all sheep at once which have been overlooked or neglected during the preceding months. Dress all sheep in order to destroy the parasites with which they are so tormented, using 'dips' which will not discolour the wool. Hill-pastured sheep not thriving may recover and do well if placed in fields in which there are either naturally formed sheltered places, or better still in which sheltered sheds can be erected. See to the condition of all 'stells' that they be in good repair. It will pay in the long run if one 'stell' be provided with a small structure, in which various medicines and necessaries useful on emergencies can be stored up, under lock and key, and one part of which may have room for a small shelter for the shepherd, fitted with one of the small but admirably acting stoves to be had so cheaply now. By having such a place and with such conveniences and 'stock' many a good lamb or sheep may be saved which would otherwise be lost. See to the general condition of the flock as regards health, and the diseases to which many are so liable; provide in short as far as possible for all possible contingencies in the way of accidents, &c., &c., in the severe weather now coming on.

NOVEMBER.

Keep ewes which have been served, and which in early districts are expected to lamb early, as quiet as possible; keeping a sharp look-out upon dogs—specially stray ones—which run among sheep and, worrying and fretting them, do them infinite harm—especially when in lamb. This is one of the advantages of feeding sheep in sheds, for they can be told off in different classes and no dog worrying of any one class. This system possesses many advantages, and will doubtless, with certain modifications, be that of the future of sheep-feeding. Ewes pastured must have an allowance of sliced turnips, as the grass is sure to be bare. Sheep fattening for sale on the turnip brakes, should have hay supplied to them in the racks, and daily allowance of oil-cake from three-quarters of a pound to two pounds daily, according to circumstances. Straw, cut into chaff, may be occasionally substituted for hay, changes of food being beneficial; meals or grains in like manner taking the place of the oil-cake. If the fattening sheep are being fed in or on stubble or pasture fields, the turnips with which they are supplied should then be given to them sliced and the straw or hay cut, the whole being supplied in racks; the usual method of spreading them on the field surface, although it has its advantages, is by no means economical. A piece of rock salt should be supplied to each rack.

DECEMBER.

Sheep fed in the pasture fields, or folded on the turnip brakes, will find all the advantages of the shelter sheds we have so persistently advocated, both as regards their general condition and the state of their wool, the latter point especially where the sheep are folded on the turnip brakes and the weather is wet, and land consequently trashed and muddy. The colder the weather, the more care must be taken as to the food of the sheep, this being good and nutritious to make up for the demands made upon their system by the cold. Should any of the hillside sheep have been overlooked in the salving for the getting rid of parasites, no time should be lost now in doing the animals. There are various kinds of salves in use, the simplest of all being tar and butter.

JANUARY.

The weather still continuing to increase in severity if normally of the usual kind, the greater the care requisite in the tending and looking after the sheep. Sheep fed upon turnips will require some food calculated to maintain the animal heat, for say what some will, animals exposed to cold and wet, with all the varying temperatures of this climate, and fed with frozen, half frozen, and at all times cold food, must have something given to them by which the balance—and more than the balance—of warmth will be maintained. Oil-cake, meals, artificial foods, &c., should therefore be given with no sparing hand, one pound to two pounds daily being the usual allowance; but this may be varied according to change of weather, &c., &c. With these foods hay and straw chaff should be given, in fact the main point to be considered is that above alluded to, keeping up the animal heat with food extra to that required for fattening, without which feeding can never be satisfactorily accomplished. The necessity to give ewes about to lamb, or not far off the lambing period, good supplies of nourishing food is even still more apparent; as they have in addition to be prepared for their expected progeny. Give, therefore, ewes in this condition good food, and see that they be well sheltered from all severe weather. The popular notion that a ewe in poor condition is better fitted to undergo her labour than one in good, is altogether erroneous and leads to grave losses.

FEBRUARY.

The remarks made last month will apply pretty closely to this; those animals set aside for fattening must have food calculated to fatten them in the most economical and in the quickest way. This appears so conclusive that the marvel is that it should be overlooked, and the notion entertained by so many that the way to fatten a beast of any kind is to stint it of its food. Juster and more correct, because more scientific views, as to feeding are now however being widely disseminated, and we may shortly expect to witness a revolution in sheep as great as we have already witnessed in that of cattle feeding. This month being usually a very severe one as regards weather, it will be essential to afford protection to ewes which are expected shortly to lamb. Scores throughout the country of valuable lambs are sacrificed by being left exposed in the open field to all kinds of weather, and that often of the most bitter kind. See remarks made in previous month as to 'special' shelter sheds. In the case of ewes expected shortly to lamb a change of food will be necessary; where previously fed chiefly on turnips, a change to grass land will be found beneficial, and if not in very good condition through effects of exposure or neglect, an allowance of oil-cake, corn, meals, or artificial foods should be given. Sheep and lambs intended to be fattened off for market as early as possible, should also have full supplies of food given them; oil-cake, &c., being allowed them with hay and straw chaff in proportion and quantity according to the period at which they are intended to be sold off, &c., &c.

MARCH.

For sheep getting ready for the market this is a trying month for the feeder, the pasture grasses not yet having come in, while the supply of turnips begins to fail, and has in many instances wholly failed. Where mangolds have been stored up they will come in very usefully, but caution is required to be observed in putting the animals upon them, as they are often apt to scour them when put on suddenly, especially if not previously properly stored before. This tendency may be reduced or got rid of by cutting or slicing the mangolds and mixing them with cut straw, oat being the best; the mixture will be all the better for fattening by having in it some rough meals, as bean meal, &c., or tares or corn may be given. Give a handful of good sweet hay daily, and see to the general condition of the animals. Ewes about to lamb should be carefully looked after, their 'note' ascertained as to date of being served, and those first due sheltered at nights and in bad weather. Now will be the time to find the value of shelter sheds, which can be used for this purpose, as also for protecting the young lambs. If proper sheds be not erected, very good temporary shelter can be made with hurdles or stakes and straw or gorse or broom branches. To keep up the flow of milk, feed the ewes on a mixture of appropriate feeding stuffs, and give hay of the best quality and straw for cutting up. Pay particular attention to their bowels and general state of health, as also to the lambs; apply proper remedies on the appearance of the symptoms of disease after the birth, and on no account subject them to rain in the fields. Many a lamb is sacrificed to the cruel habit of allowing them to remain in the open fields during wet weather.

APRIL.

Attend to the condition of sheep fattening for the market; as the pasture grasses will yet be very poor, they should have a daily supply of good sweet hay, an allowance of oil-cake, and meals of various kinds. It is a good plan to feed them with a mixture of cut hay, oat straw, sliced or pulped roots with ground grain, or meal, beans, or peas. The whole should be well mixed together with the addition of a little salt, and placed in the manger of the field racks. The daily allowance of oil-cake should not be omitted. Increase the quantity of this as the time for sale approaches. Fattening sheep house-fed may be fed in the same way, but they will be found to take less than the sheep in pasture fields. Keep the floor of the sheep-shed free from soft littery straw, nothing being worse for sheep, giving them a tendency to foot-rot; some prefer sparred and boarded floors with spaces between as the best, the manure dropping through and keeping the boards comparatively clean. Give house-fed sheep daily exercise. Sheep already lambed should have as much succulent food as can be got for them to promote the flow of milk. See to the state of their bowels. Shelter them and their lambs during wet, damp, or cold windy weather.

MAY.

If towards the middle part or latter end of the month the weather be apparently settled for moderate warmth, washing and shearing should be done. The washing precedes the shearing or cutting ten to fourteen days; carry out both operations with gentleness, especially the latter. The washing should be very carefully done, going to the roots of the wool tufts, aiming at uniformity of purity. When one part of the fleece is well, and another badly cleaned, the appearance, if not the quality of the after fleece, is materially affected. The same remark applies, even with greater force as regards carefulness, as to the shearing or cutting. The shepherd should pay particular attention to the lambs, and on the first appearance of the skit or scour, remedies should be instantly applied. Pay particular attention to all classes of sheep when mangold wurtzel is given. The change to this food should be gradual, as it is apt to affect the bowels. If rye, tares, or clover be sufficiently advanced, fold fattening and store sheep, or feed them on cut food in yards or sheds; for food in addition to the field produce, see last month. House ewes with lambs during settled wet or windy weather; keep sheep off boggy land, and if affected by the foot-rot, change them to a hard and poor pasture.

JUNE.

Castrate tup lambs, and dock the tails of all the young lambs; turn into a small paddock the lambs which are weaned, to prevent them being run or tormented by the sheep. If the grass of this be not good, supplement it with cut forage food, as tares, vetches, or clover. Commence all changes of food gradually. Accustom the lambs gradually to the eating of oil-cake and other hard foods, meals, &c. Give house-fed sheep fattening for market, good supplies of cut green food, with daily allowance of oil-cake. For washing and shearing see last month; and as the fly begins to be rapacious towards the latter end of the month, or earlier if the weather be warm, after shearing apply some dip, such as MacDougall's, to sheep on pastures.

JULY.

Sheep pastured and supplemented with succulent green food will require little water, but where pastures are poor and the supply of green food short, they will be more frequently thirsty; see that the water supplied be pure. Where shelter sheds are not provided, or shady places in the field be absent, to mitigate the severity of the attacks of the fly, and in some cases to prevent them, use sheep dips frequently. See that no stray dogs be admitted to the field to drive and worry the sheep, and avoid this when gathering them together to apply the dip. Perform this operation either early in the morning or late in the evening, as the temperature is then lower.

Give ewes set aside for breeding liberal allowance of food, and a portion of oil-cake daily, so that they will be in prime condition to receive the ram next month. Fattening and store sheep house-fed should have regular supplies of green forage food; the former, a daily allowance of oil-cake, and one feed at least daily of a mixed food, described under the head of April.

AUGUST.

This being a bad month for the flies, the animals out in the fields should be regularly dipped, for which see last month. Look to the heads of the sheep, and if any be maggoty, apply the usual remedy and give each sheep a cap to keep the flies off. Put stock ewes upon poor pastures and lambs upon the edditch or after grass of meadows or clover fields. Breeding ewes designed to give early lambs should receive the ram, care however being taken that they have been fed into good condition. Separate old ewes and lambs designed for sale, and if not quite up to the mark, place them in a separate field, and give them extra supplies of nutritious food. Change the rest of the flock to a fresh field. In fields where grass is short and dry, supplement with cut forage food.

SEPTEMBER.

Give fattening sheep nearly ready for market an increased supply of oil-cake, and a daily feed of the mixture named in the month of April. Select well-bred lambs for serving the ewes. House-fed sheep, in the fine genial weather of this month, may be turned out with advantage to fields where the grass is good. If poor, supplement with green food. If the weather be hot and the fly troublesome, attend carefully to the dipping of sheep in the fields. Where white or stubble, or other varieties of early turnips, give supplies to the sheep, putting on the change gradually ; the turnips may be given either sliced or whole, some prefer the latter, nibbling at the roots at least at first accustoms them to the stronger kinds which follow at a later period.

CHAPTER IV.

HORSE CALENDAR.

OCTOBER.

THIS is one of the months of the year in which horses are hard worked, the work of autumnal cultivation, the finishing labours of the fallow lands, and the preparation of the land for the most important crop, the wheat; all tend to tax their working capabilities to the utmost. Their food and general care and management demand the attention then of the stableman, all important as his work is, and however trustworthy he may be deemed by his master, should have that master's eye kept closely on him to see that the work be well done. Hard food being now required, give oats as the staple food, and a daily allowance of carrots, these roots having a most beneficial influence upon the health and in keeping up the general condition of the animals. Avoid long intervals between feeding times; the horse has a small stomach, and cannot lay in a stock, so to say, of food on which for hours he can draw like the ox. The longest interval between feeding times should not exceed four hours. At each feeding time rub the animal well down with dry straw, specially cleaning his feet and lower extremities. On bringing home the animals for the day, the grooming should be done with the most scrupulous care, and should the day have been wet they must be rubbed down with dry straw till they are quite 'warm and comfortable.' Next to good food is careful grooming. If the nights are at all cold, or the day has been wet and stormy, give the last meal in the form of a warm mash made up of hay cut into short lengths, or chaff as it is erroneously but universally termed, with a small quantity of barley meal; a smaller proportion of bean meal, maize or Indian corn too. Some feeders give cut straw as part of the mash; the best and most nutritious is that of oats; pea haulm or straw are also very good and nourishing. As in the case of cattle so in that of horses, changes of food are beneficial. After being carefully bedded and put up for the night, put a handful of good sweet hay and a few carrots into the racks and mangers, with a good supply of water. This they will enjoy much before settling for the night, and serves to give them a good sleep, and keep them from fretting and worrying during the night. Adjust the ventilation so as to ensure a good supply of fresh air, but without draughts or cross currents. Young colts should be broken in. Do this gently and 'affectionately,' for upon the gaining of the 'love' of a young horse depends mainly the whole of his future docility and steadiness, and upon these much of his usefulness in the field. See to the way in which the 'groom' does this important work of breaking in; many a fine horse is utterly ruined in temper through bad, nay cruel training. Kindness will do more, and in quicker time, than harshness. A bad-tempered groom is almost sure to make a bad-tempered or vicious horse. Accustom them gradually to the various parts of the harness. Wean foals, and turn them into a small paddock having a good bite of grass during the day, but house them during the night in yards with comfortable shelter sheds, keeping them out of hearing of the dam. Accustom them gradually to the change, treat them gently and kindly, and give them frequent small feeds of corn, a carrot or two, and a handful of good sweet hay. At night bed them off with a warm mash.

NOVEMBER.

If the field work of the farm has been properly managed, the heaviest portion will have been got through well by this time, or be greatly reduced in amount and in its hard character; so that with this the food may be proportionately reduced also. Do this with judgment, for some stablemen injure the horses permanently in some cases by attempting to save too much in the way of food. The condition of a horse depends upon the quality of food, or is more quickly influenced by the way it is adjusted than perhaps any other of our farm stock, this arising from the physiological structure of the animal. Study the tastes and likings of the horses as regards their food. This is almost a rule having no exceptions, and is of great importance; a horse eating his food with the zest which a 'liking' for it gives will much more likely thrive better upon it than another who does not care for it. Groom carefully on the return of the animals from work; see to the condition of the feet especially and the lower extremities, that they be thoroughly dried. The practice of leading horses into drinking-ponds, whatever be the temperature of the air or the water, suddenly cooling their limbs after hard work in the fields, and thoroughly wetting the hair of the lower limbs, is a bad one, and often gives rise to 'weed' and 'grease,' both most troublesome complaints. They may be avoided by rubbing the extremities thoroughly dry before bedding the animals down. Some go to the 'root of the matter,' and will not allow horses to be led into ponds in cold weather after hard work in the field. This, besides preventing the complaints before named, will often prevent those stomach and bowel affections brought on by the animals suddenly drinking large quantities of cold water when in a heated state. See to the supply of water in the stable mangers, to the ventilation, the cleanliness of all the food vessels, and that of the bedding. For the food see last month.

DECEMBER.

Little needs to be added to that said under last month. If the weather is in its usual condition, the work of the horses may be said to be reduced to a minimum, field work being almost wholly put a stop to, save that of carting manure to the various fields to which it is to be applied, and market carting. With reduced work will be given reduced rations, but those must not be on, or indeed at all approaching, the 'starving system,' or something like it which is the favourite apparently with some stablemen. Although the heavy feeding required when the animals are in full work is not required now, and would be injurious if given, their proper condition must be maintained by judicious supplies of nutritious food; the period rapidly approaching in which they will be called upon to do full duty. Give changes or variety in food, and see to the thorough cleanliness of the stable and all its belongings. Although not always wet, groom carefully and regularly, as this has a most beneficial action on the skin and its secretions.

JANUARY.

As last, so this month, if the weather is in its 'normal' condition, that is truly 'wintry,' the work of the horses of the farm, so far as that of the field or 'tillage' is concerned, is reduced to its minimum, carting being the only form in which any demand is made upon the animals. In frosty weather, this being confined, or should be chiefly confined to the getting in and depositing in the fields of manure, and in 'thaws' the sending out of produce to the nearest market town and bringing back manure, either stable or 'town manure' from ash-pits, &c., &c. All this, although not taxing the powers of the horses to the same extent as field work, ploughing, &c., &c., is still hard work; and although the food rations may be reduced from those of farm 'field days,' they must be such as to keep the condition of the animals up to the proper point. For notes on which and cognate subjects, the reader is referred to last month and that preceding; only remarking here that in the feeding of horses, authorities differ as widely in their practice as do doctors with their proverbial difference. In consulting the matter given on this subject in the text, we would again remind the reader of the importance of attending to the special likes and dislikes of the animal.

FEBRUARY.

As the weather gets more 'open,' the amount of field work is increased in proportion, and in proportion likewise the food supplies are increased also; this being chiefly in the form of larger supplies of corn. The hay supplied should be of the best quality, and when given with the nightly mash, which should not be stopped, if even then, till the cold weather has fairly left, it should be in the form of chaff. Some prefer to give it in this form even when given as a dry food, but as a rule the animals will prefer it in its natural or uncut condition. Carrots should form part of the daily food, care being taken to have a supply of these grown sufficient to last the whole season. Parsnips are as good as carrots for horses, and are as well liked by them, while they possess the great advantage of being so hardy that they may be left in the ground if need be all the winter, being taken up as wanted; and they keep so well that there is no difficulty to have a supply 'all the year round.' It is a most valuable root, and both it and carrots keep the horse in capital condition. The recommendations as to general care of the animals, given under the head of the months of October and November, apply equally well to the present month, and should be as carefully attended to. As in the case of cattle, strict attention should be paid always to the general health of the horses, especially as regards the condition of the bowels. In truth greater attention is required in their case than in that of cattle, as horses are subject to a wider range of complaints and diseases, and are much more liable to be attacked by them. Attend therefore to the slightest symptoms of anything 'being wrong,' and do not rest satisfied with the idea too prevalent that 'it will soon be all right.' Diseases as a rule do not pass away without attention being paid to them; but rather go on quickly from bad to worse.

MARCH.

Work being now, under usual circumstances, in full swing, as the phrase is in the fields, preparing the land for spring crops, and getting in such as are yet to be sown, and the horses therefore in full work, they must now be put on full rations, oats and corn again forming the staple, as it is the most sustaining of all the foods given to them. Beans are more nutritious, and are as supporting, but their fault is a tendency to make the animals constipated. This with some is so decided that they cannot be given to them, or ought not, unless given along with some food having a corrective or opposite tendency. Given along with a full allowance of oats, two bushels per week or thereby, they will suit the generality of animals, especially if carrots, some twenty to thirty pounds daily, be given along with them. A warm mash at night has a good influence upon the bowels. Feed regularly, and with short intervals between the feeds. In wet weather rub down with dry straw, and have the lower extremities thoroughly clean and dry, and the animals comfortable in every way before bedding them. To keep them easy—restlessness is bad for all stock—during cleaning down give them a handful of sweet hay and a few carrots to be munching at. But, as before said, there is a great deal to be done in finding out the likes and dislikes of animals as regards food, and horses are no exception to this common-sense rule.

APRIL.

Hard work being still more the rule this than even last month, increased food rations, both in the bulk and the quality of the materials of which they are composed, must be the rule also. This does not, however, mean as some feeders injudiciously think it does, heavy feedings at each 'meal.' On the contrary, remembering what we have before said as to the smallness of the stomach and digestive organs of the horse, the meals must be comparatively light, and the intervals between them correspondingly short. They should be proportioned to the 'yoking,' or periods under which the animals are at work, the two being arranged accordingly. The system universally followed in Scotland as regards the intervals between the feeding times of the ploughmen, the four hours—or, in the vernacular, 'fowr oors'—suits admirably for the animals, this being the longest period during which they should be allowed to fast and work. There is no more mistaken economy, if the term be allowable, than that of long 'yokings,' or working periods, for horses; under judiciously short ones they will do more work at less cost of food and wear and tear of the system. For remarks on the general system of feeding, grooming, stable management and health, see months of October and November. The green forage food now ready, as winter rape, rye, and vetches, cut along with the straw, and mixed with oats and beans, crushed and ground into meal, will form a capital food, and it will, given judiciously, accustom the horses to the change from the winter to the summer green feeding. A little salt should in all cases be added to the mixture. If vetches or tares be the cut green food, they ought to be allowed to lie for a short period, as if given fresh cut, they are apt to act somewhat strongly on the bowels. Mares about the foaling time should have still shorter periods of work, and these gradually lessened as the time of foaling approaches, work being altogether discontinued for a short time previous, although daily exercise in the yard or paddock is essential. The food given at this time must be nutritious, to meet the drain on the system, but not too stimulating, as this is apt to induce symptoms of milk fever. For ten days or a fortnight before the 'note,' or calculated or recorded time of foaling, particular attention must be paid to the condition of the bowels, it being essential to keep them gently open. Neglect of this has resulted in the loss, through after milk fever, of many a valuable animal. Young colts under training for the 'yoke' should be gradually accustomed to the work, gentle persuasive tenderness being the rule. If men are seen or known to be in the habit of breaking in colts under a different system, they should be warned for the first offence, and made distinctly to understand that the second offence brings 'dismissal without appeal.' A rule of this kind has been known to work where all others have failed, and failure where such valuable stock is concerned is of great importance. The work of young colts should be easy at first, and under it they should be well fed and carefully guarded and attended to.

MAY.

For remarks and recommendations as to foods, feeding, and general care and management see last month, to which the following may be given as supplementary: if carrots are still to be had, or parsnips, they should form part of the daily food, as also green cut forage food. Where grass is cut fresh to form part of the food, it should not be cut till the dew is off the ground, or the rain dried up when rain has fallen some time before. If there be no sun to dry it, it should be allowed to remain in the house for some time till dried. The work being this month unusually heavy in order to overtake the 'turnip brake,' or to get the turnip crops in, the food supplied must be abundant in quantity and good in quality, corn or oats being the staple. Avoid long spells of working, and if the day should prove to be wet, take special care to rub the animals well down till they are thoroughly dry on being brought in for the night, looking specially to the state of the feet. If any should show signs of shivering after they are rubbed extremely dry, give them a warm mash and small dose of medicine.

JUNE.

Turnip-sowing still in many districts going on, at least the early part of the month, the seed not being got in later than the 10th, and much heavy work being still to do, as in hay harvesting, food must be correspondingly kept up; for remarks on which see last two months. Keep changes up as to kind of food, and take advantage of supplies, which should now be abundant, of green cut forage food. For evening meals, capital mixtures can be made with these and with crushed oats and bean meal. Maize or Indian corn is often used; it gives a capital 'coat,' glossy and healthy-looking, and it is a nutritious food; but great care, especially with some animals, is requisite in using it, as it is apt to create troublesome disorders, not always easy to understand, or if understood to remove. It is perhaps best given in the form of meal and mixed in a mash along with other food which will act as a corrective. Do not turn out horses into pasture fields which have been at work all day; by preference turn them into 'Hammels,' the courts of which will accommodate a pair of horses comfortably, but the better plan after a hard day's work is to keep them in the stable, taking care, however, to have this well ventilated, yet free from any draughts. This is a good month for mares to be 'served;' it is scarcely necessary to say that the stallion should be of a first-rate breed. To save money many farmers put to the mares the most wretched 'screws' they can get hold or hear of; this practice is worse than throwing away money. Young colts not worked during the day may be pastured at night, but if the weather be wet, they will be better kept in 'hammels' or in courts with shelter sheds; so also with horses not worked during the day.

JULY.

The work of this month is much less severe upon the horses than that of the preceding month, but as they have in prospect the severe labour of the reaping machine at the end of it—in early districts—their strength to meet it must be kept up by the giving them good supplies of food; and there is still a good deal of work to be done in the way of odd jobs, so that they must not be let down. Proportion the rations, however, to the amount of work to be done; the minimum in any case being three, the maximum from five to six pounds daily of corn; of course these weights are divided according to the number of times the animals are fed. Some breeders give the allowance of corn at one time, making up the other feeds with various substances, a wasteful and we need scarcely say a prejudicial system. See preceding months of April, May, and June as to details of general care, management, and modes of feeding. Those animals not in full work may be pastured, care however being taken to keep them from the torment of the 'plague of flies,' of which some farmers think very little, but which others, wiser in their day and generation, know have a most prejudicial influence upon their health and condition. One day of good, or rather bad torment, will do more harm than days of neglect in other departments. Such evils can be prevented by the provision of 'shelter sheds,' as to which we cannot write too often or urge upon the attention of stock-keepers too strongly. Taking everything into consideration, the advantages arising from the system of stabling or yard-feeding and sheltering of horses, infinitely outweighs that of open-field pasturing, even with the advantages of shelter sheds. Apart from all other considerations, the mere gain in manure is a point to be well considered by practical men, and the feeding with cut food—of which lucerne is perhaps the best—adds greatly to the 'manurial makings.'

AUGUST.

The work of this month, including as it does reaping of the cereals, &c., is severe upon the horses, as anyone may see who watches even for an hour or two their work in the field on a hot day with a heavy crop. The ploughing also of lands which have been occupied by the wheat crops just reaped, adds also to their labour; so that altogether the horses have their fair share of work to do, and require correspondingly good supplies of food. The hours of work should be short, dependent in the case of reaping upon the state of the crop, whether laid and heavy, or a fair standing up and therefore comparatively light crop. For remarks on the general care, feeding, and management, see preceding months.

SEPTEMBER.

The work during this month begins to be comparatively light, the reaping in early districts wholly got through with, the principal work being the autumnal culture, and the last or finishing touches of the fallow lands preparatory to the putting in of the seed. Particular attention must be paid to the health of the animals, as this is a period of the year to which they are more than usually liable to attacks of various complaints and diseases.

Attention to the condition of their bowels is found to ward off many an attack which might and would otherwise prove difficult to deal with, if not in some instances turn out fatal. Exposing the animals to night air, which they cannot possibly avoid, must now be absolutely given up as a practice wholly wrong.

CHAPTER V.

PIG CALENDAR.

OCTOBER.

PUT up store pigs which are advanced enough to begin to be fattened, feed them liberally on the best food at command, corn and peas, beans, &c., and hard grains, forming part of their food, with the usual liquid foods, as dairy refuse, mashes, &c.

Fattening pigs nearly ready for the butcher, should be finished off with regular feeds of thick meal mashes, oatmeal being reckoned the best, maize next in value; a little bean meal will give firmness to the flesh. Keep store pigs regularly and progressively improving, the best picked out for future fattening; and sell off, if desired, such of the others as can be spared. Give young pigs, of the last farrowing of the season, as much of the best part of the dairy produce as can be spared from the feeding of the fattening hogs, and such sows as may have litters. Mix occasionally some meal with the milk, which should be given in a warm state, especially towards the latter part of the month; an occasional feed of cabbages may be given then. These with carrots, mangolds, turnips, will form an excellent food for store pigs, in the form of boiled mashes, to one of which in the day add a little meal. Feed sows with litters on warm mashes and not too thick. In all cases the sties and feeding troughs must be kept scrupulously clean, the bedding of cut straw frequently removed, to avoid the accumulation of dung.

NOVEMBER.

Put sows in good condition to the boar, to have farrows in March, the first of the season. Give sows which may have litters, warm mashes and abundance of dairy refuse, such as whey, butter or skimmed milk. For fattening pigs give mashes, as stated under last month, making these more nutritious as they approach the selling period. Attend to the careful bedding of all the stock and to the careful cleaning of sties, troughs, and bodies of the animals alike; especially in the latter case with fattened pigs about to be sold, and swine with litter.

DECEMBER.

The general treatment of all classes of stock to be very much the same as described under last month; but the more severe the weather, the less the quantity of cold food given them the better, roots and green food in all cases being given as warm mashes. These, in the case of fattening pigs, to be thickened with meals (*see* October). The bedding must be especially attended to. That in the yard may be cut, but in the sheds of the sties should be long straw, especially in the case of young pigs, so that they can burrow under it for warmth. Although opposed to popular opinion, there is no animal of the farm so sensible to cold as the pig; none suffering so much, and deteriorating so much under its influence.

JANUARY.

Keep pigs fattening for bacon regularly and well fed, mashes such as we have described under October, roots and cabbages forming the basis, with the addition of such dairy refuse as can be had, and brewers' and distillers' liquid, and solid refuse grains. Young pigs of the last autumn's litter should be provided as liberally as possible with dairy refuse; a good mixture with the latter being bruised peas and oats, with occasional additions of carrots or beetroots and cabbages. Sows which have been put to the boar for spring farrowing to be kept in good condition, with ample supplies of nearly all the kinds of food which the regular systems of cropping, which are supposed to be carried out on the farm, can afford.

For remarks upon general work connected with littering, &c., *see* previous months.

FEBRUARY.

Sows expected to breed in March must be carefully attended to, special attention being paid to the condition of their bowels, to avoid undue constipation, which may be said to be the foundation or cause of nearly all complaints. Put up for fattening such of the store pigs as may be ready. Commence the richer foods, now to be given, gradually increasing as they get near the period of finishing off. The food should consist chiefly of warm mashes of boiled roots, parsnips, if to be had, forming the largest portion, these being specially adapted for pigs. The mashes should not be too thin, but rather thick, approaching almost to the solid; and as the fattening proceeds, increase the quantity of meal, which should form one of their constituents. Potatoes also may be used for mashes, and now and then a handful of one or other of the best artificial or condimental foods may be given with advantage. Salt is said by some to act prejudicially, if not indeed, as others maintain, as a direct poison; this may be when given in excess, but we have always found when given moderately, that is in quantity sufficient merely to flavour the food and take off its natural insipidity, that the pigs have always relished the food more keenly, and have at all events appeared to thrive exceedingly well. Another food, if it can be so called, or condiment if one wills, is coals, of which all pigs are exceedingly fond, why no one has yet been able to say; but the fact remains, that they eat them with such avidity as to make it appear that they are essential to the maintenance of their good condition. Cinders are sometimes given, but coals appear to be best, which should be given in smallish pieces, about the size of an egg; too much should not be given. We incline to believe that coals act beneficially upon pigs, on account of the sulphur they contain. Sulphur, indeed, should be given in occasional small doses to pigs.

MARCH.

Make preparation for the farrowing of sows, which should take place chiefly this month. Have the sty thoroughly cleaned out, feeding troughs, &c., and good sweet litter supplied in abundance. Fix a board at the sides of the sty after the manner of a lean-to or shed roof, leaving a space below it into which the young pigs may run, as the sow, especially if large and heavy, is apt to overlay them, crushing them up against the walls, as all pigs in lying down prefer to have something solid to bear upon. Provide a hamper to the sty, when the sow is about to farrow, into which the young pigs should be put as they are born, and kept till the labour of the sow is completed; after which, the pigs must be returned to the sow to suckle for a short time. When satisfied, the pigs must be put back into the hamper provided with a fresh supply of cut straw; take out the wet litter from the sty, and replace it with dry cut straw, then restore the pigs to their mother. Pay close attention to her, that she does not show a desire to eat her pigs. The treatment of other classes of stock is the same as the last two or three months.

APRIL.

Pay particular attention to farrowing sows and their litters, the latter receiving with advantage, about the age of five or six days, and for some time after, a separate food at least once daily of warm milk thickened with a little meal, the use of barley meal being avoided. Give the sows warm mashes moderately liquid, attend carefully to their bedding, so that it will be dry and warm. Bring on store pigs progressively into a condition fit for fatting. Every variety of food will be taken by them if of a good breed, and the food be properly prepared. Finish off fattening pigs ready for sale; for treatment of others progressing *see* previous months, and do not neglect regular brushing of their hides.

MAY.

Put the sow to the boar for the second and regular farrowing of the season. Attend to farrow sows and young pigs—*see* last month. Give store pigs, and those put up for fattening, feeds of such green forage food as may be sufficiently advanced for cutting; such as tares, rye, &c., with potatoes and roots to form the bulk of their food. Give young pigs after being weaned feeds of dairy produce, mixed with meals of various kinds.

JUNE.

Attend to sows about to farrow and to those which have litters, details of treatment of which will be found under March. Give store pigs green cut food in their yards, which should be supplied with abundant litter, so as to produce lots of manure, and keep pushing them on progressively into good condition, for being drafted into the fattening sties. Provide a small field, near the steading, in which pigs can be put for some hours a day, avoiding their exposure to strong sun, which blisters and inflames their hides.

JULY.

Store pigs will be easily fed and managed this month, as green foods of various kinds should be abundant, this being nearly all they require, except the occasional feed, if not a daily one, of some more solid or nutritious food, for which see last month. Feed weaned pigs liberally, as also sows with farrows. *See* previous months.

AUGUST.

Store pigs may be either turned out to the stubbles of corn fields which are harvested, or fed in yards, as some prefer, for the more economical saving of their manure; if the latter, they must be fed on cut forage food, brewers' and distillers' wash being used in preference to dairy refuse, which it will be more economical to store up for the coming winter months, when it will be scarcer than now. In both cases the store pigs should have solid food, as stated in last month, for which also see as to young pigs and sows with litters.

SEPTEMBER.

Finish off fattening pigs, within three weeks of sale, with oatmeal and maize. Store pigs should all be fed in yards, excepting those which the farmer may desire to put out to any stubble field, with cut green food, such as vetches or clover, and the refuse of green crops, such as roots which have run to seed, &c., &c. Feed with nutritious food fattening pigs. For treatment of young pigs, sows about to litter, *see* last month. Prepare for the winter months all sties, cleaning them thoroughly out and making them, as sailors say, 'snug,' or as housekeepers, 'in apple-pie order.'

CHAPTER VI.

POULTRY CALENDAR.

OCTOBER.

CLEAN out thoroughly the hen-houses, &c., and repair all fittings out of order. Take up the old, and lay down new floors, if of earth; and make and put everything in order for the coming winter months. Where the erections are extensive, and special heating apparatus be applied to them, see that it be in good repair, so that it may not be found in bad working order when wanted in cold weather; if such be not provided, and a continuity of egg-laying be desired, it will be worth while to fit up one or other of the numerous forms of simple heating-stoves which can now be easily had; or, failing these, an old-fashioned iron stove, which will cost but a few shillings, will be better than nothing in the way of artificial heating. If this be used, take care that it is so arranged as to prevent sulphurous fumes or smoke from filling the hen-house. Failing the carrying out of even this last simple method of obtaining the necessary warmth, if there be more houses than one, draft the poultry from the thinly-filled ones into one which will be well stocked, the fowls being thus more comfortably warm than when a few only are together. Pay attention to the prevention of damp, looking specially to the condition of the roof, that no drip be coming through it. Select the birds to be fattened for the Christmas market and succeeding months of winter and early spring; also those which are intended to lay for the same period, when high prices are obtained; and likewise those adapted for bringing up broods, or as nursing mothers, whether of chickens or ducklings. The labours of the month will be comprised in attending to these three classes, and in the daily regular cleaning out of the houses and water-troughs, &c., &c. Feed regularly and frequently, the latter more especially, as the cold weather increases. For details of food and feeding see text.

NOVEMBER.

The work of this month is still more easy than that of the last, being confined chiefly to keeping the houses in order, and maintaining and regulating the proper degree of warmth—60° Fahr., or a little over; but the poultry will not quarrel with a considerably higher temperature. Do not forget that poultry came originally from tropical climates; on this hint act. Pay special attention to the birds set aside for fattening, arranging them as to age and condition; so that they will come in ready for market in a series or successional order. For the best fattening foods, time, and method of giving them, see text.

DECEMBER.

The fattening of the birds set aside for Christmas market must now receive its last stage, so that the birds will be finished off in as plump and saleable a condition as possible. Avoid feeding which gives flabbily fed birds, aiming at having the flesh firm, evenly laid on, and of the white colour so much esteemed at table. To fatten quickly the birds should be confined in a small warm room, to which a very little light is admitted, and the last stage of what may be called extreme fattening should not exceed twelve or fourteen days, extra fattened fowls being liable to inflammation and other complaints. Where cramming is adopted for fattening the birds, the food given, for which see text, should be in one meal a day, this being as much as can be forced into the bird; attend to the condition of the other classes of birds, feeding them regularly with warm food made up in a thickish or pasty condition; with which in very cold weather a little cayenne pepper may be mixed. Good clean kitchen stuff, scraps of meat, &c., may be given with advantage to the fowls. Meaty bones will engage their attention for many an hour, and will form, moreover, nutritious food. See to the supply of clean water and of old mortar, egg shells, gravel, or sand, for the fowls to peck at.

JANUARY.

Feed fattening fowls frequently, finishing them off for market, as explained in last month and in text. The white flesh so much desired by purchasers will generally be secured by giving them drinks of milk in which rice has been boiled, the rice itself being used as a solid food along with other kinds. See to the condition of the houses, the supply of water and other necessaries. Comparatively few hens will be laying now, as a general rule, but much depends upon the breed, cochins and brahmas laying best, the Spanish breed being also good winter layers. The great point to be aimed at is to keep the birds in a warm and thoroughly dry house, on food calculated to maintain the heat of the body, and the giving of it regularly. Oats are excellent food, and should be given the birds before roosting. Another point is keeping the birds free from vermin, for which purpose keep the dust baths thoroughly supplied with dust; change frequently the materials of which their nests are composed; fumigate the houses when empty with brimstone, and sprinkle a little of the flour of sulphur in their nests. To keep up the succession of broods (see text); hens selected for setting should be induced to become broody for the end of the month for the earliest hatches.

FEBRUARY.

For treatment of fattening fowls and laying hens, see last month. Prepare nests for broody hens; set them in quiet places, and to those who begin to sit pay particular attention to their supply of food and water. If soft food be given them, as a rule dry grains should be added, oats being by far the best. Let the sitting hens have access for half an hour at the most daily to a place in which there is a dust bath and a supply of old mortar, at which they can peck.

MARCH.

The hard work of the poultry yard may be said to commence this month, hens becoming fast broody, and towards the end of it several hatches may be expected. For all the details connected with the setting of hens, the feeding and care of chickens, see text. For those connected with fattening fowls and laying hens, see previous months. In setting ducks' eggs for hatches, the broods of which are to be reared for sale as food, select those that are the produce of Aylesbury ducks and Rouen drakes. Early broods of turkeys will require the most careful treatment both as to feeding and housing, warmth being essential. The male bird must not have access to them. Goslings are much more easily reared; they may be left to the care of the geese; geese are excellent careful mothers. They must have access to a pond and a run of grass.

APRIL.

The work of this month is chiefly connected with the care of broody hens and young chickens; the latter must be carefully looked after. See to laying hens, which will be now laying abundantly. Set turkeys with eggs, not exceeding fifteen in number, for the birds' earlier hatches (see last month). Feed young goslings with soft food, and let ducks of the first hatch have access to the pond. See to the supply of food, which if properly attended to will make them ready for sale at least by the end of next month.

MAY.

The work of this month so closely resembles that for last month, that little needs be said in addition to what was given under that head. Attend carefully to sitting hens, chickens when first hatched, and those of the earlier broods to be kept, regularly increasing in good condition.

JUNE.

The chickens of the earliest brood being nearly ready for market, set them up in coops for the last fortnight before despatching them for the market, in order to finish them off with abundant supplies of fattening food. Select from the broods the best birds from which to rear broods. As a great variety of foods can now be obtained, keep changing the systems of feeding for all classes of poultry, so as to have them as varied as possible.

JULY.

Where good grass runs are provided for the birds of all classes, especially if they have access to fields, they will almost keep themselves; but even in such circumstances, give them morning and evening feeds in the yard, oats and beans being the evening food, which will bring them home to roost in good time. Select from the chickens the birds intended to be kept for purposes named under the head January, which see. For laying eggs for sale the Spanish breeds are the best. The Dorkings are good mothers, and the Cochins are good both for sitting and nursing, and are capital winter layers. A cross between the Dorking and the Spanish makes an excellent bird for sale as food.

AUGUST.

The remarks made last month will apply almost to this. Eggs being abundant and cheap, preserve numbers for family use, and for winter sale, but as preserved eggs only. For methods of preserving see text. Continue the selection of breeds as in last month. Sell off or kill the cockerels, keeping the best for breeding purposes at the rate of one bird to six or eight hens.

SEPTEMBER.

Sell off cockerels of the later batches as are in good enough condition, as also pullets which are not designed to be kept. Continue to preserve eggs, and to collect, arrange, and set aside for domestic use feathers of such birds as have been plucked and dressed before being sold. Begin to prepare for the winter months.

CHAPTER VII.

SUMMARY CALENDAR OF GENERAL FARM WORK.

OCTOBER.

HIRE and stock farms. Insure property from fire without delay. Hire yearly servants.[1] Sow winter tares, if they have not been already sown in September. Winter beans and seed wheat may also be sown. Dig up and carry root crops, and protect them from frosts. Manure grass lands. Sow wheat. Lay up fallows. Manure and plough for peas, beans, barley, and oats. Scour out drains, ditches, and other watercourses. Collect and convey decayed and fallen leaves to the yards, that they may be saturated with urine for manure. Water the meadows. Repair the fences. Get the straw-yards, cow-houses, and stables ready for the cattle, as this is the last month for their continuing abroad. Put fatting beasts to cabbages, carrots, or turnips; cows in milk to cabbages, in a separate yard; dry cows to chaff; fatting sheep to turnips; and the teams to chaff, hay, mixed fodder, or other dry food. Put rams to ewes. Wean foals. Plant trees. Destroy weeds. Harrow stubbles. Plant quick-sets. October, it should be remarked, is one of the busiest seasons in the whole year; and comprises that period of good or tolerable weather which usually takes place before most field business is stopped by rain, snow, or frost; hence it may not unfrequently happen that work, here noted as requiring to be done, must be finished in the following month. Whatever business, therefore, the farmer cannot execute in October, he must finish as early as he can in November.

[1] As in many instances farmers do not give characters, and it is not always easy to form a quick and correct judgment of the accounts given by individuals who want situations, it has been suggested, with a view to obviate this difficulty, that farmers might have, among themselves only, printed circulating letters, requiring merely their signature, and containing the moral character of the servant, his skill in business, careful or slovenly mode of doing it, length of time he has been employed, age, constitution, and other requisite information.

NOVEMBER.

Finish ploughing fallows; and endeavour to close wheat-sowing within the early part of this month, at the very latest. Continue watering the meadows. Dig and cart manures. Destroy ant and mole hills, and level pastures. Repair fences, and continue to scour out ditches. Under-drain wet lands. Cut down wood. Buy in store-pigs for the yard, and put up bacon hogs to fatten. Kill fat beasts and swine already fattened off for curing bacon. Attend to the feeding, warmth, and comfort of cattle. Select young calves to breed from. Keep fatting sheep on turnips or cabbages, with hay, and lean ones on the remnant of summer grass, and on sheep-walks. Stack and preserve carrots, if not already done, and turnips from frost. Get in and store swedes. Pit potatoes. During November and December the subsoil plough may be used with advantage to pulverise and break up the subsoil, and render the land more permeable to the atmosphere and to moisture.

DECEMBER.

As bad weather usually sets in this month (if not before), farmers should keep a strict watch for fine open weather, to do all the out-door work remaining unfinished. Carefully attend to the littering, cleanliness, and ventilation of the farm-yards, cow-houses, stables, and cattle-sheds. Pare and burn old ley-grounds. Moss-harrow and level pastures and meadows. Collect turf, cart earth, marl, or clay from ditches, banks, or pits, to form temporary foundations for cattle-yards, and to absorb the liquid manure. Attend particularly to ewes near the time of lambing, and litter them if kept in folds, and feed them well. Occasionally give fat sheep some hay. Well litter swine. As at this season the teams are generally unemployed, let every opportunity offered by open weather be diligently employed in repairing fences, cleansing ditches, and keeping the drains in efficient order, &c. Flood the water meadows. Sell house-lambs. Put boars to sows for spring litters. Finish ploughing for spring crops left undone in October or November. Settle quarterly bills and farm accounts.

JANUARY.

Carefully watch cows near the time of calving, and allow them some green food, or roots, besides hay. Take care of ewes that have already lambed, or are near the time of lambing; shelter them as much as possible; if still kept on turnips, allow them also a small quantity of hay; cabbages are an excellent food for them. Fatten beasts. Marl lands. Cart the mud from ponds and the scrapings of ditches. Repair fences and hedges. Drain wet lands. Examine water-furrows and water-meadows. House weanling calves and foals. Cut and spread ant-hills. Finish killing and curing bacon, if not already done. Burn lime. Cart manure, especially on to grass land. Sow salt over wheat land if the slugs attack it.

FEBRUARY.

Plough such lands as are sufficiently dry, for the earliest crops. Turn up the fallows, in order that the frost may pulverise them and kill the insects. Sow furze. Plant beans and vetches, and sow hardy peas, and black oats, and cabbage seed. Plant, remove, and repair hedges. Lay up meadows and pastures about Candlemas. Manure and roll grass lands. Attend to the cleanliness and warmth of ewes lambing, and do not keep them in damp or wet yards. Give sheep oil-cake. Water meadows. Plough and prepare the land for parsnips, carrots, and sainfoin, and dress the latter with gypsum. Sell off fat beasts. Sell fat lambs and fatten ewes on clover.

MARCH.

Turn sheep into old watered meadows. Shut up meadows and pastures for grass crops. Watch cows near calving and ewes near lambing. Turn out calves dropped the preceding month among the fatting beasts. Geld lambs. Finish sowing beans, peas, and oats, left unsown last month; and now sow white oats and barley, flax and hemp. Top-dress wheat with soot, ashes, lime, or salt and lime. Watch sows about to farrow, especially young ones. Buy lean beasts to fatten for winter consumption. Soil cattle. Dispose of fat beasts and wethers fattened in winter. Repair hedges. Sow parsnips. Sow spring tares, white beet, turnip, cabbage, and spring rye, white peas, potatoes, sainfoin, and lucerne. Sow carrots and chicory. Feed new lays. About the end of this month sow the common clover, and if the land shows symptoms of being *tired* of clover, plough in from $1\frac{1}{2}$ to 2 cwts. of gypsum with the seed. Brew beer. Kill the bacon hogs during this month, before the weather gets warm. Attend to the cleanliness and comfort of the poultry. Settle quarterly bills and farm accounts.

APRIL.

Early this month finish sowing barley. Continue to sow lucerne, sainfoin, rye-grass, clovers, and hay seeds. Hand-hoe wheat, and hoe beans and peas. Attend to cows calving and ewes lambing. Castrate lambs and pigs. Soil cattle. Sell fat lambs and porkers. Put mares to stallions. Turn cattle into pastures, if the season be forward. Put sheep into water-meadows. Attend to mares foaling. Destroy ant-hills and mole-hills. Roll and bush-harrow grass land. Hoe potatoes and carrots. Finish repairing fences. Plant mangold-wurzel.

MAY.

Put bulls to cows and boars to sows. Wean young pigs of the first litter. Sow buckwheat, lucerne, sainfoin, and Swedish turnips for winter use. Dress clover, lucerne, and sainfoin with gypsum. Watch mares foaling. Early this month cross-harrow fallows. Hoe early planted potatoes; cleanse drilled peas and beans; and plant out potatoes for winter consumption. Turn cattle into pastures. Graze pastures laid to rest at Candlemas, and shut up such as are to be fed off at Midsummer. Breed horned cattle, if needful. Purchase wethers to be fattened off during winter months. Fold sheep; and examine them, lest they be fly-struck. Pare and burn. Water meadows. Destroy moles and other vermin. Drain swampy and boggy land. Cut, dry, and house turf, for winter-fuel. Mow tares and lucerne for green fodder. Attend carefully to the dairy. Commence sowing swedes.

JUNE.

Put bulls to cows. Sow common turnips; hoe carrots and swedes, already in rough leaf, if the weather be not too dry. Hand-hoe corn crops. Attend to the cabbage crops. Dig and cart fossil manures. Cart out manure, and plough it with as little loss of time as possible. Wean lambs. Wash and shear sheep. Dispose of fat stock. Soil cattle. Clean out ponds, and prepare the mud for manure. Pare and burn. Mow grass lands. Make hay. Mow rye-grass and sainfoin. Continue to get in turf for winter fuel. Cut down weeds in hedges. Settle quarterly bills and farm accounts.

JULY.

Put bulls to cows. Finish the weaning of lambs. Shear sheep, if the month of June has been too wet or cool. Fold them on land intended to be sown. Hand-hoe turnips, and horse-hoe potatoes. Sow cole-seed. Weed cabbages, and hoe those planted in June early in this month. Hoe carrots and parsnips. Finish mowing grass lands. Mow lucerne. Finish haymaking. Hoe lucerne. Cut early peas and rye. Pare and burn. Continue clearing out ponds, and prepare the mud for manure. Reap early rye about the end of this month. Plough fallows, and cart out chalk, marl, and fossil manures. Shut up rowen. Clear out the barns. Prepare the stack yards, &c. Look to the waggons. Watch the wheat crops, and reap them, though not quite ripe, if they appear to be mildewed. Take boars from the sows.

AUGUST.

Reap and mow every kind of grain and pulse as they ripen, and without loss of time, not waiting for them to become dead-ripe. Sow rape, turnips, vetches, and rye and barley for winter use. Set the flocks, and sell off fat sheep and lambs. Keep wethers well. Watch sows (particularly young ones) near the time of farrowing. Sow grass seeds on old pastures. Transplant lucerne. Weed potatoes by the hand if the horse-hoe cannot reach them. Hand-hoe broadcast turnips the second time. Sow cabbage seeds for plants to be transplanted in the following April. Cut lucerne. Turn sheep into sainfoin cut in June. Lay down lands to grass. Collect fern, heath, &c., for winter litter.

SEPTEMBER.

Sell off spare fat stock. Put rams to ewes, for early lambs. Geld pigs farrowed in August. Wean and castrate foals. Purchase half-fed sheep and beasts for winter fattening. Manure grass lands. Scarify grass lands. Plough fallows for the last time. Plough winter fallows, and lay them up in ridges that the frost may penetrate and destroy vermin. Turn cows and fatting beasts into sainfoin rowen. Sow winter tares and rye, and upon cold backward soils sow wheat. Turn out swine to pick up acorns, and put up bacon hogs to fatten. Keep cattle and sheep out of clover lands and those newly laid down to grass. Look to and keep clean the poultry. Fatten geese. Examine and balance the accounts of the previous twelve months.

CHAPTER VIII.

OBSERVATIONS ON THE WEATHER.

AMONG the various phenomena which attentive observers have found to indicate approaching changes in the atmosphere, the following may be selected as most to be depended upon:—

I. *By animals.*—Previous to rain and wind, or stormy weather, neat cattle and sheep seem more than usually desirous of feeding in their pastures, and to leave them with reluctance. A similar change is announced by the uneasiness of swine, who grunt loudly, and retire to their sties; by geese and ducks washing themselves repeatedly, and with little intermission, flying anxiously backwards and forwards; by swallows flying low and skimming along the surface of the water, twittering with more loudness than usual; and by poultry rolling much in dust and sand, or gravel. Wet and windy weather is likewise indicated by dogs becoming drowsy and stupid, and exhibiting an evident reluctance for food, except grass (particularly the species denominated dogs' grass, or couch-grass): and by cats losing their vivacity, and remaining within doors. Continued rain is announced by pigeons returning slowly to their cotes; a change from cloudy or unsettled to greater wet, by flies stinging and swarming more than usual; and a sudden variation, accompanied with a storm, by wild ducks, plovers, bustards, and other aquatic birds, withdrawing to the sea-coast, or to the marshes.

The contrary circumstances evince the longer or shorter continuance of fine weather; to which may be added, that bees flying abroad, and labouring with that industry which has become proverbial; crows croaking in the morning; the robin or red-breast singing early from the more elevated branches of trees; and gnats flying in a columnar form within the rays of the setting sun are all indications of fine or serene weather.

II. *From the appearance of the earth.*—Moist stones and a dry soil prognosticate rain; a continued fall of which may be expected if the ground seems nearly dry, and the roads almost if not wholly free from mud. The contrary occurrences announce that the evaporation of moisture has ceased, and consequently that fine weather is approaching.

III. *From the atmosphere.*—If in the evening a white mist is spread over a meadow contiguous to a river, and is evaporated by the sun's rays on the following morning, it is an indication of fine weather throughout the day: so in the morning, if a mist, which is impending over low lands, draw off towards those which are more elevated, it announces a fine day. The gradual diminution of clouds, till they can no longer be seen in the air, is a sign of fine weather; so likewise is the continuance of abundant dew upon the grass after a serene day. The aurora borealis is generally a sign of coming fine weather. The contrary events announce a change of weather, which may be more clearly known by the clouds gathering and lowering; by the sky, after serene weather, becoming undulated as it were with small clouds. During winter, if the clouds appear not unlike fleeces, *i.e.* thick and close in the middle and very white at the edges, the surrounding sky being remarkably blue, they indicate hail or snow, or cold chilling showers of rain. Further, where the clouds appear moving in two opposite currents, and the lower current is wafted rapidly before the wind, it is a certain sign of rain; and if they occur during summer, or generally in hot weather, they announce thunder-storms. If the rays of the sun break through the clouds, and are visibly dazzling in the air, the latter is loaded with vapours that will speedily descend in showers of rain. Thunder is mostly preceded by hot, and followed by cold and drizzling, or showery weather. Frequent variations of the wind to the different points of the compass evince the speedy approach of rain, particularly if it whistles or howls in its course through the atmosphere. A sudden and extreme change of temperature, whether it be from cold or heat, or *vice versâ*, is usually followed speedily by rain. The west wind is usually damp, on account of the vast quantity of vapour it collects in its progress over the Atlantic Ocean; the south wind, which blows from the torrid zone, is the warmest of the four, as the north wind is the coldest; while the east wind is the most dry; but if rain falls during the prevalence of an easterly wind, it may be expected to continue, with little intermission, for four-and-twenty hours.

IV. *From the seasons.*—1. A moist autumn, followed by a mild winter, is usually succeeded by a dry and cold spring, in consequence of which vegetation is materially retarded: such a spring occurred in 1741.

2. Should the summer be unusually cold and wet, the ensuing winter may be expected to be extremely cold; for the heat or warmth of the ground will be dissipated or carried off in consequence of such unusual evaporation.

3. Very wet summers are mostly attended with an increased quantity of seed on the dog-rose and whitethorn bushes; so that the uncommon fruitfulness of these shrubs may be regarded as a general indication of an intensely cold winter.

4. A severe winter is uniformly predicted by cranes and other birds of passage migrating early in autumn; for these travellers never take their flight southwards until the cold season has commenced in the northern regions.

5. Should frequent showers fall in September, it seldom rains in May; and the reverse. There usually falls less rain in April than in October, in the proportion of one to two: in March than in November, in the proportion of seven to twelve.

6. On the contrary, should the wind blow from the south-west, during either summer or autumn, and the air be uncommonly cold for those seasons, a profuse fall of rain may be speedily expected.

7. A kind of crisis takes place in the atmosphere after great storms, rain, or similar violent commotions of the clouds, so that they are for some months attended with a regular succession either of bad or of fair weather.

Lastly, a cold and rough autumn prognosticates an intense winter; as the latter season, when rainy, is mostly succeeded by an unproductive year.

For the preceding remarks we are chiefly indebted to an interesting tract (which, in fact, every farmer should possess), entitled 'The Farmers' and Gardeners' Directory, containing the most approved Rules and Directions for foretelling the Changes which take place in the Weather,' &c. We shall conclude these hints respecting the atmosphere with the following rules laid down by Mr. Kirwan, from observations which had been made in England, during a period of 112 years, from A.D. 1677 to 1789[1]:—

1. When no storm has either preceded or followed the vernal equinox, the ensuing summer is in general dry, or at least is so five times out of six.

2. If a storm happen from an easterly point on the 19th, 20th, or 21st day of May, the succeeding summer will also be dry four times in five. A dry summer will likewise follow if a storm arise in any point of the compass on the 25th, 26th, or 27th days of March.

3. Should there be a storm, either at south-west or west-south-west, on any day from the 19th to the 21st of March, the ensuing summer will be wet five times out of six, but if the winds blow from the north-east at this period, the probability is the summer will be dry.

In England, if the springs and winters are dry, they are generally cold; but if moist or humid, they are usually warm: whereas dry summers and autumns are mostly hot; so, on the contrary, moist summers are cold. Thus, if the moisture or dryness of a particular season are ascertained, an idea may be formed with tolerable precision respecting its temperature; and the farmer, by attending to the various indications of the weather, will be enabled to provide accordingly for the exigencies of his cattle stock.

[1] Transactions of the Royal Irish Academy, vol. v.

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