**Sheep breeding and management.**

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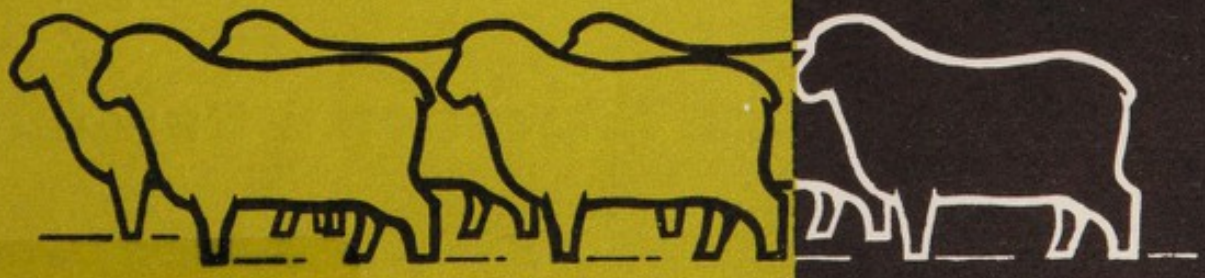
# SHEEP BREEDING AND MANAGEMENT





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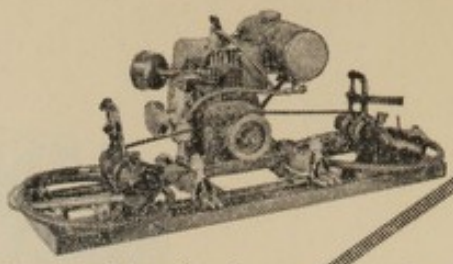

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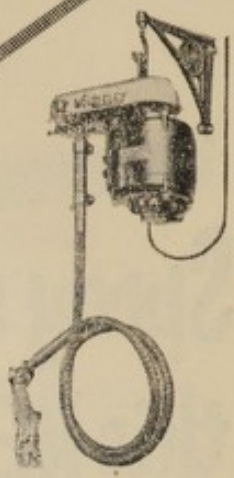

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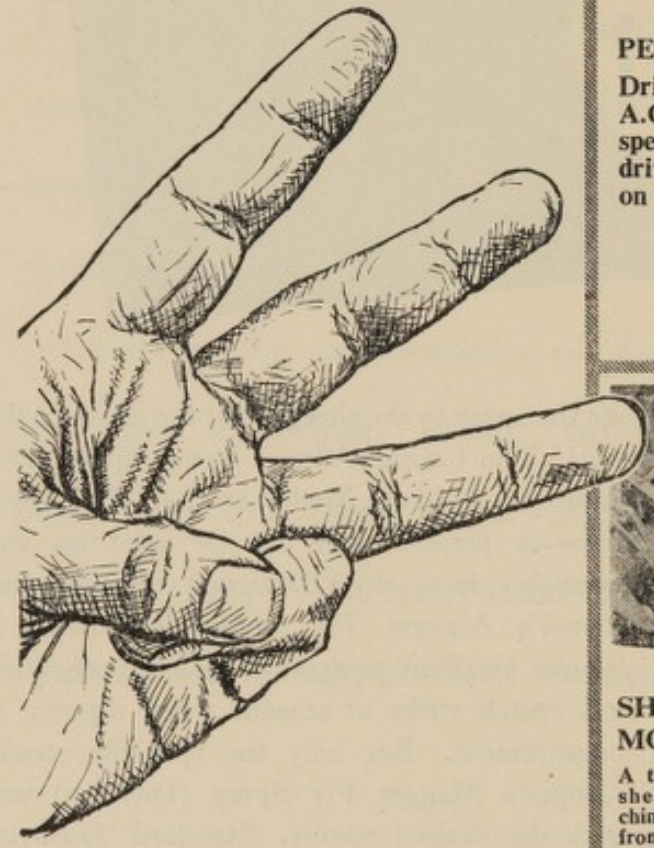

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# Sheep Breeding and Management

*Bulletin No. 166*



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# Contents

# Foreword

SHEEP have always played an important part in our farming. Their numbers have fluctuated, but over a long period have been maintained, and the present position is that they are slowly and surely regaining their pre-war level. But methods of sheep husbandry have altered greatly, responding to the changed economics of modern farming and market needs. In the last century "sheep and barley" farming was almost universal on the lighter soils of the east and south of England, and that was farming in the grand manner. The shepherd was the autocrat, and only after his needs had been supplied could room be found for cash crops and for other types of livestock. Economic changes defeated this system and hurdled flocks have almost disappeared. But still the sheep, indispensable on high ground, has its honoured place on lowland pastures, for total production is higher where mixed grazing with cattle and sheep is practised than where either graze alone.

It is common to bewail the shortage of shepherds, many families of whom carried on from generation to generation with the accumulated knowledge gained from practice. No one would deny the great value of experience nor the necessity for the man in charge of a flock to have real interest in sheep, but some of the empirical knowledge, and all of the newer scientific knowledge, can be set down on paper. We now have some understanding of nutrition and effective means of combating many of the ills to which sheep are heir. In the matter of breeding, scientific progress is slow, but it can at least point the road to improvement. Thus the issue of this new bulletin will, it is hoped, be warmly welcomed by farmers and students of British agriculture alike.

Several well-known authorities have contributed to the writing of this bulletin, to all of whom the Ministry is greatly indebted: in particular, Professor T. L. Bywater, B.Sc., M.S., of the University of Leeds, for the chapters on marketing, mountain and hill flocks, and breeding; Mr. J. F. H. Thomas, M.Sc. (Agric.), Lond., the well-known Wiltshire farmer, for his contribution on lowland sheep; Mr. W. T. Rowlands, M.R.C.V.S., for advice on flock health; Mr. W. P. Dodgson, the Ministry's Chief Livestock Officer, and Mr. R. J. Richards, for the chapter on breeds; Mr. N. K. Green, B.Sc. (Agric.), A.R.I.C.S., F.L.A.S., of the Ministry's Agricultural Land Service, on the subject of equipment; and Mr. W. B. Mercer, C.B.E., B.Sc., N.D.A., who acted as general technical editor and contributed the introduction and the chapter on nutrition.

H. G. SANDERS
*Chief Scientific Adviser*
*(Agriculture)*

*Ministry of Agriculture, Fisheries and Food*
*November 1956*

# SHEEP BREEDING AND MANAGEMENT

## Introduction

THE sheep is a multi-purpose animal yielding wool and flesh, milk and parchment, to say nothing of such oddments as tallow and soap; moreover it is a preserver — in some senses a creator — of land fertility. The fortunes of sheep husbandry have ebbed and flowed and changed direction again and again as the relative values of its several products have changed. Today, after a long period of depressed prices, wool has resumed something of its former monetary value. Paradoxically, hill sheep are not expensively clad, but in the lowlands it is a poor sheep that does not wear a winter coat worth £1.

It is a curious fact that the fibres making up a fleece are not good heat insulators. Their value lies rather in their form than in their substance. Owing to their natural wave or "crimp", they entangle air when massed in fleece or yarn and then acquire properties possessed by no other product, natural or artificial. Strong, elastic, durable, absorbent, heat-retaining and almost fireproof, wool would seem, as Allan Fraser has said, "especially designed by Providence for the health and comfort of mankind as well as for sheep". It is capable even of generating heat while absorbing moisture.

We do not know what types of sheep existed in early times. They must have roamed the fells and mountains of the Pennines and Wales, a major care of pastoral folk; probably they were small and not very thick on the ground. In the south and east, where the life of a denser human population centred in villages and large arable fields, rather bigger sheep lived on the wastes or in the forest and were admitted to the arable land at specified periods only. So controlled, they were invaluable to the community, producing at once a source of income from wool, milk and meat for subsistence, and fertility to the fallows. They were integrated with the farming system.

In the turbulent centuries which saw the break-up of the manors, a very different situation arose. Sheep became, in effect, an alternative to farming. Wool was very profitable — it formed the foundation of our commercial history — but no means existed to combine large-scale wool production and corn growing. No one as yet had any conception of what in modern times is called alternate husbandry; that had to await the introduction of "artificial" grasses and roots. So the sheep became a leading figure on the national stage, part cause and part effect of a social and economic revolution. Cultivated lands and common grazings alike were turned into ranches for commercial wool production, particularly in the eastern counties, the chalk lands of the south, and the Cotswolds; though from the prominence which Leominster achieved as a wool market it would seem that sheep must have been very plentiful also in the counties of the Welsh marches.

Development of the meat qualities of sheep came in the eighteenth century as land was enclosed and men learned to cultivate crops in a full rotation. It coincided in time with the flowering of Bakewell's genius. Equally important from the standpoint of British flocks was the transform-

ation of the Scottish scene; Blackfaces from the Pennines and Cheviots from the Borders spread out to bring, in course of time, prosperity to lowlands and highlands alike. Bakewell paid some attention to wool, but early maturity, body conformation and meat qualities were his main concern. His imitators took the same line. By this time our population was growing, and as it grew the relative values of meat and wool changed; it was not long before the value of a wether carcass was seven or eight times that of its fleece.

The first official statistics (1867) reveal England as predominantly a stock country, with over 6 million cattle and 20 million sheep, the latter fairly well distributed, but with a tendency to predominate in the corn-growing areas, since on all lowland farms they lived mainly on arable crops. There was a high concentration in East Anglia, in the limestone and the chalk counties, where Down and Long-wool breeds were managed under an elaborate system of folding; great reliance was placed upon them as a means of maintaining fertility and preparing the land for corn — especially barley. The system produced carcasses of great weight, often excessively fat, for many of the wethers were kept for two years or more. Monetary turnover was therefore slow. Nevertheless the folding system was eminently sound in the circumstances of the times; corn growing was profitable, labour was cheap, the consuming public had not as yet grown fastidious, families were still large enough to require big Sunday joints. It broke down gradually, but with gathering speed as the century wore on, owing primarily to falling corn prices, though social changes also created new demands. Prices of animal products fell also, but at a much slower rate. Mutton remained relatively dearer than beef, and as the standard of living in the country rose, the taste of the buying public became more discriminating. A taste for smaller joints of mutton and for lamb was fostered by the importation of frozen supplies (it is often said, with some truth, that the modern taste for small joints stimulated imports, but it is equally true that the quality of the imports stimulated the demand for small joints).

During the past half century the whole character of sheep farming has altered as the general tempo of farming has quickened. Sheep farmers were well placed to change their methods. Britain is a small island with a great variety of terrain and climate. It had, and has, great stocks of hill breeds in the south-west, in Wales, in the northern counties, and above all, in Scotland. If the carcasses of Lincolns and Cotswolds were too big and fat, those of the hill breeds were small. Small and tender joints involved slaughter of sheep no more than a year old. Quick maturity was found in judicious crosses between Down or Leicester breeds and one or other of the mountain breeds. If folding was expensive, mutton and lamb could be produced equally well from grass-fed sheep. Sheep farming had to be judged against the rival claims of cattle, particularly those of the dairy cow. Cattle required winter housing — very expensive housing in the case of the cow — and considerable quantities of concentrated foods. Sheep, on the other hand, required no housing and made but a tiny call on concentrates. Moreover, lamb production gave a quick turnover of capital.

English sheep farming nowadays divides into two fairly clear-cut sections — in hill regions the production of stocks destined to be fattened in the lowlands or to form foundation material for lowland flocks, and in the lowlands, the production of lambs which can be maintained on grass and sold fat within a year of birth.

In the lowlands the focus has shifted from the southern and eastern counties to the midlands and the west. The following figures illustrate the extent of the shift.

*Total cattle and sheep (000's)*

| | 1895 | | 1955 | |
|---|---|---|---|---|
| | *Cattle* | *Sheep* | *Cattle* | *Sheep* |
| Norfolk | 125 | 521 | 203 | 60 |
| Hereford | 89 | 319 | 151 | 510 |
| Merioneth | 38 | 377 | 41 | 495 |

In studying the statistics of what may be called the national flock, it is necessary, of course, to bear in mind the fact that practically all wethers today are sold before they are one year old, hence comparisons of total sheep do less than justice to the size of the present flock. There have indeed been fluctuations. The succession of wet years which culminated in 1879 took a heavy toll; losses in the blizzards and floods of 1947 were appalling. In both of the world wars we were compelled to sacrifice sheep for the sake of corn and milk. Even so, our ewes today are as numerous as in 1870.

Yet problems of management remain; in particular, the rules governing optimum ratios of cattle and sheep — a matter of supreme importance in marginal areas — and the integration of sheep with intensive grass production, have yet to be worked out. Like all gregarious animals, sheep are subject to the ravages of epidemic diseases. Fortunately they are good subjects for prophylactic measures, and progress in all branches of epidemiology has been rapid during the past two decades; but the health of the flock cannot be left to nature. It must be actively pursued. Science has not satisfactorily explained the role of the flock as a fertility-builder; still less has it solved the problem of canine delinquency or devised effective methods to keep away unseemly visitors which "creep and intrude and climb into the fold".

By a strange dispensation of Providence, the shepherd derives from the dog family his chief ally and one of his most formidable adversaries. On the one hand, he is dependent upon them for control of his flock — management of any flock is difficult without trained dogs; management of hill flocks would be quite impossible. The potential skill which has been bred into them is one of the richest fruits of domestication; — at the other end of the scale, straying dogs virtually rule out sheep-keeping on some farms.

CHAPTER I

# Markets and Market Requirements

IN the modern world it is the task of the farmer to produce food and other raw materials required by a population which is largely urban. The nature of these requirements changes from time to time, as also does their extent, and the farmer, to make a success of his business, must be ready, so far as circumstances allow, to adjust the process of production and marketing to meet these developing needs.

There were difficulties enough and to spare in the days of subsistence farming, when the "consumers" were the farmers themselves and their families; but subsistence farming did at least have the advantage of clear objectives and inducements that were at once both direct and effective. Nowadays the farmer and his customers may live at opposite ends of the world and, in consequence, problems arise which can only be solved by effective market intelligence coupled with a price structure which reflects quickly and faithfully any changes in the quantity and quality of consumer demand. In so far as he succeeds in meeting these demands the farmer will not only make a living for himself but will also share with the housewife the deep satisfaction that comes in the fulfilment of one of life's basic needs and abiding pleasures — good food, well cooked and attractively served.

In countries like Australia that are remote from markets but have climatic and other conditions favouring the production of a fine uniform wool, the fleece is still the primary product. In modern Britain, however, although the wool clip is still an important item in the farmer's income, mutton and lamb are now the most valuable products.

## MUTTON AND LAMB

TABLE I

*Consumption of Meat in the United Kingdom (lb per head of population)*

| | *Beef and Veal* | *Mutton and Lamb* | *Pork Bacon and Hams** | *Total excluding offal and canned meat* |
|---|---|---|---|---|
| Pre-war (a) | 54·9 | 25·2 | 38·7 | 118·8 |
| 1948 | 39·4 | 22·8 | 12·0 | 74·2 |
| 1949 | 38·1 | 21·9 | 16·0 | 76·0 |
| 1950 | 46·7 | 25·1 | 25·7 | 97·5 |
| 1951 | 33·7 | 15·4 | 23·9 | 73·0 |
| 1952 | 32·4 | 21·4 | 30·8 | 84·6 |
| 1953 | 36·8 | 24·2 | 37·0 | 98·0 |
| 1954 | 43·9 | 21·6 | 42·8 | 108·3 |
| 1955 (provisional) | 46·2 | 24·4 | 43·5 | 114·1 |

(a) Average 1934-38

* Includes bacon used for canning, but excludes imported canned

More mutton and lamb is eaten per head of population in Britain than in any other country in the northern hemisphere.

During the second world war, and in the years immediately following, the amount of meat consumed in Britain was determined by the availability of supplies and not by consumer demand. It would seem, however, that we have not lost our taste for meat in general, nor our partiality for mutton and lamb in particular.

TABLE 2

*Consumption and Source of Supply of Mutton and Lamb in the U.K.*

| | *Consumption per head lb* | *Percentage home-produced* |
|---|---|---|
| Pre-war (a) | 25·2 | 37 |
| 1951 | 15·4 | 38 |
| 1952 | 21·4 | 34 |
| 1953 | 24·2 | 30 |
| 1954 | 21·6 | 41 |
| 1955 (provisional) | 24·4 | 30 |

(a) Average 1934-38

Total consumption of carcass meat and bacon and ham in 1955 was less than pre-war by some 4·7 lb per head of the population. Consumption of mutton and lamb was only 0·8 lb down on pre-war, whereas beef was 8·7 lb less and bacon and ham, 3·0 lb; on the other hand, consumption of pork increased by 7·8 lb per head.

The amount of sheep meat eaten in 1955 has been restored almost to pre-war level, but beef was still only five-sixths of pre-war.

The British farmer has a very big market for mutton and lamb on his doorstep, so big that if the size of the national sheep flock and the output of sheep meat were *doubled* we should still be producing only two-thirds of the national requirement at the present rate of consumption and this might well be capable of being increased.

Any increase in home production of sheep must come from two main directions — through improved techniques of production, e.g., by control of disease, by breeding better sheep, by improved grass production and use, or, by the substitution of sheep for other enterprises in the planning of land use on the farm; in either case, success will depend upon the quality of the product and its price.

## QUALITY IN MUTTON AND LAMB

The British sheep farmer is faced with the difficult problem of marketing *all* his fat sheep — good, bad and indifferent — in competition with selected carcasses from overseas and it is necessary, therefore, to aim at high-quality production and to seek out and adopt those techniques which will help to achieve it.

The housewife may not know how to distinguish between the knuckle end of a leg of lamb and the fillet, nor be able to recognize in the butcher's shop the subtle but highly significant differences between similar joints from

animals of different ages: but when the joint arrives on the table, these differences are there and none of us has any difficulty in deciding whether the joint is of high quality or low.

A high-quality joint of mutton or lamb is tender, succulent and free from excess either of fat or of bone; it must have subtle rather than full flavour and preferably be suitable for cooking quickly under the grill, in the frying pan or in the oven.

Before a carcass of mutton or lamb appears in the butcher's shop, it is "dressed"; in other words the blood has been drawn, the skin (and with it the fleece) removed, and pluck and offal taken away; in most districts, the head and the legs below the knee and hock joints are severed from the trunk.

Before the meat is sold to the housewife, it is divided into "cuts" or "joints". The pattern of subdivision is broadly similar in all parts of the country and is usually on the lines shown in Fig. 1.

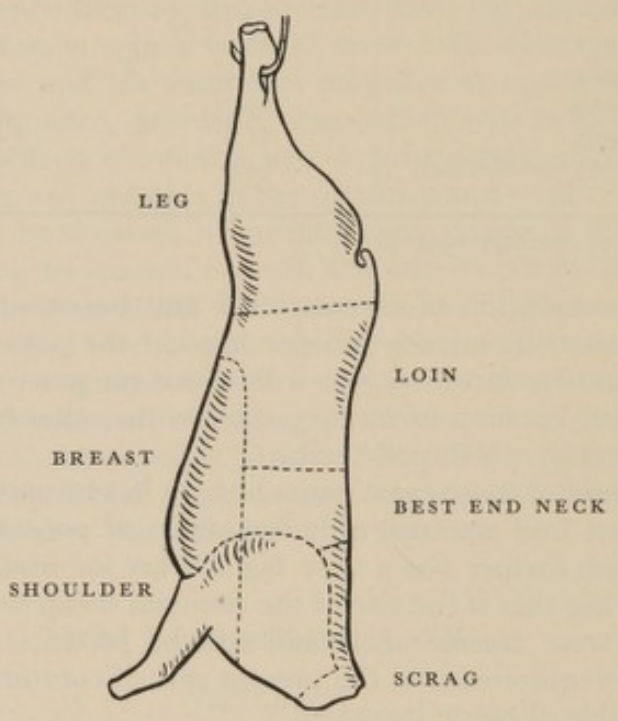



Fig. 1. Diagram of mutton carcass showing different "cuts"

The different joints vary in quality: some are lean and tender with just sufficient fat and not too much bone and are suitable for grilling or roasting; others, lacking these qualities, must be boiled or stewed and therefore sell at lower prices.

In Table 3 are given the proportions and comparative values of the main sub divisions of a well-finished carcass of lamb.

TABLE 3

| *Joint* | *Weight as percentage of carcass* | *Comparative retail price per lb* (loin = 100) |
|---|---|---|
| Saddle (loins) | 20·0 | 100 |
| Shoulders | 23·0 | 90 to 95 |
| Legs (hind) | 28·0 | 90 to 95 |
| Remainder | 29·0 | 45 to 55 |

These figures are based on pre-war conditions when retail prices were more closely linked to quality than now, but they reflect quite clearly the kind of relationship we must expect to be faced with in the future. The figures for mutton follow closely those for lamb excepting that, as between high and low quality cuts, price discrimination may be proportionately even greater.

All meat is affected by "hanging" or conditioning but, in the main the quality of the meat that is produced from a fat sheep has already been determined by the time it leaves the farm. The most important considerations in the live sheep are age, weight, fatness, conformation and the development of the bone.

## Age

Sheep may be sold fat when no more than eight or ten weeks old or they may be several years old, for example, fat ewes. These differences account for much of the difference in quality in the meat produced.

With advancing age, the flesh of animals undergoes vital changes: the muscle fibres in the lean meat thicken so that the grain of the meat becomes coarser: the cell walls become tougher and more gristle develops at the points of attachment to the bone which itself becomes increasingly calcified: the colour deepens from pale or cherry-red to a darker red and the meat takes on a fuller (in rams a stronger) flavour. In consequence, the meat from older animals is not so acceptable as from young lambs and the discrimination against the older animal is undoubtedly growing.

Of course, there is a market at a price for all classes of fat sheep but the price paid for mature sheep is generally low.

## Weight

The big Sunday joint that reappeared during the week in various guises is no longer wanted. We like our meat freshly cooked at each meal and as few meatless days as possible; this means smaller joints and more of them. The problem is not how to cut big joints into smaller ones — that presents no real difficulty; the main problem arises from the housewife's wish to cook the meat quickly. Small joints must come from young animals if they are to be tender and succulent when cooked quickly, as in roasting and grilling. If the joint comes from an old animal it is best pot-roasted, boiled or stewed.

In Britain there is no weight classification for fat sheep that is both well established and widely accepted. But, under the Fatstock Guarantee Scheme, there is provision for support for the marketing of lambs, hoggets, and sheep of certain standards, provided that they have an estimated or actual dressed carcass weight of not less than 17 lb. There is, however, no encouragement under the Scheme to market lambs over 70 lb; hoggets over 76 lb; or other sheep over 86 lb dead weight.

### *Carcass Percentage*

Carcass percentage is affected by fatness and conformation as well as by the weight of the live sheep and it is not possible to give exact liveweight limits corresponding with the deadweight classes.

In light-weight sheep in thin condition, the killing-out percentage may be as low as 40 per cent. In fat lambs generally it varies from 45 to 52 or 53

per cent. In heavy fat sheep the percentage may be as high as 60 per cent or more but in finished hoggets it is generally from 47 to 53 per cent, varying a good deal with the type and age of the fleece.

Carcasses of ewes of the heavier breeds and other mature sheep tend to be over-fat and their meat is wasteful and coarse-grained. Light to medium-weight lamb carcasses are most popular, but heavier weights are also quite acceptable, as they are less likely than heavy-weight hoggets and ewes to be over-fat.

Within each class of sheep, the cost of production per unit dead weight tends to decline with increasing finished weight and the premium paid for handy weights varies from time to time so that there is no fixed optimum weight for marketing; rather, the farmer must decide in the circumstances of the time and of his farm what is the best weight at which to market his sheep, bearing in mind the preference (other things being equal) of the public for meat from light-weight animals of the smaller breeds and crosses.

## Fatness of Finish

The main tissues of the body are muscle, bone, nerve and fat. In the new-born lamb there is a high proportion of bone and nerve and very little fat. As the lamb grows and develops, the proportions of bone and nerve to total body weight decline while the proportions of muscle and fat rise.* This growth rhythm shows itself also in the body parts; thus at birth the head and legs (especially the distal bones) are well developed in relation to the trunk; after birth, the growth gradient is from the extremities in the general direction of the loins — which is the last part of the body to fill and develop. When the loin has acquired its finish, the animal is "mature". In early-maturing breeds the development of the back and loin takes place early in life because of their capacity for growing and fattening at one and the same time.

Tenderness and succulence in roasted and grilled meat depend on there being sufficient fat mixed with the lean meat to keep it moist while cooking. When it arrives on the table, however, any excess of fat is discarded; this surplus fat, whether removed by the butcher or left on the side of the plate, is waste and lowers the value of the meat. We need not enter into the reasons for the modern abhorrence of fat — it is a fact and must be accepted.

In practice, it is difficult, one might even say impossible, to over-fatten lambs marketed under about five months old. In fact, high quality in lamb is more closely related to adequate finish than to any other single factor. In older sheep the reverse is true: they readily become heavy and over-fat and deteriorate in quality and value. The mountain breeds are a notable exception to the general rule; being naturally lean as well as small they are difficult to over-fatten and are capable of producing fine-grained meat of acceptable quality up to two years old or even older.

Demand throughout the year tends to be met by sheep of different breeds and types — fat lambs from hurdled flocks in spring, and from grass-land flocks throughout the summer; fat hoggets in autumn and winter, mainly from lowland flocks, and hoggets and shearlings from hill and mountain flocks in spring and early summer.

In a finished lamb carcass, fat should constitute about one-third of the

* For further discussion of growth and development of meat quality see Appendix I.

total weight: in hoggs the proportion is a little higher — about two-fifths.

The balance of fat to lean is affected by the development and amount of muscle in the joint as well as by the fatness of the sheep. In a high-quality carcass there should be maximum development and thickness of muscle, as exemplified by the right-hand carcass in Plate VIII.

### Conformation

Quality of meat varies from place to place in the carcass and the value of the whole carcass depends on whether it is well developed in the most valuable parts.

The best lambs are blocky and thickset with medium to short bone and relatively light heads and necks. They yield carcasses that are clothed in deep flesh all over and well developed in the best places — the leg, loin and shoulder.

Bone is inedible and therefore wasteful but there can be no sheep without bone. Fine, long bones, as in primitive breeds, are associated with poorly developed muscle and general lack of depth of flesh. Accordingly, breeders aim at short thick bone and assess these characters in the live sheep by examination of the cannon bone in the leg.

Two points may perhaps be repeated: first, all meat improves with hanging for a few days before being cooked and meat from mature animals is rarely satisfactory without this conditioning; secondly, the quality of the meat on the plate is greatly affected by cooking; unless the housewife cooks each joint in the way most appropriate to it and at optimum speed, quality will naturally be affected adversely.

### Guaranteed Payments

A detailed account of current Fatstock Guarantee Scheme arrangements is published each year in a booklet prepared by the Ministry of Agriculture, Fisheries and Food.* It describes the classes of fat sheep which attract the guaranteed payments under the Scheme. So far the emphasis has been on well-finished animals with a good depth of flesh and without excessive fat. At present small economical joints are most in demand.

There is still a great deal to be learned about the true nature of quality in meat and how to recognize it in the live animal; we need more information too on the significance of quality in consumer demand and the relationship between carcass quality and cost of production and profit. Meantime, the present marketing facilites and the operation of the Fatstock Guarantee Scheme prices for fat sheep, by providing satisfactory alternative marketing methods for fat sheep and by encouraging the production of higher quality, would appear to justify confidence in the development and the stability of the sheep industry in this country in the immediate future.

## WOOL

The manufacture of materials from wool is one of Britain's greatest industries, and requires each year vast amounts of wools of all kinds and from many different sources. Naturally much of this wool now comes from overseas but

* Fatstock Guarantee Scheme, 1956-7. Obtainable from H.M. Stationery office (addresses on back cover) or through any bookseller. Price 1s. 6d. (1s. 8d. by post).

British flocks still supply a significant amount, and the sale of wool is a valuable contribution to the sheep farmer's income. Much imported wool derives from Merino or Merino crosses — breeds which have been developed in Australia, South Africa and South America purely for their fleece value. Considerable quantities also come from breeds of recent origin such as the New Zealand Corriedale and the American Columbia, which produce good quality wool and a useful carcass.

## The Wool Industry

The wool textile industry produces for three major forms of consumption — clothing, industrial fabrics, and household and furnishing fabrics. The processing of wool for these three prime uses may be done on either of two systems, namely, worsted and woollen.

### *Worsteds*

In worsted processing, the wool is scoured to remove grease, dirt, and any other foreign matter. It is then combed to remove the short fibres (noils), and to achieve a parallel arrangement of the long fibres into a rope-like "sliver", which is called a top, and which is of standard weight per yard. For convenience, this top is made up into balls of a standard weight. In subsequent mechanical processing, this rope-like sliver, or top, is reduced in thickness by drawing out the fibres, and eventually it is reduced to such an extent that it is possible to spin from it a yarn which in turn is woven into material. The value of wools suited for worsted processing is derived mainly from capacity to yield a substantial weight of top from each pound of fleece wool. Wools must, of course, be free from kemp, coarse fibres, foreign matter such as vegetable fibres, and colour.

### *Woollens*

In woollen processing, the wool after it has been sorted and blended is generally scoured, oiled, and then carded to mix the wool and ensure that the fibres are *not* parallel one with another, but arranged as irregularly as possible. It is then spun into a yarn which can subsequently be used for making up into materials in the same way as yarn made on the worsted process.

For processing on the woollen system, long uniform fibres are not important as for worsted processing. Materials produced on this system are more suitable for felting because of the looser arrangement of the fibres. Tweed cloths are generally made from yarn produced by the woollen process. It is interesting to note that tweeds often derive their character from the presence of varying proportions of kemp and coarse fibres, but for other wool cloths and for hosiery wear, kemp, coarse fibres and coloured fibres are undesirable. Foreign matter such as vegetable fibres, flecks of paint and tar, and wool coloured by bloom dips are most undesirable for any form of material.

### *Carpets*

It is perhaps worth while recalling that a large proportion of the British wool clip is suitable for carpet making; indeed, not only is it used for this purpose in the United Kingdom, but it is also exported. In the main, it is the coarser mountain-type wool which is used for this class of trade because of its durability and springiness.

## Price and Quality

Wool prices vary tremendously, not only according to the utility value of the wool, but also according to fashion and demand. Generally, the finer wools are the higher priced ones and coarse wools cheaper; some of these lower priced wools are for the carpet trade. Whatever the use may be for any particular type of wool, certain factors, such as determination of quality, the yield, length of staple, soundness of fibre, colour and style have to be taken into account.

## Yield

When raw wool is scoured a certain amount of weight is lost, and this is called the "shrinkage". The weight of the clean wool remaining is called the "yield". Thus scouring removes dirt, foreign matter and yolk and leads to the shrinkage, which may be as high as seventy-five per cent in fine Merino wool and no more than twenty per cent in clean coarse wools.

Unwashed British fleece wools may lose twenty-five to fifty-five per cent in scouring, but if the dung and dirt are not cut away before shearing, the loss could be higher and the value of the fleece per pound correspondingly lower. If the sheep are washed before shearing some of the dirt and the soluble fractions of the wool yolk are removed and the wool may fetch a higher price. Generally, within a week of washing, the grease will begin to rise again on the wool.

## Fineness

The fineness of the wool fibres and their uniformity in length mainly determine the quality of yarn that can ultimately be spun. The most valuable fleeces are those in which the fibres are uniform and fine over the whole body, that is, each fibre being of the same cross-section along its length and free from weakness or tenderness arising from disease and debility. Though fineness and uniformity of fibres can be affected by disease and by feeding, these characteristics are mainly inherited and capable, therefore, of improvement by selection and culling. An increase of fineness, however, will involve a reduction in fleece weight unless it is combined with an increase in length or density.

## Length

The length of the wool fibre varies greatly and tends to be proportionate to its thickness; coarse fibres being long and fine fibres short. Thus Merino wool is usually $2\frac{1}{2}$-$3\frac{1}{2}$ inches long: medium Down wool, 2-$4\frac{1}{2}$ inches and Long-wool 6-10 inches or even longer. If it is intended for combing, the wool should be uniform in length; it will then give a good yield of top with only a small proportion of short fibres to be rejected.

The spinning quality of wool depends on its uniformity of length of fibre, fineness and strength. In the trade a series of numbers, called "quality numbers" are used to express this standard. These numbers, however, should not be confused with the "spinning count" which is used in reference to the spun yarn, for this latter number is one which can be definitely determined. For example, if there is one hank of 560 yards in one pound of yarn, then it is called a "ones count". If there were two hanks each of 560 yards in one pound of yarn, it would be called "twos" and so on.

The quality of wool, of course, varies according to the different parts of the fleece, the finest being on the shoulders and the coarsest around the breech. Similarly, different breeds produce varying qualities of wool, for example, Merino wool will usually be in the quality number range 60's to 100's, Australian and New Zealand cross-bred will be 40's to 80's, English Down 50's to 58's and Long-wool 28's to 46's. It is questionable whether our very moist climate is suitable for sheep of the Merino type, but a case could be made out for raising the quality of some of our wools, e.g., improving the Long-wool. A move such as this would improve correspondingly the cross-breds involved.

### Purity

The commonest impurities in wool are dirt, vegetable matter and branding materials such as paint, pitch and tar. Each of these could cause damage to the wool and could lead to blemishes in the finished material. Natural faults such as kemp, hairiness and coloured fibres can be equally damaging, but as these are inherited they should be bred out of the fleece.

### Soundness

The value of wools for spinning, particularly for worsted processing, depends on strength and elasticity as well as fineness. If a sheep is in poor condition because of disease or malnutrition the amount of wool substance (keratin) developed is reduced and the wool fibre becomes thin and possibly weak. This may lead to a break in the fleece, with matted ends on either side of the break—a "cotted" fleece. Alternatively, the whole fleece may be shed. When wool from unsound fleeces is combed those fibres which are not already broken will possibly do so and the fleece will yield a higher proportion of noils and a correspondingly small fraction of top.

In the main, the soundness of wool seems to be a reflection of the nurture and health of the sheep.

### Character

One great asset of our British wool production is the specialist character of our wool types; the waviness of fibre, extreme springiness and resilience, and in some types, the brightness and lustrous appearance are highly valuable. It is because of this character in our home-grown wool production that we find the wools so suitable for the many and varied purposes of industry, of clothing, and of the household.

CHAPTER II

# British Breeds

THE quality of the cross-bred flocks from which most home-produced lamb and mutton is obtained depends largely on that of the pure breeds from which they are derived. The pure breeds, indeed, form our foundation stock.

This chapter describes briefly the characteristics of each pure breed and gives a short account of the history and development of breeds to suit the varied soil and climatic conditions of Great Britain.

Except where otherwise stated the fleece weights cited are those of greasy (i.e., unwashed) fleeces of ewes kept under ordinary commercial conditions.

## LONG-WOOL BREEDS

Long-wool sheep, of which the chief breeds are the Leicester, Border Leicester, Lincoln, Romney Marsh, South Devon, Devon Longwoolled, and Wensleydale, are associated with fairly rich soils or with districts where arable food is plentiful. They are characterized by their absence of horns, great size, long wool (usually presenting the silvery glistening appearance described as "lustre"), heavy fleece and white, or almost white, face and legs.

Nearly all the long-wool breeds have been, at one time or other, improved by crossing with the Leicester.

### BORDER LEICESTER

Border Leicesters are mainly bred in the north of England and throughout the lowland districts of Scotland. The fame of the breed lies not so much in fleshing qualities or wool, but mainly in the value of the ram as a crossing sire. Only some ten per cent of the lamb and shearling rams sold annually go into Border Leicester pure-bred flocks: the remainder are mated with ewes of other breeds.

It is a comparatively fine-boned sheep and may safely be used upon small-sized ewes without fear of abnormal losses due to difficult lambing. The most important cross is that from the Cheviot ewe, i.e., the Border Leicester × Cheviot or Scottish Half-bred. Nearly as popular is the Greyface, from the Blackface ewe.

The head is hornless, of medium size, covered with short white hairs, and the characteristic nose is aquiline. The ears are large, white with occasional black spots, and prominent. The neck is distinctly long, and the head is carried in a gay manner. The breed has an exceptionally wide and level back, and is easily fattened. The modern tendency is towards a rather short and dense fleece. The average weight of a ewe fleece is 8 lb.

Under good management, flocks will often produce 170 per cent of lambs. The ewes are good milkers.

### IMPROVED DARTMOOR

The Dartmoor, although classed as a Long-wool, is really intermediate between the hill and lowland breeds. Some flocks are summered under hill

sheep conditions on the rough heath land of the Forest of Dartmoor, which is exposed to every wind, and experiences a very heavy rainfall. The breed owes much of its robust constitution to its natural selection under this invigorating climate and is the hardiest of the Long-wools.

The Dartmoor has a speckled face of medium length and a head well covered with good curly wool. The ears, coloured tan inside, are inclined to be thick, with a covering of white hair inside and out. The breast is deep and wide, the back level, with broad loins. The body is deep, carried on strong short legs, and should be evenly covered all over with a coat of long, curly, lustre wool. The average wool clip is from 15 to 18 lb, though a ram can produce double this weight of fleece.

The ewes are prolific and are capable of rearing good fat lambs on improved pastures away from their native heath.

### White-Face Dartmoor

White-Face Dartmoors — locally called Widecombe Dartmoors — have been known to exist on the Moor since the earliest records, although a flock book has only recently been established. At one time they were a horned breed but this feature has tended to disappear and now the male sheep only may be horned. The sheep are hardy and can thrive on the poorest pasture, many grazing at an altitude of 500 — 1,500 feet.

As the name denotes, the breed is characterized by a white head and face, the face being free from wool. The fleece is white and of good staple, with a fairly strong crimp. The average weight of ewe clip is 12-16 lb.

### Devon Longwoolled

Reputed to be a breed of great antiquity, the Devon Longwoolled is one of the oldest breeds of the West Country. The Dishley Leicester appears to have had some influence in fixing the type. Covered with a heavy curly fleece, with a long staple, it is typical of the longwool breeds of the south-west and in many features is similar to the South Devon.

The face is white, with black nostrils, the head well covered with wool, the ears white with an occasional black spot. The shoulders are level with the back, which is broad and firm.

It is a quiet, contented breed and matures fairly early. The ewes, prolific and good milkers, cross well with Dorset Down, Hampshire or Suffiolk rams to produce fat lambs.

The wool clip is heavy. Fleeces average about 14 lb, with 12 inches of staple.

### Kent or Romney Marsh

This breed is grazed more densely in the Marsh, from which it originated and took its name, than in any other part of the country.

Due to their adaptability, sheep of this breed have proved successful in most sheep-breeding countries throughout the world. They are excellent foragers, graze evenly and are highly resistant on their home ground to parasitic worm infestation.

A typical Romney should be wide and level between the ears, with a good thick fore-top and a well-covered poll. The face is white, full and broad and not too long, with a black nose. Its neck and shoulders should be thick and

strong and well laid into well-sprung ribs and a deep body. The legs, white in colour, are strong boned.

The wool is denser than that of any other Long-wool and of finer quality, though it is shorter and less lustrous. It is classed as a demi-lustre. An average weight of fleece is 7½ lb.

The breed is not notably prolific, giving up to 120 per cent of lambs under ordinary conditions. Large numbers of ewes are crossed with South-down rams. The lambs so produced fatten readily and are of excellent quality.

## Leicester

The Leicester was the first British breed to be improved by systematic selection and inbreeding. Bakewell began the work of improvement about 1755 and aimed at producing a valuable carcass, regarding fleece quality as a secondary consideration. It has been used in the improvement of other Long-wool breeds.

The chief centre of the breed is on the Wolds in the East Riding of Yorkshire. There is a growing tendency to cross the Leicester ewe with the Suffolk ram to obtain a leaner type of mutton. Other flocks are kept to produce rams for mating with Blackface or Masham ewes.

The ewe produces a heavy fleece averaging 10-13 lb of long, lustrous, silky wool, with a marked evenness of length and diameter of fibre. The fleece should continue to and cover the crown of the head.

This breed has an exceptionally wide and level back, firmly fleshed. Legs, like nose, should be covered with short white hair from the hocks downwards; they should be set squarely and be capable of carrying a heavy sheep.

Recent trends in breeding and in management have aimed at the production of a leaner carcass.

## Lincoln Longwool

The present-day Lincoln — the outcome of crossing the coarse large-sized old Lincoln with the Leicester — is the largest of all the English sheep. It has been the established breed of the county of its name since about 1750 and thrives best there and in colder climates.

It is white-faced, with a woolly tuft on the forehead and is exceptionally free from foot-rot. It resembles the Leicester to some extent but is rather larger and produces a heavier but lower quality fleece. Yearling ewes have been known to produce a staple of 32 inches and ewes average about 14 lb per fleece.

The majority of the lambs are carried on throughout the winter, being fed on sugar beet tops. The breed has done much in the past to grade up the native breeds of other countries, both for wool and mutton production.

## South Devon

The South Devon is the biggest of the Long-wool breed in the south west, and has been a predominant type throughout Cornwall and south Devon for well over a century.

For weight of carcass and fleece, it is rivalled only by the Lincoln, which in many respects it resembles.

The face is clean, with head well covered with curly wool: the ears, often black-spotted, are covered with hair. The body is deep, with well-sprung ribs. The legs should be straight, set wide apart and of medium bone.

South Devon sheep will thrive on hard fare but respond readily to liberal treatment, either folded or grazed, and produce a carcass with a high proportion of lean meat. Crossed with a Down ram, the ewes produce early-maturing fat lambs.

The wool is long, dense and curly and of exceptional weight, many ewe flocks averaging 16 lb per fleece.

The breed is very docile, a valuable characteristic for their native district where field boundaries are mainly banks.

### Wensleydale

The Wensleydale breed, found mainly in the Skipton-Hellifield district of Yorkshire and in north Lancashire began to take definite shape about a century ago and became fixed in type about 1860.

The breed is notable not only for wool and fleshing qualities but also for the crossing value of the rams. The majority of ram lambs are sold for crossing with the blackfaced hill breeds of the north — producing the well-known Mashams in England, and the so-called Yorkshire crosses in Scotland — chiefly on farms where lambs are to be sold as stores in autumn rather than as early fat lambs.

A popular attribute — which it shares with the Teeswater — is the ability to produce the attractive black spot on the face and legs of its progeny, notably from the Swaledale.

The head, with its silky blue face, is of a good size, with a strong muzzle, and is carried gaily on a long strong neck, well set up on the shoulders. The back, giving a particularly vigorous and stylish appearance, is broad and equal in height from shoulder to tail. The body should be deep and the legs straight, of medium length, with plenty of bone and no coarse hair.

Bright, lustrous, long wool of open character, divided into uniform little knots or purls, covers nearly the whole of the body. The average ewe clip is 9 lb.

### Teeswater

As the name implies, Teeswater sheep are indigenous to Teesdale and have come to the fore during the last thirty years, although some mention of them is made in nineteenth century literature.

Their primary purpose is similar to that of the Wensleydale — the production of rams for crossing with hill-bred ewes for the breeding of half-bred or Masham lambs. Different types of ram are favoured for the different breeds of ewe, for example, a finer-wooled ram is needed for the Rough Fell or Scottish Blackface, whereas for the more mellow wool of the Swaledale or Dales-bred ewes, a ram with a heavier type of wool is selected.

No specification of type is laid down for the breed, which is similar to the Wensleydale. Teeswater sheep have been consistently bred on a purely commercial basis. A ram is seldom used on ewes of the breed until he has first been proven as a "good getter" of half-breds. Fleeces average 7 lb.

## SHORT-WOOL BREEDS

The Short-wools include six breeds that are generally described as Down breeds, together with six others.

The Down breeds — Southdown, Shropshire, Suffolk, Hampshire, Oxford and Dorset — were originally associated with downlands or similar districts of fair elevation, with dry soils and climate. They are now found under a wide range of conditions in all parts of the country. They are horn-less, dark-faced and dark-legged, and the majority have medium-weight fleeces of close, fine wool, comparatively short in length. The mutton is generally of good quality, fine in the grain and rich in colour.

The remaining breeds are the Dorset Horn, the Western or Wiltshire Horn (white-faced horned), the Devon Closewool, the Ryeland (white-faced), the Kerry Hill (speckle-faced), and the Clun Forest (dark-faced).

### Clun Forest

Originating from the hilly ranges on the borders of Shropshire, Radnorshire and Montgomeryshire — typical upland sheep runs — flocks of Clun Forest are now distributed over most counties of England and Wales. The Clun has a wide range of usefulness and can truly be described as a general-purpose sheep, because of its adaptability to a great variety of conditions — whether on rough pastures or under more intensive management. The breed society was established as recently as 1925.

The Clun has a clean, open, dark brown or soft black face with the top of the head nicely covered with white wool. The ears are of medium length and should be carried high, giving the sheep an alert appearance. The shoulder should be strong, without coarseness, followed through by a deep well-sprung rib. The hind legs should be strong, set well apart with clean hocks, giving an excellent carriage. The fleece is fine and of first quality, set close to the skin; an average clip is about 6 lb. Lean fleshing is a characteristic of the breed.

### Devon Closewool

This medium-sized breed owes its origin to the careful selection and stabilization of the cross between the Devon Longwoolled and the Exmoor Horn. Although a breed society was not formed until 1923, sheep of this breed have been bred in north Devon for well over a hundred years, the original home being Exmoor and its borders. The Closewool is very hardy and is primarily a grassland sheep, capable of thriving throughout the year without hand feeding.

Standing on short legs, set wide apart, this is a deep, thickset type of sheep, symmetrical in appearance, with a good width through the heart. Ears are short and covered with fine white hair.

As the name implies, the wool is very close and of medium staple. An average ewe fleece weighs about 8 lb and is of good quality.

On rich lowland pastures the ewe gives good results when crossed with a ram of the Down breeds.

### Dorset Down

Although a flock book was not issued until 1906, the Dorset Down has been a distinct type in Dorset and the adjacent counties for upwards of 150 years.

A middle-sized type of Down sheep, it was originally formed by mating

Southdown rams with Hampshire ewes, and then crossing the progeny with the original Down sheep of the west.

A good type of Dorset Down is free from all coarseness, and has a fairly long, clean face with a wide muzzle. Face, ears and legs are of greyish-brown colour.

A fine, close fleece gives wool of good quality that usually realizes a high price. The average weight is 4¾ lb washed, 6 or 7 lb unwashed.

The ewes breed very early in the year, and, before the war, were often lambed down in November and December.

### Dorset Horn

Though found mainly in Dorset, Isle of Wight and Somerset, the Dorset Horn can adapt itself to localities other than the chalk farms of its native district. The ewes are prolific and a striking peculiarity is that they will often take the ram as early as April or May, so that they lamb in October, to produce out-of-season lambs up to Easter. A proportion will breed twice a year.

Distinguishing features are their pink-skinned nostrils and lips, white face and legs: the horns are thin, with a symmetrical curve.

The wool is of very high quality, and clear white when scoured. Shearing generally takes place in June, when both the lambs and ewes are shorn, the ewes yielding 6 lb fleeces of washed wool.

Although the breed attained fame as "hurdle" sheep, experience has shown that they can be run on grassland with equal success.

### Hampshire Down

This is an old-established breed which was well adapted to the mixed down and arable holdings of the chalk uplands in Hampshire and Wiltshire. No breed has done more in the past to maintain fertility on such farms. It has been exported to most parts of the world.

The face and ears are a rich dark brown, almost black, well covered with wool over the poll and forehead. A bold masculine head is an essential feature in rams.

Hampshires are rapid growers, lambs reaching great weights. It is claimed that, under good management, they will increase in live weight at the rate of 1 lb per day for the first two months of life.

The hindquarters should be particularly full, and the shoulders markedly wider than in other breeds. In fact, the heavy head and wide shoulder have restricted the use of rams of this breed for crossing with the smaller sorts of ewe, although a valuable asset of the ram is his ability to impart size and early maturity to his progeny.

The wool is white, of moderate length, close, with fine texture and of high grade. A good average clip would be 5-6 lb.

### Kerry Hill

The breed derives its name from the Kerry Hills in Montgomeryshire, which have carried this breed since 1809. The Kerry Hill is essentially a hill sheep, with inherited hardiness and robust constitution. It is very adaptable, whether taken to higher altitudes than its natural habitat, or, as is more usual, to lowland grazings.

In general appearance it is evenly balanced, bold and stylish, with a gaily-carried head. The sharply defined black-and-white markings of the

face and legs, and a black nose, are distinctive. Ears are set high and are free from wool: neck and shoulders are strong, blending into well-sprung ribs. There is good length from hip to tail, with hindquarters well fleshed to the hock: legs of strong bone are well set and fairly clear of wool. The wool is dense and white: ewes should average about 5½ lb of washed wool.

The ewes have a good reputation for prolificacy and nursing qualities. A heavier Down ram of the larger breeds on a Kerry ewe produces excellent fat lamb. The Kerry ram is commonly used for crossing on Welsh mountain ewes to produce the "speckled face" sheep popular in mid-Wales.

### Oxford Down

The Oxford Down breed was formed about 1830 by the mating of improved Hampshire ewes and a few Southdowns with Cotswold rams. It is the largest and heaviest of the Downs.

Though chiefly found around its native county, the breed is kept in many parts of England and there are some well-known flocks in Scotland. Oxfords were introduced into America in 1853 and have since found their way into most sheep-breeding countries.

The Oxford is a big, upstanding sheep with a bold appearance, with a poll well covered with wool and adorned by a topknot. The face and legs are very dark in colour. The legs are well set apart so as to carry the broad-framed, symmetrical body. This breed has a longer staple of wool, and cuts a heavier fleece than any other Down breed, averaging about 8-9 lb.

The Oxford Down is one of the most prolific of the Down breeds. In the north, rams are used to a great extent for crossing on the Half-bred or Grey-face ewes.

### Ryeland

This is one of the oldest breeds in the British Isles. It originated in Herefordshire, where it is still largely found, but is now also located in adjacent counties. In appearance it rather resembles the Southdown except that it is higher on the leg, has a bigger frame and its head carries a larger ear, while the face is whiter, with less wool. In fact, one of the breed points nowadays is that too much muffling of wool on the face is a drawback. In its early stages, the Ryeland was small but it has now become a compact sheep of medium size. It has a wide back with a substantial girth and a frame evenly let down, making a good bottom line. Legs should be free from tanning.

The wool is of good quality, with an absence of black fibres, deeper in the staple than the Southdown and of a clear white colour. Ewes clip an average fleece of about 6½ lb. The breed forages well, is docile and easily managed but, being quick maturing, the lambs are apt to get too fat if liberally fed.

### Shropshire

The fact that this breed originated from the sheep which roamed the hills and commons of its native county and adjacent districts probably accounts for its strong constitution. The flock book was formed in 1882 and the Shropshire soon became a successful, dual-purpose sheep. The rams are largely used for crossing, being partly responsible for the development of the popular Clun breed, which shows many similar characteristics. Face and ears are soft black in colour, with a covering of wool on the poll; the neck is very short and muscular, the back long and broad, with a deep, well-fleshed

body on short legs of good bone, which are the same colour as the face. The Shropshire clips a fairly heavy dense fleece of wool of good staple and fine texture. An average weight of a fleece is 8 lb.

The ewes are prolific and good nurses; records have shown very high lambing percentages.

The breed has been exported extensively and at one time was largely used to produce freezers of Merino crosses.

### Southdown

The Southdown was the earliest improved breed of the Short-wool type. Towards the end of the eighteenth century John Ellman, of Glynde, near Lewes, began to improve the small sheep that had existed for centuries on the chalk hills of Sussex. It has since been developed into one of the most famous breeds of British livestock. The wool commands top price for British wools, and for quality of lamb carcass the breed is unsurpassed. There is hardly a breed of Down sheep that has not benefited by an infusion of Southdown blood. Southdown rams are very prepotent and are used more than any other for producing small high-quality fat lamb overseas.

The Southdown has a rather short, woolly face, mouse-coloured, with the upper portion and the ears covered with close wool. The very compact body is blocky with a notably wide deep chest and short, woolly legs.

The wool clip averages about 4-4½ lb. The average length of staple is 2-2½ inches and the wool possesses unusual qualities of crimpiness and creaminess of lustre.

### Suffolk

Suffolk sheep were originally bred by crossing the old black-faced Norfolk horned ewes with Southdown rams. Classes were opened for the breed at Suffolk agricultural shows in 1859 and thenceforward it was given the name of "Suffolk". The Suffolk Sheep Society was established in 1886.

The breed is easily identified, being the only one with a clean black face and ears. It excels as a mutton breed, having a broad and level back with strong loins, and is well covered with lean meat. This is one of the reasons why the breed is outstanding for crossing. Suffolks and their crosses have a long list of successes in carcass competitions.

Rams are mated successfully with hill or lowland breeds, a popular cross being with the Scottish Half-bred. With the long-wool, the quality of carcass is combined with size and fleece.

The wool is moderately short, white and dense, an average fleece weighing 5½-7 lb. The percentage of black fibre was rather high in the past but this fault has been largely corrected.

### Wiltshire Horn

The Wiltshire Horn — once known as the "Western" — is descended from sheep once native to Wiltshire but is mainly found today in Northamptonshire and the adjoining counties and in north Wales. Though an old breed, the flock book was only established in 1923.

The chief peculiarity of the breed is that the sheep grow little or no wool. The skin is white and covered with thick, matted hair, something like that of a horse but with a little wool which is shed as it fattens. The rams carry majestic horns which bend downwards but away from the face. It is claimed

that the loss in wool is compensated by increased fattening propensities and relative freedom from blowfly trouble.

The flocks are retained wholly for the breeding of rams, which are popular for crossing with a number of the smaller-sized breeds (particularly hill ewes) for fat lamb. The crosses capture the early fat market and reach select carcass weights when fed on grass only. The progeny have narrow heads and it is seldom that any difficulty is experienced at lambing.

## MOUNTAIN BREEDS

Apart from their generally small size, good quality of mutton and ability to live on mountain or moorland grazings, the mountain breeds have few other characteristics in common, though the Scottish Blackface, Swaledale, Rough Fell, Dales-bred and Lonk form an allied group and are said to be descended from the earlier forest breed of the country.

The Derbyshire Gritstone is sometimes grouped with these, but is softer-wooled and hornless.

The others are the Cheviot, North Country Cheviot, Black Welsh Mountain, Welsh Mountain, South Wales Mountain, Exmoor Horn, Herdwick and Shetland.

The quality of their wool varies widely. The coarsest is used for carpet-making, the intermediate for Harris and other strong tweeds, and the finest for hosiery and flannel.

### Black Welsh Mountain

Though doubtless Black Welsh Mountain sheep are descended from the same original stock as the ordinary White Welsh Mountain and were collected by some enthusiasts from "sports" of that breed, flocks have been in existence for a century. The flock book was instituted in 1922, and small flocks can now be found outside their native country. The breed is easily identified, as it is the only completely black breed of sheep. Though seldom run as hill flocks they have proved to be most suitable for rough wooded park grazing. The rams, being horned, are similar to the Welsh Mountain, having a small head, with face and forehead free from wool. The fleece averages about 3 lb of short black wool, which has a special market, since it does not require dyeing and can be used with white wools for cloth of mixed colours. Curly wool is undesirable except between the horns. The breed is light in the bone and produces small joints of meat, free from wasteful fat.

### Cheviot

As the Centenary Ram Sale was held in Hawick in September, 1945, it will be appreciated that the Cheviot must be a breed of very old standing. It is still chiefly found grazing the Cheviot Hills bordering England and Scotland, being more suitable to the grassy hills than to the "black" or heath land of their rivals, the Scottish Blackface. The white, clean face and arched nose, large dark bright eyes with pricked ears on a deep symmetrical body, together with a gay carriage, give the Cheviot an air of distinction. Though originally Cheviot rams were horned, the majority today are hornless, except the hardy Lockerbie type in which a small horn is still in favour. Rams of the latter type are much sought after for the Brecon Beacon hills in Wales, especially those with an occasional brown spot on face or leg, which is

believed to be associated with hardiness. Cheviots and Cheviot-Welsh Crosses have long thrived on this range of hills in Wales. The Cheviot is noted for good-quality wool — a ewe flock cutting an average fleece of 4 lb — suitable for the production of high-class hosiery and Scotch tweeds. Draft Cheviot ewes are mated with the Border Leicester to produce the famous Scottish Half-bred ewe.

### Derbyshire Gritstone

The Derbyshire Gritstone breed is one of great antiquity and has long been established in the hills of the Peak District of Derbyshire, where for more than a century the flocks have been kept pure. It is the only hornless breed of the heath type and stands rather higher on the leg than other hill breeds. It has a fairly long, polled head, free from wool, and ears curving slightly forward. The face and legs have attractive well-defined black-and-white markings. The back is straight and longer than most hill breeds. The Gritstone has the softest wool and the closest fleece of all the breeds of the Black-face type, free from kemp and roughness in the skirts, and is claimed to produce one of the finest hosiery wools. It is extremely hardy and capable of producing good lean mutton of medium weight and prime quality. The ewes, when crossed with Down rams, turn out good fat lambs. Fleece weight averages 5 lb. Flocks are now to be found on the hills in east Lancashire, and in the industrial West Riding of Yorkshire.

### Exmoor Horn

The Exmoor Horn or Porlock is an ancient breed, native to the Exmoor and Brendon Hills in west Somerset and north Devon. Although heavier, with broader shoulders and chest than most other hill breeds, it has proved to be very suitable for its native hills, where hardiness is essential. The Exmoor Horn has a white face, with a close forelock; both sexes are horned. The horns should curve nicely downwards and outwards and be fairly wide apart on top of the head. The general conformation is thick and blocky, on strong-boned and wooled legs, set well apart. It grows a strong fleece of thick medium-length wool of good quality, with an average weight of about 5½-6 lb. Pure-bred lambs are not usually sold until August, when a large number are sold as stores for autumn feeding. The ewes cross well with most Down rams and produce lambs of good carcass weight.

### Herdwick

Claimed to be of Scandinavian or Spanish origin, the Herdwick is believed to be the hardiest of British mountain sheep and is only found in the high, scanty grazing fells of the Lake District of north Lancashire, Cumberland and Westmorland. A characteristic of the breed is that the lambs, born almost black, turn much lighter in colour as they become older. It is probably the only breed where the colour of the fleece can distinguish the old from the young. Although Herdwicks can claim to be free from infusion of any other breed on their old native hills, many useful flocks of the Herdwick-Swaledale cross can be found on the adjoining, more grassy, fells. Only the rams bear horns, which are of a fine nature; the head is broad across the forehead, with a grey arched nose; the body is deep and round, with legs well covered down to the fetlock with strong short bristly hair. It grows a very strong coat of wool with some kemp, showing a grey pelt after shearing, with a mane or

ruffle round the neck and shoulders to the point of the breast. The average fleece weight is about 3½ lb. Many of the smaller wether lambs are retained to run the hills. Draft ewes produce good lambs from Leicester, Wensleydale or Down rams.

### Lonk

Lonk sheep have existed on the hill ranges of east Lancashire and south-west Yorkshire and north-west Derbyshire for a very considerable time and the flock book was formed in 1905. Though the face and leg markings of pure black-and-white resemble the Blackface or Rough Fell, its fleece is of a finer and closer texture and Lonks stand higher on the leg, with a longer body, than any other horned Blackfaced hill breed. The average weight of fleece (which is white) is about 6 lb; it is free from kemp and grows evenly from head to skirtings. The horns are set low and wide at the root, and there is a neat tuft of wool on the forehead. Though naturally a good ranger, and able to withstand the exposed hill climate of its native heath, being rather bigger than the majority of hill breeds, the Lonk is equally popular on the lower-lying land, where it is capable of growing to a heavy weight with better wool. Rams have been used with success with the smaller Blackfaced horned breeds. Lonk ewes produce good fat lambs from most breeds of rams but perhaps the most popular cross is the Wensleydale, especially for the store lamb trade.

### North Country Cheviot

Some 160 years ago a flock of ewes taken from the Cheviot Hills to the county of Caithness formed the nucleus of the North Country Cheviot. These sheep, then known as "long hill sheep", increased rapidly, thrived in the high hills of Sutherland and soon supplanted the highland cattle in the north of Scotland. Today, this breed, bigger than its namesake in the south, is one of the largest of the hill breeds and is run extensively on marginal farms throughout Scotland, where ewes produce a good pure-bred fat lamb or the noted Half-bred store lamb from a Border Leicester mating. High fecundity is a marked characteristic on reasonably good land. The North Country Cheviot has a white head and face, free from blue or brown tinge. The ears are larger and less erect than those of the south country Cheviot. The head is longer, with wool well up to the back of, but not between, the ears. An average washed fleece should weigh about 5 lb from a Caithness ewe, or 3½ lb from a Sutherland or hill type. It should be white, free from curls or kemp; it is largely used in the Scottish tweed trade.

### Rough Fell

The Rough Fell, which graze a large portion of the fell land in the county of Westmorland have been bred pure for many generations but the flock book was not instituted until 1926. A horned breed, like the Scottish Blackface and Swaledale, it is similar to the former in many respects, except that it differs by growing a dark toppin on the forehead and has a shorter head, with more white predominating. The features which distinguish it from the Swaledale are the irregular face markings—the lower part of the face of the Rough Fell usually being black — together with a much stronger and longer staple of wool. It has a strong frame, broad and deep, and strong bone of medium

length with a little feather on mottled legs. The wool is white, with a good lash, the average weight of fleece being 4¾ lb; it is used for carpet yarns.

The ewes are in demand for crossing with lowland breeds and are usually mated with Leicester, Wensleydale or Teeswater rams, the latter crosses being in greater demand.

### Scottish Blackface

Believed to have found its way into Scotland from the border counties, the Scottish Blackface has predominated throughout the rough heather-covered or "black" hills of Scotland since about the middle of the eighteenth century.

The Blackface and Cheviot breeds that superseded cattle in those early days are still the two main hill breeds of their respective heather and grass hills of Scotland. The Blackface has formed a solid foundation in Devonshire and has become the main hill breed in the Dartmoor area.

Known at one time as the "Short Sheep", it has been improved both in length and in early maturity during the past half century.

The Blackface ewe is a good mother and under good management her lamb will gain ½ lb live weight per day from birth until four months old. The distinct black-and-white markings, the Roman nose, large horns sweeping downwards and outwards, the slightly crested neck and the general carriage give the breed a distinctive, almost majestic appearance. The deep body is covered with a strong fleece of long staple, averaging about 4-5 lb; it should be free from blue and kemp.

The draft ewes crossed with the Border Leicester produce the famous Greyface.

### Shetland

The Shetland is the smallest of British breeds of sheep, hardy, active and specially suited to the climatic conditions and grazing of the rocky headlands and heather-clad moors of the Shetland Islands and other similar surroundings. The breed is unique and retains many of the characteristics of wild sheep. It is chiefly noted for the fineness and softness of its wool, and the quality of its mutton in well-fed sheep is rapidly coming into favour. It can be crossed successfully with such breeds as the Cheviot or Border Leicester but the wool quickly deteriorates with better-quality feeding. Unlike the more domesticated breeds, the Shetland produces several shades of wool. The more common colours are white and moorit (moor red) but there are other natural shades, such as fawn, grey and brown. The more careful breeders keep the flocks of different colours separate.

In Shetland, the sheep are not shorn, the loose wool being picked off at intervals and the finest sorted out for the local industry of shawl-making. The average yield per ewe is 2 lb.

### Swaledale

No breed of hill sheep has spread more rapidly in recent years than the Swaledale, which is now found in large numbers in the six northern counties of England: in fact, it outnumbers all other breeds of hill sheep in England today.

In many respects, the "Swale" resembles the Blackface, except that the upper portion of the face is dark and the muzzle is white or grey (mealy). The Roman nose is less pronounced.

Longer-bodied and higher on the leg, it has not the depth and carcass-weight of the Blackface, but the lighter forequarters, greater body-clearance and shorter staple of wool are a great help against "balling" when foraging in deep snow.

A characteristic of the fleece is a very tight "bind" or undercoat, which does not blow up and expose the skin. An average fleece is 3½ lb.

The Swaledale is very agile, a splendid forager on the poorest roughage, and the ewes can rear a lamb under adverse conditions.

When drafted to low-lying farms, the ewes produce excellent crossbred lambs, in particular, the Masham, sired by Teeswater or Wensleydale rams, and the Mule, sired by the Blue-Faced or Hexham Leicester.

### Dales-bred

Dales-bred sheep, which in appearance are very similar to Swaledale, are claimed to be the original hill type indigenous to parts of the West Riding of Yorkshire, more especially to the Settle District.

In comparison with the Swaledale, the Dales-bred is a little larger, with more distinct black-and-white markings on the face and legs, and the outer-coat of the fleece is longer and more "purly", with less black. In an average hill flock the fleece weighs about 3¾ lb. The ewes are good foragers, excellent milkers and are capable of producing eight or nine crops of lambs under sound management. Lambs mature early for a hill breed and many are sold off the hills in August and September. The Teeswater ram crossed with a Dales-bred ewe produces a most attractive half-bred or Masham. The bright black-and-white markings on face and legs, combined with a very lustrous purly coat, add considerably to its value at lamb sales.

The breed has recently increased in popularity and this has been reflected in higher prices for draft ewes.

### Welsh Mountain

This small, active, hardy breed of sheep has always existed, so far as is known, on the highest hills of Wales. Despite attempts from time to time to improve the breed in size and quality of wool, hill farmers have been reluctant to change the type and have more or less retained the original chacteristics.

The ram has fine, nicely curved horns, with a slightly tanned face and legs, free from wool. The eyes are prominent and bright, with small thin ears. The light fore-end, strong muscular back and well developed hind-quarters are associated with the activity needed for existence on the steep mountain grazing. The flavour of its small joints and the deep milking qualities of the ewe are two of its important characteristics. Although the smallest of the commercial breeds, the ewes are capable, on improved pastures, of producing heavy fat lambs by lowland rams, popular crosses being with the Wiltshire Horn or Suffolk.

The wool, which is fine and close, has an average washed fleece-weight of 2 to 2½ lb.

Hill farmers usually favour ewes with a certain amount of kemp, which they associate with hardiness.

### South Wales Mountain

This breed, considered to be of the same origin as the Welsh Mountain, has certainly proved more suitable to the hills of Glamorgan, Monmouth and

parts of Brecon and Carmarthen than any other hill breed. The smoke-polluted vegetation of the large industrial areas of south Wales appears to have little ill effect on these hardy sheep, where other breeds have failed. It is the largest of the Welsh Mountain sheep. Rams carry horns which are round and not set too close at the roots. The face is white with tan markings, bright dark eyes and thin oblique ears. The legs, which are tan-marked like the face, are rather longer than those of its rivals from the north. The greatest contrast in the two types has always been in quality of wool. The South Wales type grows a stronger coat of a mixture of wool and kemp, with a pronounced neck ruffle of strong bristly brown hair extending to the point of brisket. Any wool on the underpart of the cheeks, poll or butts of ears is considered a defect in breed points. Lambs are born with good weather-resisting birth-coats and usually their necks and lower portion of the tail are tan coloured. The fleece weight averages 3-3¼ lb.

On improved pastures the ewes are capable of rearing a heavy lamb, with a good killing-out percentage, by any Down ram.

## CHAPTER III

# Breeding

BREEDING methods are to a large extent governed by the conditions under which flocks are kept, and by the objectives of the breeder; it is desirable, therefore, to open this chapter with a brief description of flock types and of the general pattern of British sheep breeding. The main objective of all sheep husbandry in this country is the production of fat lamb. Though the wethers of all breeds contribute to the total reaching the market, most of our fat lambs are produced on lowland farms whose breeding stock is obtained by purchase of pure-, or cross-bred ewes from one source and rams of another breed from a second source. Many of these lowland crossing flocks breed no replacements but dispose of the ewes as they age. Such flocks are known as flying flocks. Other lowland farmers maintain permanent breeding flocks by rearing an appropriate number of ewe lambs annually. The lowland crossing flock may be regarded as the focal point in British sheep breeding; all other flocks are engaged to some extent, directly or indirectly, in supplying foundation ewes or rams to sustain it.

Breeding flocks producing foundation stock may be classified according to their function, the classification coinciding roughly with the terrain in which the flocks are found.

### MOUNTAIN FLOCKS

These comprise small, hardy, pure breeds occupying practically all our mountain and moorland grazings, for example, the Scottish Blackface, Cheviot, Swaledale, Welsh and Exmoor Horn.

### UPLAND FLOCKS

A. *Crossing*

The majority of upland flocks are made up of draft pure-bred mountain ewes and carry first-cross lambs, for example, by Border Leicester rams in

Scotland, Wensleydale and Teeswaters in the north of England and by Kerry Hill rams in Wales.

B. *Pure-bred*

(i) Flocks of upland breeds intermediate in size and character between mountain and lowland breeds characterize some districts. These flocks resemble in many respects the first crosses out of mountain ewes.

Of these upland breeds the Clun and Kerry Hill, native to the Welsh borders, and the Devon Closewool in the foothills of that county are good examples.

(ii) Flocks of Border Leicester, Wensleydale, Teeswater and other breeds are kept, usually at rather lower altitudes, primarily to produce rams for crossing with mountain ewes. Quite commonly flocks of type A are also found on the same farms.

### Pure-bred Lowland Flocks

These consist mainly of Down and Long-wool breeds maintained, although in diminishing numbers, to provide rams for crossing on lowland farms to produce fat lambs, for example, Suffolk, Hampshire, Oxford, Shropshire and Leicester.

The general system of sheep breeding will be seen to involve an annual downspill from the mountains and uplands, a steady blending of mountain and lowland blood. The females in the lowland commercial flock may be either pure-bred, as in the case of the Clun and Kerry Hill or (more usually) cross-breds resulting from matings between an upland or lowland ram and a hill ewe, for example, the Half-bred (Border Leicester × Cheviot) and Masham (Wensleydale or Teeswater × Swaledale).

By this system the fullest use is made of qualities developed in the mountain breeds. After three or four years in an environment of climatic hardship and low-level nutrition, ewes no longer fitted for mountain life will continue to breed and raise good lambs when transferred to a more favourable situation. The system permits breeders to concentrate on a relatively small number of objectives.

The general pattern prevailing throughout the country may be illustrated by a diagram (Fig. 2) of the course of events current in the north of the country.

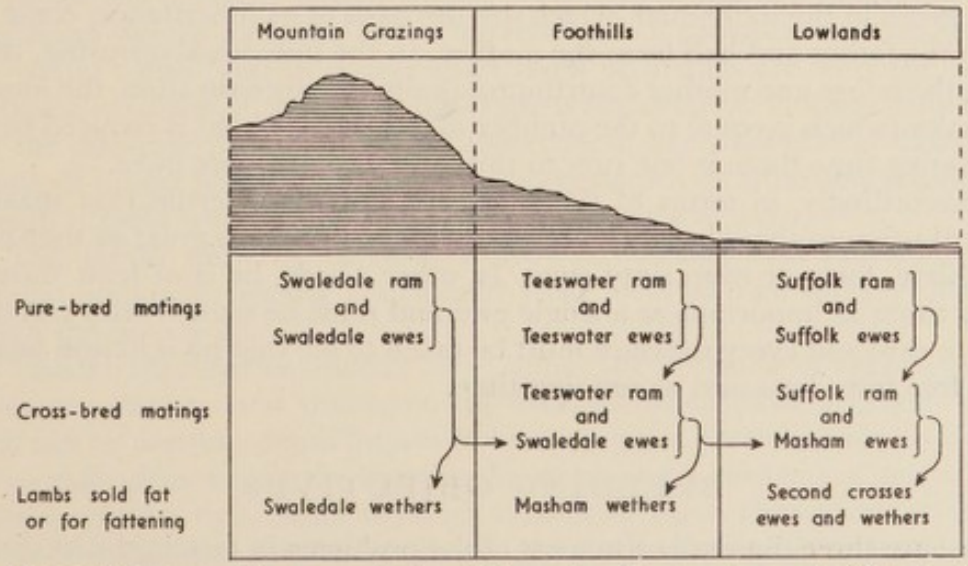



Fig. 2. Diagrammatic representation of sheep breeding in the north of England.

## SEXUAL MATURITY

The ewe lamb may reach sexual maturity at six months in lowland flocks but more commonly at about seven months, and in some breeds it can be mated in its first autumn. In mountain flocks, kept under rigorous conditions, lambs are born about six weeks later in the spring than in lowland flocks and do not ordinarily reach sexual maturity in their first year; some may even fail to conceive when run with the ram at eighteen months old. In most British breeds of sheep, heat and conception are confined to the second half of the year and mainly to the last quarter, but if conception does not then take place, ovulation continues until February or March. Lowland flocks come into heat early in this period, hill flocks later and mountain flocks last. As well as being affected by the nutritional state of the ewe at tupping time, the likelihood of a ewe conceiving twin lambs or triplets also varies during the breeding season, fertility rising to a peak in most lowland breeds about the middle of October and then falling off. The point of maximum fertility varies with breed, season and management and must be studied on each farm if maximum returns from the lamb crops are to be secured.

If the ewe fails to conceive at one heat period, oestrus recurs fourteen to eighteen days later. Heat lasts from one to three days and, in the absence of the ram, there may be eight or even ten heat periods in the mature lowland ewe during the usual tupping season, whereas in mountain ewes under mountain conditions the number may be as few as two or three. The gestation period is usually twenty-one weeks but it commonly varies up to a week either way.

Ewe lambs, even of the fertile lowland breeds, produce few twins, fertility gathering as the sheep gets older and reaching its maximum at three or four years old. Though one might expect the size of the lamb crop to fall off with increasing age, there is some evidence to show that, from three to six or seven years old, the exigencies of season are more telling than increasing years.

Rams become capable of effective service at about the same age as ewe lambs and puberty varies in much the same way with environment and season.

Conception consists in the fusion of the male cell or sperm with the female cell or egg to produce the fertilized egg from which the individual springs. The genes in the individual, which are the basis of its inheritance, come half from the father and half from the mother. In the individual offspring, therefore, the father and mother contribute equally but, by castration, the number of males (which is equal to the number of females at birth) is reduced so that at mating time there is one ram to thirty or forty or more ewes.

Accordingly, in terms of the flock, the individual fertile ram makes a contribution to the inheritance of the next generation as great as that made by thirty, forty or even sixty ewes. In other words, he is at least thirty or forty times as important as a single ewe and must be chosen with commensurate care and every measure must be taken to see that he is fit and healthy and free from lameness at tupping time.

## BREEDING OBJECTIVES

There are three dimensions to most of the problems in farming: first there is *quantity* — how much can be produced; then, *quality* or the acceptability of

what is produced; and thirdly, *economy* as measured by cost of production. It may seem a simple matter to define success in sheep farming in these terms as maximum quantity of the highest quality at the lowest cost. But the biggest sheep and the heaviest fleece may be of lowest quality, and the highest quality of lamb may be costly to produce. Indeed, the three elements of the problem are often in conflict and their reconciliation represents the sheep farmer's first difficulty. We can begin by trying to define the various components which together give the type of sheep we need, treating in turn lowland commercial, mountain, upland, and finally, lowland pedigree flocks.

## Lowland Commercial Flocks

As the majority of lowland flocks are used for raising fat lambs the greatest element of success is undoubtedly the size of the lamb crop in relation to the number of ewes put to the ram. The number varies from 100 or fewer, to 200 or more lambs raised from 100 ewes tupped. On good land, the farmer ought to be able to rear not fewer than 150 lambs from 100 ewes put to the ram.

The size of the crop of lambs is mainly a function of the ewe; if she is of a prolific breed or cross and provided the ram is fertile, there is every chance of many twins and a big crop: no matter how fecund the ram is, if the ewe lacks fecundity the crop will be small.

The character next in importance to prolificacy in the flock, is again a function of the ewe, namely, her ability to produce an abundant flow of milk such as will nourish a pair of twins satisfactorily and bring each of them to a finished live weight of 80 lb or more at five months of age or earlier.

Food costs more than all the other elements in production, and winter keep twice as much as summer grass keep. It is important, therefore, that the ewe flock should be a grassland flock; thrifty and able to live through the winter with the minimum of expensive crops and concentrates. The ewe should be long-lived and capable of continuing for many years to produce good crops of lambs, thereby minimizing the amount to be charged as depreciation against each lamb.

As for the fleece, it must keep the sheep warm and dry in winter, be of maximum weight and also of the highest quality compatible therewith. In the wetter areas (and in winter most parts of Britain are wet) the water-shedding qualities of the fleece are of great importance. A fleece consisting, like the primitive fleece, of a warm undercoat of fine wool with a "fledge" or thatch of longer fibres to shed the rain, is perhaps best from this standpoint, though it lacks weight and quality and uniformity of wool.

The lambs must be capable of growing quickly and fattening early without elaborate feeding and should yield meat of high quality that will please the housewife.

Though all these characters come under the influence of such factors as nutrition, climate and management, each seems to have a genetic basis; each can be developed and improved by appropriate breeding methods. One of the difficulties facing the breeder, however, is the element of conflict and incompatibility that exists between certain of these characters: thus, the fleshy breed is often not a milky breed, and the thrifty ewe is often a lean and rather late-maturing type. Whether these conflicts are really due to incom-

patibilities between the genes, or are simply a reflection of the increasing difficulty to be surmounted with each added objective in livestock breeding and improvement, is not easy to decide; but at any rate the highest development attained in each and all of these various traits has never been achieved within one breed: rather do we find each breed to be well developed in some directions but none in all.

The lowland commercial flockmaster tries to avoid these difficulties by cross-breeding. He seeks a thrifty prolific ewe (which may itself be either pure or a cross) which is a deep milker, with as good a fleece and carcass qualities as are compatible. He mates her with a ram that is of suitable size, deep in flesh and therefore early maturing, compact in the bone — in short a ram with all the characters which contribute to carcass quality, high growth rate and early maturity.

When animals possessed of these qualities are mated a heavy crop of lambs with a high potential for growth, fattening and carcass quality is produced. Moreover, the lambs are provided with the copious milk supply necessary to nourish and develop these characters, by ewes which live cheaply and have a long breeding life and, therefore, a low rate of depreciation.

*Selection of Ewes and Rams*

There are many breeds and crosses of ewes and many breeds of rams with which the lowland flockmaster may sustain his breeding flock.

Amongst the better known cross-bred ewes are the following: *Scottish Half-bred* (Border Leicester × Cheviot), *Masham* (Wensleydale or Teeswater × Swaledale), *Greyface* (Border Leicester × Scottish Blackface), *Welsh Crosses* (Kerry Hill × Welsh, Border Leicester × Welsh), *Exmoor Crosses* (Border Leicester × Exmoor).

Though pure-bred ewes of the mountain breeds are kept in some flying flocks, the rather bigger upland pure-bred ewe is generally favoured, for example, Clun Forest, Kerry Hill, Dorset Horn, Devon Closewool and North Country Cheviot.

The choice of the ewe will usually be a matter of personal inclination, proximity of supply or price, but it is important that she should be suited to the quality of the grazing; she should be as big an animal as the land will sustain. Small ewes are liable to grow fat and lazy on rich land; big ewes are unable to produce good lambs on land of low productivity. For rich land Suffolk × Scottish Half-bred, Suffolk × Clun and Suffolk × Kerry Hill ewes are suitable; for land that is not quite so rich, the Clun and Kerry Hill amongst the pure breeds, and Scottish Half-breds, Mashams, Border Leicester × Welsh and Greyface, amongst the cross-breds, are likely to be suitable ewes; for poorer quality lowland, smaller ewes such as the North Country Cheviot, Kerry Hill × Welsh, or Border Leicester × Exmoor are likely to do best.

The ram to be mated with these ewes will depend on the size of the ewe, the weight at which the lambs are to be marketed and the milk flow of the ewe — a deep milking ewe being capable of fattening a more growthy lamb than the ewe that is not so milky. The most popular rams for fat lamb breeding are the Hampshire, Suffolk and Oxford on ewes of the larger breeds, and the Dorset Down, Shropshire, Ryeland or Southdown on smaller ewes, or when lighter weight lambs are wanted. Rams from other breeds also have their advocates, for example, Wiltshire Horn, Romney Marsh and Leicester,

each in its own district, are used for crossing. It is, however, not enough to choose a suitable breed: success will depend equally on selecting a ram with good qualities from that breed.

*Flock Maintenance*

The main arguments against the maintenance of flocks by constant purchase of ewes, are that ewes are expensive to buy and liable to introduce diseases such as orf and foot rot. These are substantial objections but they can be met to some extent by buying young ewes for crossing, or by choosing the most appropriate of the pure breeds and either keeping them pure, or maintaining a nucleus of pure-bred ewes mated to pure-bred rams. If, for instance, Cluns were chosen, the flock might be made up at mating time as follows:

1. one-quarter pure Clun ewes put to pure Clun ram;
2. one-quarter pure Clun ewes crossed with Suffolk ram;
3. one-half first-cross Suffolk × Clun ewes mated to a Hampshire ram.

Pure-bred ewe lambs from 1 would go into 2 and be crossed for two years and would produce the ewe lambs to supply 3. The best of the pure-bred ewes from 2, i.e., those with good records of fertility and suckling qualities would in due course be transferred back into 1 to maintain and improve the pure-bred nucleus. A self-contained crossing flock on these lines, purchasing only an occasional ram, would be on sound genetic, hygienic and financial lines.

## Mountain Flocks

Mountain flocks constitute the source from which spring the upland farmer's crossing ewes and, in turn, the lowland commercial flockmaster's supply of first-cross breeding ewes.* On the majority of hill farms the sheep and their owner are very much at the mercy of the elements which, by a stubborn combination of hostility and intractibility, dictate the breeding policy to be followed. There is a strict economic limit to the improvements in environment which can be made on a hill farm; so the prime object in mountain sheep farming tends to be the maintenance of those qualities of thrift and hardiness which adapt the sheep to their unfavourable conditions and thereby increase their chances of surviving. It follows that there is only limited scope in mountain flocks for introducing "improvements" such as increased size, earlier maturity and finer wool. Fortunately the characters which are favoured by natural selection as it operates in the mountain flock — vigour, thriftiness and milkiness — are of great value when combined with increased size, fertility and fleshiness in first and second crosses by lowland rams.

## Upland Pure-Bred Flocks

The upland pure-bred flocks, for example, of Kerry Hill, Clun and Devon Closewool, supply the commercial lowland flockmaster with ewes for crossing from land of poorish quality in the foothills. Both the situation and the

* To help hill farmers, the Hill Farming and Livestock Rearing Acts, 1946-1954, authorized the payment of the Hill Sheep Subsidy. The rate is fixed by the Agricultural Ministers in the light of conditions prevailing from time to time in the hill sheep industry. County Agricultural Executive Committees can give full information about the subsidy.

quality of land on upland farms lie midway between those of the mountain and the lowland farm and in keeping therewith, the breeds of sheep are intermediate in size and in other characters; thus, they are smaller, hardier and milkier than Downs and Long-wools but bigger, fleshier and less hardy than the mountain breeds. The objective in breeding is to fix and maintain a type with a heavy fleece of good quality wool, that will produce a good crossing ewe for the lowland farm, and wethers that will fatten readily either as lambs or hoggets. This can be regarded as the general-purpose type in which excessive development of individual characters is sacrificed to the maximum balanced development of *all* characters. Success therefore depends on effective improvement in all directions at one and the same time and can never come easily.

### Upland Ram Breeding Flocks

The value of rams of such breeds as the Border Leicester, Teeswater, Wensleydale and Kerry Hill for crossing with mountain ewes derives from their ability to transmit a combination of size, flesh, fertility and milkiness with a heavy, uniform fleece of long fine wool.

A breeding policy for these breeds, therefore, must put emphasis on twinning, suckling qualities and growth rate, on deep flesh, good conformation with neat head and shoulders, on fleece weight and quality and, finally, on prepotency, i.e., the ability to stamp these qualities on the majority or all of the offspring.

### Pedigree Lowland Flocks

To an ever increasing extent, Down and Long-wool flocks are being replaced on commercial farms by the flying flock and by such pure breeds as the Clun and Kerry Hill. In consequence, the Down and Long-wool flocks have come to be regarded mainly as a source of rams for crossing in lowland flying flocks. To fulfil this purpose satisfactorily, the ram must confer upon his offspring adequate size and high growth rate, early maturity, short bone, and a uniform depth of flesh together with full development at the most valuable points — loin, leg and shoulder. The fleece, too, should be heavy and the quality of the wool uniformly high, though this is of less importance when all the lambs are sold fat early in life than if they are sold as hoggets or kept on as breeding ewes.

It has been suggested, with some logic, that there are more lowland breeds than we need, but against this must be set the obvious need for crossing rams of several different types in order to produce fat lambs (early, mid-season and late), hoggets, and shearlings from ewes varying widely in size, milkiness and rate of maturity.

## BREED IMPROVEMENT

Many, if not all, of the characters in sheep are influenced in their development by the nurture of the individual. The relationship between level of feeding and size is well known: thus, flocks of the same breed and similar breeding kept on different farms may differ markedly in size and conformation. The buyer of upland breeding ewes is always on the lookout for flocks of productive sheep that have been kept small and neat by being raised on

hard, dry land, since these are more thrifty yet equally productive and therefore more profitable.

It is well known that both the conception rate and milking capacity of ewes are profoundly influenced by nutrition. Yet there is good evidence also for the existence of a heritable basis for each of these characters. There is, too, well-placed confidence amongst flockmasters that, provided rams which transmit these qualities in high degree can be identified and mated to ewes which are well endowed with the same qualities, the progeny, on average, will be better endowed than the general run and that thereby, progress, though slow and uncertain, will be achieved.

The first essential in any attempt at breed improvement is to resolve and define, according to the nature of the grazing for which the sheep must be adapted and the purpose and place of the breed in the pattern of sheep breeding, the true meaning of the term "improvement" as applied to that breed; in other words, the breeder must have a sound and clear conception of his objectives.

*Flock Records*

If the qualities sought are quantitative and can be measured, arrangements ought to be made to keep appropriate records and to base selection and culling on these records. Where prolificacy and fertility, mothering quality and milk yield are particularly valuable, for example, as in Wensleydale, Border Leicester, Kerry Hill and Clun, records must be made of the numbers of lambs born, the numbers reared, and (as a measure of the milk yield of the ewe) the rate of progress of the lambs. It is not easy to decide what standards are practicable but, clearly, a ewe capable of raising twins regularly and bringing them to 75-85 lb live weight at four or five months old must be the ultimate aim. The best evidence of merit in a ewe is the performance of her daughters; if they also can attain the desired standard of breeding performance it will be evident that the ewe is capable of transmitting her qualities to her offspring; in modern terms she will be "progeny tested".

The progeny test is particularly valuable as a basis for choosing the ram which transmits valuable characters such as suckling quality. The extent to which he transmits these qualities can be measured if records are obtained from a random sample of a number of his daughters — say, a dozen. By the time his daughters have been tested the ram will, of course, be at least $3\frac{1}{2}$ years old; but provided he is still fertile he may prove of immense value in any flock, particularly in a pure-bred flock where qualities of prolificacy and milk yield are sought after. Unfortunately, there are never likely to be enough good "proven" rams to go round; most breeders have to be content with the next best — a son of a proven ram out of a proven ewe that has regularly produced well-suckled twins.

For each quality in the individual there is an age when assessment is most effective; thus, in the ewe, prolificacy and milking qualities require a minimum of two crops of lambs for their assessment, while the longevity potential, by its very nature, is more fully expressed with each advancing year. On the other hand, early maturity — the ability to flesh up while young — is a quality which clearly can best be judged in the young animal. Certain characters are more clearly reflected against one background of feeding and management than against another. For example, the full poten-

tial of the individual ewe for milk production will only be achieved if an adequate diet is provided: to discover maximum differences between individuals, all must be liberally fed. With "hardiness' the reverse holds: against a lavish background, all sheep should live and thrive, whereas, if conditions are difficult and rigorous, the hardy individual will do better than the less hardy and can therefore be recognized and kept for breeding.

It may be added that over-stocking and lack of hygiene may so damage the flock as to make selection difficult or even impossible.

*Inbreeding*

The farmer with a flock of registered sheep will be faced, sooner or later, with the decision whether to adopt or avoid inbreeding. Inbreeding is the mating of related stock: the closer the relationship and the greater the number of generations of inbreeding, the more distinctive will be the results. Inbreeding introduces no new genes: it tends on the other hand to produce genetic purity. It affects bad and good genes equally, and, in the early stages, produces greater diversity and increased numbers of inferior animals. Provided these are weeded out, there is the possibility, as in the smelting of metals, of producing something pure and valuable.

Inbreeding is not advisable at all in commercial flocks, and in registered flocks its success will depend on the intrinsic qualities of the foundation stock and upon ruthless culling in each inbred generation.

Linebreeding is a mild type of inbreeding and partakes less, therefore, of its risks as well as of its advantages.

## CHAPTER IV

# Nutrition

The digestive system of sheep is similar to that of cattle.

If animals of appropriate weights are selected, close parallels can be drawn between the weekly requirements of one and the daily intake of the other. Thus a growing lamb of 80 lb live weight on a lowland farm needs about 10 lb of starch equivalent per week, while a 10 cwt store bullock consumes the same quantity daily. At comparable stages of growth, both lambs and bullocks require about 2½ lb of starch equivalent, in addition to maintenance, per lb of liveweight increase. Under comparable conditions of feeding the store lamb may be expected to put on liveweight increase at the rate of 2 lb per week, and the bullock at the rate of 2 lb per day, although a liveweight increase of 2 lb per week for a lamb is rather low.

## CAPACITY FOR MEAT PRODUCTION

During the war, a great many of our sheep had to be sacrificed in the interests of corn growing, but ever since we started to expand meat production sheep have occupied a very important place in the national economy. Sheep reproduce themselves faster than cattle; they reach slaughter weights within three to eighteen months of birth, whereas cattle need from two to three years.

Mutton production can therefore be expanded more quickly than beef production. The contribution which sheep can make to the national larder naturally depends to some extent on the age and weight at which they are slaughtered. Throughout the control period during and after the last war, there were sound reasons for feeding them to heavy weights and thus using to the full the potentialities of our ewe flocks. Light-weight lamb, for which there is an increasing demand, involves a very uneconomical use of our breeding stock. This type of lamb is a luxury product.

If we attempt to compare cattle and sheep as converters of forage into human food, important differences in grazing habits must be noted. Sheep are able to thrive on mountains and moors on herbage which would not support cattle. On lowland farms, they eat the same plants as cattle, but they graze in a very different manner. They nibble at the choicest bits whereas cattle tend to take everything before them. Sheep are fastidious even in consuming hand-fed foods — they eat good hay readily and reject bad. When grazing alone on enclosed farms they often allow pastures to grow away from them to their own detriment; for late in the summer the grass may become so stemmy that they cease to thrive or may even lose weight — either they cannot digest enough, or they will not eat enough to maintain growth. In practice, they rarely graze alone throughout a season on enclosed farms, but share the pasture with cattle. On hill farms, where they are often the only grazing animals, their influence on the flora is considerable, since they nibble continuously at some species and neglect others.

Which type of animal is capable of producing the greater quantity of meat per year from a given acreage is a difficult question to answer and is rather an academic one in any case, since mixed grazing is the normal practice in this country; but such evidence as we have suggests that sheep are capable of producing at least as great a weight of meat as feeding cattle. It is generally believed — and again there is some experimental evidence to support the belief — that cattle and sheep together produce greater returns per acre than either does separately. Sheep have a relatively higher protein requirement than cattle, due partly to their immaturity and partly to their wool production.

## GROWTH RATES

The natural growth curve of the lamb, like that of most young animals, is steep at first, then gradually flattens out. The shape of the curve is dependent in the first place on the breed. Mountain breeds are smaller and grow more slowly than the Down and Long-wool breeds, no matter what the standard of nutrition. A Down ewe reaches a weight of 150 lb or thereabouts by the time she is 18 months old; a Welsh or Blackface ewe reaches little more than half the weight in the same time. Apart from extremes of this kind, however, the effect of natural breed differences is often outweighed by management. In general, hill sheep lead a precarious existence, working hard to collect enough food to maintain life — in fact, hill ewes often lose weight during the winter. By comparison, lowland sheep live in luxury; so much so that it is necessary at certain times to limit their intake. All types of sheep have to contend with a food supply which varies in quantity and quality with the march of the seasons, and all alike have to battle with winter and rough weather.

All types, too, stand exposed to infection by parasites, particularly

intestinal worms which spend a portion of their life in or on the ground. The effects of heavy worm infestations are obvious and have long been known; only in recent years has it been recognized that sheep can acquire a tolerance for parasites, and are not noticeably unthrifty when moderately infected with worms, though their growth rate may be slowed down. Worm control must be regarded as a main factor in shaping the growth curve.

In upland and hill regions, the problem of their nutrition is immensely complicated by the exercise forced upon the sheep in scrambling about and by the rigour of the climate. Although it is not possible to do much more than guess at the energy they consume in searching for food and in keeping themselves warm it is obvious that the maintenance requirements of hill sheep are much higher than those of sheep on lowland farms.

Growth, then, is as much a reflection of the habitat and system of management as of the inherent capacity of the animal. It is extremely difficult to define nutrient requirements precisely, still more to ration sheep in the sense in which rationing is understood with dairy cows and stall-fed beasts. Certain broad principles are, however, fairly clear.

## THE EWE

The ewe spends about a third of the year in gestation, a third in lactation and a third resting. During pregnancy her needs, at first low, rise steadily and it is known that the weight and vigour of her offspring and her own milking capacity depend in no small measure on liberal feeding as she approaches lambing. Though her needs can, in part, be met by provision of good grazing, supplementary feeding with hay, roots and a corn or cake mixture, balanced as for cows, has the same effect as the steaming-up ration given to calving cattle.

The last weeks of her gestation period are the most critical in her life. The aim at this time should be to feed her well but to restrict the bulk of her diet. It is extremely difficult to meet the requirements of hill ewes, but with lowland flocks concentrates are fed for the last month or six weeks, the daily ration starting at $\frac{1}{2}$ lb per head and rising to $\frac{3}{4}$ or 1 lb per head. Only high-quality hay should be fed and that at a declining level as the concentrates are increased. Roots, if fed at all, should be given in strictly limited quantities.

During lactation she is a voracious feeder; necessarily so, since great demands are made upon her. Ewe's milk contains 6 per cent of protein and over 7 per cent of fat. Yields of milk are not known with any degree of accuracy but in the larger breeds they probably amount to 3 gallons or more per week at the peak. Since the lamb does not begin to nibble grass until it is three or four weeks old its start is dependent on the quantity of the dam's milk. Certain breeds — notably the Scottish Half-bred — have a high reputation for their suckling capacity, but every shepherd endeavours to raise the milk yield of his flock to as high a level as possible, no matter what the breed. Concentrates are usually fed to lowland flocks for some weeks after lambing.

After weaning the ewe has a long rest period. Normally this coincides with the period in which pastures are past their best and it is in the interests neither of the shepherd nor the sheep that she should be fed as in May. In the lowlands it is sometimes difficult, particularly in the west of the country, to find pastures sufficiently bare to ensure that the ewe will not grow fat.

As she approaches the next season it is important that she should be put on to a rising plane of nutrition to ensure a high conception rate. In a sense her year may be said to begin three or four weeks before she has access to the ram. Ewes and lambs make heavy demands on pastures and are better able to turn pasturage to good account than are store sheep of any kind. They yield a greater return in liveweight increase per acre.

## THE WETHER LAMB

The life of the wether lamb is brief, but while it is alive it has the best keep that the season affords. It is normally born at or about the time when pastures, being at their best, produce a flush of milk in the ewes and offer food of high nutritive value to the lamb itself. Even on mountains the herbage is, for a time, very nutritious.

On lowland farms supplementary feeding of concentrated foods is resorted to, whenever it is desired to obtain the maximum or near-maximum growth. Pedigree breeders customarily feed ram lambs very liberally in this way, and concentrates are probably essential in the production of early fat lamb. (Special feeding is even more necessary in winter-lambing flocks on arable farms producing fat lamb for sale in March and April. Here the normal practice is to allow lambs access through creep hurdles into the forward folds where they can have their pick of the fodder crop and consume their concentrates without competition from the ewes.) The concentrates should be both palatable and digestible. Although on strictly nutritional grounds high protein foods are not needed it is usual to include some of them in the mixtures for the sake of palatability. Thus, mixtures of linseed cake or beans, with crushed oats, and bran in equal proportions and a few locust beans to add flavour are much favoured.

Flocks producing early lambs are usually small compared with the size of the farms they are on; they are treated as rather a favoured group. Most of the animals slaughtered as early fat lamb average nearly 4 lb per week from birth to slaughter. Where sheep raising is a main farm enterprise, flockmasters have to be content with a less liberal treatment of lambs and a slower growth rate. On such farms, lambs of the breeds and crosses usual in the lowlands may be expected to grow at the rate of 3-4 lb per week for the first two months thereafter they grow more slowly, averaging rather less than 3 lb per week from birth to weaning, single lambs keeping the equivalent of three weeks' growth ahead of the twins throughout. Lambs of the hill breeds grow much more slowly, attaining weights of 40-60 lb by the time they are five months old.

On sheep-raising farms the post-weaning period is often difficult because by September both permanent grass and leys have a declining feeding value and the area of maiden seeds is usually small in proportion to the size of the flock. It is not unusual, therefore, at this time of year for lambs to lose weight, which is recovered only when autumn forage crops become available.

## THE FATTENING LAMB (HOGGET)

Though there have been great advances in recent years in the management of leys to produce winter keep, it is rarely possible for the shepherd to obtain from them much more than maintenance for his flock. The leys are used

therefore primarily for carrying on hoggets either until next season's grass is available or until fattening on forage crops can begin. Lambs can, however, be fattened on leys or permanent grass with hay and concentrates. Silage can also be fed at grass successfully, though sheep usually take a little time to accustom themselves to it.

Winter use of arable crops divides broadly between the forage crops and by-products in the autumn, and roots in the later months.

On forage crops of which rape, rape and turnips, or kale are typical, hoggets fatten readily and liveweight increases of about 2 lb per week can be maintained for twelve or more weeks. Hay and concentrates are usually fed in addition. The amount of green material consumed can only be roughly estimated, but the daily ration by the time the hogget reaches 100 lb live weight can probably be put at about 16 lb. There is no need to include high protein cakes in the concentrates.

In sugar beet growing areas, many hoggets are fattened on the tops.

Although there is generally much waste, crops usually afford enough tops to provide a week's keep for 100 hoggets per acre — an effective yield, that is, of some 4-5 tons. Beet tops are not quite so rich in protein as kale and rape, so a protein-rich constituent can be added to their ration.

Root crops, i.e., turnips and swedes, have for a long time been the staple diet of winter-fed sheep but they lack the protein needed by an animal still under one year old. Hay and concentrates are therefore essential, the daily ration closely resembling that of animals on forage crops save that a concentrate mixture containing more protein is used. Cereal grain, sugar beet pulp and linseed or decorticated groundnut cake in equal proportions make a suitable mixture, to be fed in quantities ranging from ½ lb per day at the outset to 1 or 1¼ lb per day at the close of the feeding period.

*Weekly Diet Sheet for 120 lb Liveweight Hogget*

| *Requirement* | *S.E.* | *Dig. protein* | *Appetite, Dry Matter* |
|---|---|---|---|
| | *lb* | *lb* | *lb* |
| Maintenance | 10·0 | | |
| 2 lb L. Wt. | 5·0 | | |
| *Total* | 15·0 | 1·75 | 23 |

| *Ration* | *S.E.* | *Dig. protein* | *Dry Matter* |
|---|---|---|---|
| | *lb* | *lb* | *lb* |
| 1 cwt swedes | 8 | 0·75 | 11 |
| 7 lb hay | 2·5 | 0·25 | 6 |
| 7 lb concentrates | 4 | 0·70 | 6 |
| *Total* | 14·5 | 1·7 | 23 |

If hay is not available, or the quality is inferior the trough food must be correspondingly increased.

## THE EWE HOGG

The objective in rearing ewe lambs to replenish the flock is to secure rapid growth during the first few months and thereafter liveweight increases at a declining rate. Many lowland breeds if liberally fed during the first summer

are sufficiently well grown by October to breed from. On hill farms provision of winter keep, sufficient in quantity and quality to keep the ewe lambs thriving, is a major problem, only solved in many cases by sending the stock away to lowland grazing. This problem is discussed at length in Chapter VI.

## CHAPTER V

# General Flock Management

THREE types of flock are to be found on farms which carry sheep — the permanent breeding flock, the flying breeding flock, and the dry (i.e., non-breeding) flock.

### PERMANENT BREEDING FLOCKS

To deal comprehensively with general management, it is best to consider first the sequence of tasks which have to be carried out throughout one year in keeping *permanent* breeding flocks. This sequence is the same in all flocks irrespective of the type of sheep and where they are kept, but the timing of the successive operations varies greatly. In some breeds, most of the lambs are born early in the year. The lambing season for other breeds reaches its peak during the month of April although for the Dorset Horn, under orthodox management, autumn is the lambing time.

The first task is to make up the breeding flock for the coming year. The flock ewes must be culled and all fit ewes retained. These must be sound in the udder, in dentition, and in general health; in pure-bred flocks, they should be representative of the breed. Most established breeding flocks are kept "in regular ages". To achieve this the oldest group of ewes is drawn out to be sold (for further breeding if warranted sound) and flock numbers are made up by in-drafting an adequate number of home-bred or purchased ewe-lambs or shearling ewes. Before they are mated, it is advisable to flush the ewes in lowland flocks by putting them on to a higher plane of nutrition for at least a fortnight before the rams are turned out. This ensures a less protracted lambing season, and also a higher proportion of twins. (In hill and mountain flocks which live under hard conditions twins are not desirable, and flushing is seldom practicable.) Almost any forage crop such as rape or turnips or a good ley which has been rested to develop a strong sward will serve. Maiden rye grass and clover seeds are particularly useful, as are stubbles on which shed corn has germinated. Failing good grazing, concentrates can be used.

#### RAMS

In lowland flocks, the number of rams normally allocated is one to sixty or seventy ewes if the rams are shearlings or two-shear. If ram-lambs are used, as in the case of the early breeding Down breeds, it is safer to allocate one to fifty ewes. In selecting rams, attention should be paid to type and breed character. Before the rams are turned out, it is a common practice to raddle or mark them on the breast with a colouring so that ewes are marked after

they are served. This will show the progress of the mating and, consequently, it is a guide to management during the lambing season. The heat periods in ewes normally occur at intervals of fourteen to eighteen days and the marking colour on the rams should be changed periodically throughout the mating season, using a darker colour each time; for example, the first colour may be red, the second blue and the third black. By this means any ewes returning to service are readily noted. Normally the rams should not be left out for more than seven weeks; the majority of ewes will be mated during the first four weeks. If rams are left out too long the lamb crop will not be improved; very late-born lambs are seldom profitable. The management of flock rams varies according to environment. On free range flocks all the rams may be turned out together, but in flocks kept under intensive or close-folding conditions, they may be turned out in alternate shifts. In some pedigree flocks, individual rams may be allocated selected groups of ewes. If an undue proportion of ewes return to service, a fresh ram or rams must be obtained.

After the majority of the ewes are settled to the ram, a slightly lower plane of nutrition is advisable during the first half of the gestation period but, during the later weeks of gestation, it is most desirable that ewes should be kept in rising condition up to the onset of lambing. Though the gestation period of the ewes is normally one hundred and forty-seven days or twenty-one weeks, preparations for lambing should be complete by the twentieth week, because a small proportion of ewes will lamb before the one hundred and forty-seventh day. A similar small proportion may carry their lambs for a day or two longer than the normal period.

## The Lamb Crop

It is customary to refer to the lamb crop as a percentage of the total ewes mated. Owing to the wide range of natural prolificacy existing in our native breeds, and the wide range of environmental conditions under which our sheep are kept, lamb crops vary between fifty and one hundred and eighty per cent. The main factors which determine the size of the lamb crop are the breed, the environment and the survival rate. Certain breeds and types, particularly those of intermediate size (see Chapter III) are naturally more prolific than some other breeds. Under adverse climatic and nutritional conditions, naturally prolific breeds yield a lower-than-average crop of lambs. Similarly, breeds and types whose natural prolificacy is not high will produce a higher-than-average crop under favourable environmental conditions.

Climate and management play a vital part in determining the final number of lambs reared. In the first place, bad management and bad weather during the later weeks of the gestation period may result in abnormal numbers of pre-natal deaths, or of lambs born lacking in vigour at birth, and deficient milk supply in ewes. The importance of diet during the later stages of pregnancy has already been stressed.

According to district and breed type, lambing takes place under a wide range of conditions. In early-breeding arable flocks, specialized shelter of a temporary or permanent character is usually necessary. In flocks which lamb later, little or no artificial shelter may be needed though full use should, of course, be made of natural shelter. The newly-born lamb is particularly vulnerable to cold while the birth coat is still wet. In dry weather, a lamb born with plenty of birth vigour will be on its legs quickly and sucking. In cold driving rain or very cold wind, weakly lambs are soon chilled to death.

The provision of shelter and warmth from an external source can do much to save them.

Close supervision is necessary during the lambing season. A few ewes may need manual assistance but there will not be many of them in flocks that have been well managed and kept free from disturbance by dogs. If assistance is given it should be correctly timed. Some cases of malpresentation will occur but the number should not exceed more than five to ten per cent of the total flock. In one of the commonest forms, both forelegs are bent downwards in the uterus and only the head of the lamb appears. When this occurs, the head must be pressed back and each foreleg raised so that the feet precede the head during delivery. A small proportion of excessively large single lambs may also be expected.

Assuming that lambing has been successfully accomplished, it is next necessary to see that lambs are mothered. Under intensive conditions, it is customary for ewes to be penned for a short period to ensure that they have accepted their progeny. Under free range, lambs are quite often lost by their dams; a ewe, for instance, may produce twins and leave the weaker lamb to its fate. It is the task of the shepherd, by constant watch, to prevent or remedy such mishaps, and to ensure that the maximum possible proportion of lambs born survive. When many multiple births occur it is helpful to him, particularly in finding the mothers of lambs which have become "lost", if the lambs and ewes are given identifying marks.

The udders of milking ewes should be kept under close supervision. If, as sometimes happens, some form of mastitis develops, prompt diagnosis and treatment may prevent the loss of the organ, or in very acute cases the death of the ewe.

One of the greatest problems of the lambing season is the motherless lamb. Though the death rate in ewes should not be high, a lambing season without some mortality in ewes is rare. For the orphan there are three possible fates — an early death from starvation, artificial rearing by the feeding bottle, or adoption. Of these, the last is preferable and every experienced shepherd will try to foster lambs on to ewes which have plenty of milk but which have lost their own lambs. Ewes recognize their lambs entirely by sense of smell and the age-old method of fostering is to drape the skin of a dead lamb over a live lamb when putting it on to a ewe. It is desirable to pen the ewe for two or three days to ensure that she has taken to her adopted lamb. Under extensive conditions of management it is not possible to do much for lambs which are not mothered because detailed supervision is very difficult when a flock is widely dispersed. Nevertheless, it should be the aim of every shepherd to bring the flock under conditions of environment which permit of close supervision during lambing.

Apart from deaths from exposure and starvation some loss of lambs may occur through attack by foxes, badgers, and carrion crows. The possibility of diseases such as lamb dysentery and pulpy kidney must also be reckoned with, and treatment of these is dealt with in Chapter IX.

During the months of May, June, July and August watch must be kept for blowfly strike. Sheep blowflies are most active during periods of damp sultry weather when the fleeces of ewes and lambs are moist. The menace of blowfly attack can be efficiently controlled by dipping, but this practice is normally carried out after shearing, so that there is a period before shearing when the closest vigilance of all sheep is essential. Lambs soiled in the breech

region are particularly liable to attack. If at any time maggots are discovered the wool should be cut away from the affected spot and disinfectant applied. While scouring is often due merely to an over-succulent diet, it is often a sign of parasitic worm infestation. In the latter case worm dosage is essential.

### Crutching or Tail Trimming

Crutching or tail trimming should be carried out on all adult sheep some weeks before shearing takes place (Long-wool ewes are sometimes crutched also before the rams are turned out.) There are two reasons for crutching as an early summer routine task. In the first place, if the soiled wool is shorn off from the tail and breech region the risk of blowfly strike is much reduced and, secondly, the removal of this soiled wool greatly facilitates the subsequent task of shearing since it reduces the amount of soiled wool or "daggings" which has to be removed before fleeces are rolled. Crutching may be done either by hand shears or machine clippers. The task must not be carried out in the case of milking ewes until there is little risk of cold windy weather because removal of the protective covering of wool on the breech and at the back of the udder increases the liability to mastitis.

### Tailing or Docking Lambs

Tailing or docking of lambs is necessary in all lowland flocks which enjoy a succulent diet liable to cause scour. It is not practised in mountain and hill flocks because the tail affords some protection to the udder region in ewes. The length of dock, i.e., tail stump, left varies according to breed and type. In the case of the Down breeds, a very short dock is left, but in other breeds it is customary to leave more length of tail, sometimes as much as one third of the natural length. Very short docking is undesirable because it deprives the sheep of a natural protection against the blowfly. Two methods of docking are practised in this country:

1. In lambs under the age of three weeks the tail may be cut away by a firm stroke with a sharp knife. Some bleeding may occur but in young lambs this is seldom serious.
2. Tailing by means of the docking iron should be carried out on older lambs, say at the age of eight to ten weeks. The iron is heated sufficiently to sear the flesh, thus preventing excessive bleeding and reducing risk of infection of the tail stump.

Normally when tailing has been carried out the first accurate count of lambs reared can be taken.

### Castration

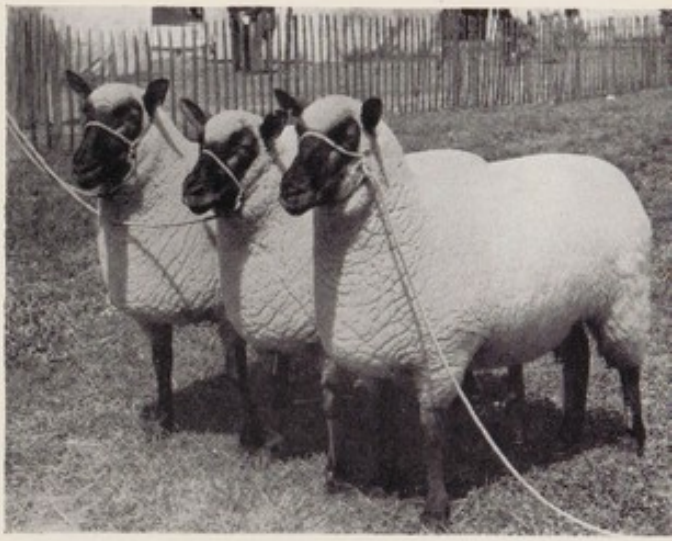
In permanent flocks not more than one-fifth of all the male lambs need to be retained for breeding; in flying and cross-bred flocks none are needed. The bulk of the ram lambs are, therefore, castrated. This improves the quality of the flesh. There are four methods of carrying out the operation.

1. The method known as "drawing" can be safely used in the case of lambs between the ages of three and six weeks. It should not be applied to older lambs. The end of the scrotum is severed with a sharp knife, the testes are pressed out and drawn away by a special forceps until the spermatic cords break.

Black Welsh Mountain ram

Border Leicester ram

Cheviot ewe



Clun Forest ewes

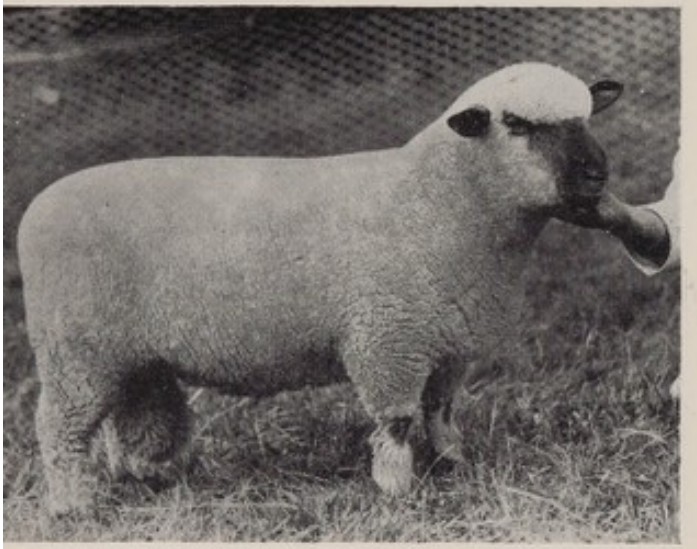
Dales-bred ewe

Dartmoor ewe

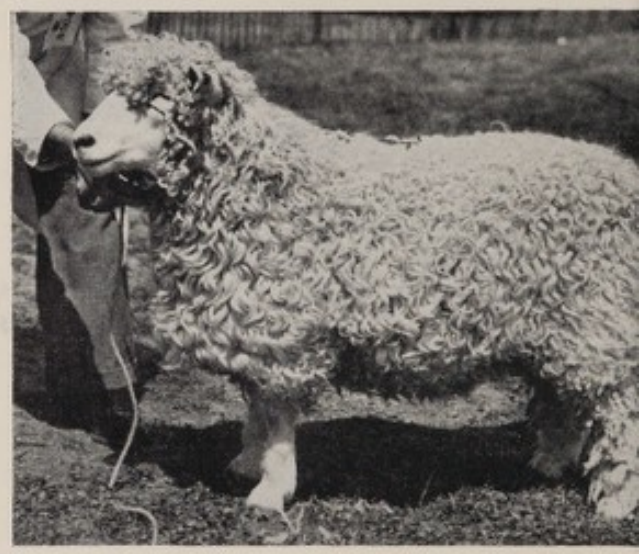
PLATE I

Devon Closewool ewes

Derbyshire Gritstone ewe

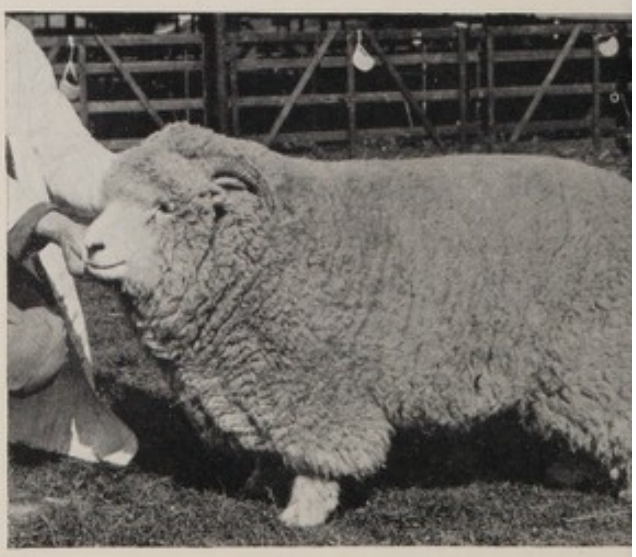


Dorset Down ram



Devon Longwoolled ewe

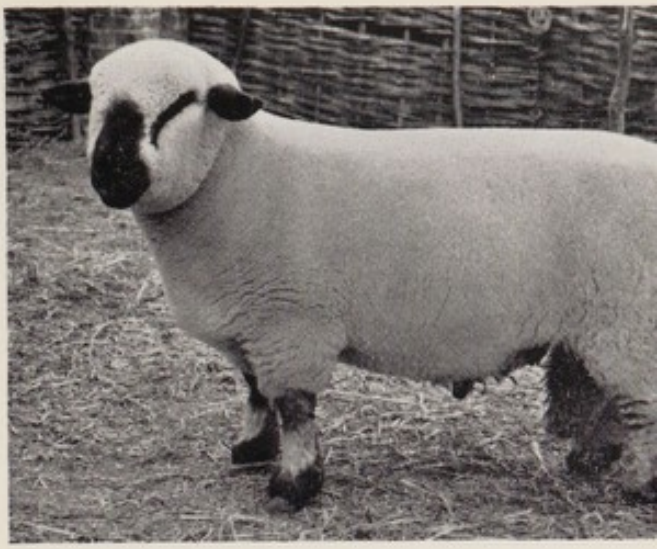
Dorset Horn ewes



Exmoor Horn ewe

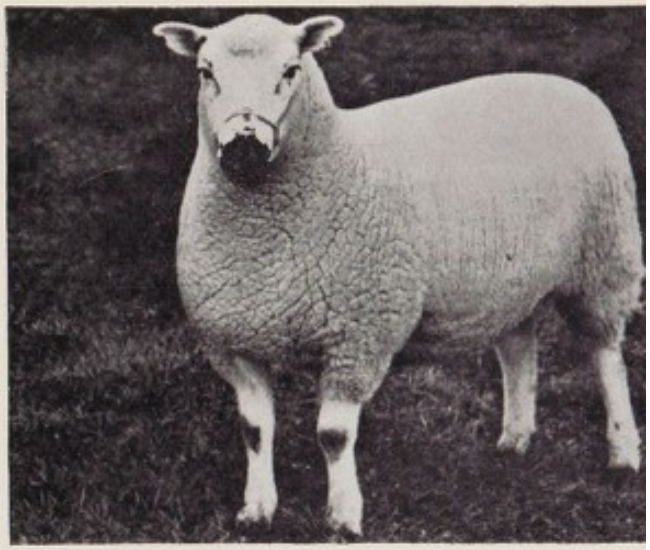
PLATE II

Herdwick ewe and lamb



Hampshire Down ram lamb

Kent or Romney Marsh ewe



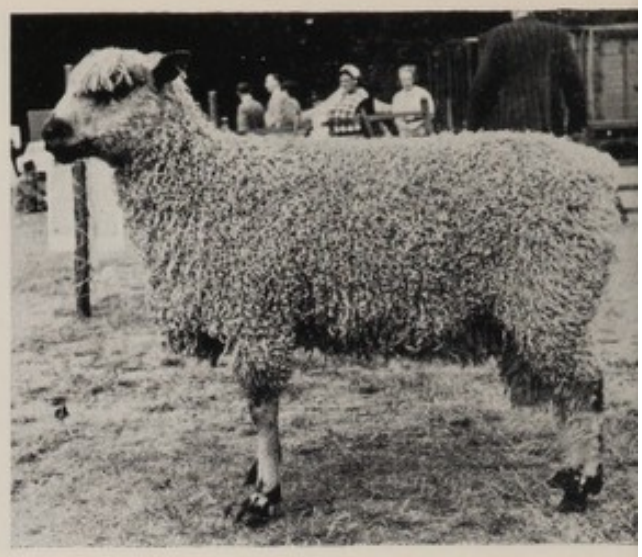
Kerry Hill ewe

Leicester ewe

Lincoln Longwool ewe

PLATE III

Swaledale ewe

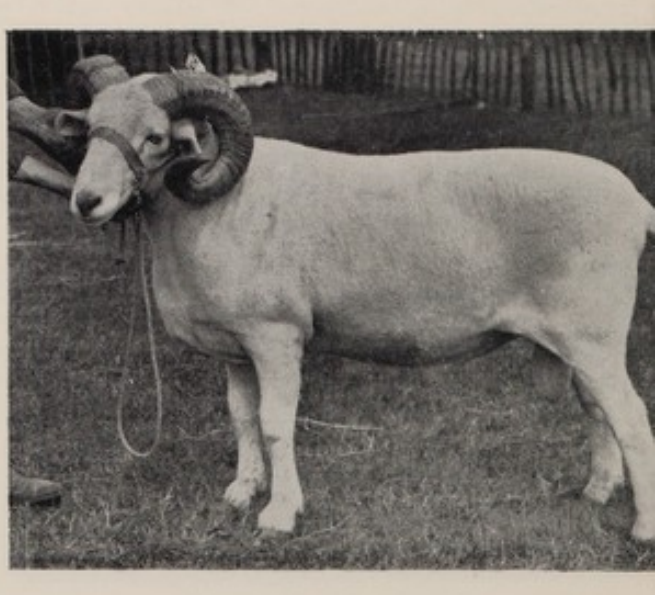


Teeswater ram

Welsh Mountain ewe

Whiteface Dartmoor ewes

Wensleydale ewe

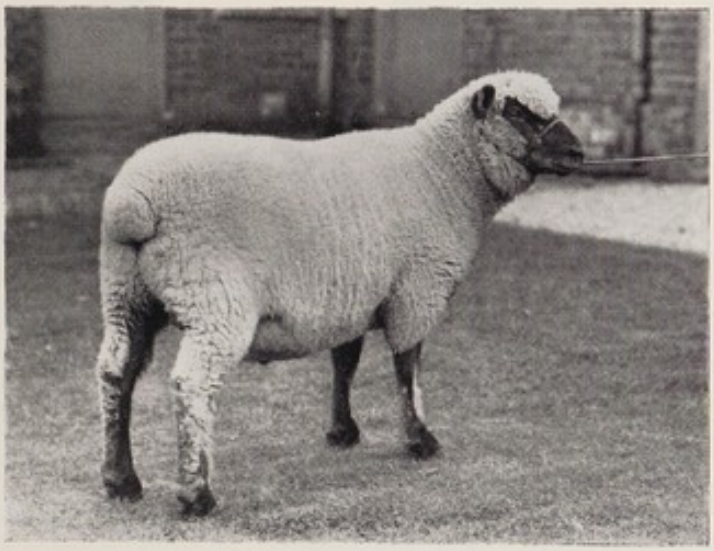


Wiltshire Horn ram

PLATE VI

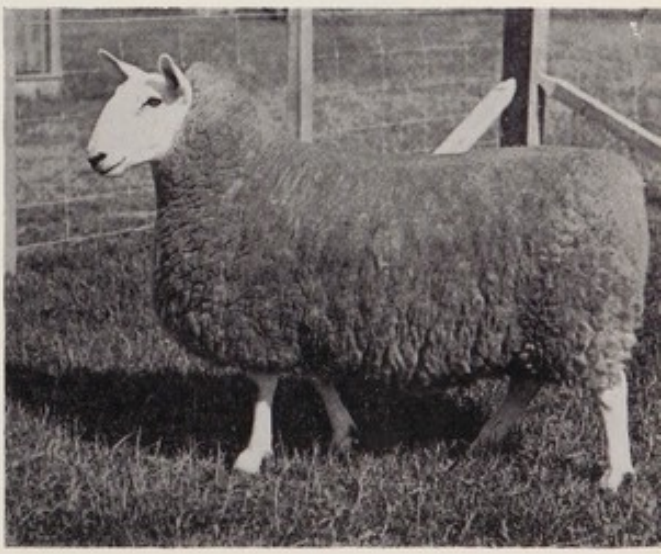
Greyface ewes

Welsh half-bred ewes



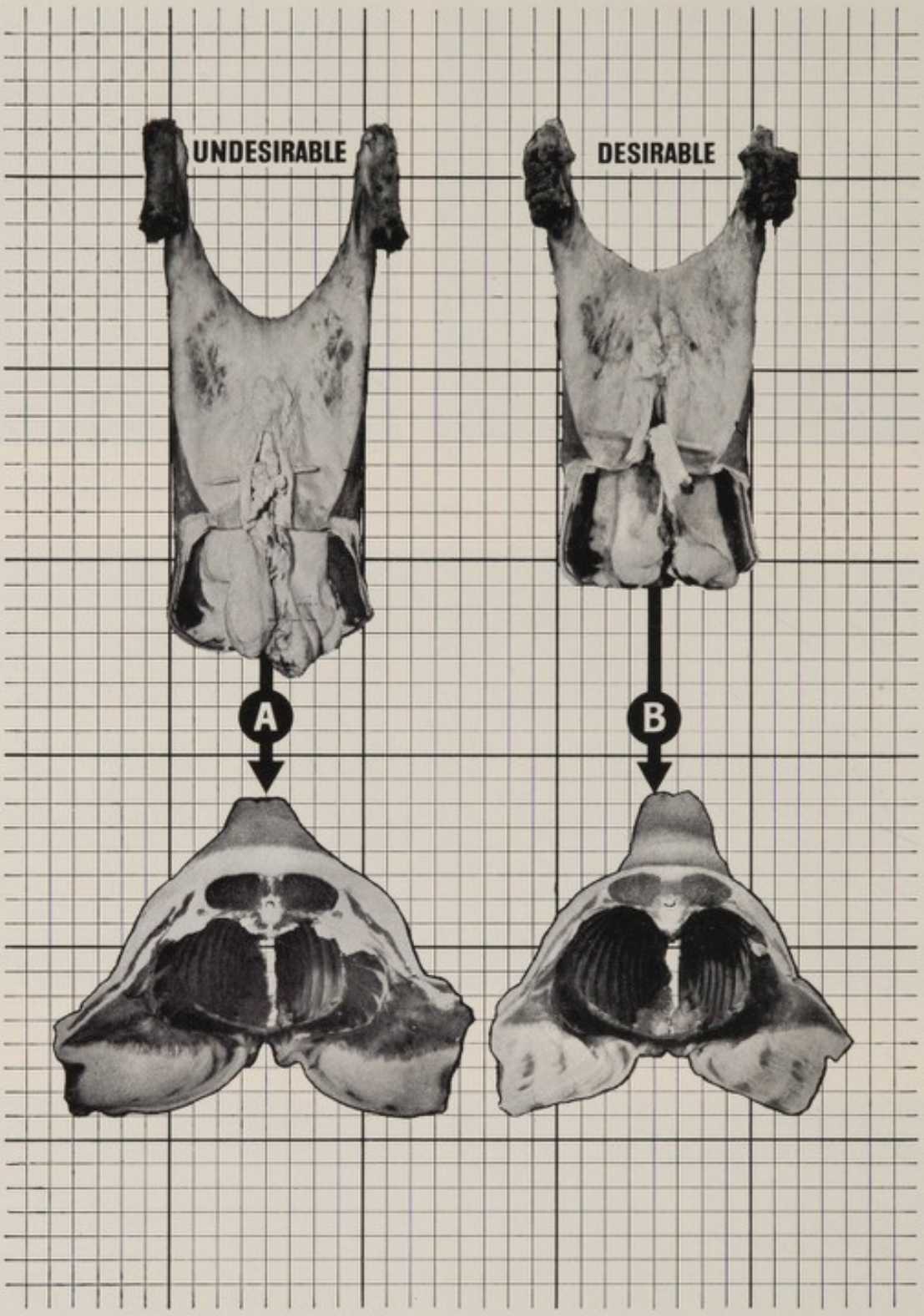
Southdown x Clun lamb


Masham ewes



Scotch Half-bred ewe

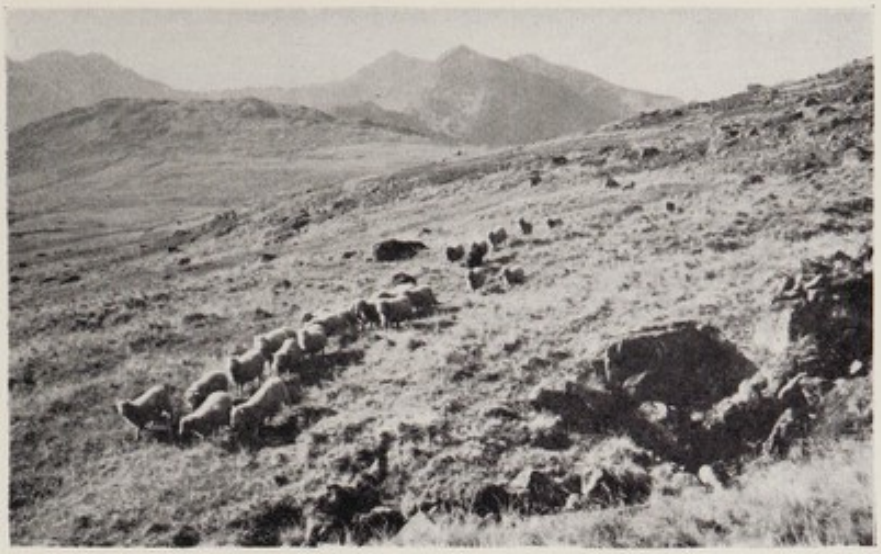
PLATE VII




Carcasses of mutton, showing desirable and undesirable types of leg and loin

A. Leg narrow, bones long; loin too fat

B. Leg well filled out, bones short; loin not too fat, eye muscle deep



Mountain grazing

Upland grazing

Lowland grazing

PLATE IX

Sheep folded on rape and turnips

Sheep on oats and vetches — controlled by an electric fence

Ewes and lambs folded on swedes

PLATE X

Straw and hurdle lambing pens

Dipping sheep

Care of feet — *Left:* Special sheep chair for treating foot-rot
*Right:* A cheap and simple alternative to the sheep chair

PLATE XI

Bringing sheep down the hill for shearing

Shearing by machine

2. For older lambs it is advisable to use a clamp before severing the testes from the cords and to apply a hot iron to sear the severed ends. This prevents serious bleeding. The method is usually employed in ram breeding flocks, where late castration is unavoidable because male lambs must be given adequate time for development before the best are selected for breeding purposes.
3. The "bloodless" method involves the use of a special instrument which can exert great pressure on the spermatic cords through the walls of the scrotum. There is no cutting and no loss of blood; the tissues of the cords are so damaged by pressure that the testes atrophy and disappear. This method is perhaps more humane, and avoids the risks of blood-poisoning and septic infection, but has two major disadvantages. Unless carried out by a careful operator, it may result in a small percentage of imperfectly castrated wethers; lambs operated on by this method should be carefully checked through one month later. In the second place, lambs "bloodlessly" castrated show a rather more masculine character and coarseness than those dealt with by the two previous methods.
4. The "elastrator" method involves placing a small, highly tensile rubber ring around the neck of the scrotum as soon as the testes are developed. The pressure exerted by this ring causes atrophy of the entire scrotum. It is not widely used in this country.

Both docking and castration call for careful attention to hygiene, in the interests of both the sheep and the shepherd.

## Weaning

After tailing and castration have been carried out, the next routine task is to wean the lambs; this should be done when the average age of the lambs in the flock is about fourteen weeks, but in flocks producing early fat lambs, many will have been marketed before reaching this age. It is unfair to ewes which are to breed again to leave their lambs with them too long; they get rough treatment from lambs which are more than twelve weeks old and some damage to teats and udders may result. The breeding ewe needs a period of rest and recuperation before the onset of the next breeding season: this rest period can commence only after the lambs are weaned.

Weaning is a simple operation: it is only a matter of separating the lambs from the ewes and removing them out of earshot. The ewes should be put on to a lower plane of nutrition to hasten the cessation of milk secretion. Lambs after weaning should be given the best available keep in order to lessen the check in growth which may occur because milk has been eliminated from their diet. It is important that they should be put on to clean land unlikely to be infected with parasitic worms.

## Shearing

Early-breeding flocks are sheared after the lambs are weaned, but in flocks lambing during March and April, shearing must be done before the lambs reach weaning age. The time of shearing is governed by the "ripeness" of the fleece. At a certain stage in growth, the yolk (or yelk) rises in the wool. This ripening is hastened by good feeding and hot weather, and retarded by privation and cold weather. The time for shearing, therefore, is determined by environmental and climatic conditions. Dry sheep, that is hoggets and

barren ewes, are ready for shearing earlier than ewes which suckle lambs. In most breeds, only sheep over one year old are shorn, though in the case of the Dorset Horn, the Dorset Down and certain Long-wool breeds, the lambs also are shorn. In southern England, shearing may be carried out during April and May in the case of dry sheep, whilst ewes are shorn during June; further north and in mountain flocks shearing cannot take place until one or two months later.

Today shearing is done to a very large extent with machine clippers, but with certain types of fleeces a good operator can shear nearly as quickly with hand shears. In shearing, the expert operator controls the sheep with a minimum of effort. Two of the commonest faults are causing injury to the skin of the sheep, and injury to the fleeces by double-cutting (i.e., leaving too much wool on the skin and taking a second cut) thereby reducing the length of the staple.

The value of wool in the fleece is determined by its origin and by the way it is handled. During shearing great care should be exercised to prevent the contamination of fleeces by such extraneous matter as straw, dirt and droppings. Before individual fleeces are rolled, soiled and broken pieces (dags) should be removed for separate packing.

In bygone days, it was customary to wash sheep before shearing by immersing them in running water, but this is seldom done now.

### Dipping

Under normal conditions, sheep are dipped a few weeks after shearing when they have grown sufficient new wool to hold the dip substance. Dipping is controlled by statute, the regulations being issued by County Councils. As the by-laws vary considerably every flock owner should be conversant with those of his own county.

Statutory dipping was introduced as a means of controlling sheep scab, but has proved to be an important routine practice in flock management because it deals effectively with most of the external parasites which affect sheep — lice, ticks, keds and the sheep blowfly — all of which can cause loss of condition. In recent years, the introduction of new pest-controlling substances has greatly increased the effectiveness of dip preparations. Some of them persist in the fleece for a long time and correspondingly reduce the labour of shepherding. There are a few simple rules which must be observed in dipping.

1. The dip preparation used must be mixed according to the maker's instructions and the dip bath kept at the correct strength.
2. Sheep should be rested before dipping and not dipped when overheated.
3. It is preferable to refrain from dipping when sheep are fully fed. To ensure a complete penetration of the fleece by the dip substance, sheep should be thoroughly immersed in the dip bath for at least one minute. In northern England and in Scotland, it is a common practice to dip flocks during the late autumn, using special dip preparations designed to control sheep keds and ticks and to augment the weather-resisting properties of the fleece.

### Care of Feet

In lowland flocks, particularly those which live on soft clay and loamy soils,

there is a tendency for the feet of sheep to become soft and to develop an abnormal growth of hoof; commonly, the front part of the hoof grows too long, while the wall tends to curve inwards over the sole. Whilst mountain flocks and flocks living on stony soils may need little attention to their feet because normal wear permits normal growth, it is necessary in lowland flocks to regard feet-trimming as a routine operation in good flock management.

Excessive hoof growth should be corrected by use of a knife, at least once a year. Timely use of the paring knife preserves a good hoof shape and reduces risks of foot rot infection. Treatment of this trouble is dealt with in later chapters.

### Dosing

Whenever flocks are kept under fairly intensive conditions, lambs inevitably acquire a worm burden which will, if untreated, seriously retard their rate of growth. Dosing must therefore be regarded as a routine operation.

## THE FLYING BREEDING FLOCK

Management of the flying breeding flock involves the purchase of draft ewes — usually of hill or upland type — and their resale after they have borne one or more crops of lambs. It is a flexible system admitting of at least three variants. The simplest procedure consists in wintering and lambing them only, the ewes and lambs being sold together as "couples" early in the spring. The more usual practice is to raise a crop of lambs, disposing of as many as possible of them in the market for early lamb and to sell the ewes fat as early as possible in the summer. The chief drawback to this system lies in the loss on resale of the ewe, which may amount to the value of one lamb. To reduce this loss some farmers retain about half the ewes for further breeding, thereby reducing the number which have to be purchased in the succeeding season. Thus, shepherding of a flying flock may be anything between winter and lambing duties only, and a routine closely approaching that of a permanent breeding flock.

A point of some importance arises when draft ewes are brought on to a lowland farm from poor mountain grazings. If introduced suddenly to rich leys they sometimes suffer from "Strike" arising from mineral imbalance. They should spend the first week or so after arrival on second-grade or bare pasture.

## FLYING DRY FLOCKS

Flying dry flocks usually consist of lambs purchased in the autumn to consume surplus grass, root, and fodder crops; they are disposed of when fat during the winter or the following spring. In the case of late-maturing types and hillbred lambs, the time of disposal may be as late as June or July, in which case a clip of wool may be taken. Another type of flying dry flock consists of pure or cross-bred ewe hoggs destined to become breeding ewes. These can be wintered more cheaply than fattening sheep and, after yielding a clip of wool, they can be disposed of at the autumn sales as shearling ewes.

CHAPTER VI

# Management of Mountain and Hill Flocks

One third of the farm land of the United Kingdom is classified as rough grazings. These rough grazings consist mainly of hill and mountain land — broken, remote and, in the main, incapable of economic improvement at present. Used in part for forestry and in part for sport they are the fountain-head of our whole sheep industry, based as it is on the draft hill ewe. Without her, the sheep industry as a whole would collapse. The scope for expansion of mutton and lamb production depends primarily on the number and suitability of ewes bred in the hills.

## IMPROVEMENT OF HILL GRAZINGS

Hill grazings are characterized by their sour, peaty, soils, lacking both body and fertility; in summer the weather is cool, in winter cold and stormy, and at most times of the year there is rain or snow, or both. In the face of the grazing animal, therefore, the plants which survive are those perennials which start their growth late in the spring and grow slowly and grudgingly at the best of times; many have tough and woody leaves, and sheep do not eat them readily. In greater or less degree, these protective qualities are found in all common moorland plants: for a short period in summer and early autumn, there is plenty of keep on hill pastures, but in winter and early spring only the withered growth of the previous year remains.

Many recognizable plant associations occur in hill grazings but the commonest are of the three types:

1. Heather (*Calluna*) dominant
2. Mat grass (*Nardus*) and Flying Bent (*Molinia*) dominant
3. Bent (*Agrostis*) and fine-leaved Fescue (*Festuca*) dominant

Of these, the bent-fescue pastures which are found on the lower slopes are most productive and provide the best keep in open weather. Heather, if burned on a rotation of twelve to twenty years according to the rate of growth and recovery, is of inestimable value in periods of snow and frost. Though less palatable than grass, it is eaten at all times of the year and is believed to provide essential mineral elements as well as variety in the diet. *Molinia* is a deciduous grass and though useful — especially for cattle — in summer, provides little winter keep: mat grass is avoided except for a short period of growth in summer and is not a productive species. Two other species which contribute usefully to the maintenance of the sheep are bilberry (*Vaccinium*) and cotton grass (*Eriophorum*) the latter being particularly valuable in spring when the fresh, tender shoots are eaten with relish by the hungry flock.

Heather and the fescue-bent association — particularly if it contains wild white clover — provide most valuable keep and are therefore to be encouraged by every possible means: most other species, and especially bracken (*Pteridium*), mat grass and deer grass (*Scirpus*) are competitors and so far as

possible should be stamped out. Bracken is particularly damaging because it colonizes deeper soils at lower levels which would otherwise be capable of carrying grasses and wild white clover.

The main lines of improvement are, for heather, regular but not too frequent burning; for bracken, eradication, or at least control by crushing or cutting or, where feasible, by ploughing and reseeding (if this can be done in July, it is the quickest and cheapest method of control); for fescue-bent pastures, application of lime and phosphates, or if suitable, ploughing and reseeding either direct or after a pioneer crop.

## WINTER KEEP

Improvements which increase summer keep without any increase in winter are unlikely to be worth while: the limiting factor always in hill farming is winter keep: in summer the shortage is not of keep but of grazing animals to maintain the sward at the right stage to ensure winter keep and the persistence of the desirable species.

Two principles should be kept in view therefore:

1. Every improvement should aim at increasing winter keep;
2. Improved areas should be as extensive as possible in order to avoid crowding the flock on to small areas: better still, improvement should be accompanied by fencing: the most sheltered and responsive areas should be treated and, so far as practicable, they should be reserved to provide early spring grazing.

Where rough grazings are not held in common but are parcelled out amongst the farmers, fencing-in of the lower grazings to provide more winter keep should be the first aim in improvement. These areas should be grazed by cattle only in summer and rested from August until required by the flock in winter, in order to allow foggage to grow. They should also be rested if possible for three or four weeks after lambing in the interests of parasite control.

If he can manage it, every hill sheep farmer should have hay, silage or other fodder available against the worst of the weather. This may be placed at strategic points on the grazing itself or it may be possible to bring the sheep to the fodder on low ground. Such fodder should not be given unless the sheep have real need of it: if they are starving or if the lamb crop is in jeopardy it is unwise as well as cruel to withhold it.

### Hill Drainage

Hill draining by open gutters is another improvement that should be made where needed. Open hill drains will generally pay good dividends by opening up new areas for grazing, by encouraging better species to replace rushes and sedges, and by controlling fluke where this disease exists.

### Hill Cattle

Historical accounts of hill farming point to the keeping in former days of many more cattle and fewer sheep than at present in the hill districts.

The reintroduction of cattle to the hills deserves consideration both for

the returns from the cattle themselves as well as for the benefit conferred on the grazing, and therefore indirectly upon the sheep; the additional grazing animals keep summer growth in check and help to maintain the vegetative as against the seeding stage in the plants. Unfortunately not all hills are suitable for cattle, which rarely do well on peat. In considering cattle, however, it is necessary to remember that their requirements for winter feed are heavy: unless there is lowland arable to meet this need, agistment is a safer proposition than purchase. Further, though a limited number of cattle on the hill will help the sheep, too many will leave the pastures bare and deprive the ewe flock of vital winter keep.

## BREEDING AND IMPROVEMENT OF HILL SHEEP

Having improved the grazing so far as possible, the flock should then be improved by breeding till they are just as big and productive as the grazing will justify without expensive feeding or elaborate shepherding.

A profitable flock is likely to be one from which the greatest number of draft ewes and wether lambs of the highest quality together with a valuable clip of wool are sold each year. To achieve these results the ewes must be hardy and live well; they must rear a good crop of lambs — one per ewe if possible and well suckled; they should have the greatest size and weight compatible with the required degree of hardiness, and grow a fleece of the highest quality and weight which the animal can with safety carry; and finally these qualities must be passed on to the next generation.

### Hill Flocks should be Home-Bred

There is no place in hill farming for flying flocks. Not only must the hill flock be vigorous and hardy in the general sense but it must be born and bred to the hill and therefore familiar with the limits of its grazing, even if there is no fence; capable of finding food and shelter at all times of the year; immune in the natural sense against the diseases and difficulties inherent in the grazing; and able, in the case of the ewe, to pass on this knowledge and immunity to her lambs.

In some areas in the north of England, the flock is the property of the landlord and the tenant takes it over when he enters, and is expected to deliver up a fixed number in each age group when he leaves the farm or else to pay compensation to the owner. In Scotland, the flock is not tied to the land but the "hefted" sheep have an "acclimatization" value i.e., a value higher than that of similar sheep bought from elsewhere. These acclimatization values have sometimes been high but the alternative to paying them is to heft a new flock on the land and this is tedious as well as expensive, the losses amongst the bought-in ewes deing heavy in the early years.

In the breeding and improvement of hill sheep the qualities of a good ewe flock should be kept in view. Some characters, for example, size, flesh, type of fleece, face colour, can be seen and judged both in the ram and in the ewe lamb. By far the most important characters however, are inward or physiological, such as hardiness, prolificacy, milking quality and longevity; these cannot be gauged accurately from outward appearance — indeed quite often external characters are positively misleading.

There is only one test and proof of the presence of these physiological qualities — that the ewe has lived and bred regularly and satisfactorily on

the hill without pampering. The ewe that has proved herself is far more valuable as a breeder in the flock than the ewe lamb or the young ewe. Hill farmers would do well, therefore, to set off against the immediate financial advantage of keeping ewes in regular ages and selling them as young as possible, the undoubted breeding value of the proven older ewe and the superiority of her progeny — sons and daughters — for use in the flock, over the progeny of younger untested and unproved ewes.

Conditions vary so much in hill farming that there is probably a type best adapted for each locality, and even for each farm. It is safer, therefore, that the breeding of rams should be in the hands of many scattered breeders who are also commercial hill farmers and not be centralized in the flocks of specialized ram breeders who may, or may not have typical hill grazings and hill flocks. For the same reasons, housing and heavy feeding may add to a ram's sale value, but are much more likely to depreciate than to enhance his intrinsic value as a breeder by making him soft and lazy and liable, therefore, to leave many barren ewes.

Summarizing, the best advice to give to a hill sheep farmer is to buy his rams locally, preferably from a poorer grazing than his own and to mate them first to a few of his proved older ewes and then to use their sons in the flock as a whole. In this way he will be increasing the chances of using hardy rams that are adapted to the condition of his district and flock.

By the same token, widespread breeds can with advantage be divided and bred as regional types each adapted to its own particular district.

## Teeth and Mouth

For obvious reasons, the mouth parts and teeth of hill sheep are vital if the sheep is to be able to collect enough food and chew it effectively. The teeth should be strong and short and the jaw neither undershot nor overshot but of such proportions that the incisor teeth meet the pad on the upper jaw.

## Fleece

The fleece is required to protect the sheep against cold and wet and, of these, wet is the more serious. The most effective fleece is one that is of light weight, and consists of two coats — an inner coat of close soft wool and an outer coat of long, hair-like fibres which thatch the fleece and keep the inner coat dry.

The advantage of a lightweight fleece is that it requires less protein to produce and therefore leaves more for growth, pregnancy and lactation. It is not to be wondered at that the sheep with a long heavy fleece is often a poor milker since one pound of wool contains about as much protein as three gallons of cow's milk. The lightweight fleece is also less of a burden to carry about the hill, and, if in addition, it sheds water well, it is relatively even lighter in wet weather than a big absorbent fleece.

Here, as with hardiness, there is conflict between the value of the fleece to the sheep and its monetary value to the farmer: the point of reconciliation is not easy to decide but it would for instance be much better to have fifty fleeces averaging 3 lb each from a flock all of which survived than say forty fleeces each of 4 lb from a flock in which there had been heavy mortality. As with hardiness and prolificacy the optimum weight of fleece may well be the weight of fleece on those five-year-old ewes that have survived under the conditions of the farm.

It will be recognized of course, that the weight of wool is influenced as

much by feeding and season as by breeding — sometimes more; accordingly, in assessing the optimum fleece type, the results over at least three or four seasons should be taken into consideration.

### Wintering of Ewe Hoggs

It is now widely accepted that few hill grazings are capable of providing suitable feed and conditions for ewe lambs from six to twelve months old.

In order to develop the necessary body and frame as well as its reproductive potential, the lamb in its first winter requires the more liberal diet of a lowland pasture supplemented by a little hay in bad weather. But overrich feeding at this stage is equally bad: the lamb then grows a big tender body that is more difficult to support, thereby reducing its chances of survival when it returns to the hill. This is particularly liable to happen on lush reseeded grass in an open winter when protein contents are at unusually high levels.

If there is sufficient enclosed land, the ewe lambs can be wintered at home, but they will be healthier on pastures that have carried few sheep or none at all, and when wintered away, they leave the home pastures all the cleaner for the breeding flock at lambing time.

In recent years, the cost of wintering ewe lambs away has been high, and suitable farms difficult to find. Various alternatives, including shed feeding are being tried. Indoor feeding may provide a solution if the sheep are only inside for an hour or two each day and turned out to rough grazing for the remainder of the day. The main consideration should be to maintain the ewe lambs in fit store condition and to encourage them to retain the natural habit of actively foraging for themselves.

## SYSTEMS OF FLOCK MANAGEMENT

The basic principles of hill sheep farming are common to all parts of the country but practices differ a good deal from one district to another.

### Scotland

In Scotland the typical hill sheep farm consists of the hill itself, which may or may not have a boundary fence, together with an area — usually relatively small — of fields or "in-bye" at the lower end. The hill grazing is rarely subdivided with fences and in the crofting areas grazing may be in common; in some townships the sheep form a "club stock" which is the joint property of the members of the township. In most areas in Scotland, the hill grazings are allotted to the various farmers, the boundaries or marches being recognized but often unfenced. In the south of Scotland, the grazings attached to each farm are commonly subdivided by natural boundaries, (by the watershed at the top, by mountain streams or valleys on each side, and at the lower end by the outside boundary of the enclosed fields) into cuts each with its own hefted flock of two hundred or more ewes and followers. The ewes know and remain on their own grazings and are provided with high and low ground, dry and wet, heather and green land, and are able to find food and shelter at all seasons of the year.

Conditions are not so severe in the border hills as further north, and on some of the Cheviot Hills it is possible to winter the ewe lambs on their native grazing. In central and north Scotland the grazings are mainly much poorer, and are rarely subdivided into cuts and hefts; in the north-east the ewes are

often taken into enclosed land in the new year and given supplementary feed until after lambing. Where the area of enclosed land is small in relation to the area of rough grazings as it is in central, west and north Scotland, the ewes are wintered on the rough grazings, but, to compensate, are kept thinly on the ground — one ewe to eight or ten acres being quite common. Where the ewes are wintered on the hill, it is recognized practice to try to keep them off the lower grazings as much as possible in late summer and autumn, by herding them up the hill each day. The purpose, of course, is to preserve as much fresh keep as possible on the lower grazings for winter and spring when the high ground is likely to be snow-covered or frost-bound and inaccessible.

## North of England

In the north of England, a good deal of the hill land is grazed in common; the grazing rights belong to farmers whose farms are adjacent to the hill and may either be "stinted" or controlled — each farmer being entitled to a fixed number of sheep "gaits" and sometimes cattle gaits — or unstinted, in which case the number which may be grazed by a farmer with grazing rights, is not limited except by voluntary agreement. Some of the unstinted moors are overstocked to the detriment of the grazing and of the sheep. The persistence of commonage in the north of England and elsewhere has usually hindered the improvement of grazings. Nowadays, there are encouraging signs of freer agreement and co-operation amongst commoners in the matter of improvements.

Many hill sheep farmers in the north of England take their ewes on to the enclosed land in the new year and some of them on the better grazings run a lowland ram (usually a Wensleydale or a Teeswater) with the hill ewes for part of the breeding season; care is however taken to see that a sufficient number of lambs—usually at least two-thirds—are by hill rams so as to provide the proportion of pure-bred ewe lambs needed to keep the flock going. In these flocks the ewes are often drafted at five years old, but may be kept longer if some cross-bred lambs are raised.

## Wales

The pattern of hill farming in Wales is diverse; as in the north of England the flock is generally run as one unit and not divided, as in the south of Scotland, into hefts. There are a number of areas where common grazing is the rule, but in many districts the land is allotted to the farm and may or may not be completely fenced in.

Quite commonly, in addition to his lowland fields, the Welsh hill farmer has a considerable area of fenced mountain or *ffridd*, on which he maintains his breeding flock in winter and spring and grazes store cattle in summer. In this way, the Welsh sheep farmer achieves by fencing, what the Scottish farmer seeks to ensure by herding his sheep up the hill in autumn — a supply of clean, fresh keep for the breeding flock in winter and spring. Many Welsh farms however have insufficient *ffridd* to accommodate all their stock and their problem of agistment of the ewe hoggs is as acute as in Scotland. In very rough winter weather, Welsh sheep may be taken down to the lowlands and given a little hay or other fodder.

## THE HILL FARMER'S YEAR

Space will not allow a separate account to be given of the programme of events under the many and diverse hill-farming systems that exist in Great Britain. The more important may be briefly described.

### Culling and Selection

It is difficult to be dogmatic about the best age at which ewes should be drafted out. On general grounds, it is clearly desirable to retain them in the flock as long as possible. The hardiest and best adapted ewes tend to survive the longest; one must assume that they produce the best daughters (and for that matter, sons) since by the very fact of their survival they have demonstrated their adaptation to the conditions of the grazing. Suitability to environment cannot be judged while an animal is still young. Weak and defective animals can of course be culled as lambs, but there is a good deal of evidence to show how difficult it is to put the culling and selection of ewe lambs, or even shearlings, in a hill flock on a sound and rational basis. At this stage, the qualities that will help the ewe to survive and reproduce itself successfully under hill conditions cannot be recognized.

On the other hand, there are certain disadvantages in retaining ewes until they are five or six years old. Ewes in their prime at three or four years old will, other things being equal, winter better on the hill than older ewes. But, whatever the arguments, the age of drafting is often settled for the hill farmer by the size of his lamb crop. If one lamb per ewe is reared, the flock can be sustained without the necessity of keeping the ewes after they are four and a half years old. If the crop falls much below this figure, drafting must be put off for at least another year; for unfortunately, small lamb crops are commonly associated with a high mortality rate in the ewes.

### Rams

On the whole, ram lambs are not suitable for use in hill flocks. Shearlings, two- and three-shear rams, are preferable to older rams which may have lost their vigour and activity. If there are to be few barren ewes, the rams should be free from lameness and in fit but not fat condition. The same is true for the ewe: she should be fit — neither lean, nor fat — at tupping time.

Contrary to the practice in lowland flocks, one ram is allowed for thirty to fifty ewes according to the age of the ram, the nature of the grazing, and whether tupping is in fields or on the open hills.

The guiding principle as to the date of turning out the rams is the time when sufficient keep can be expected in the spring to nourish the ewe immediately before and after lambing.

In late districts it is not safe to begin lambing before the end of the third week in April and tupping therefore begins about the end of the third week in November. In favourable areas, lambing may start at the beginning of April and tupping therefore at the end of October or the beginning of November. On most hill farms, according to conditions, the dates will fall between these two limits. Rams should be taken away at the turn of the year so that lambing finishes at the end of May.

### Lambing

The most exacting stage in the gestation of the hill ewe is during the last six

or eight weeks before lambing — from mid-February until the grass comes. It is at this stage that the body of the foetus is mainly produced and the udder developed in preparation for lactation.

If spring is not delayed and especially if there is a supply of cotton grass and heather the ewe will be able to take care of herself: if spring is delayed, and especially if there is a prolonged spell of frost and snow at this time, a satisfactory lambing can be assured only by giving supplements such as hay or silage or, if the land is available, by taking the ewes to lowland grazings.

At this time of the year, reseeded sheltered sections of the hill are invaluable provided they are protected by a sheep-proof fence, and have been rested in the winter.

Lambing may take place on the hill and, given sufficient attention and reasonable weather, results will be satisfactory.

It is much easier, however, to look after a lambing flock on enclosed fields and this type of management is often followed, especially in bad weather. The flock must be put back to the hill without delay after lambing — within days, if possible — lest disease build up on low ground, and also to make room for lowland grazing stock.

Ewe hoggs generally return from their winter quarters in April and should be returned to their hill grazings without delay.

### Shearing

In a hill flock, shearing is usually left until the end of June or the beginning of July and, in some districts in Scotland the end of July is regarded as the appropriate time. If shearing is done early, before the weather is warm, there is a danger of losses through chills; even in July, hand shearing was preferred to machine work until a special head was made which left rather more wool on the body.

### Dipping

When and how often dipping is necessary will naturally depend on the incidence of external parasites and on the existence and terms of statutory dipping requirements. Quite commonly, the flock is dipped after shearing, again in the month of August and finally before tupping time.

Spray dipping for the control of blowfly has been developed successfully in recent years. Given an appropriate dip and provided there is sufficient pressure, results are usually quite satisfactory.

### Weaning

Wether lambs are weaned in August and sold for fattening on lowland farms: ewe lambs may be left with the ewes for another month and after weaning are sent away to winter — usually in the beginning of October.

At this time, draft ewes, together with any younger ewes that have been culled, are sold in the ewe sales and the shepherd's year begins again with the preparation of the breeding flock for tupping.

In the hill flock, even more than with lowland sheep, success depends very greatly on close observation, intelligent anticipation and constant attention to the all-important details of husbandry by the shepherd and master. Amongst the important considerations must be mentioned specially, routine preventive measures against diseases of all kinds — foot rot, husk, stomach

and intestinal worms, fluke, ticks, braxy, pulpy kidney and other troubles which affect the flock from time to time. Though effective curative measures are now available for dealing with most of these troubles it is still true that "prevention is better than cure".

## CHAPTER VII

# Management of Lowland Flocks

THE term "lowland flocks" is here used to include all flocks on farms whose elevation is less than eight or nine hundred feet. A distinction between such farms and those of high elevation is that much of the land will be enclosed or under arable cultivation, whereas on mountain, hill, and moorland farms of higher elevation, there may be a very large area of unenclosed land of low stock-carrying capacity.

Between the limits of sea level and nine hundred feet a very wide range of environmental conditions are to be met with, and the farming systems followed vary greatly according to soil type, rainfall, and accessibility. Thus we have farms specializing in sheep production, beef production, dairying, and arable cropping. In the case of the three latter farm types, there may or may not be a sheep enterprise.

By nature, sheep are best suited to well-drained land. The lighter types of soil and undulating uplands, particularly those on chalk and limestone provide a much better habitat than low-lying, heavy soils which are ill-drained; but well-drained land of low elevation, such as the Romney Marsh area, is more suitable for them than land of higher elevation which is lacking in natural drainage. They can thrive under the high rainfall conditions of the western half of Britain because much of the land has natural contours which favour drainage. There are two reasons why non-porous and badly-drained soils are ill-suited to them; in the first place such soils favour the persistence of the snail which is the intermediate host in the life cycle of the liver fluke and, secondly, they increase the difficulties of keeping the feet in sound condition.

The systems of farming which include a sheep enterprise may be roughly summarized under the following heads:

Lowland Grass; Mainly Arable; Mixed.

## LOWLAND GRASS FARMS

On lowland grass farms sheep may be the main enterprise or they may be subsidiary to cattle kept for dairying or beef production. If the number of sheep kept exceeds the number of cattle by more than five to one, the sheep may be regarded as the major enterprise because more than half of the pasture growth is being consumed by them. More usually the sheep are restricted to about the same number as the cattle and their role is then subsidiary. The shepherd's task in that case is much easier as sheep maintain a much higher health standard when the rate of stocking is low.

Sheep possess two great advantages over cattle on grass farms. They

require no winter housing and they cause less damage to pasture in winter time by treading. Much land which will not carry cattle in winter, because of its liability to poaching, will carry sheep.

The great drawback to sheep as a major enterprise is the seasonality of growth of pasture swards. Some provision for change of pasturage can be made if a sufficient number of enclosures, adequately fenced and watered, exist or are arranged; indeed, only in this way can stocking be properly controlled. But pasturage alone can seldom serve the needs of a permanent flock. During the late winter and early spring — the so-called "hungry gap" — it is almost impossible to provide for the flock without arable crops or supplementary feeding; hay, silage and one or other form of trough feed has to be used. By using modern techniques much can be done to promote the growth of out-of-season grass, but the fact still remains that hard frost and deep snow often prevent its utilization at the time it is needed.

As a minor enterprise on grass farms sheep offer great possibilities. The simplest case is that of flying flocks of hill lambs. Large numbers of this class of sheep are, in fact, wintered annually on lowland farms, being kept in little more than store condition until the grass comes in the following season, when they fatten readily. Some ranging is generally permissible, though it has the result — which is sometimes serious — that the flock tends to gather on the driest spots to lie down.

There is a strong case on good summer grazing farms for using cattle as the main enterprise in the summer and sheep during the winter, the sheep being sold off before the swards are needed for the cattle. Similarly, on dairy farms, flying flocks have a definite place; utilizing any herbage there may be on pastures when cattle are housed for the winter, they can be got away during the flush season of grass in the following spring.

## MAINLY ARABLE FARMS

Throughout the whole of the nineteenth century, the sheep flock played a vital part in the farming of the great area of the English light chalk and limestone uplands. The farms on these soil formations were generally large and often lacking in field boundary fences. Hence, there was developed an intensive system of sheep management based on a complex system of cropping and the moveable pen or fold of hurdles. In the daily routine of the shepherd, the setting up of a new fold for his flock was a major task. The farms included a good deal of unenclosed and often steep downland. This land was grazed by sheep under supervision of the shepherd and his dog during the day, and at night the flock returned to its fold on arable land to leave their droppings for the enrichment of the soil. The system involved complicated rotations to provide a succession of crops for folding off. An example of such a rotation is the following: wheat — winter barley and vetches, followed by swedes or swedes and kale — rape or rape with turnips — wheat — oats — clover and rye-grass mown for hay — clover and rye-grass folded off. Rotations of this type used a high proportion of the arable acreage for sheep and involved a high expenditure in labour both for direct shepherding and for the cultivation of the crops to be utilized by sheep alone. The success of the system turned largely on the weather. The feeding value of certain crops was much affected thereby. For example, forage crops such as rye and winter barley soon lose their digestibility as they mature. Cruciferous crops are liable to fail in dry

seasons and are sometimes seriously damaged by frost. When this system was evolved, it was considered essential to keep a folded flock to maintain the fertility of chalky soils light in texture.

The system is little practised today; modern mechanization and fertilizer usage have made it possible to maintain the productivity of light land without the sheep fold. Nevertheless, the arable system of sheep farming has certain advantages to offer.

1. It permits a high rate of stocking because feeding is strictly controlled by the movable fold, while the frequency of ploughing tends to prevent any build-up of parasitic worm population in the soil.
2. It favours intensive management and supervision.
3. Except in unfavourable seasons the abundance of winter feed permits of early (January) lambing and thus of the production of fat lambs in April. Still more important in the case of ram-producing flocks is the fact that the ram lambs are so forward in growth and development that they can be sold for use during the late summer and autumn.

It has, however, to be admitted that folding crops seldom provided complete keep for the flock. Some hay and trough feeding was practised during winter.

It does not seem probable that the arable flock system will ever regain its former popularity, but any significant increase in sheep numbers in the south and east of England can only be brought about by the adoption of a modified form of the system. Where there is adequate permanent fencing, penning in folds can be restricted to the winter months and the flock can spend much of the year in free range grazing on leys and stubbles.

## MIXED FARMS

There is much scope for a greater use of sheep in mixed farming systems to augment the profitability of farms without incurring a heavy capital outlay in permanent equipment other than sheep-proof fencing.

From the shepherd's standpoint, the mixed farm possesses a considerable advantage over the all-grass farm because of the variety of keep that can be provided; the winter scarcity gap can be closed by means of root and fodder crops. Moreover, the unsaleable residues of certain cash crops such as sugar beet, Brussels sprouts and shed corn can be turned to account by sheep. One of the penalties of intensive cereal cropping during the past two decades has been an increase of fungoid diseases, especially those of cereals, and a steady rise in the prevalence of Root eelworm. Some attention must now be paid to greater diversification of cropping, and the use of cruciferous crops to be consumed on the land by sheep during the winter months offers one means of achieving this end.

Broadly speaking, we can differentiate between mixed farms on which sheep are kept as profitable "scavengers", and mixed farms on which a permanent breeding flock is always kept and some portion of the arable acreage is always devoted to specific crops for consumption by sheep. The simplest enterprise is, of course, the flying flock for winter mutton production, store lambs being bought in the autumn for disposal in the following April when the land they have been penned over is planted with a cereal crop.

But with few exceptions — small farms and holdings in suburban areas for instance — mixed farms lend themselves well to the maintenance of permanent breeding flocks: by means of arable crops, seed leys, and stubble areas after harvest, the flock can be provided with an optimum plane of nutrition during each period of the year. It is easier to maintain a flock free from serious parasitic worm infestation when the use of permanent grassland is restricted. New leys provide a much greater bulk of succulent food for milking ewes during the early summer months when a maximum secretion of milk is desirable. A further advantage in having sheep during the autumn months on farms producing grain crops lies in the fact that they can be utilized to consume weed growth in stubbles and to break down straw left by the combine harvester. Lost ears of corn are thus salvaged (though it is important to note that it is not safe to run sheep on stubbles where they can easily obtain too many ears of wheat). On the ideally laid out mixed farm the whole of the area under rotational cropping should be fenced and watered, but where this is not the case, temporary netting fences, or an electric fence can be used to enable the flock to travel round the farm. Broadly speaking, the feeding programme on a mixed farm will be as follows:

| | |
|---|---|
| *Nov. — Mar.* | Fodder crops on arable land, namely, marrow stem kale. turnips, rape, swedes and thousandhead kale in sequence, |
| *April — Aug.* | Seeds leys. |
| *Sept. — Oct.* | Seeds ley aftermath and stubble grazing. (If corn crops are undersown with Italian ryegrass and trefoil the stubbles afford a large amount of grazing.) |

## Grass Management

Grazing swards may be utilized by free range or restricted grazing. Free-range grazing implies the use of a field without subdivision; restricted grazing implies that the area available to the sheep is controlled by subdivision of fields into paddocks or by the use of a movable electrified fence. Free-range grazing involves the minimum of work and eases the problem of worm control, particularly when cattle are grazed along with the sheep, but it does not make the maximum use of land; intensive management of leys is almost impossible.

In the paddock system the size of grazing enclosures is relatively small in relation to the stock kept, and sheep are moved frequently in rotation from one plot to another. Though not yet widely practised in this country the system is gaining favour. It involves a liberal use of fertilizers and a planned programme of dosing to prevent worm infestation. It has now been demonstrated in practice that sheep can be efficiently controlled by electric fencing, and strip grazed. But there is one important practical point in management to be noted; sheep should not be allowed to run back on to previously grazed areas as this leads to a build-up of the parasitic worm population. Confinement to a grazing area by "fore-and-aft" fences or by a fold is preferable.

## Forage and Root Crops

In the consumption of root, fodder and forage crops on land three methods of control can be adopted; namely, close folding, open folding, and strip folding.

In close folding, sheep are provided with a fresh fold or pen daily, the size of the fold being determined by the amount of crop available and the extent to which supplementary feeding is practised. It thus bears some resemblance to the paddock system of grazing leys. There is no "run back" on to an area cleared of crop. On soils light and porous in texture this is advantageous for it ensures a uniform distribution of droppings, and the land is evenly trodden. It is the traditional system employed in feeding off roots, the roots being left whole in the ground or pulled, sliced and fed in troughs; the latter method is now rarely practised though it does permit of the maximum utilization of the crop.

In open folding, access to a fresh "bait" is given daily but the run back is not restricted and the distribution of droppings will not be so uniform; the areas first cleared, particularly the drier portions, will be specially favoured in this respect. Another disadvantage is that some crops, such as rape, renew their growth after a certain period and the consumption of this second growth may result in an intake of stomach-worm larvae.

The third method of arable crop utilization is in reality a variant of strip grazing. Here, using hurdles, wire, strong netting or the electric fence, a portion is divided off to last the sheep several days of feeding. This method obviates the daily operation of setting the fold.

### Supplementary Foods

Hay may be fed on the ground or in racks or cribs. Feeding it on the ground does, inevitably, lead to some wastage. Silage may be fed on the ground or in troughs; if silage is used to supplement the winter diet, it is very important that sheep should be accustomed to it gradually, otherwise it may be difficult to get them to eat it when the need arises in periods of severe weather. Where roots are used to supplement winter and early spring grazing, they can be hauled and laid on pastures. When concentrated foodstuffs are used it is essential that adequate trough space — about nine inches per sheep — should be available. Compounded foods in cube form reduce wastage.

## CHAPTER VIII

# Sheep Farming Equipment

Equipment needed for the management of sheep includes dipping baths, spraying pens, handling pens, fencing, gates, lamb creeps, hay racks, feeding troughs, foot-rot baths, and buildings and appliances for shearing and handling wool.

### DIPPING BATHS

A dipping bath should be designed to suit the breed and number of sheep to be dipped, and to make the dipping as economical of labour as possible; it should also be sited to make filling with water, and emptying, as easy as possible.

There should also be a double draining pen, to enable as much as possible of the dip from the fleeces of the dipped sheep to be returned to the bath for use again.

## Site

There are several points to be considered when choosing a site for a sheep-dip. Water, preferably a piped supply, should be available and there should be convenient access to the dip both for the sheep and for the lorry or tractor and trailer which brings building materials, drums of dip, etc. The site should be reasonably dry and sheltered. A gently sloping site provides good drainage for surface water and also allows the sheep to be worked uphill, which they prefer. If the only available source of water is a stream, the bath can sometimes be so sited that the stream can be wholly or partly diverted into it, thereby saving labour.

## Size

The size and capacity of a dipping bath should be calculated to suit the number of sheep to be dipped, and a useful guide is to allow a half gallon per head of the total flock, with a minimum of 140 gallons. The required capacity in gallons can be converted into cubic feet when it is known that one cubic foot of water equals 6¼ gallons.

## Filling and Emptying

Baths should be emptied and thoroughly cleaned before dipping begins, and as often as is necessary during dipping operations. If this is not done the dip becomes inefficient, and impurities which accumulate are deposited in the fleece.

The dip may be pumped out and the liquid carted to a suitable place of disposal, or it can be emptied by an outlet pipe fitted with a stopcock leading to a soakaway pit.

Because of the poisonous nature of the fluid, great care must be taken in its disposal, otherwise the farmer may find himself in difficulties with the authorities concerned with public health and with the prevention of pollution of rivers.

In particular, the fluid should not find its way into any cesspool or septic tank or, without permission of the Local Authority, into a sewage disposal system. If it reaches the sewage system, the purification process will be arrested. The County Agricultural Executive Committee should be approached, if there is any doubt about the choice of site for a soakaway.

## Types of Bath

There are two types of dipping bath suitable for use in Britain.

The Short Swim Bath with a capacity of from 170 to 400 gallons is suitable for flocks of up to 1,000 sheep, of any breed, and is the most economical type for most flockmasters in Britain. The sheep are lowered into it tail first.

The Long Swim Bath with a capacity of from 1,000 to 1,500 gallons is suitable for larger flocks. The sheep jump or slide into it, feet first.

### *Short Swim Bath*

The sheep are caught and lowered in turn, into the bath, either on their backs (a roller of rubber or hard wood makes this easier), or on their feet (in which case there should be a short smooth or rounded concrete slope

down to the liquid). These baths are commonly of about 250 gallons capacity, (Fig. 3) suitable dimensions being:

| | ft | in. |
|---|---|---|
| Width at bottom . | 1 | 0 |
| Width at top . . | 2 | 9 |
| Depth of bath . | 4 | 1 |
| Depth of fluid . | 3 | 6 |
| Length at top . . | 11 | 0 |
| Length at bottom . | 6 | 0 |
| Step up to exit ramp . | 1 | 0 |

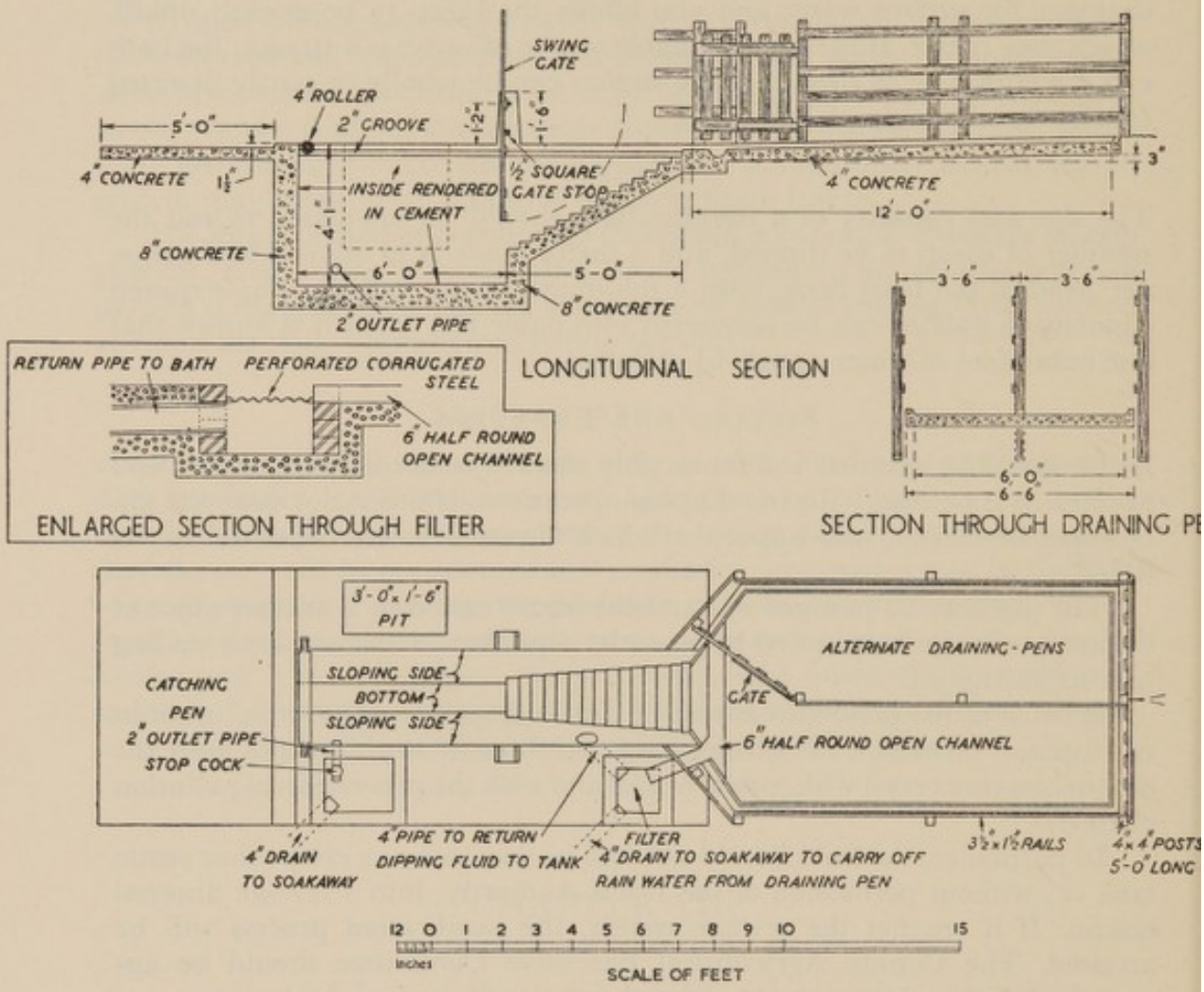



Fig. 3 The short swim bath

Where there are only about 300 hill sheep to be dipped it is more economical to have a specially small bath (say, 170 gallons) than to use a larger bath only partly full.

Suitable dimensions for a 170 gallon bath (Fig. 5) are:

| | ft | in. |
|---|---|---|
| Width at bottom . | 1 | 0 |
| Width at top . . | 2 | 9 |
| Depth of bath . | 4 | 1 |
| Depth of fluid . | 3 | 6 |
| Length at bottom . | 3 | 6 |
| Length at top . . | 8 | 6 |
| Step up to exit ramp . | 1 | 0 |

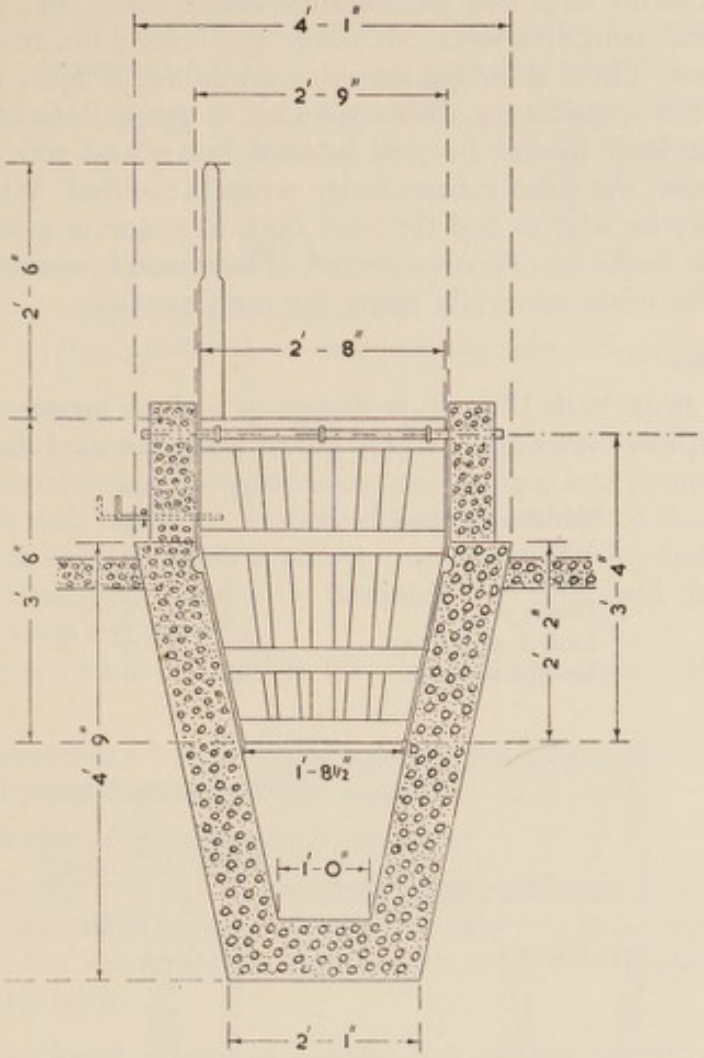



Fig. 4. Section through short swim bath, showing swing gate

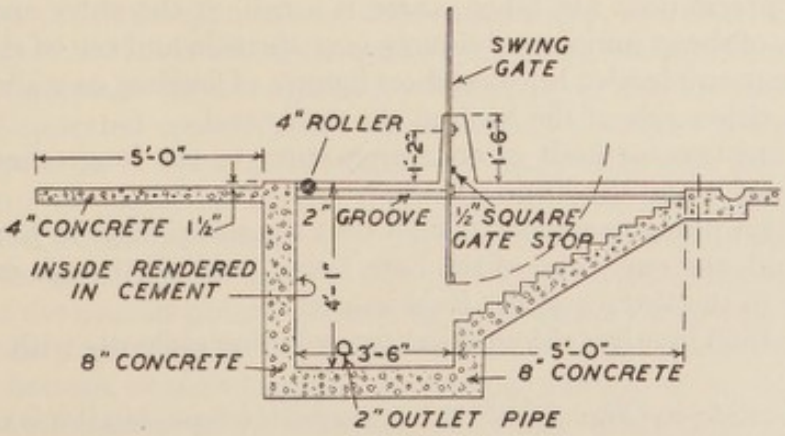



Fig. 5. Section of short swim bath (capacity 170 gal.)

The short swim bath can be obtained ready made, of 14 or 16 gauge galvanized steel, complete with exit ramp and lever gate, ready for sinking into the ground. Three standard sizes are available, of 240-, 170-, and 140-gallon capacities respectively. Other sizes up to 350 gallons can be made to order. Such a bath should be well bedded bown and soil rammed tight against it so that the sides cannot bulge when it is filled. Where the soil is yielding it may be wise to bed the steel bath in concrete 4 in. thick. Alternatively, these baths can be constructed of hardwood, masonry, brickwork or concrete, the latter generally being the most suitable.

*Long Swim Bath*

The long swim bath (Fig. 6) is deeper as well as longer than the short swim bath, typical dimensions, where guard walls are used, being:

| | *ft* | *in.* |
|---|---|---|
| Width at bottom . | | 9 |
| Width at top . . | 2 | 0 |
| Depth of bath . . | 5 | 0 |
| Depth of fluid . | 4 | 5 |
| Length at bottom . | 10 | 0 |
| Length at top . . | 20 | 0 |

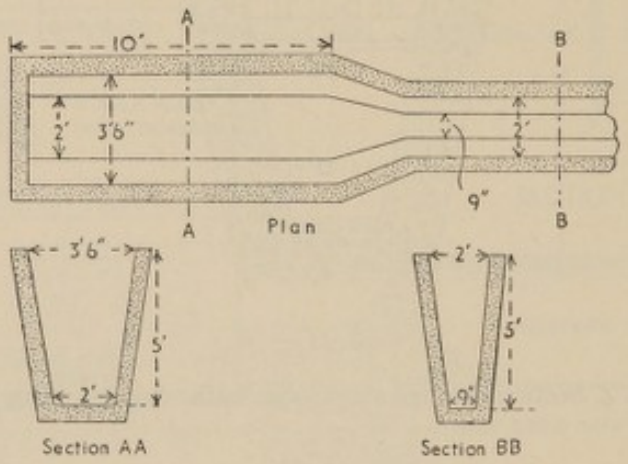



Fig. 6. Entry end of long swim bath where "direct plunge" method of entry is used

These dimensions give a capacity of about 560 gallons, which is suitable for about 1,000 sheep. If greater capacity is required it may be obtained by increasing the length (not the width or depth), each increase in length of one foot giving an increase in capacity of about 40 gallons.

Unless precautions are taken, there is a risk, at the entry end of a long swim bath, of sheep jumping obliquely over the side and out of the bath. To make this impossible, two hurdles, short lengths of fencing, or walls, should be erected on either side of the bath at the entry end.

There are two methods of arranging entry to the long swim bath, the "direct plunge" and the "side slide-in".

The direct plunge entrance is such that the sheep have to jump straight into the fluid, the entry end of the bath being vertical, though sometimes a short slope to the surface of the fluid is used.

This method involves risk of the sheep colliding violently with the sides of the bath.

The side slide-in (Fig. 7) is the more expensive type, but if it is well designed it enables the sheep to be put into the bath without any human effort.

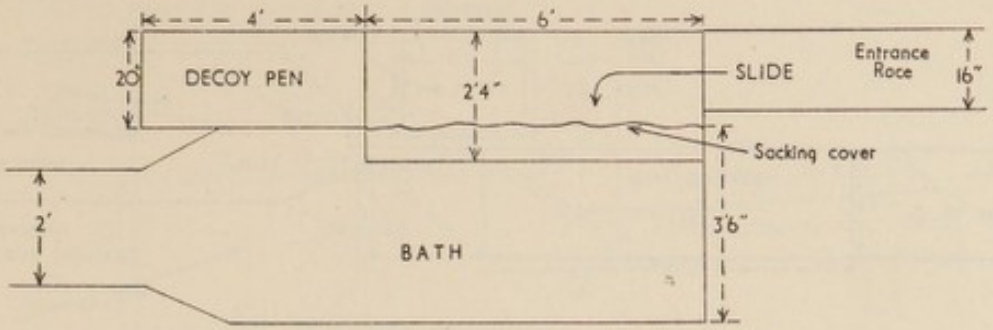



Fig. 7. Side slide-in entry with long swim bath

## SPRAYING

An alternative to dipping that is coming increasingly into favour is spraying. This method is not, however, approved for the control of sheep scab. The sheep, instead of being immersed one at a time in a dipping bath, are driven 18 to 30 at a time into a specially designed pen and held there for three minutes while they are sprayed.

A spraying system is claimed to have advantages over a dipping one in that:

1. A flock of sheep can be sprayed more quickly than it can be dipped and with less physical handling of the sheep;
2. There is less risk of injury to the sheep; and
3. Less fluid is required at any one time. This enables the residue of a dirty wash to be discarded at intervals and the reservoir to be replenished with clean wash; but the total quantity of wash needed is at least the same as for a dipping bath.

On the other hand, a spraying system has to have, as well as a spraying pen, a reservoir larger than a dipping bath usually is, piping, a pump and a power unit, which will together cost much more to install and to maintain than a dipping bath alone. But there is little doubt that spraying has the advantage from the point of view of labour economy, and for those to whom that is of prime importance, a spraying installation that has proved satisfactory in use is described here and illustrated in Fig. 8.

### Spraying Pen

The pen (Fig. 8) is 15 ft long, by 4½ ft wide and 5 ft high and is designed to hold from 25-30 hill sheep, or about 18 lowland sheep, at a time. The floor is concrete, sloped so that it will drain quickly back into the reservoir. The sides are of fencing, lined with corrugated iron sheeting, as also are the entry and exit gates. Supported centrally and longitudinally overhead is a single steel spraying pipe 2 in. in diameter, fitted on the under side with ½ in. diameter nozzles every 18 in. of its length. This pipe is mounted so that it rocks slightly to and fro and so directs the jets first towards one side of the floor and then towards the other. Along each side of the floor lies a similar pipe, but fixed so that the nozzles point obliquely up into the pen. When the sheep are in the pen, the pipes direct powerful jets of fluid at them either from the top, or from the bottom, or both together, according to which of two ways a tap is turned. A third position of the tap causes the wash to be pumped, not to the nozzles, but to operate an agitator at the bottom of the reservoir.

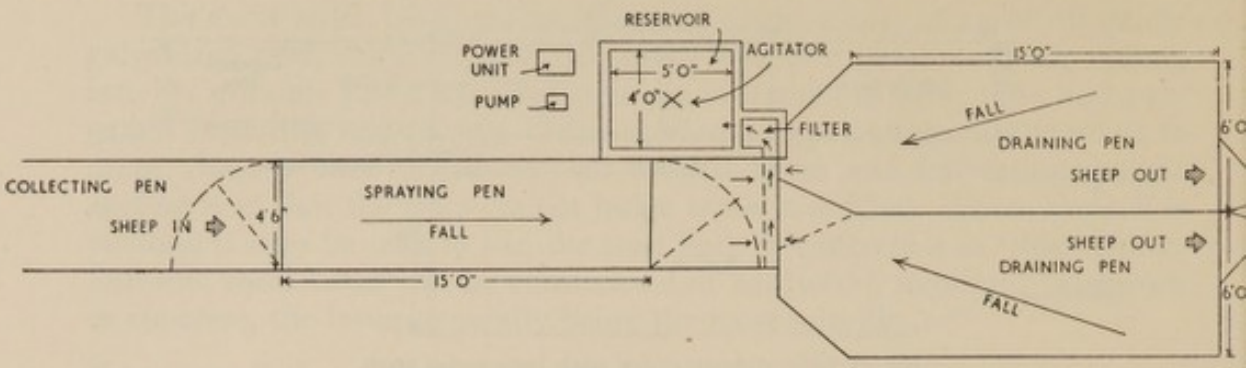



Fig. 8. Layout of a sheep spraying installation, etc.

### Reservoir

The reservoir in which the fluid is contained and mixed is sunk in the ground so that the floor of the spraying pen drains into it. Its capacity is related to the size of the spraying pen and in this case is 500 gallons. The dimensions necessary to give that capacity are $5 \times 4 \times 4$ ft and it is constructed of concrete 4 in. thick.

### Pump

In this case the pump is belt-driven and of 2 in. centrifugal type, designed to run at 2,000 rev./min. and to deliver the fluid to the nozzles at the rate of 5,000 gallons per hour.

### Power Unit

The power unit is a 4 h.p. oil engine and its power is applied to (or removed from) the pump by sliding a belt from one wheel to another. That is how the spray is turned on and off; to have a tap for that purpose would be impossible because, when it was turned off, the mounting pressure of the fluid, with the pump working, would burst the pipes.

## DRAINING PENS

After sheep have been dipped or sprayed, they emerge with each fleece saturated with about 5 gallons of dipping fluid which is valuable and should be used again. There should therefore be a pair of specially-designed draining pens side by side (Fig. 9) in which to hold the sheep until most of the fluid has dripped off. A draining pen should have a concrete floor sloped at a fall of about 1 in 50, or 1 in. in 4 ft, so that the fluid falling on it runs into an open channel to one side, this channel in turn sloping back towards the bath or reservoir. The channel should not, however, discharge directly into the bath, but indirectly through a strainer. Two draining pens are used in order to maintain a continuous procession of sheep through the bath, or the spray pen, one draining pen being filled with sheep which are held there while the other pen is filled. When the second pen is nearly full the first is emptied. In this way every sheep is made to stand and drip for at least 5 minutes or so, without holding up the line of sheep coming from the spray pen or up the exit ramp from the bath.

Pens should be designed to hold from 10 to 30 sheep at a time, 15 being the most common. An area of 4-5 square feet should be allowed per sheep, according to the size of the breed.

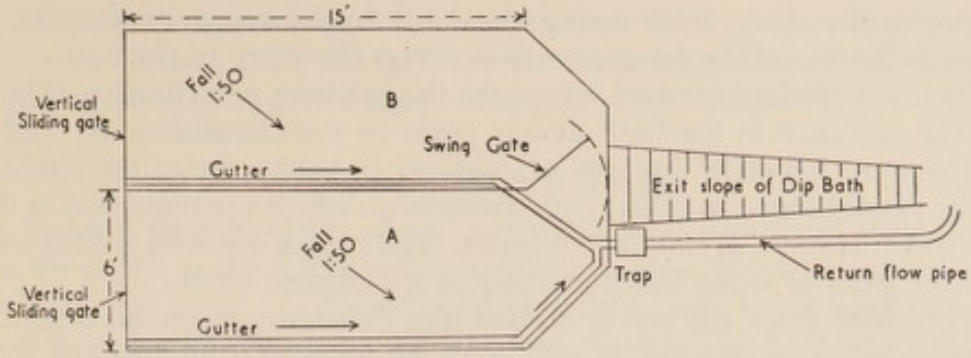



Fig. 9. Arrangement of draining pens

Drainage from the draining pens should be arranged so that rainwater is not allowed to dilute the liquid in the bath or reservoir. The dipping liquid is also filtered to remove droppings, etc., from it before it is returned for re-use.

## CATCHING PENS

It is always difficult to bring sheep up to the entrance of a dipping bath, i.e., into the catching pen, and to corner them there and force them into the bath. This difficulty can be reduced to some extent by making the approach to the catching pen uphill, in the general direction of the feeding grounds, and by

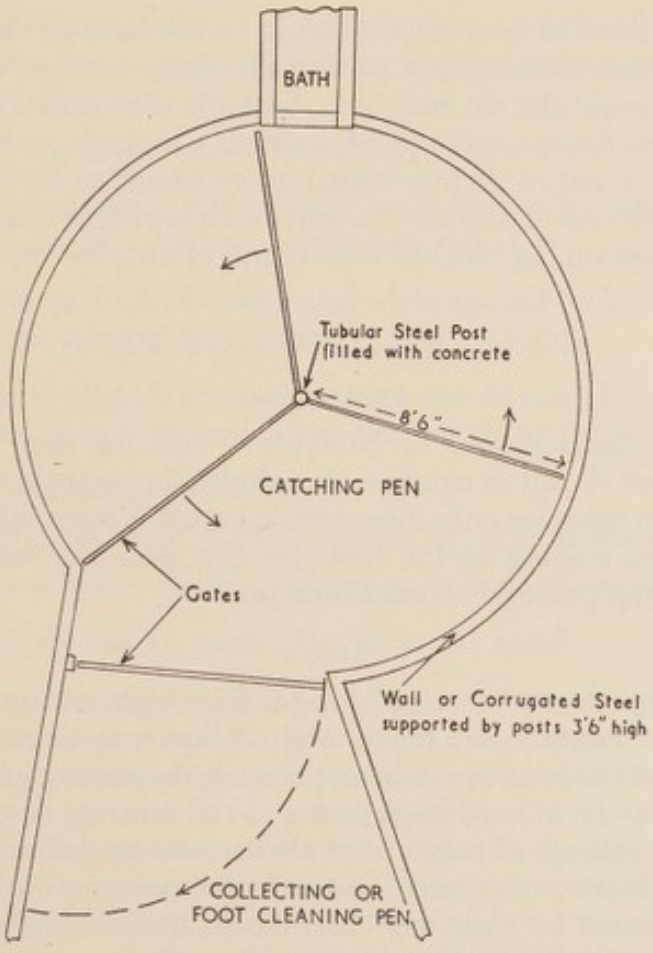



Fig. 10. Circular catching or forcing pen

preventing the sheep from seeing the bath by boarding or sheeting the approach fences and by hanging a sack across the entry to the bath.

The most efficient method is to make the catching pen circular, (Fig. 10) with the entrance to the bath at one point in the circumference, and the gateway from the collecting pen at another. In the centre of the circle is a tubular metal hinge-post filled with concrete on which are hung two or three gates which revolve as radii of the circle. The hinges are steel collars which allow the gates to swing independently in a complete circle.

With three gates, the pen is divided into three compartments which can be expanded or contracted at will, and the gates can be fastened in the required positions. One compartment is filled with sheep from the collecting pen, the second contains the sheep awaiting their turn, and the third discharges the animals into the bath. The gates can be used to move the sheep in a bunch and to keep them closely packed, which makes it easier to catch them.

When the discharging compartment is empty, the gates are moved round to allow the next compartment to be discharged and the empty one refilled. Each compartment full of sheep thus provides a "decoy" for filling an empty one, since the sheep can see through the gates. The gates may be from 6 ft to 13 ft long, but 8 ft 6 in. is a common and convenient size. Gates over 10 ft long need to be supported by a wheel under the head.

## FOOT CLEANING PENS

A refinement, aimed at keeping the liquid in the bath as clean as possible, is to provide a foot-cleaning pen so that the sheep have to walk through it just before they enter the catching pen. Suitable dimensions for it are 8 ft × 8 ft with concrete floor, surrounded by a kerb 5 in. high, to hold either 4 in. of water or else a bed of slightly wilted green bracken. If water is used the floor should be sloped to a drain provided with a plug and with a grating to prevent it from becoming blocked with lumps of dirt, faeces, etc.

## CONSTRUCTION OF PENS

### Flooring

Ideally all pen floors should be concrete — and the floor sloped so that rainwater runs off it. But to concrete the whole of a layout is expensive and a compromise is to concrete only those pens where it is essential. These include the drafting pen leading to the foot-cleaning pen, the foot-cleaning pen itself, the catching pen and the draining pens.

### Sides

The sides of the pens should be at least 3 ft 6 in. high, except the sides of the sorting race which should be 2 ft 9 in. high. A higher sorting race will make it difficult for a man to lean over when operating the sorting gates.

The sides may be of hardwood post-and-rail fencing, or all-steel fencing, or 4½ in. brick walling. If they are of all-steel construction, they should be lined with steel sheet on the inside; if hardwood post-and-rail construction is used, the rails must be close together. These precautions will stop lambs getting through the fence. In addition, the rails in a post-and-rail fence should be on the inside of the posts, so that the fence presents the smoothest

possible surface to the sheep. Wherever sheep are likely to pass closely against a length of fencing it should be lined on the inside with steel sheet, so that there is no possibility of their legs, horns or fleeces getting caught in the fence.

## FENCING

The varying temperaments of our many breeds of sheep and their propensities for escape make it impossible to do more than deal with this subject in a general way; a fence that will contain one breed may be useless for another. Nevertheless, a few notes on the standard materials and designs which are found throughout the country may be useful. Stone walling — the traditional fence of the districts where our most agile breeds are found — is not discussed since it is a local fence depending entirely on the availability of local material; it is rare to find a new stone wall being built today.

There are three basic designs of farm fence:

1. the woven wire fence;
2. the strained wire fence;
3. the post-and-rail fence.

In addition, there is a special type of fence: cleft chestnut pale fencing. Of these, the woven wire fence is by far the most suitable for sheep.

### Materials

*Woven Wire Fence*

Woven wire fencing consists of a number of horizontal wires of varying gauges held apart at varying distances by vertical wires knotted on to them at set intervals.

Three styles have been standardized.

*Cattle Fence* 45 in. high; 8 horizontal wires spaced from the bottom 4½, 5, 5½, 6, 7, 8 and 9 in.: vertical wires every 12 in.

*Sheep Fence* 36 in. high: 6 horizontal wires spaced from the bottom 5½, 6, 7, 8 and 9 in.: vertical wires every 12 in.

*Pig Fence* 32 in. high: 8 horizontal wires spaced from the bottom 3, 3½, 4, 4½, 5, 5½ and 6 in.: vertical wires every 6 or 12 in. (lightweight only).

Each style is made in two weights.

*Standard:* gauge of wire: top 8½, bottom 8½, intermediate 11.

*Light:* gauge of wire: top 10, bottom 10, intermediate 12½.

All styles are sold in 55 yard rolls (32 to the mile).

The cattle and sheep styles are, of course, interchangeable, the only difference between them being in the height and number of wires. The pig style is too low for sheep and, with verticals spaced at 6 in., unnecessarily heavy.

The effective height of a woven wire fence can easily be increased by running one or two horizontal wires — either plain or barbed — along the top; barbed wire is disliked by many flockmasters.

Woven wire fencing is strained between main posts and supported on intermediates; posts may be of wood, steel or concrete.

*Strained Wire Fence*

Strained wire fencing consists of a number of galvanized wires, plain or barbed, strained tightly between strutted main posts and supported by intermediates.

The efficiency of a strained wire fence depends on the tautness of the wires. As soon as they become slack it is an easy matter for sheep to get through, and for this reason it requires more attention than woven wire. A fence against sheep should contain not less than six wires, but seven are better. The following spacing of wires is suggested.

*6-Wire Fence:* on posts 4 ft out of ground: from ground level — 5, 6, 7, 8, 9 and 10 in., leaving a 3 in. space to the top of each post.

*7-Wire Fence:* on posts 4 ft out of ground: from ground level — 4, 5, 6, 7, 8, and 9 in. leaving a 3 in. space to the top of each post.

This arrangement of wires gives a height of 3 ft 9 in. which should normally be high enough, but a farmer can adjust the spacings as he thinks fit. Lambs will nearly always find a way through a strained wire fence.

In the past, 8 gauge wire has always been regarded as the standard gauge for farm fences. In the war, when material was difficult to come by and any gauge was welcome, it was found that 10 gauge was quite stout enough to make an efficient fence, the strength of this design being in its tautness rather than in stoutness of material. There are about 854 yd in 1 cwt of 10 gauge wire — about 300 yd more than in 1 cwt of 8 gauge. The use of 10 gauge therefore means quite a considerable saving in expense.

*Posts for Wire Fences*

*Wood.* Straining posts should not be less than 5 in. diameter at the smaller end, and not less than 6 ft 6 in. long. Intermediates should be not less than 2½ in. in diameter at mid-length.

*Concrete and Steel.* Proprietary posts are generally used and the advice of manufacturers should be sought on sizes.

*Post-and-Rail Fence*

Generally speaking, this design is unsuitable for sheep since the number of rails needed for a sheep-proof fence makes it too expensive. Where post-and-rail fences exist it is usually necessary to tack up sheep netting or woven wire.

*Cleft Chestnut Pale Fencing*

Cleft chestnut pales are spaced at distances ranging from 1 to 5 in. and wired together by two or three wires. The fencing is strained between main posts and supported on lighter intermediates. It is generally sold in 10 yard rolls and the height ranges from 3 ft to 6 ft.

It is primarily a fence for allotments, building estates and such places and is not often found on farms; the pales can easily be broken by horses, heavy-horned stock and pigs. It is, however, sheep-proof and has the added advantage of being difficult for human beings to climb. If it is high enough, dogs also find this fence difficult to pass. On the other hand it is expensive and heavy to transport.

### Erection

No matter what the design, proper erection of a fence is more than half the battle; more fences fail through bad erection than through bad material or design.

The secret of success with wire fences lies in making the straining posts immovable. This means that they must be well sunk and the earth round them well rammed — advice which it is easy to give but not so easy to carry out on rocky soils. A straining post should be sunk not less than 2 ft 6 in. in the ground; many prefer 3 ft to 4 ft. Four feet is the depth recommended in New Zealand — a country where sheep fencing has been given close study. Good strutting is essential, for the strain on a post when all wires are up is very great. The use of straining eye-bolts or ratchets is strongly recommended; then it is an easy matter to tighten up individual wires. With woven wire fencing, each wire should be strained separately.

A straining post is needed at every change of direction and contour and, on straight lengths, at every 75 to 100 yards. Intermediate posts should be spaced 9 – 10 ft apart.

### Temporary Fences

Apart from electric fencing, sheep netting is the most suitable material to use for temporary fences. This is made in two- and three-ply wire in widths of 24, 36 and 42 in., and gauges ranging from 14 to 17. It is sold in 50 yard rolls.

Woven wire can be used but it is not really satisfactory unless it is strained, and the work involved in setting straining posts is not warranted for a temporary fence. The same remarks apply to cleft chestnut pale fencing.

The subject of fencing is dealt with in detail in Leaflet No. 6 of the Fixed Equipment of the Farm Series — "Farm Fences".* The reader is also referred to British Standard Specification 1722: 1951 — Part 2, Woven Wire Fences, Part 3, Stained Wire Fences, Part 4, Cleft Chestnut Pale Fences, Part 7, Wooden Post and Rail Fences.†

## GATES

Gates for sheep pens are of various types, the commonest of which is the swing gate.

The vertical sliding or balanced lift gate, however, is particularly useful where a gate is required that can be operated by remote control, for example, where sheep are released from a draining pen after dipping. Such a gate can be pulled up or let down by a rope extending over a pulley wheel to a point beside the dipping bath, and in this way, a man working by the bath can open or close the gate repeatedly without having to walk a distance of about 20 yards each time.

This principle of remote control can also be applied to the swing gate that admits sheep to the draining pens from the bath. The gate can be pulled to one side by a rope and pulled back to the other side by a second rope with a counterbalancing weight; both ropes acting round pulley wheels.

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* Obtainable from H.M. Stationery Office, or through any bookseller, price 9*d*. (by post 10½*d*.)

† Obtainable from British Standards Institution, British Standards House, 2 Park St., London, W.1. Price 3*s*. each, post free.

A gate should always be at least as high as the fence it adjoins. Its width should suit the position it occupies.

## THE CRUSH

A crush is a pen not more than 5 ft wide at one end, narrowing to about 1 ft 4 in. at the other, and about 6 ft long, through which a bunch of sheep are forced so that they emerge singly from the narrow end. The angle at which the crush narrows should be about 30 degrees; if it is much greater or much less the sheep will tend either to emerge two abreast or not at all.

Sometimes a double crush is used which is similar in shape to a pair of draining pens (Fig. 9) but is used in the reverse direction, i.e. the sheep enter at the "square" and leave at the "tapered" end.

## SORTING, SHEDDING OR DRAFTING RACE

The sorting race is a most important feature of a set of sheep-handling pens and it should be designed with care. Usually it consists of two close-boarded wooden walls with the smooth sides facing each other, but it may be of brickwork.

The width should be from 14-18 in. according to the size of sheep, and it is important that the animals should be able to pass along it comfortably without being able to turn round or see anywhere but straight in front.

The length should be from 10-30 ft according to the number of drafting pens it is to serve — 10 ft is long enough for three drafting pens.

## FOOT ROT BATH

Where sheep run on hard or stony land their feet keep in good order naturally, but on soft or waterlogged land they are very subject to foot rot and a footbath should form part of the equipment. The footbath should be at least 10 ft long × 14 in. wide at the bottom, with a depth of 6 in. It may be of concrete or hardwood if made on the farm, or of galvanized steel if bought ready-made. Some footbath solutions have a corrosive effect on steel, and this should be borne in mind when deciding what material to use.

The footbath may be installed as a special unit on its own, with fences on either side and a crush leading to it. Where there is a sorting race it may be economical to place the footbath in that, so that the same crush and fencing may be used for sorting as well as for footbathing.

## SHEARING AND WOOL SHED

For shearing, a roof to give shade and shelter, and a concrete floor are desirable. For storing wool, walls are required as well, to give protection from the weather, though vertical metal sheeting on timber or metal framework can be used instead of solid walls.

If the same building is used for shearing and for storing wool, it is desirable to have at least two or three windows or wooden shutters that can be opened wide in hot weather, to allow fresh air to dispel the smell of sheep for the men handling them and closed after shearing is finished.

It will be easier to handle the sheep at shearing time if the floor area of

the shearing shed is divided up into pens by removable posts set in slots in the floor, and wooden rails are secured to the posts by bolts and wing nuts.

Details of a well-designed shearing and wool shed for a large hill flock are shown in Figs. 11 and 12.

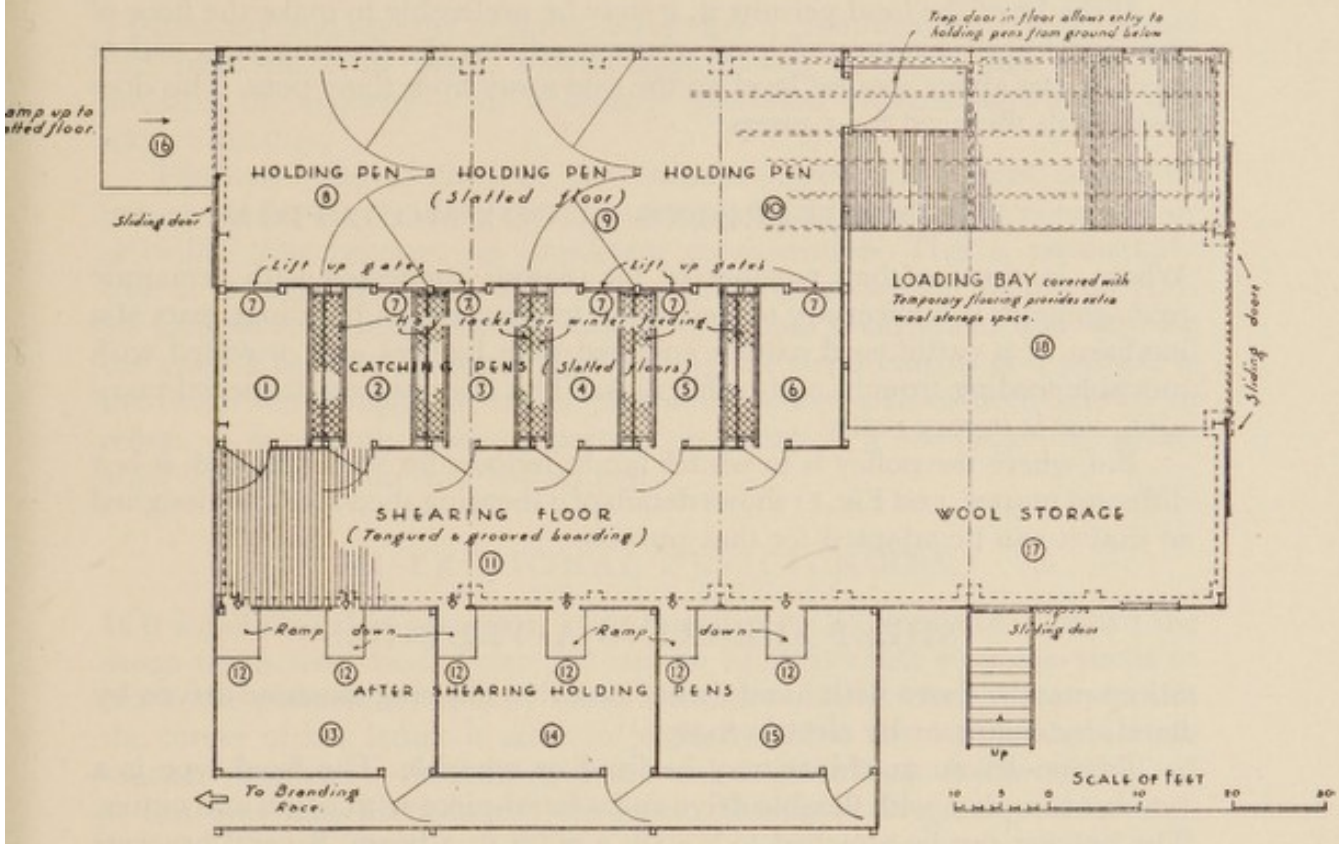


Fig. 11. Layout of sheep shearing shed adaptable for wintering lambs

KEY TO FIG. 11

1, 2, 3, 4, 5, 6. Catching pens with slatted floors and hay racks for winter feeding
7. Lift-up gates between holding pens and catching pens
8, 9, 10. Holding pens with slatted floors
11. Shearing floor of tongued and grooved boarding
12. Ramps down from shearing floor to after-shearing holding pens
13, 14, 15. After-shearing holding pens under lean-to roof
16. Ramp up to slatted floor
17. Wool Storage floor
18. Loading Bay. This, if covered with temporary flooring, provides extra wool storage space

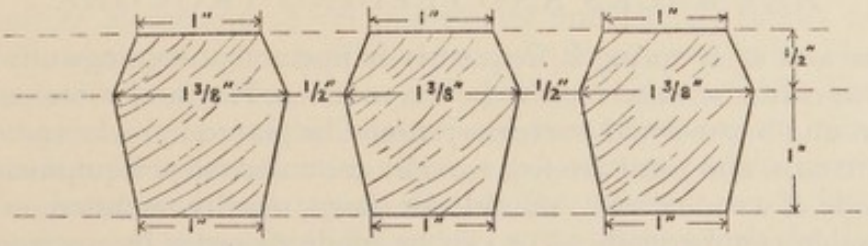


Fig. 12. Detail section of floor slats shown in Fig. 11

## LOADING PLATFORM

A loading platform at lorry height above ground level (with a ramp up to it from ground level) is a great saver of labour. It should be situated so that it can be used either for loading wool from the shed or for loading sheep from one of the drafting pens.

If the lie of the land permits it, it may be preferable to make the floor of the shed just above ground level where it adjoins the drafting pens and at lorry height above ground level on the side away from those pens. This does away with the need for a ramp.

## INDOOR FEEDING ACCOMMODATION

Where, in times of bad weather or for reasons connected with economic management, it is necessary to feed sheep temporarily in buildings, part of a haybarn or a cattle yard can be enclosed with hurdles and provided with movable feeding troughs and/or hayracks. This does not entail special planning, nor is it very costly.

But where the policy is to winter lambs indoors for weeks on end, it is a different matter, and Fig. 11 shows details of a shearing shed specially designed so that it can be adapted for that purpose.

## SHEEP SHEARING APPLIANCES

Sheep may be shorn with hand shears or with a clipping machine driven by hand, by engine or by electric motor.

Engine-driven machines may be fixed or portable. The fixed type is a bracket complete with flexible drive and a hand-piece with comb and cutter. The bracket can be attached to a wall, a pillar or a beam. Several brackets can be driven from suitable shafting or belting and they should be fixed about 5 ft above the floor and about 4 ft apart.

The portable type is part of a shearing set which includes a small petrol engine and either two or four brackets. The set is mounted on a steel frame that can be lifted bodily or pushed on wheels or skids.

In electrically-driven machines the bracket incorporates a small electric motor which is suspended from a hook, the power being supplied by a flex plugged into a socket outlet.

Electric shearing machines have been known to give severe electric shocks to men using them. Special precautions should therefore be taken to see that this does not happen, by reference to the makers and to the electrician responsible for their installation.

## HAY RACKS AND FEEDING TROUGHS

In winter and early spring it frequently happens that feedingstuffs such as hay, roots, corn and meal have to be fed to sheep. Hay and roots can be fed on the ground but to avoid waste they should be placed in racks and troughs.

Where corn and meal are fed, troughs are a necessity. Equipment of this kind (made of wood or steel) suitable for sheep, usually mounted on wheels, is obtainable commercially — or can be made to order by a carpenter or welder.

CHAPTER IX

# Causes and Prevention of Loss

THE nature and severity of sheep losses vary a great deal from year to year and from place to place. Observation shows, however, that many — probably the majority — are intimately associated with management in one way or another.

The well-being of sheep in their natural environment, must clearly be influenced by the weather, and the provision of adequate shelter, natural or artificial, thus becomes an important consideration. This is particularly true in the case of ewes in milk. Again, since sheep depend mainly on grass for food, pasture must provide sufficient, in both quality and quantity, for the sheep's need at all times. High among the requirements of a pasture is the factor that might be called palatability. Sheep have been known to refuse an apparently first-rate pasture preferring to graze the more "palatable" ditches, banks and hedgerows.

## NUTRITIONAL DEFICIENCIES

It is significant that pasture is at its lowest point of productivity when the sheep needs most food. From January to March, when ewes are about to lamb, the pastures are usually bare. Thus, not only the fate of the ewe, but the future of her lambs is often in jeopardy unless precautions have been taken to supplement the failing pasture with suitable foods. A shortage of food at this time may precipitate Twin-Lamb Disease or Pregnancy Toxaemia

### *Twin-Lamb Disease*

Although the true cause and nature of twin-lamb disease are still imperfectly understood, it would seem also to be good practice not to confine pregnant ewes too much, and, indeed, if they are over-fat in the last weeks of pregnancy, to exercise them forcibly. The provision of an uninterrupted, or preferably a rising, plane of nutrition with an adequate mineral intake, combined with reasonable activity, are sound means of preventing this disease. Moreover, such practice not only prevents twin-lamb disease but also decides the fate of the unborn lamb, and the ability of the ewe to produce an adequate supply of milk.

### *Lambing Sickness and Grass Staggers*

After lambing and during suckling the constitution of the ewe is particularly susceptible to bad weather, especially cold winds and rain. Ewes are also sensitive to certain, as yet imperfectly understood, factors present in rapidly-growing, young grass. This is reflected in an upset in health, broadly termed metabolic disorder, such as Lambing Sickness (Milk Fever) and Grass Staggers (Tetany), which are related in some way to an imbalance of certain mineral elements in the blood, e.g., calcium and magnesium and, perhaps, phosphorus. In lambing sickness the affected ewe is found down and grunting and is usually ill for a day or two, after which she dies; a few ewes, however, recover spontaneously. In staggers, death may be very

sudden indeed, with no warning of impending disaster. Although inoculation with calcium will generally effect a rapid return to normal in a short time and thus provide a useful remedy for cases of lambing sickness, the suddenness of death forestalls curative treatment in staggers. At this time, however, staggers can be prevented to some extent by trough-feeding magnesium to ewes which are on this type of pasture. The association of these disorders with young, rapidly-growing grass has been mentioned, and if such pastures are to be grazed by lactating ewes, it is advisable that the ewes should be introduced to them gradually, or that a run-back on to an older, more fibrous type of pasture should be available. A warning might be given that lambing sickness and staggers sometimes occur before lambing, if the ewes are on a pasture likely to predispose them to these disorders. In such cases it is difficult to diagnose which disorder — i.e., pregnancy toxaemia, lambing sickness or staggers, has been the cause of death.

Good management of the pregnant and milking ewe is, therefore, a matter of quantity and quality of pasture and the adoption of adequate precautions in relation to the grazing of young grass.

*Causes of Losses*

Losses from both so-called lambing sickness and staggers can recur when lactating ewes are trucked. Trucking should therefore, be avoided as far as possible. In this respect, too, attention should be drawn to the danger of ewe pneumonia that frequently follows when ewes are herded together and driven during long-continued dry periods of hot days and cold nights in early summer. The grazing of young pastures is also conducive to poisoning should the sheep be dosed at the same time with carbon tetrachloride against fluke.

Although these metabolic disturbances seem to be associated with a low calcium or magnesium content in the blood, they should not be regarded as strictly *deficiency* diseases. They are more correctly a reflection of an upset of the finely balanced mechanism that controls the mineral content of the blood. They are not, therefore, associated directly with a shortage of the mineral elements, lime or magnesium in the soil or herbage.

*Swayback of Lambs*

There are certain disease conditions, however, which are a manifestation of such mineral deficiencies, and two of them are of economic importance in this country. The more spectacular (but of lesser importance economically) is a condition affecting lambs, widely known as Swayback or Swingback. Australian workers showed a deficiency of *copper* to be the cause of this condition, the name of which adequately describes the symptoms seen in affected lambs. The lambs may be affected either at birth when they are born helpless and unable to stand or suckle (this disease should not be confused with an hereditary nervous disease often referred to as "daft" lambs), or at about three to six weeks old when symptoms, varying in severity, seem to be confined to a peculiar inco-ordination of movement, especially in the hind legs. It is particularly noticeable if the affected animals turn suddenly when their hindquarters appear to fail them. The mothers of these lambs will often show a certain amount of anaemia, and both their blood and liver will, on examination, often be found to be deficient in copper. Many such copper-deficient ewes, however, can and do give birth to perfectly normal lambs which never show any signs of illness.

The disease affects the brain and spinal cord of the lamb, which shows varying degrees of degeneration, which commenced before birth, of those parts particularly concerned with locomotion. Swayback is fairly widespread but has a low general incidence in this country, and, although a deficiency of copper plays a very important part in its causation, most of the pastures with which the disease is associated have a normal copper content. This suggests that an alternative, or more likely an additional, factor is involved which still has to be found. So closely is a lack of copper involved in the causation of swayback, however, that the disease can easily be prevented by dosing the ewes with copper, or feeding a supplement to them in the last two months before they lamb.

*Cobalt Deficiency*

Of much greater economic importance is the condition affecting the young growing animal, and proved beyond doubt to be due to a deficiency of another "trace" element — *cobalt*. In its more obvious manifestation, cobalt deficiency, which occurs only in ruminants, gives rise to what is popularly known as "Pine" or "Pining". Affected lambs cease to thrive even on abundant pasture, they become thin, the wool parts on their backs, their eyes become watery, and they appear anaemic. In uncomplicated pine there is no associated scouring but since, in this weakened state, they are more prone to attacks by worms, scouring may be present. There would seem to be certain well-defined areas throughout Great Britain — of which Bodmin Moor and parts of Scotland are good examples — where the cobalt deficiency of plant and soil is marked, and where clinical pine in lambs and even in young cattle is prevalent. Investigations show that cobalt deficiency may well be more subtle than this, and that there are very many flocks throughout Great Britain in which the sheep although appearing to thrive satisfactorily, would add extra pounds if they were fed a supplement of cobalt. This, in fact, can be most easily provided indirectly by a top dressing of cobalt applied to the pasture at the rate of 2 lb of cobalt sulphate to every acre.

*Other Deficiencies*

Other deficiencies occur to a lesser degree, and that causing rickets, particularly in the eastern counties, may be mentioned; here the deficiency is of vitamin D. Its incidence, however, does not seem to call for wholesale administration of this vitamin. Similarly, reference only need be made to the potential danger in feeding certain types of kale. Many appear to contain a rather high content of a factor likely to cause goitre in sheep and care should, therefore, be taken when feeding them to sheep.

## INSECT PARASITES

Good nutrition, both in quality and quantity, is of the utmost importance, not only as an insurance against certain disease conditions, but also as a means of building up a general resistance to ill-health caused by parasites and bacteria. Pastures, however capable they may be of providing this necessary nutrition, sometimes harbour insect and other pests which can cause ill-health in grazing sheep. Significant pests of this kind are the Sheep Blowfly, or Green Bottle, and the Sheep Tick.

*Sheep Blowfly*

The sheep blowfly or Green Bottle (*Lucilia sericata*) is responsible for the greatest number of cases of fly strike in Britain.

Before the advent of modern dips, one of the biggest summer problems of the shepherd was "maggoting", and the losses and the time spent in dressing sheep because of fly strike were prodigious. This and methods of control are dealt with in Chapter V (pp. 41, 42).

*Sheep Tick*

The sheep tick (*Ixodes ricinus*) lives partly in the soil and partly on the grazing animal, where it feeds by sucking blood. It is usually found attached to animals from April to June and again from mid-August to mid-September. To survive, the tick needs a moist, shady and relatively warm atmosphere which it finds on poor, rough and/or bracken-infested grazings. For this reason it is primarily an enemy of hill and mountain sheep. Although little is known of the actual amount of ill-health which is directly due to removal of blood by ticks, there is no doubt at all that they are carriers of some specific diseases which affect sheep and cattle. Chief of those affecting sheep is Louping Ill — a virus disease which invades the central nervous system, and which is characterized by various forms of nervous derangement and death. This disease appears to be closely associated with, and possibly complementary to, another virus infection similarly conveyed by the tick bite — Tick-borne Fever, which, as it were, paves the way for the louping ill virus. Indigenous or acclimatized sheep seldom suffer much ill-health through this cause, but newly-introduced sheep, lacking the naturally acquired resistance, readily succumb.

*Tick Pyaemia.* Closely associated with tick bites is another condition frequently called Tick Pyaemia, which is probably even more widespread than louping ill and is found only in lambs. It is caused by the introduction of pus-producing germs under the skin by the bite of the tick. These germs establish themselves in various sites quite frequently in the joints, where they multiply rapidly with the formation of pus. This condition is recognized by swollen painful joints causing varying degrees of lameness. Sometimes the germs settle in the brain or spinal cord producing a variety of nervous symptoms in the affected lambs; or again, they may settle in the heart-wall, liver or lungs, and may even cause sudden death. The radical method of controlling both louping ill and tick pyaemia is by an all-out effort to eradicate the tick from the pastures by land improvement, to protect sheep against ticks by regular dipping (see Chapter V) during the danger period, or in the case of lambs by smearing with an anti-tick salve. Such treatment will afford protection from ticks for a period of three to four weeks and in this way the danger of louping ill and tick pyaemia can be considerably reduced.

## WORM PARASITES

Other troublesome parasites are also associated with pastures, or more particularly with grazing management. The most important of these is the large group of *parasitic roundworms* that live in the stomach and bowels of sheep and cattle, and which for convenience can be classed together and referred to as "worms". These are beyond doubt the greatest individual

cause of loss to the industry, more particularly by poor thriving and often by actual loss of condition. In the stomach and bowel, the mature worms lay very many eggs, which fall to the ground in the droppings. In suitably moist and warm conditions these eggs hatch, but otherwise they remain dormant for long periods. In about four days the young larvae that emerge develop into an infective stage, and, when eaten off the pasture with the grass to which they may be attached, they develop into mature worms again in the sheep. These infective larvae are exceptionally resistant to the influence of weather and to any attempts at eradication: a few of them remain alive in favourable conditions of warmth and moisture for periods of twelve months or more. Old pastures with a well-developed mat formation and long herbage provide favourable conditions for the dormant larvae. Short herbage is, paradoxically, quite as dangerous in that it causes the sheep to graze more continuously over a wider area and closer to the ground. Such herbage, moreover, may be insufficient to meet the nutritional needs of the sheep to maintain its resistance to infection.

Conditions for maximum hatching and infective larval development are generally present in systems of folding or penning sheep on roots and similar crops, where the period of four days between hatching and infective larval development must always be the guide as to how often to move the sheep off old and on to new portions of the root crop. *Sheep must not move over ground that they have grazed for three or more days previously.*

All sheep contain a certain number of worms, each one of which must have been taken up individually off the pasture, for they do not multiply in the sheep. Ill-health does not occur until this number has become greatly increased, or conversely, until the general resistance of the sheep has been lowered in some way, by poor quality, or shortage of, pasture. Adult sheep are usually resistant both to the establishment of large numbers of worms and to their ill-effects, one of which is to reduce the sheep's appetite, whereas lambs and growing sheep are particularly susceptible. The inclusion of small amounts of cobalt in any worm treatment can be recommended. Although a resistance to worms and their effects develops with age, this never remains constant, rendering the animal capable of resisting any number of worms under any and all circumstances. It is clear, therefore, that adult sheep are a ready means of infecting pastures with worm eggs, which in a minimum of four days after hatching become a potential danger to grazing lambs. Good husbandry dictates, therefore, that weaned lambs should not be put to graze on fields which have had adult sheep on them in the previous six to twelve months. Further, it calls for the pastures on which lambs are grazed to be of good nutritional value, with herbage that is not too long. Theoretically, it is possible to rear lambs free of infection and, by a system of rotational grazing, to keep them free subsequently. This may ultimately become a practical proposition, but until it does so, attention must be paid to available methods of treatment.

The most efficient anthelmintic is *phenothiazine* given in *full* doses, and at the right time and frequency. It must be remembered, however, that even phenothiazine has its limitations; for instance, it does not kill certain of the roundworms, particularly *Nematodirus*, against which new drugs are being sought. It is prudent, therefore, to pay attention to the pregnant ewe and so reduce the number of worm eggs she is likely to spread on the pasture to endanger her lambs. Treatment of the pregnant ewe with pheno-

thiazine three to four weeks before lambing can be recommended, and this can be repeated at intervals of four weeks, if necessary, until the lambs are weaned. The lambs should be dosed first when they are six weeks old and at intervals of one month afterwards, if necessary. This interval allows for the complete development of the worm to maturity, the only stage at which it is vulnerable to phenothiazine. Good nutrition, however, is a fundamental necessity in avoiding and overcoming serious trouble from worms.

*Fluke or Liver Rot*

Despite the valuable discovery of the anthelmintic properties of carbon tetrachloride and hexachlorethane in relation to the treatment of fluke-infested sheep, Fluke or Liver Rot still presents a major hazard to the well-being of sheep in certain years. It is important when attempting to control this disease to appreciate that, unlike the roundworms already mentioned (where infestation was direct from the contaminated pasture), the flat fluke-worm has a more complicated life history involving an intermediate host. Thus, the eggs laid by the mature fluke and passed out on to pasture with dung, hatch out a small fluke and that *must spend the next period of its life in a freshwater snail*. This is essential. In the snail it multiplies and develops through two or three stages before emerging to become infective to sheep and cattle. This is highly significant, for even granted that all sheep and cattle could be successfully rid of adult egg-laying flukes, rabbits would still enable the life cycle to continue, *but destruction of the snail sees the end of the fluke*. In recent years it has been recognized that sheep can be affected with what might be termed "acute" fluke or liver rot where massive infestation of the liver by young flukes has taken place and considerable haemorrhage and liver damage has resulted. In such cases death may occur relatively suddenly before the usual symptoms have had time to develop and the sheep may seem to be in good condition. Nor must one lose sight of the fact that the invasion of the liver by young flukes, and their subsequent migration through the liver tissue may hasten death from what is popularly known as *Black Disease*. Treatment must, therefore, be considered in the light of both acute and classic liver rot.

*Dosing*. Here it is of considerable importance to draw attention to certain features associated with carbon tetrachloride. It has always been rightly acknowledged to be a potential poison even in doses of 1 c.c. — the generally recommended dose — particularly when given to trough-fed (concentrate) sheep. Today, with the great improvement in the nutritive value of young leys these too must be regarded as a form of "concentrate feed", and dosing with carbon tetrachloride must be done when sheep are off concentrates, and off young leys. They should be kept from concentrates for a week afterwards. However, *hexachlorethane*, which is far less toxic, is now available and is equally as effective as carbon tetrachloride. But, because of the possibility that *acute* liver rot may occur, it must be pointed out that both drugs are ineffective in killing liver flukes that are not mature or approaching maturity, i.e., ten to twelve weeks old. In classic liver rot the flukes are always mature at the time true clinical symptoms and losses are evident, but in acute liver rot this is never so. What can be done in the case of acute liver rot?

Research work has proved that, by increasing the dose of carbon tetrachloride, it is possible to kill fluke worms when they are as young as six weeks old. It is found that in acute liver rot, disease is apparent when the flukes are as young as this. In general practice, therefore, treatment, first of a small group (six to ten animals), can be undertaken with 3, 5 or even 10 c.c. carbon tetrachloride *under very careful veterinary supervision*. If this is done without any ill effect, the rest of the flock may be dosed.

*Destruction of Snails*. The general shortcoming of both drugs gives additional reason for stressing the great need to concentrate attention on the snail in the control of liver rot. The snail haunts, generally limited in extent, should be sought and a suitable treatment with copper sulphate (bluestone) be applied from March to April in an attempt to reduce their numbers and, if possible, to eradicate them. If one is to see the end of liver rot, ditches should be kept clean, and wet swampy areas should be fenced off, in addition to the routine preventive treatment of sheep and the destruction of the snails.

## LOSSES FROM FOOT ROT AND OTHER CAUSES

Associated in no uncertain way with pasture, Foot Rot is another condition of tremendous economic importance in this country. The loss of meat alone through unthriftiness caused by foot rot must be substantial. There are two kinds of foot rot; the one benign and affecting only a few individuals, the other virulent and infectious. The latter form demands the particular attention of all shepherds, who if they are good shepherds, will treat all cases of lameness. It seems that the infection, although short-lived after leaving the grazing animal, is passed on to the pasture and remains alive for about two to three weeks at the most. This is exceedingly important knowledge, for it offers for the first time a possible means of control, based particularly on Australian observations but confirmed only in a very limited number of observations in this country. This calls for minute and detailed attention to the feet of every member of the flock and careful paring and treatment* with 10 per cent formalin in any observed case. It is important that this should be done on a concrete floor so that the infective parings can be swept up and burned. The apparently healthy sheep must be passed through a suitable foot bath (see Chapter VIII) containing a solution of 4 to 8 per cent copper sulphate, or 2 to 4 per cent formalin, after which the healthy flock should be returned to a clean pasture, i.e., one unoccupied by sheep in the previous two weeks. The affected but treated sheep should not be mixed with the clean flock until all lesions are healed. At the end of the week, the process should be repeated in the case of the affected sheep. Those then healthy should be returned to the clean pasture where they will remain reasonably free of infection but will still need careful observation. There are obvious difficulties in this procedure but, if it is practised thoroughly it has obvious advantages that may well outweigh the difficulties. In any case, there is no excuse for the lack of care of the feet of sheep, which, unfortunately, is so common. If, however, there are only a small number of sheep affected it is often better to destroy them in the interest of the rest of the flock.

* A 10 per cent tincture of chloromycetin is now available and high claims are made for its successful use in the treatment of Foot Rot.

*Scald*

The grazing of young, lush pastures has introduced another foot condition, sometimes mistaken for foot rot, which is known as Scald. Here the skin between the toes becomes inflamed and moist. Although troublesome, the condition is not infectious and the lesion is much milder. It is thought to be due to the effect of certain pasture plants, but proof of this is not yet available.

*Photosensitization*

Lastly, there is a condition sometimes seen in sheep at pasture or on rape which appears to be a form of photosensitization. It is thought that something in the pasture or rape sensitizes the skin of the head and ears, in particular, to the sun's rays. As a result, the head and other hairy parts of the body become intensely inflamed and rather swollen. The ears swell to twice their normal size and are so heavy that they remain pendulous. Later the tips shrivel up, die and drop off. If the sheep is caught early and placed in the dark for a day the trouble tends to subside. It is said that photosensitization may be caused occasionally by carbon tetrachloride and phenothiazine dosing.

This fairly comprehensive list of ailments of sheep indicates the diversity of their nature and apparent causes. Despite this, however, it is abundantly clear that one thing appears in common, namely, that by careful management, including the taking of certain specific preventive measures, the health of sheep and their productivity can be maintained at a high level. Emphasis must, therefore, be placed on good husbandry. With the knowledge now available of the various causes of ill-health and disease, flockmasters have the remedy in their own hands. Any losses that do occur should, however, be investigated as quickly as possible, *for it is only on the basis of an accurate diagnosis that suitable treatment can be based.* More co-operation between the farmer and the veterinary services is needed. Sheep mean so much to our agricultural economy that they deserve nothing but the best in our efforts to maintain their health.

# Appendix I

## GROWTH AND DEVELOPMENT OF MEAT QUALITY

The development of quality in fat sheep is a function of the reaction in the animal between heredity and the environment in which it lives. The researches of Hammond* and his colleagues have shown that the tissues of the body attain their maximum growth rates at different times and in a characteristic chronological sequence. Nerve and bone develop earliest and are followed by muscle and finally fat, which is the last tissue to be laid down in the body. The order of development is the same in all breeds of sheep, but in the improved mutton breeds the process is telescoped so that the sequence proceeds more rapidly and the development of the later-growing tissues, e.g., fat, is carried to a far greater extent than in unimproved breeds of sheep.

Corresponding with this growth sequence in the tissues of the body there are differential anatomical growth gradients characterized by rapid growth in the extremities of the body, i.e., head and legs, in early life, followed by waves of growth moving from the extremities towards the trunk and in particular towards the loin, which is the latest region of the body to grow and develop.

As a result of this rhythm of growth, the new-born lamb is well developed in the head and legs which consist largely of bone and nerve, but has a very small trunk; as it matures the body lengthens and deepens, growing at a greater rate than the extremities; the proportion of muscle and fat in relation to bone increases and the valuable joints, such as the shoulder, the back and the leg of mutton, increase in size and weight in relation to the less valuable parts, such as the head and shanks.

In such breeds as the Downs, whose meat-producing qualities have been much improved, the development of the back and the hindquarters takes place earlier and is carried to a far greater extent than in wild sheep, e.g., the Mouflon, in which the process ceases at a stage corresponding with the lamb at about three months old in one of the improved breeds. If animals from one of these improved breeds are liberally fed and kept until they are fully developed they tend to become over-fat, a condition unknown in primitive sheep. The rate and extent of these developments have been increased by breeding and selection, but, as Palsson and Verges† have shown, the development of the body is influenced also by the level of feeding at various stages throughout the development of the individual. They found for example, that animals of quite different body types were produced when different sequences of high and low planes of nutrition were imposed on animals of similar breeding. A low plane of nutrition throughout resulted in long-boned, shanky animals lacking in finish as well as in general depth of muscle and flesh; a high plane of nutrition in the early stages followed by a low one tended to produce a similar type; when a low plane of nutrition in the early stages was followed by a high one, and to an even greater extent

* Hammond, J. *Farm Animals; their breeding, growth and inheritance*, 2nd Ed., London, Arnold, 1952.

† Palsson, H., & Verges, J. B., *Effects of the plane of nutrition on growth and development of carcass quality in lambs*, J. Agric. Sci. **42**, 1–148, 1952.

when a high plane of nutrition was imposed throughout the period, animals with short, plump bodies, deep flesh and good development of muscle and of the later-maturing joints, such as the loin were produced.

These researches have opened up a new vista in the study of growth and development in meat animals and will no doubt lead to further discoveries. Already, valuable guidance has been afforded to the sheep farmer; thus it is clear that to produce early fat lamb under six months old to greatest advantage it is necessary to provide a high level of nutrition throughout the life of the lamb, both pre-natal and post-natal. It explains too why lambs which genetically are small framed, e.g., Southdown crosses, will on that account mature more quickly and on a somewhat lower level of feeding than long-legged, rangy breeds. Whether the rangy breed would produce a blockier type of lamb if only moderately nourished in the early stages — thereby limiting skeletal growth — and well fed later to promote fattening, is an interesting point about which the evidence is not conclusive. At any rate it is clear that, to produce high-quality fat lambs it is necessary not only to breed sheep of a suitable type but to feed them appropriately; in the case of fat lambs, to feed them well at all stages, and, with hoggs and hoggets, to see that nutrition in early life is adequate and the store period (if there is one) is neither too long nor too lean.

# Appendix II

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HERDWICK SHEEP BREEDERS'ASSOCIATION
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LONK SHEEP BREEDERS' ASSOCIATION
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SOUTH DEVON FLOCK BOOK ASSOCIATION
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SOUTHDOWN SHEEP SOCIETY
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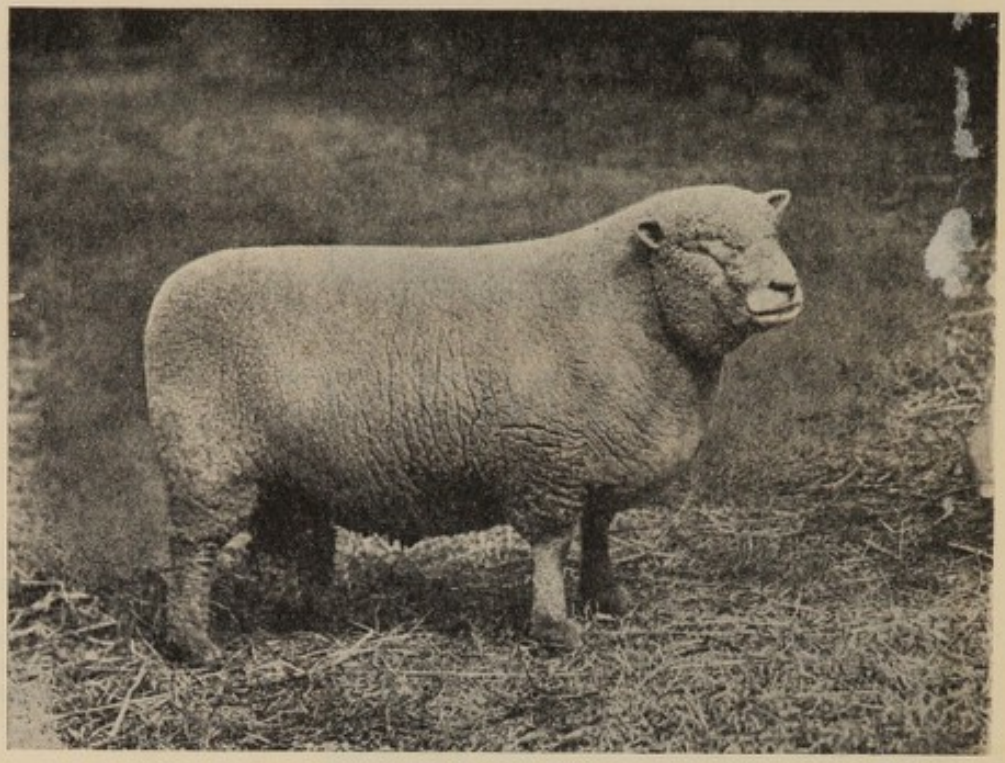

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