SHEEP HUSBANDRY IN ATLANTIC CANADA

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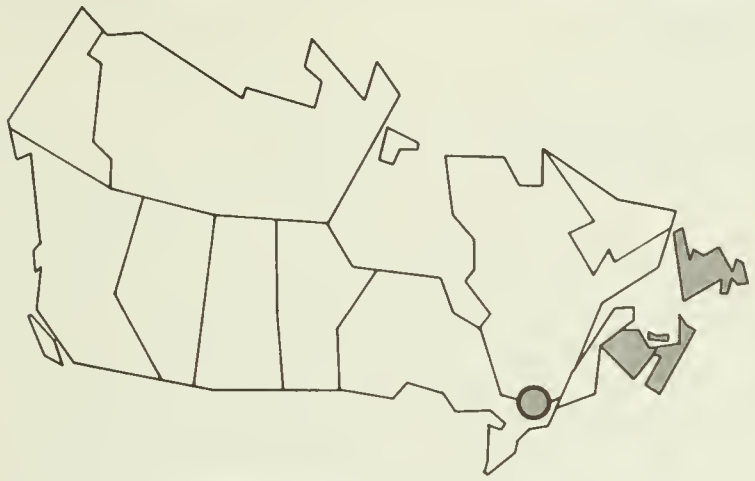

CANADA

NEW BRUNSWICK
NEWFOUNDLAND
NOVA SCOTIA
PRINCE EDWARD ISLAND

SHEEP HUSBANDRY IN ATLANTIC CANADA

Contributors

F. A. STEWART, (chairman), Livestock Division, Agriculture Canada, Moncton, N B
R. J. CURTIS, New Brunswick Dept. of Agriculture and Rural Development.
M. M. GREENING, Newfoundland Dept. of Forestry and Agriculture.
W G MATHEWSON, Nova Scotia Agricultural College
R. PERRIN, Prince Edward Island Dept. of Agriculture and Forestry.
P B. STEAD, Nova Scotia Dept. of Agriculture and Marketing
Dr. J. W. G. NICHOLSON, Agriculture Canada, Fredericton, N.B.
JAMES ADAMS, Nova Scotia Agricultural College
Dr. L. B NETTLETON, DVM, Truro, Nova Scotia

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INTRODUCTION

Sheep should play a more important part in Atlantic Canada's agriculture than is now the case. Indeed, conditions indicate that sheep production should be a more important part of agriculture here than in the rest of Canada because of the ability of the Atlantic region to produce excellent pasture year after year and because features such as stoniness, uneven topography and remoteness from market, which hinder many other forms of agriculture, are lesser impediments to sheep raising. For example, a degree of stoniness may reduce foot rot in sheep, and a remote location may offer greater freedom from predatory animals. This is not to say that sheep do better on poor land than on good; however, certain factors which make land economically unsuitable for cash crop farming or dairying, for example, may have a lesser effect on sheep. The Atlantic region's distinctive ability to produce good pasture should not imply a hidebound adherence to an extensive system of husbandry; good possibilities also exist for more intensive systems.

At Confederation in 1867, there were some 800,000 sheep and lambs in the Maritime Provinces; today there are about 55,000 on ''census'' farms in these provinces, with another 9,000 in Newfoundland. Reasons for the decline may be surmised rather than stated as fact. However, the trends away from self-sufficiency and towards specialization and urban living have probably been the main factors. The decline in sheep numbers has been accelerated recently by an increasing and largely uncontrolled dog population and by the greater cost of fencing sheep as compared with cattle.

Despite an encouraging trend towards larger flocks, mean flock size in the Atlantic Provinces is below the Canadian mean of 61 sheep and lambs (1971). The value of sheep and wool sold represents only 0.5% of the value of all farm products in the Atlantic region but this proportion rises to over 5% in certain counties of Cape Breton Island. Fewer sheep flocks are found on high-output farms (measured in value terms) than on those achieving more modest outputs.

These facts considered alone seem to indicate a depressed industry, but there are encouraging signs of renewed interest and an upturn in production. Mean flock size is increasing; total numbers have ceased to fall and the 1970 and 1975 importations of breeding stock into Nova Scotia have created widespread interest and some increased participation. A new abattoir, specifically designed for sheep slaughter, has been built in Nova Scotia. The three Maritime Provinces have effective producer associations and substantial government assistance, both advisory and financial, is available. In Newfoundland, the provincial government is also active in industry promotion. Home- and station-testing Record of Performance programs have been established.

Last but not least, lamb and, to a lesser extent, wool prices have improved substantially and the probability is that enhanced prices may be expected for the next few years. In sum, these things indicate a revitalized industry.

ESTABLISHING A FLOCK

Before becoming involved in sheep raising, every prospective flock owner should consider the following factors: his experience in the business, the type of farm available, the condition of the land and buildings, and availability and cost of breeding stock. Other considerations are climatic conditions, availability of markets and, probably the most important, what type or breed of sheep is best suited to conditions.

Too many people have been lured into sheep production by claims concerning the ease with which sheep can be raised. A successful operation depends upon the ability of the owner to master production techniques. The novice should start out with a small flock. After he has acquired experience and has mastered production methods, he can increase the size of the flock so that it provides a major source of income.

As a general rule, a beginner is advised to buy commercial ewes rather than purebreds. Grades are more easily obtained, less expensive, and involve less financial risk. When experience has been gained the individual can replace his flock with more expensive purebreds, if desired.

Commercial flock on good pasture

Most commercial sheep raisers hope to produce market lambs of good quality weighing 36 to 45 kg (80 to 100 lb) at 5 months of age. Because a certain percentage of the annual income from the flock is from the sale of wool, the weight of fleece produced should be considered. Open-faced sheep are more popular than those with wool on their face and legs because they are easier to shear and are free of wool blindness.

Good breeding ewes are usually difficult to locate. The owner of such sheep is not willing to sell them unless he has a surplus or is planning to go out of the business.

Generally speaking, trade in sheep is confined to the fall months. Sheepmen who have fed their flocks all winter are not likely to sell them until the lamb crop has been sold. In the fall the lambs are sold and the sheepman then culls his flock, discarding the poor producers. Because of this, the novice should take great care when buying aged ewes.

SELECTING EWES

The following suggestions may be useful when buying foundation ewes:

- Select a breed that will best suit your farm conditions. If the land is rough and the vegetation is less than good, the hardier breeds such as North Country Cheviot or Blackface should be considered.
- If possible, select a breed that is popular in your area. This ensures the beginner of a more abundant and more uniform supply of foundation stock.
- Remember that a ewe is at her peak of production between 3 and 5 years of age. If such ewes are available and have sound mouths and udders, they are likely to be the best buy.
- In many cases older ewes are available at lower prices. A prospective buyer should check the mouth, udder, and general condition of these sheep to be sure they are sound and likely to produce at least one more lamb crop.
- Ewe lambs are the main source of breeding stock. Well-developed ewe lambs may be bred in the fall or winter of the year in which they were born. The first lamb crop will not be as large as that from a similar number of mature ewes.

When choosing stock, be sure to do the following:

- Check the mouth to determine the age of the ewe and to see if the lower teeth and the upper pad meet correctly. Sheep may have ''undershot'' or ''overshot'' lower jaws, which are undesirable, inherited traits.
- Check the udder to make sure there are no physical defects or damage caused by mastitis. If there is mastitis damage the udder will feel hard or lumpy.
- Check the feet to make sure they are not infected with foot rot. The disease is quite common in the Atlantic area and can cause great damage if infected animals are left untreated.
- Examine sheep for external parasites. This is not a serious problem, but a buyer should be aware of it and treat infested sheep.
- Stand back and take a good look at the animals you are about to purchase. Are they the breed you want? Have they got the correct conformation? Are they big enough for their age?
- Check the wool for quality, length of fiber, density and crimp.
- Ask the owner for any production information, such as Record of Performance (R.O.P.) test data, that he has on the ewes.
- When the novice is selecting breeding animals, he should ask the advice of an experienced sheepman before making a final decision.

North Country Cheviot ewe and twin lambs

SELECTING RAMS

Generally, the selection of a ram is easier than that of a ewe. A tested, purebred ram should be the first choice of both purebred and commercial producers. The fastest way to improve the desirable qualities of market lambs is through the use of good sires.

When selecting a ram, the following points should be considered:

- Size of the ewe flock. A well-grown ram lamb is capable of breeding 20 to 25 ewes. A yearling or mature ram can service 40 to 50 ewes.
- General appearance. The ram should be large, have good feet and legs, and a strong, wide top line. A breeder ram should not be overly fat; a large frame and good bones are more important than weight alone.
- Check the mouth to make sure there are no problems that could affect eating.
- Check to make sure both testicles are intact and normal in size.
- Check fleece for quality and density of wool.
- If purchasing an aged ram, look at some of his offspring so that you can evaluate his performance. Obtain any R.O.P. data that may be available on the ram or his progeny.
- When purchasing a ram lamb, evaluate his size and weight in relation to his age. Obtain any R.O.P. data available and evaluate his performance relative to others in the test group. Look at the sire and dam of the lamb. It is advisable to buy a twin ram. Twinning is not highly heritable, but with continuous selection it is possible to increase lambing percentage.

RECORD OF PERFORMANCE

In the previous section R.O.P. data was mentioned. The R.O.P. testing program enables the performance of rams and ewes in the breeding flock to be evaluated.

R.O.P. testing is a very important tool in the selection of rams and involves placing ram lambs on a feeding trial for a 50-day period. Over this period, weight gains are recorded and at the completion of the test the average daily gain and adjusted final test weight are calculated.

It has been proven that weight-gaining ability is highly heritable (50-60%). This means that high-performing rams are likely to pass this characteristic to their offspring. The use of such rams will yield increased rate of gain in market lambs and so decrease the number of days to market.

In many cases the mature ram also will have sons that have been tested. If we use a high-testing, mature ram with a record of high-testing offspring, we can be more confident that this ram will again produce fast-gaining market lambs in the future.

It is important that producers keep a good set of flock-performance records. These are necessary to evaluate the performance of the breeding stock as an aid in culling and in deciding which ewe lambs to retain for breeding.

By identifying the superior animals in a breed or flock, R.O.P. testing plays an important role in a breeding program.

BREEDS

In the Atlantic Provinces, sheep breeds are commonly classified as sire and dam breeds.

The sire breeds are kept mainly for their rapid growth, early finishing and desirable meat and carcass qualities. These breeds include the Suffolk, Hampshire, Shropshire and Oxford. They are not as hardy or thrifty as the dam breeds, which include North Country Cheviot, Leicester, Scottish Blackface and crossbred ewes containing varying percentages of these breeds. Ewes of the dam breeds are noted for their milking and mothering ability and will maintain acceptable lambing percentages even when kept on marginal land. In many instances ewes of these breeds are used in crossbreeding programs with sire-breed rams to produce offspring that combine the good characteristics of the two breeds used.

Crossbred ewes, North Country Cheviot X Leicester

In Atlantic Canada, there are also several breeds that are maintained for special reasons; these include Dorset, Kerry Hill, Clun Forest, Hexham Leicester and Finnish Landrace.

Regardless of the breed kept, every sheep producer should strive to produce animals that are best suited to his breeding, feeding and management program, and to local environmental conditions.

SUFFOLK

The Suffolk was developed in England by breeding Norfolk Horn ewes to Southdown rams. Hampshires may have been used later to add size. Suffolks outnumber other sheep breeds in Canada. In the Atlantic region, the breed is adapted to farm flock production and is popular for crossbreeding programs and production of market lambs.

Breed description:

- large size; rams weigh 110 to 135 kg (250 to 300 lb), ewes 80 to 100 kg (175 to 225 lb)
- bare head; black face; bare, black legs
- rams, ewes polled
- fleece: ⅜ Staple, weight 2.2 to 3.6 kg (5 to 8 lb); black fibers may be present

Advantages:

- growth rate
- aggressive breeders
- prolificacy
- milking ability
- carcass quality

Disadvantages:

- unthrifty on sparse pasture
- lambs may lack vigor at birth

HAMPSHIRE

The Hampshire, a popular sire breed, was developed in south-central England by breeding native ewes to Southdown and Cotswold rams. The Hampshire is used for crossbreeding purposes to produce market lambs.

Breed description:

- large size; rams weigh 110 to 135 kg (250 to 300 lb), ewes 80 to 100 kg (175 to 225 lb)
- black face, some wool on top of head and jaws, wool on legs
- rams, ewes polled
- fleece: medium quality, ⅜ Staple, weight 2.7 to 3.6 kg (6 to 8 lb)

Advantages:

- growth rate
- adaptable to farm flock production
- prolificacy
- milking ability
- carcass quality

Disadvantages:

- not adapted to sparse pasture
- large head and shoulders may cause lambing problems with small ewes
- some wool on face and legs

OXFORD

This breed originated in south-central England where it was developed by using Hampshire and Cotswold crosses and selection for size and productivity. The introduction of new breeds has resulted in a decline in the popularity of the Oxford in the Atlantic region, where it was once a favorite of sheepmen.

Breed description:

- large size; rams weigh 90 to 135 kg (200 to 300 lb), ewes 80 to 90 kg (175 to 200 lb)
- dark brown to gray face; wooled legs and head
- rams, ewes polled
- fleece: ⅜ Staple, weight 3.6 to 4.5 kg (8 to 10 lb)

Advantages:

- growth rate
- prolificacy
- milking ability

Disadvantages:

- lambs are slow finishing
- wooled face may cause wool blindness

CORRIEDALE

This breed originated in New Zealand for lamb and wool production and is the product of Lincoln and Merino crosses. Corriedales are not popular in the Atlantic region, but are used elsewhere in Canada to develop hybrid white-faced ewes in a three-way crossing program.

Breed description:

- intermediate to large in size; rams weigh 100 to 125 kg (225 to 275 lb), ewes 68 to 80 kg (150 to 175 lb)
- white face; wooled legs
- rams, ewes polled
- fleece: medium length, ⅜ Staple, weight 4.5 to 6.8 kg (10 to 15 lb)

Advantages:

- heavy fleece
- flocking ability (tendency to flock together)
- crosses well with sire breeds to produce market lambs

Disadvantages:

- slow to reach market finish
- only fair prolificacy and milking ability

DORSET

The Dorset originated in southern England as a horned breed named the Dorset Horn. In 1948 a polled mutation occurred in the breed and from it the Polled Dorset was developed. At present the polled type overshadows the Dorest Horn in popularity in the Atlantic provinces.

Breed description:

- medium size; rams weigh 80 to 100 kg (175 to 225 lb), ewes 55 to 72 kg (125 to 160 lb)
- white face, wooled legs
- rams and ewes: polled, scurred or horned
- fleece: ⅜ Staple, weight 2.7 to 3.6 kg (6 to 8 lb)

Advantages:

- length of breeding season
- can produce more than one lamb crop each year
- milking ability
- useful in crossbreeding programs to increase length of breeding season
- Dorset-cross ewes produce a fleece free of black fibers
- suited to production of early lambs

Disadvantages:

- prolificacy is not as high as desired in Atlantic region
- foot problems seem to be more serious in this breed
- needs more size for crossbreeding purposes

NORTH COUNTRY CHEVIOT

This breed, developed in northern Scotland, is noted for its hardiness and maternal instinct.

Breed description:

- medium size; rams weigh 100 to 115 kg (225 to 250 lb), ewes 68 to 90 kg (150 to 200 lb)
- white face, bare head and legs
- rams, ewes polled
- fleece: ⅜ Staple, weight 2.7 to 3.6 kg (6 to 8 lb)

Advantages:

- hardiness, vitality
- bare head and legs
- well suited to crossbreeding programs to produce market lambs
- prolificacy
- maternal instinct

Disadvantages:

- lambs finish slowly
- nervousness in some strains
- need for new bloodlines in Atlantic area

LEICESTER

Leicesters were used extensively to develop new breeds of sheep and their blood is found in many of our sire breeds today. In Canada the name ''Leicester'' generally presupposes the Border type but there has been some admixture of English Leicester breeding. However, there is no flock-book differentiation except in the case of the Hexham Leicester, of which individual animals were imported into Nova Scotia in 1970.

Breed description:

- medium size; rams weigh 100 to 125 kg (225 to 275 lb), ewes 88 to 100 kg (175 to 225 lb)
- white face, clean legs and head
- rams, ewes polled
- fleece: low ¼ or coarse, weight 3.6 to 5.4 kg (8 to 12 lb); long, open fleece

Advantages:

- crossing ability to produce good half-bred ewes
- mothering ability
- prolificacy
- milk production

Disadvantages:

- lack of hardiness
- open fleece
- slow finishing
- scarcity of good stock in Atlantic Canada

In Nova Scotia, Leicesters have been crossed with North Country Cheviots to produce Scotia half-bred ewes. These are hardy, good mothers and produce well.

SCOTTISH BLACKFACE

Originating in the highlands of Scotland, this breed has also become popular in low, grassland areas where it is used in crossbreeding programs. Blackfaces are being used with Hexham Leicester rams in crossbreeding programs. Many are also being bred as purebreds. The breed could be very useful for an extensive sheep production system on rough land.

Breed description:

- small size; rams weigh 68 to 90 kg (150 to 200 lb) ewes 45 to 60 kg (100 to 130 lb)
- black mottled to gray face, bare head and legs
- rams, ewes horned
- fleece: long, coarse, weight 2.2 to 2.7 kg (5 to 6 lb)

Advantages:

- very hardy under harsh conditions
- performs well on sparse grazing
- vitality of newborn lambs
- excellent mothering ability
- crossing ability to produce good half-bred ewes
- milking ability

Disadvantages:

- coarse wool
- slow finishing to market
- inadequate muscling of lamb carcasses

SHROPSHIRE

The Shropshire, developed in England, contains Cotswold, Leicester and Southdown blood. It is noted for its combination of wool and mutton qualities. Recent selection emphasis has been on size, openness of face, and carcass quality.

Breed description:

- medium size; rams weigh 90 to 100 kg (200 to 225 lb), ewes 72 to 80 kg (160 to 180 lb)
- dark face, wool on legs and top of head

- rams, ewes polled
- fleece: ⅜ Staple, weight 3.2 to 4.0 kg (7 to 9 lb)

Advantages:

- prolificacy
- early maturing
- meaty lamb carcass
- lambs marketed at light weights
- crossing ability
- adapted to wide range of climatic conditions

Disadvantages:

- dense covering of wool over legs and face in some strains
- lambs overfinished if marketed at heavy weights
- need to add size

FINNISH LANDRACE (Finnsheep)

This breed is native to Finland where it has been developed under conditions of rugged climate and scant feeding. Finnsheep are well below acceptable standards for fleece production, growth rate and carcass quality. Through crossbreeding it is hoped that the multiple birth characteristic of Finnsheep can be transferred to a good commercial crossbred ewe.

Breed description:

- small size; rams weigh 72 to 80 kg (160 to 180 lb), ewes 55 to 63 kg (120 to 140 lb)
- white face, bare legs and face
- rams, ewes polled
- fleece: long, lacks density, weight 1.8 to 2.2 kg (4 to 5 lb)

Advantages:

- prolificacy (3 or 4 lambs/lambing)
- early estrus
- longer breeding season
- shorter gestation period

Disadvantages:

- light fleece
- slow growth rate
- low carcass quality
- small size

CLUN FOREST

The Clun Forest is a dual-purpose breed, used either as the ewe breed or the sire breed in the production of market lambs. It has enjoyed a spectacular rise in popularity in Great Britain during the past few years.

Breed description:

- medium size; rams weigh 80 to 100 kg (175 to 225 lb), ewes 68 to 80 kg (150 to 175 lb)
- brown face, bare legs and face
- rams, ewes polled
- fleece: medium length and density, weight 2.7 to 3.6 kg (6 to 8 lb)

Advantages:

- adaptability to wide range of climatic conditons
- prolificacy
- mothering ability
- use as dam lines and for market lamb produciton

Disadvantages:

- suitability for crossbreeding is not clearly defined
- scarcity of breeding stock

BREEDING

THE EWE

The ewe undergoes more or less regularly recurring estrus at intervals of 16 to 17 days during the autumn and winter months.

Wild sheep tend to lamb in the spring, when environmental conditions are most favorable for the newborn, and they also have a short breeding season.

Domestication and selection have resulted in marked variations between breeds in the length of the breeding season. In addition, there are tendencies within breeds for the ewes that breed earliest in one year to breed earliest in other years. These ewes also tend to be the last to stop cycling if there is no ram present.

There is potential for extending the breeding season through selection. Ovulation rate and lambing percentage are normally higher in early and mid-season than towards the end of the breeding season, thus more twins are born early than late. This may be due partly to deterioration of pasture in late fall.

A number of factors other than those brought about by selection also influence the basic reproductive pattern. The most important of these is light. In the Atlantic region the onset of estrus occurs after the days begin to shorten. By using lightproof buildings it has been shown that an artificial decrease in the day length, either sudden or gradual, will induce estrus in ewes. Just how light influences estrus is not fully understood.

Temperature also has an effect on breeding. It is a common observation among flock owners that the start of breeding activity tends to be earlier in years of early fall frosts than in years of mild, open fall weather. Moreover, it has been found that late shearing delays estrus significantly.

Nutrition plays a vitally important part in the growth of ewe lambs and through this on the proportion of the lambs that will breed during the first autumn. With mature ewes, the level of nutrition is the major factor influencing the ovulation rate and, consequently, the lambing percentage. Very inadequate nutrition can increase markedly the proportion of barren ewes.

There is a steady rise in the average number of lambs per lambing in all breeds until ewes are 5 years old, the number decreasing gradually thereafter. Relatively fewer ewe lambs will breed than will older ewes and of those that do, the conception rate is lower. At the other end of the age scale, knowledge is less certain because most flock owners dispose of their aged ewes before natural death. Though there is certainly decreased reproductive performance after 5 or 6 years, there is probably a sharper decrease in milking ability and thus in the growth rate of lambs of aged ewes.

Introduction of a ram hastens the onset of estrus and flock owners in other countries find this of sufficient importance to warrant keeping one or more vasectomized rams for this purpose alone. However, this effect is associated with the ram's introduction among ewes that have not yet ovulated, such ewes tending to show heat about 22 days after the ram's introduction. Ewes already cycling are unaffected. On the other hand, keeping a ram with the ewes throughout the year has no such stimulatory effect and may even retard breeding.

Hormones may be used (in Canada, for approved experimental purposes only at present) to advance the natural breeding season, to induce earlier re-breeding, to synchronize estrus and/or to increase lambing percentage. Treatment is more effective with ewes that are approaching the breeding season than with these that are not cycling. Suckling tends to inhibit estrus, although it is not wholly clear whether this is the result of the lactation itself or the lamb's presence. Synchronization increases the number of rams required since more ewes come into heat on any one day. Treatments that combine light control and the use of hormones have generally been more effective than either measure used alone.

THE RAM

Recent work has shown that there is also considerable seasonal variation in fertility and sexual activity in the ram. In particular it is known that the scrotal size (circumference) in rams varies seasonally and is greatest in the fall. If, as seems justifiable, it is accepted that size and sperm-producing activity go together, then it is clear that the ram is both most active and most fertile at the same time that ewes are cycling. Very possibly the same factors such as light, temperature, and nutrition which stimulate the ewe also act on the ram. In the ram's case, it is unlikely that complete sexual inactivity ever normally occurs even in summer. However, differences in rams' activity and fertility do occur both between breeds and between individuals within a breed.

INHERITANCE

Every lamb is born as the result of the fusion at conception of one sperm and one ovum, followed by a period of about 147 days of development in the dam's uterus. Thus the lamb's genetic makeup (genotype) is determined at conception and subsequent environmental influences such as the dam's uterine capacity and milking ability, the lamb's own feeding, health, management, etc. are superimposed on this genotype to determine the individual's performance and productivity. The same concept applies also on a flock basis.

In any flock, there is variation among individuals in all traits. Some of this is genetic in origin; some is induced environmentally. The term ''heritability'' is used to denote the proportion of total variation which is passed on from one generation to the next. Heritability differs from trait to trait. For example, blood type is wholly heritable and not at all influenced by

environment, whereas longevity is largely environmentally controlled. So many things can happen to a ewe in a lifetime that her continuance to a ripe old age is heavily dependent on such things as freedom from accident or disease, which are environmental in nature. Among traits of economic importance, prolificacy rates low in heritability, weaning weight moderately so, while most fleece characteristics are quite highly heritable.

The higher the heritability of a particular trait, the more responsive it is to selection. Selection is the means by which flock performance is improved, and the rate at which improvement can be made is dependent on the superiority of the selected animals and the heritability of the traits in question. Improvement in any one trait is hastened when selection is made for this trait alone; retarded when, as is more customarily the case, other traits also must be considered.

In a practical sense, selection is best made on the basis of individual performance and of the performance of related animals.

An example may assist in understanding the principles involved. Suppose that twin ewes and a twin ram are kept from a flock with a lambing percentage of 100. Knowledge that the heritability of prolificacy is only about 5% would lead to the expectation that under similar management and at ages comparable to the original flock, progeny of these selected individuals would achieve lambing percentage levels of about 105%. Progress in this case would be slow but should not be ignored. By the same token, progress in improving fleece weight (estimated heritability of 60%) could be made much more quickly, but, depending on the relative prices of lamb and wool, might be no more rewarding financially.

BREEDING SYSTEMS

Crossbreeding is customarily carried out to combine the qualities of two or more breeds and to obtain the benefit of hybrid vigor or heterosis. Heterosis is the superiority of crossbred animals over the mean of the parent breeds for a trait. To use an example, at comparable weaning age North Country Cheviot, Border Leicester and Half-bred (Border Leicester X North Country Cheviot) lambs in the Nova Scotia Agricultural College flock in 1972 had mean weights of 29.9 kg (66 lb), 25.8 kg (57 lb) and 32.2 kg (71 lb) respectively. The amount of heterosis occurring in this case may be calculated as follows:

$$\frac{32.2-(29.9+25.8)/2}{(29.9+25.8)/2} \quad \frac{71-(66+57)/2}{(66+57)/2} = 0.15 \text{ or } 15\%$$

This example is given to illustrate the method of measuring heterosis and should not be taken to indicate relative breed merit since numbers were small. Further, the amount of heterosis found in a particular cross will depend not only on the breeds used but on the individual animals used and on management. In general terms, it may be expected that heterosis may amount to 0 to 5% of the parental mean for mature body measurements, 5 to 10% for growth rate and 10 to 15% for fertility. Recent data from the Canada Department of Agriculture Research Station at Lennoxville, Que., showed that in a comparison of purebred Suffolk, Oxford and Cheviot ewes and of 2- and 3-breed crosses, the latter ewes produced 9% and 17% more multiple births than the average of the parent breeds. At Lethbridge, Alta., in comparing lambs of the Romnelet, Columbia, North Country Cheviot and Suffolk breeds and their crosses in terms of weaning weight, final market weight, total feedlot gain and weight per day of age, it was found that single crosses had a 4 to 5% superiority in the four traits measured over the pure breed means while 3-breed crosses had 7 to 18% superiority. However, of 12 possible single crosses only one or two outperformed lambs of the top-performing pure breed.

In general, the more dissimilar the parental breeds, the greater the amount of heterosis produced by crossing. Heterosis tends also to be greatest in traits involving vigor and fitness. Reproductive characteristics are heavily dependent on fitness; thus traits such as prolificacy which are among the least heritable are among the most responsive to heterosis produced through crossbreeding. This is fortunate, since it gives the sheepman a second approach to the improvement of prolificacy (the first being through better feeding and management).

Grey face ewes, and lambs sired by Suffolk rams

Previous discussion has shown that heterosis is maximized in a 3-breed cross. This normally implies running a ram of a third breed with first-cross ewes; for example, the use of a Down ram on Greyface (Hexham Leicester x Scottish Blackface) or Half-bred (Border Leicester x North Country Cheviot) ewes. In these crosses the maternal qualities of hardiness, prolificacy, milking and mothering ability are combined in the dams; carcass quality and rate of gain being contributed by the sire. The use of a sire of a prolific milking breed on meat-type ewes where the progeny are destined for slaughter would clearly be irrational.

If selection is the sheepman's first tool in making genetic progress, then his breeding system is a natural second. Systems can be listed under five headings:

Inbreeding
Linebreeding
Random mating
Outcrossing
Crossbreeding

Inbreeding and linebreeding involve the breeding of related animals. Parental relationship increases the likelihood that lambs will inherit the same genes from both sire and dam. Relationship between two animals measures the probability of genetic likeness; hence its use in predicting the probable merit of an animal with no performance record if there is a closely related animal whose performance is known. Linebreeding is a form of inbreeding differing only in degree, in which an attempt is made to retain relationship to an outstanding ancestor.

When we talk of ''common blood,' we refer to the genetic similarity between related animals. What the lamb does inherit is not its dam's blood (much less its sire's) but from both parents the genes which determine blood type, conformation and performance characteristics. On the other hand, relationship can be measured. For example, parent and offspring are 50% related as also are full-sibs (full brothers or sisters). Half-sibs are 25% related. Except in the case of identical twins or if the parents of full-sibs are themselves related, no two animals are likely to have a relationship greater than 50%.

The effects of inbreeding are: 1) to increase uniformity and prepotency *within* inbred lines, and 2) to increase differences *between* inbred lines. It concentrates undesirable as well as desirable genes that may be present in the parent stock and thus often necessitates simultaneous heavy culling. Inbreeding is best used only in large top-quality flocks in knowledgeable hands.

Random mating implies absence of genetic improvement and has nothing to recommend it for commercial production.

Outcrossing is the system preferred by most owners of small purebred flocks. It involves the use of rams unrelated to the ewes and is a safe system, less likely to result in the appearance of undesirable characteristics than when inbreeding is used. Outcrossing may also create a small degree of heterosis.

Crossbreeding has already been discussed and is the system of choice for the commercial producer.

Whatever breed or breeding system is chosen, genetic improvement can only be made by understanding selection, and breeding according to planned objectives. Careful assessment of individual and flock performance is time well spent. The use of records is a necessary part of sheep raising in all but the smallest flocks.

NUTRITION

The ability of sheep to obtain 80% or more of their nutrient requirements from locally produced forage places the sheep industry in an enviable position in the Atlantic region. Emphasis should be placed on forage programs in this region of productive pastures. However, there are times in the reproductive cycle of sheep when grain feeding will pay in terms of increased production. Grain feeding should be considered at breeding, late pregnancy and during lactation.

FORAGE PROGRAM

If forage is to provide most of the nutrients for sheep, it must be of high quality for most of the year, although it is not essential for ewes in the 2 weeks after weaning, before breeding, and for the first 3 months of gestation when the ewes' energy requirements are at a minimum. However, the feeding level must be high enough at other times to allow the ewes to maintain body condition from year to year.

Legume or mixed hays, corn silage, grass silage and high-quality pasture are excellent sources of nutrients for sheep. Forages containing a high proportion of legumes are good sources of protein, calcium, and carotene. Early cutting is essential to obtain good-quality hay or grass silage. Wilting grass for silage will increase the amount of dry matter consumed daily when this is the only feed offered. During the last month of pregnancy, ewes will eat less silage than hay, and supplementation with dry feed may be desirable during this period.

The most economical source of forage is pasture. Highly productive, minimum acreage pastures reduce

the cost of fencing, but may increase the difficulty of controlling internal parasites (worms). Annual rotation of grazing land is desirable to minimize parasitic infestation. Grasses or grass-legume mixtures are preferred over pure stands of legume because of the risk of bloat. Grazing cattle and sheep together makes efficient use of all available forage as each will eat herbage left by the other. Rape, kale and fall rye may be used to supplement and extend pasture feeding.

THE BREEDING FLOCK

A well-fed, healthy ram is essential for successful breeding. Rams should not be allowed to become too fat or paunchy between breeding seasons. They should be separated from the ewes at the end of the breeding period. During the winter feeding period mature rams will require only a light feeding of grain in addition to all the roughage they will consume. Young, growing rams may require more grain and protein supplement depending upon the quality of the roughage available. The nutrient requirements of rams of several body weights are shown in Table 1.

Good pasture should be provided in the summer and about 460 g (I lb) of grain should be fed daily starting a few weeks before the breeding season. A mixture of equal parts of cobalt-iodized salt and dicalcium phosphate should be available free choice in boxes protected from rain. During the winter feeding period, a vitamin-mineral mixture is recommended if vitamins A and D are not added to the grain being fed. Exercise is important for rams and the pens should be adjacent to the yard. To minimize fighting it may be necessary to restrict space initially when rams are penned together.

The practice of putting ewes on excellent pasture or feeding 230 to 460 g (0.5 to 1.0 lb) of grain daily at breeding time is called *flushing*. It has been proven to increase the proportion of twins or triplets if the ewes are in poor condition prior to breeding. If the ewes are already in good condition, there will be little benefit from flushing. Flushing should begin at least 2 weeks before the ram is turned out with the ewes and it should be continued through the breeding season. Grain or clean grass aftermath may be used but red clover should be avoided as its estrogen content may cause infertility.

Pregnant ewes will consume an adequate amount of average to good quality hay or silage to meet their energy needs for the first 15 weeks of pregnancy. This should be supplemented with a mineral fed free choice. During the last 6 weeks of pregnancy, the forage should be supplemented with up to 460 g (1 lb) of grain daily. The amount of grain and its protein content should be varied according to the quality of the forage and the condition of the sheep.

TABLE 1. NUTRIENT REQUIREMENTS OF SHEEP IN PERCENTAGE OF TOTAL RATION (BASED ON AIR-DRY FEED CONTAINING 90% DRY MATTER)[1]

Daily feed		Percentage of ration				
Body wt (kg)[2]	Daily gain or loss (g)[3]	Per animal (kg)	TDN (%)	Protein (%)	Ca (%)	P (%)
EWES						
Nonlactating and first 15 weeks of gestation						
45	32	1.2	50	8.0	0.27	0.21
54	32	1.4	50	8.0	0.24	0.19
64	32	1.5	50	8.0	0.22	0.17
73	32	1.7	50	8.0	0.20	0.16
Last 6 weeks of gestation						
45	168	1.7	52	8.4	0.24	0.18
54	168	1.9	52	8.2	0.23	0.17
64	168	2.1	52	8.0	0.22	0.16
73	168	2.2	52	7.8	0.22	0.16
Last 8-10 weeks of gestation						
45	−36	2.1	59	8.7	0.30	0.22
54	−36	2.3	58	8.4	0.28	0.21
64	−36	2.5	56	8.0	0.27	0.20
73	−36	2.6	55	8.0	0.27	0.20
Last 12-14 weeks of lactation						
45	32	1.7	52	8.4	0.26	0.20
54	32	1.9	52	8.2	0.25	0.19
64	32	2.1	52	8.0	0.24	0.18
73	32	2.2	52	7.8	0.24	0.18
Replacement lambs and yearlings						
27	136	1.2	55	11.0	0.21	0.19
36	91	1.4	50	8.7	0.20	0.18
45	64	1.5	50	7.6	0.20	0.18
54	32	1.5	50	7.0	0.20	0.18
RAMS						
Lambs and yearlings						
36	181	1.4	62	10.0	0.20	0.18
45	136	1.7	57	8.6	0.18	0.16
51	91	1.9	50	7.6	0.17	0.15
64	45	2.1	50	6.9	0.16	0.14
73	45	2.2	50	6.6	0.15	0.14
LAMBS						
Fattening						
27	159	1.2	55	12.0	0.23	0.21
32	181	1.1	55	11.0	0.21	0.18
36	204	1.5	62	10.7	0.19	0.18
41	201	1.7	62	9.5	0.18	0.16
45	181	1.8	62	9.4	0.18	0.16

[1]Source National Research Council (U S)
[2]1 kg = 2 2 lb
[3]1 g = 0 035 oz

TABLE 2. SUGGESTED GRAIN MIXTURES FOR SHEEP

Ingredients	For pregnant & nursing ewes (12-14% CP)			For fattening lambs & creep feeding (15-18% CP)					
Formula	1	2	3	4	5	6	7	8	9
	— lb[1] —								
Oats	70	40	25	28	23	78	33	23	20
Barley	18	43		60			50	30	53
Wheat								30	
Corn			53		60				
Wheat bran	10	10	10			10			10
Soybean oilmeal (50%)		5	10	10	15	10	15	15	15
Dicalcium phosphate	1	1	1	1	1	1	1	1	1
Salt (cobalt iodized)	1	1	1	1	1	1	1	1	1
Total (lb)	100	100	100	100	100	100	100	100	100
TDN (%)	67	71	73	73	75	66	73	75	73
CP (%)	12.0	13.6	14.5	15.1	15.5	16.0	17.0	17.0	17.8

[1] 1 lb = 0.453 kg

The nutrient requirements of sheep are shown in Table 1; examples of grain mixtures are given in Table 2.

A lack of readily available energy during the last month of pregnancy can lead to pregnancy disease, which may be fatal. Older ewes are especially susceptible. A well-fed flock, receiving good forage and a grain supplement before lambing, should not encounter this problem. Nursing lambs should be creep fed during the barn-feeding period to promote greater gains prior to weaning. A simple grain mixture, high in energy, is recommended since the ewe's milk supplies a considerable amount of protein. Table 2 includes suggested creep feed mixtures.

REARING LAMBS ON MILK REPLACERS

A lamb will die of starvation during the first days of its life if it has been rejected by its mother or has been orphaned; if it is the weakest lamb in a set of triplets and cannot compete for the mother's milk, or if it is the weaker of twin lambs produced by a ewe with only one functioning teat. Lambs that would die as the result of such circumstances can be saved by rearing them on milk replacers. These may be fed either warm or cold. Lambs to be raised on milk replacers should receive colostrum within a few hours of birth, either from their mothers or from a supply kept frozen until needed. They will have to be assisted for the first day in learning how to nurse.

Preferably, the milk replacer should be formulated especially for lambs, but a high-fat, "vealer" calf formula may be used instead. The milk replacer is mixed with water to give a 20% solids content (mix 1 part powder to 4 parts water, by weight). Milk replacer must be fed several times a day for the first week, but after that warm milk replacer need only be fed twice a day. Cold milk replacer can be kept in front of the lambs at all times provided it does not warm up and turn sour. The addition of 0.05% formalin to the cold milk replacer will help to prevent souring and will aid in controlling abomasal bloat.

Creep feed and fine hay should be provided for the lambs, beginning in the first week. A formula such as number 9 in Table 2 or a commercial calf starter is suitable for the creep feed. Lambs can be weaned from milk replacer at 3-4 weeks of age provided they weigh 11 kg (25 lb) or more. Light lambs will benefit from longer feeding of milk replacer. (For further information see publication 1507, *Artificial Rearing of Young Lambs,* available from the Information Division, Canada Department of Agriculture, Ottawa).

FEEDING MARKET LAMBS

With market lambs, close attention must be given to proper feeding and management practices to prevent losses of animals and to obtain economical gains. Enterotoxemia (pulpy kidney or overeating disease) can result from feeding too much grain or from putting lambs on feed too quickly. The lambs

should be vaccinated for enterotoxemia about 2 weeks before going on feed and they must be watched closely for signs of internal parasites (worms or coccidia). Infestations can build up rapidly in lambs, greatly reducing their rate of gain or even killing them.

The most economical gains are obtained from lambs on pasture, or fed good-quality hay, or silage supplemented with some grain. The addition of an antibiotic at the rate of 22 g/tonne[1] (20 g/ton) of complete feed will frequently be beneficial, especially if the lambs undergo stress caused by such conditions as cold or wet weather, crowded pens or by shipping.

To prevent digestive upsets, lambs must be started on feed carefully. Give only good-quality hay for the first 1-3 days, then start feeding grain at a rate of not more than 115 g (4 oz) per head daily. Gradually bring the rate to the intended feeding level over a 2-3 week period. Be sure there is adequate trough space so that all lambs can feed at once: 25 to 30 cm (10 to 12 in.) of trough per lamb.

The rate of gain and the amount of feed required per unit of weight gain will vary, depending on the grain-to-roughage ratio of the ration and the age of the lambs. Increasing the amount of grain will increase the rate of gain and reduce the amount of feed needed to produce a kilogram (or pound) of gain. Young, light lambs require less feed per unit of gain than do larger lambs. For example, in a project conducted at the Nappan Experimental Farm, lambs fed a high-grain ration required 4.7 kg of feed/kg of gain (or 4.7 lb of feed/lb of gain) compared with 5.7 kg (or 5.7 lb) of feed for lambs fed a ration containing 40% roughage. Averaged over all rations fed in this experiment, the lambs required 4.6 kg of feed/kg of gain from 22.6 to 29.4 kg of body weight; 5.0 kg of feed from 22.6 to 36.2 kg, and 5.9 kg of feed between 22.6 and 43 kg of body weight. In pounds, the average was 4.6 lb of feed/lb of gain from 50 to 65 lb of body weight; 5.0 lb of feed from 50 to 80 lb, and 5.9 lb from 50 to 95 lb of body weight.

REPLACEMENT EWE LAMBS

Ewe lambs must be adequately fed if they are to become well-developed breeding ewes. They should be weaned at 10 to 12 weeks of age, treated for worms and placed on a good-quality pasture or fed a good growing ration until their first breeding season. They should not be allowed to become excessively fat.

Well-developed ewes can be bred to have their first lambs at 12 to 14 months of age. The practice of breeding ewe lambs is becoming more common and increases the lifetime production of the ewe, provided she is fed well during her early years of life. The ration must provide sufficient nutrients for the continuing growth of the young ewe as well as for gestation and lactation. To ensure this ewe lambs must be kept separate from the mature ewes.

[1] 1 tonne = 2,200 lb

Good management practices are important with feeder lambs

VITAMINS AND MINERALS

Sheep of all ages require various vitamins and minerals. Most of these are found in adequate amounts in conventional rations but some must be added.

Vitamin A and D levels are often inadequate but these vitamins can be added to the ration or given by injection. Good natural sources of vitamin A are green pasture, grass silage, and well-cured, early cut hay. The main dietary source of vitamin D is sun-cured hay but it can be manufactured in the skin of animals exposed to sunlight. Synthetic vitamins can be added either to the mineral mix that is fed free choice or to the grain.

The mineral supplements commonly required in the Atlantic region are phosphorus, calcium, salt, and cobalt. These are supplied by commercial mineral mixes or by a mixture of dicalcium phosphate and cobalt-iodized salt added to the rations as shown in Table 2 or fed free choice in covered boxes. Mineral mixes that are low in copper must be selected as sheep require less copper than most other animals.

Stiff lamb disease (white muscle disease, muscular dystrophy) is widespread and can be prevented by injecting lambs with a vitamin E-selenium preparation available from your veterinarian.

WATER

Sheep require less water than cattle and for this reason the provision of an adequate supply of clean, fresh water is often neglected. However, water is essential for sheep during warm weather and when they are receiving dry feed. They will not consume as much feed as they need if they are forced to eat snow for water in the winter. The ewe's water requirements are high during lactation. Lambs on milk replacers with a 20% solids content also need an adequate supply of water.

BUILDINGS AND EQUIPMENT

Sheep raising requires some type of shelter, handling facilities and fencing. An efficient enterprise requires careful planning to meet present conditions and allow for future expansion. Consideration must be given to the location of the shelter, the construction method, and space requirements to accommodate the livestock, operating equipment, and the feed and bedding supplies.

A shed or some other type of shelter is needed to protect sheep from extreme climatic conditions. Research has shown that although fleece provides suitable insulation in still air, wind rapidly reduces the value of this insulation. An increase in wind velocity of 6.4 km/hr (4 mph) is equivalent to a drop of 5.5°C in temperature for a sheep with fleece that is 25 mm (1 in.) long. Rain also has a detrimental effect; it has been found that 10 mm (⅜ in.) of rain an hour has the same chilling effect as a 16 km/hr (10 mph) wind. A combination of wind and rain can result in extremely unfavorable conditions.

Open housing methods that provide little or no roofed shelter may be suitable in areas with cold but dry conditions. However, this type of housing is not practical for the milder but wet and windy conditions in the Atlantic region, where walls or fences are needed for protection from the wind and a roof for protection from rain.

Housing for sheep is frequently restricted by limited funds. Often it is a low-cost shelter or an existing building which has been converted for sheep production purposes. The problem is to find a structure that is not only suitable but also economic.

The initial cost is not the only factor determining whether a building is economic; the amount of use to be made of it must also be considered. When planning the layout, thought should be given to additional uses that could be made of the building.

LAYOUT

Once he has decided on the type of management system and the size of his flock, a sheepman can proceed to design the layout of the building.

Floor and other space requirements are given in Table 3. These figures are useful guidelines for deciding the size and shape of the structure and should be used with consideration of the size of the breed to be housed and the total number of animals per pen. The layout of the pens in the shed should be based on the floor and feed rack space requirements shown in the Table. This will avoid an imbalance which could result in inadequate feeding space in relation to floor area.

A producer may design his own layout or, alternatively, use one of the various plans available from the Canada Plan Service. These plans, covering a wide range of sheep facilities, are intended for use across Canada and may be used unchanged or modified to suit individual requirements. Leaflets describing the various plans, and the working plans themselves, are available from your provincial agricultural engineer or extension adviser.

STRUCTURES

His management system and type of production are important factors in the sheepman's choice of the type of structure to cover the interior layout. Sheep require less protection from cold than do other livestock, but — in common with other farm animals — the young need warmer and better controlled conditions than the older animals.

Open-front sheds are common and are suitable if properly positioned and provided with windbreaks to control wind and drifting snow (see section on environment). Shed roofs should be sloped to the rear to prevent rainwater and snowmelt from draining into the sheep yard. Alternatively, a gable-roofed structure with an open end facing the yard may be used. If an existing building is to be converted for sheep housing and has a roof sloping toward the front, eave troughs must be installed to prevent drainage into the feedlot area.

An enclosed building equipped with openings in walls and roof for ventilation, and with sufficient insulation to prevent condensation in the roof, can provide a suitable environment for sheep, with the temperature within the building slightly warmer than that outdoors. Such buildings are popular in Atlantic Canada, often being conversions of buildings erected originally for other purposes.

TABLE 3. ACCOMMODATION FOR SHEEP

Accommodation	Ewes and Rams	Feeder Lambs
Feed lot		
hard surfaced	15 sq ft per head[3]	6 sq ft per head
soil[1]	70 sq ft per head	30 sq ft per head
Open front shed		
floor area	15 sq ft per pregnant ewe 10 sq ft per dry ewe	6 sq ft per head
ceiling height	9 ft min[4]	9 ft min
Slotted floors[2]		
area per animal	7 sq ft	4 sq ft
% slotted floor area	100	100
slot width	¾ in.[5]	⅝ in.
slat width	2 to 3 in.	2 to 3 in.
Lambing pens (not slotted)		
claiming pen only	4 x 4 ft min	
lambing and claiming pen	4 x 5 ft min	
Feed rack		
length per head	16 in. group feeding 6 in. self-fed	12 in. group feeding 4 in. self-fed
height at throat	12 in. small breeds 15 in. large breeds	10 in. small breeds 12 in. large breeds
Feed storage		
hay	3 lb/head—day (small breeds)[6] 5 lb/head—day (large breeds)	2 lb/head—day
grain	⅓ lb/head—day	½ lb/head—day (maintenance) 1 to 2½ lb/head—day (finishing)
Bedding storage	¾ lb/head—day	¼ lb/head—day
Water		
surface area	1 sq ft/40 head	1 sq ft/40 head

[1]Soil surfaced feedlots should be used only where annual precipitation is less than 20 in. With soil surface, a paved feeding strip should be provided adjacent to each feed bunk. This paved strip should be at least 6 ft wide, or as wide as the tractor used for cleaning and the strip should slope at ½ in./ft away from the feed bunk.

[2]An alternative to slotted floors, for ewes, rams or lambs is 1 by 2 in 10-gauge expanded and flattened metal mesh. Expanded metal mesh floors may be covered with a solid panel to retain breeding for lambing

[3]1 sq ft = 0.093 sq metre

[4]1 ft = 0.305 metre

[5]1 in. = 2.54 centimetres

[6]1 lb = 0 453 kilogram

A building in which the environment is completely controlled may be used in an intensive, year-round sheep production operation. This type of operation requires a more expensive and carefully designed building that is fully insulated and equipped with a mechanical ventilation system. Other features may include controlled lighting and heating. A specified environment is maintained within limits regardless of outdoor conditions. To obtain a financial return on the capital cost of such a building, it must be used in a highly intensified production system.

New buildings erected for sheep are most often of the pole frame type with metal or wood sheathing. They may include structural poles within the structure which are useful to support pen dividers but will restrict the use of tractors in the building and limit future alterations. Interior poles may be omitted and trusses used to give a clear-span roof between the longitudinal walls. Wall poles are usually set at 2.4 m (8 ft) centers on concrete pads that extend 1.2 to 1.5 m (4 to 5 ft) into the ground. Roof trusses at 0.6, 1.2 or 2.4 m (2, 4 or 8 ft) centers carry the roof and may also support a ceiling if insulation is required. Squared poles may be used instead of round ones in the construction of a frame building. Although more expensive than the round poles, the squared type make it easier to frame and insulate the walls.

Alterations, including provision of openings for ventilation, generally will be required if existing structures are to be used to house sheep. The resulting layouts may not be ideal but savings in initial costs can justify the limitations. Since no standard plans are available for such modifications, a sheepman contemplating the conversion of an existing building should inspect structures that already have been modified.

ENVIRONMENT

Recommended temperature limits for housed sheep are -20 to 30°C, with relative humidity ranging from 50 to 75%. This provides a large temperature range, but temperatures usually are well below the upper limit. A good ventilation system is essential to allow a draft-free supply of fresh air and to remove warm air without causing condensation. Inadequate ventilation seldom is a problem with open-front buildings, although there may be problems sometimes with condensation under the roof. Semi-enclosed buildings may have pockets of stale air which can result in excessive dampness. To avoid this, adjustable air inlets should be installed at various points in the building.

Lambs require a warmer environment and this can be provided at one location within a cold building by fencing off a small area and covering the area with a false roof covered with bales. For newborn lambs, heat may also be provided in a limited area and this may be done with heat lamps. One duplex electrical outlet per pair of lambing pens is recommended. Dampness must be avoided because lambs can survive in a cold, dry area but not in one that is cold and wet.

Good lighting is important and should be provided in all areas of the sheep barn where management operations are carried out. One light for every 4.8 m (16 ft) of feed alley is recommended.

An open-front shed or open-end gable-roofed structure should be positioned so that the open part faces to the south for maximum effect of winter sunlight. With open-type buildings, snow accumulation around or in them is often a problem but this can be avoided or at least kept to a minimum with the use of properly placed windbreak fencing and eave openings.

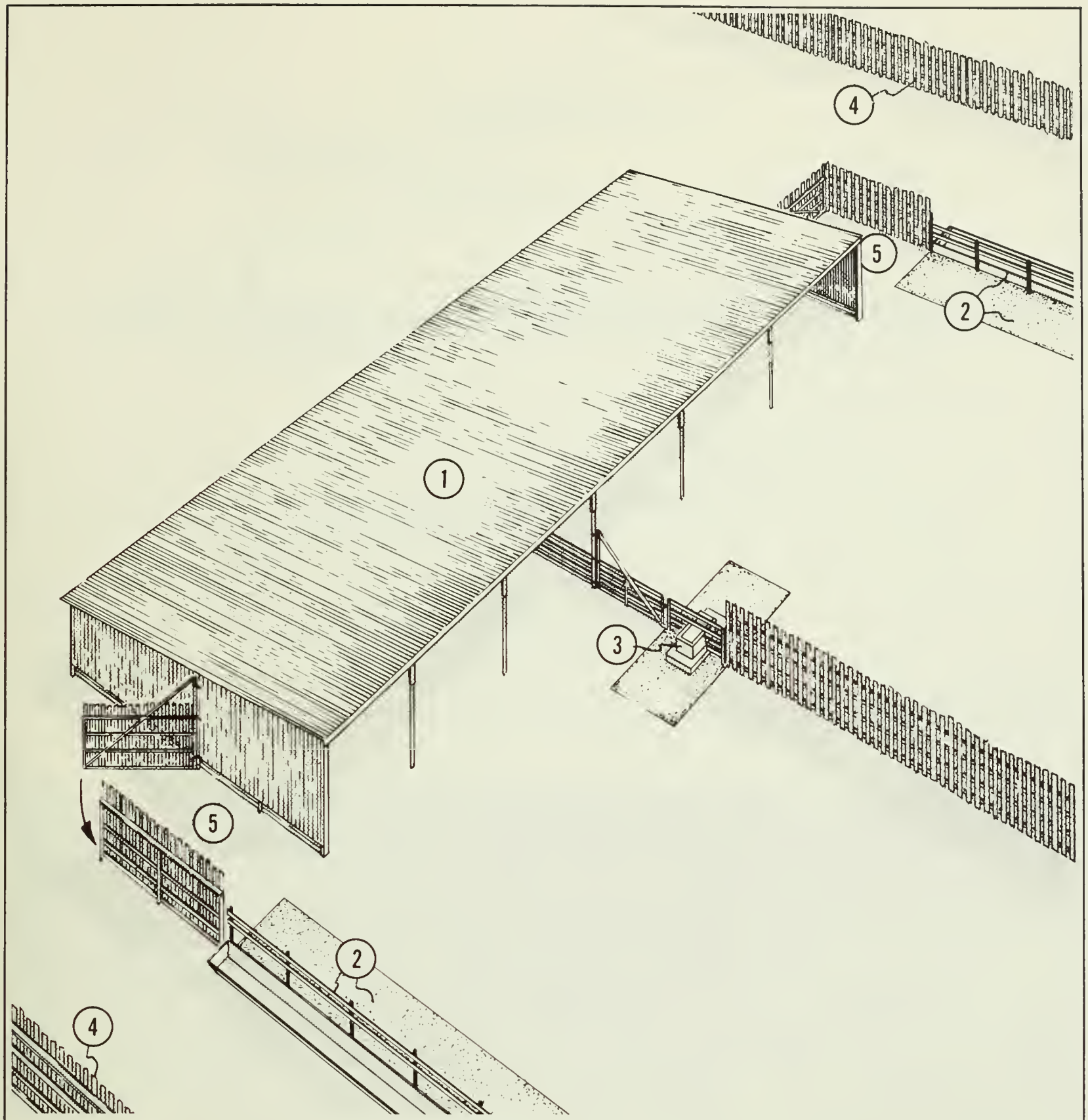
Windbreak fences should not be connected directly with the open corners of the building, otherwise wind and snow sweeping over the roof will be deflected into the shed. The fences should be set back to provide ''swirl chambers'' outside each front corner (Fig. 1). The swirl chambers should be at least 4 m (13 ft) square but may be as wide as the depth of the shed. Silos and other structures should never be located near the open part of the building.

Adjustable openings in the north eave and wall are important to control wind, snow and humidity (Fig. 2). Details of the eave opening are given in Fig. 3. Ventilation details for a gable-roofed building, either fully enclosed or having an open end, are given in Fig. 4. The installation of cable-and-winch controls for opening and closing the eave and sidewall openings to meet weather changes is recommended for long, open-end gable-roofed buildings. Long open-front sheds may require interior partitions spaced no more than 11 m (36 ft) apart for wind control within the structure.

FLOORS

Sheep barns may have solid floors of compacted earth, gravel or concrete, or slotted floors of wood or metal. Regardless of the material or construction, floors must be dry.

Compacted earth or gravel floors are the most common because they are cheaper and quite suitable. The floor level should be above the outside grade and well drained. Concrete floors, although more expensive, are easier to clean than earth or gravel floors. The concrete should be laid to provide a 1% slope to drains to ensure a dry floor. The minimum thickness should be 90 mm (3.5 in.).



1 Open-front shed, roof slopes away from lot
2 Fence-line feed bunk and paved feeding area
3 Frost-proof waterer
4 Windbreak fencing on unsheltered sides
5 Swirl chamber behind front corners of shed

Fig. 1 Sheep drylot unit with open-front shed, fence- line feed bunks and windbreak fencing.

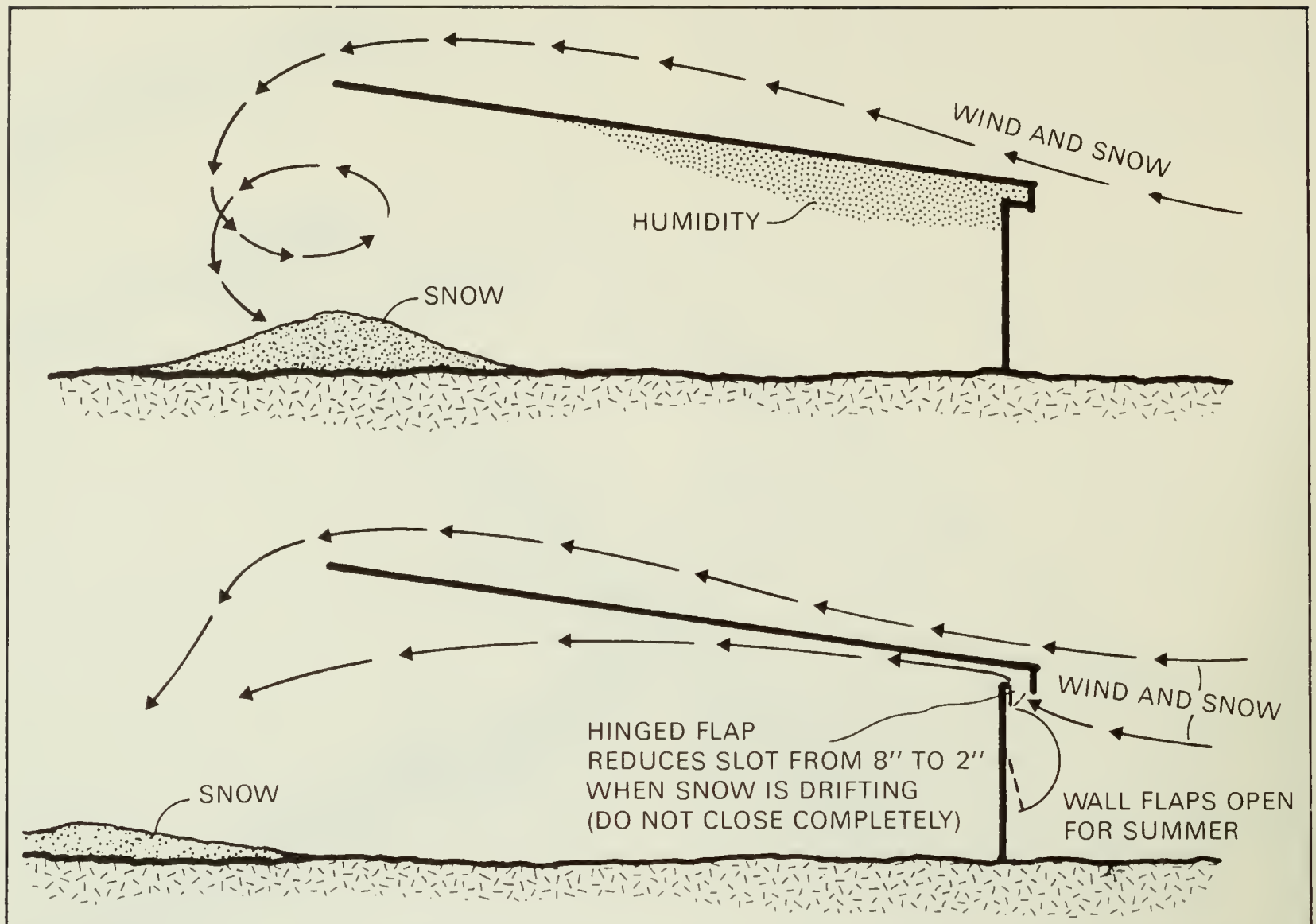


Fig. 2 Open-front shed with tight back wall (top) can have snow and humidity problems. Adjustable eave and wall openings (bottom) improve ventilation and help to control snow drifting.

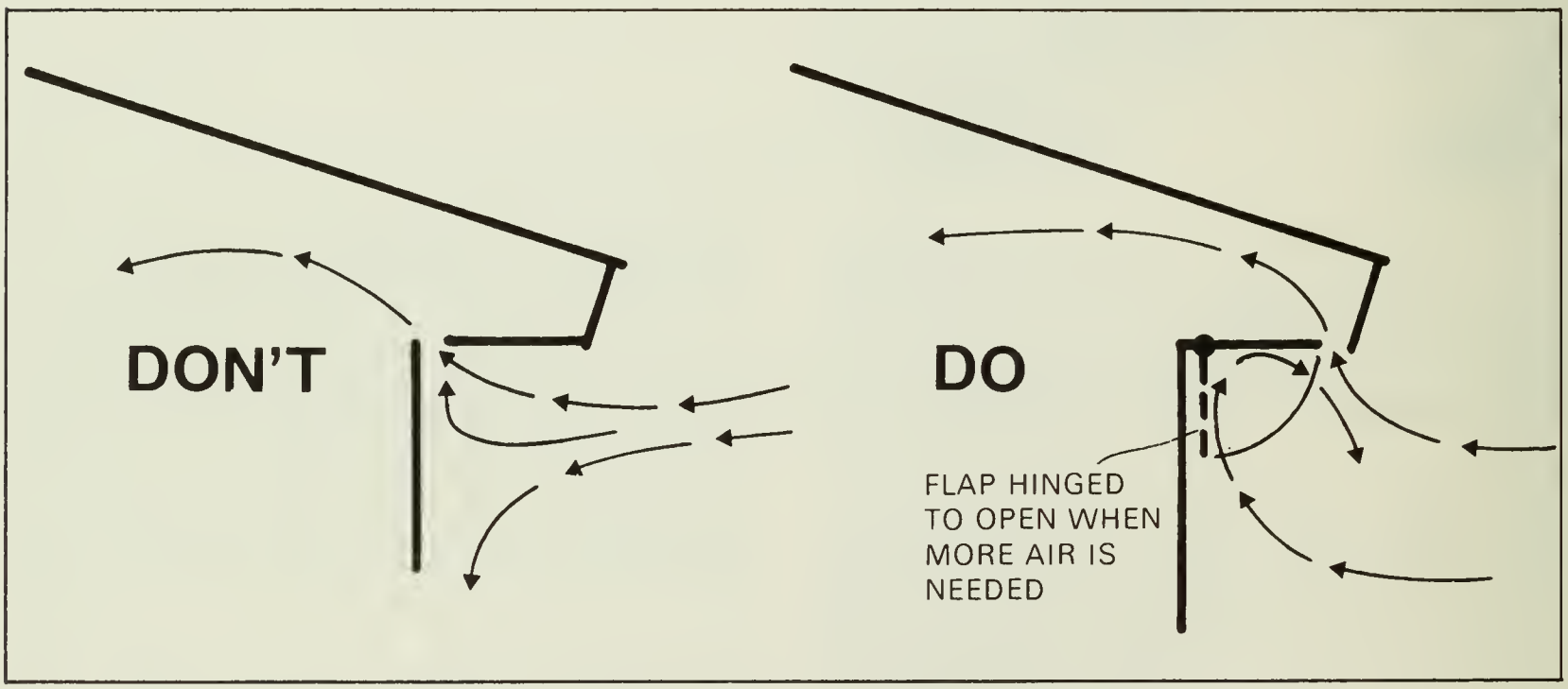


Fig. 3 Eave slot adjacent to wall (left) feels the full pressure of the wind and lets in snow; eave slot adjacent to eave face board (right) controls wind and helps to keep out snow.

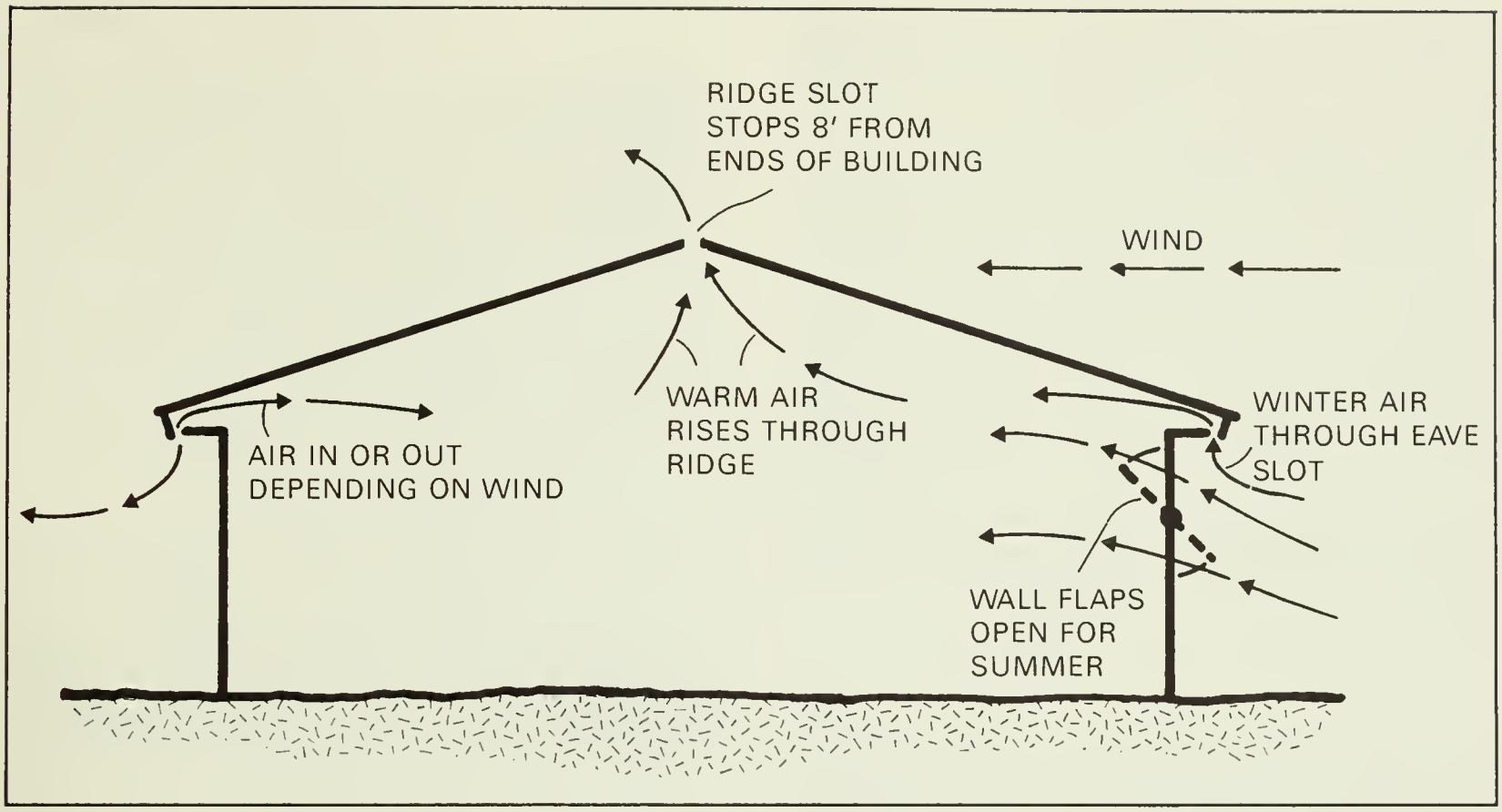


Fig. 4 Wall flaps, and eave and ridge openings are used for ventilation of open-end or closed sheds.

A sheep barn equipped with slotted floor

Slotted floors consist either of wood slats spaced 16 to 19 mm (⅝ to ¾ in.) apart, or of expanded 25 x 50 mm (1 x 2 in.) 10-gauge flattened metal mesh. Slotted floors should be 600 to 900 mm (2 to 3 ft.) above a subfloor. The raised floors add to the cost but this is partially offset because less floor area is required per animal, allowing a smaller structure to be used. Solid floors require bedding. Bedding is not needed with slotted floors but all hay must be kept off the floor to prevent the slots from becoming blocked. The manure from the sheep passes through the slots and collects on the subfloor from where it may be removed annually. It is important that broken or worn slats be replaced to avoid injury to the animals. In cold weather, the area under the slotted floor should be closed at the sides to avoid rising drafts; in warm weather, the manure should be well ventilated to promote drying.

STORAGE

Animal housing has to be located around or close to feed and bedding storage and sheep are no exception. The storage space required can equal the space needed by the sheep themselves.

EQUIPMENT

Suitably designed and constructed equipment in the sheep house contributes in large measure to the success of the enterprise. Plans of equipment are available from the Canada Plan Service.

Feeders

Feeders are an important part of the equipment and may be constructed in various designs and sizes. Feeders may be made for holding either hay or grain or both. They should be easy to fill and clean, and designed to prevent the feed from being pulled out by the sheep and wasted on the floor. The height at the throat is 300 to 380 mm (12 to 15 in.) for ewes and 250 to 300 mm (10 to 12 in.) for lambs. The sheep may eat between vertical, sloping or horizontal bars or obtain the feed from under a vertical or sloping solid partition. Sheep feed from one or both sides of the feeders, the latter method being more economical in space and materials. A six-sided sheep feeder is included in CPS plans. Some designs of grain feeders have a double trough which can be turned over to provide a fresh trough for the grain.

Feeders, if placed in a suitable position, can act as pen dividers. Movable feeders and partitions facilitate cleaning or use of the building for other purposes.

Waterers

These are not easily moved and are usually placed on some structural part of the building. They should be insulated and heated to prevent freezing. Troughs or bowls with float mechanisms are suitable and may be set on a raised platform so the sheep can step up to drink but cannot foul the water.

Winter feeding with walk-in feeder

A practical hay-feeding rack

Lambing pens

These range in size from 1.2 m (4 ft.) square to 1.5 m (5 ft) square and are constructed of movable partitions as they are required only for a short time. These pens should be located in a warmer part of the building or in a separate section and should be provided with overhead electrical outlets for heat lamps, which should be suspended so that they will not be readily damaged. Small feeding boxes or easily washed plastic pails are used in the pens. One pen is required for every six to ten ewes, depending on the management system.

Creep feeder

A barn with ewes and nursing lambs can have an area partitioned off for a lamb creep in which the lambs can feed. An opening in the partition should be large enough for the lambs to squeeze through but too small to admit the ewes. This opening can be equipped with vertical rollers to make it easier for the lambs to get through while protecting their fleece from damage. The creep area should allow approximately 0.3 to 0.4 m^2 (3 to 4 sq ft) per lamb.

HANDLING FACILITIES

Well-designed facilities will make the job of handling sheep faster and easier.

Sheep corrals or sorting yards consist of a series of pens arranged to allow controlled movement of the animals with a minimum of effort. The pens vary in size and are used for different purposes, such as collecting, catching or handling. They are connected by gates located in the corners of the pens so that the sheep can be herded into the corners and through the gates. To assist in directing sheep into some areas, pens may be somewhat funnel-shaped, with one side straight and the other set at an angle of 35° or narrower; alternatively, pens may be equipped with a movable section by which the pen size can be reduced and the animals crowded toward the opening.

The main and often central part of many yard layouts is the chute. With this, the sheep are forced into single file formation and can be separated into groups through sorting gates or held for treatment or directed to a footbath, spray, scales or to the loading point.

The chute should be at least 3 m (10 ft) long and sufficiently wide for a sheep to pass through but not wide enough for it to turn. This requires a width of 350 to 400 mm (14 to 16 in.) for ewes and 300 mm (12 in.) for lambs. Where both ewes and lambs are to be handled, the chute may have both sides sloping outward from the bottom, with a width of 230 to 300 mm (9 to 12 in.) at ground level and 400 to 450 mm (16 to 18 in.) at a height of 760 mm (30 in.). Alternatively, straight sides with a full width may be built and a spacer partition hung on one side to reduce the width when lambs are being handled.

Cutting chute and sorting pens in operation

Chute walls must be tightly boarded (preferably with plywood sheets) to avoid gaps in which the feet and horns might be caught. Sorting gates should be short, 600 to 760 mm (24 to 30 in.), so they may be opened and closed quickly and easily. Gates can be controlled from the entry end of the chute for a one-man operation.

A footbath generally leads from the chute. The floor of the bath may be of concrete or metal, but in either case it should be corrugated or curved to open the cleats in the hooves.

Three main areas are required for shearing operations: a holding area for sheep to be shorn, a clean shearing area and an area for holding sheep after shearing. Existing handling facilities can also be used for shearing operations.

Handling areas should be adjacent to or incorporated into the housing layout. For economy, pens should be used for multiple purposes.

FLOCK HEALTH

Sheep are susceptible to a variety of diseases and disorders, and flock health should rate high in the priorities of producers if losses are to be avoided or kept to a minimum. Vaccination and the maintenance of hygienic conditions are important for the protection of the animals' health. Surveys have shown that about 20% of the lambs born in New Zealand and Britain fail to survive to the 15th day, and another survey has shown that a similar loss occurs in Nova Scotia. In many cases faulty management — either of the flock or of the individual lamb — has been found to be at the root of the problem.

The diseases and disorders that may affect sheep are described in detail in Canada Department of Agriculture's publication 1481, *Sheep Diseases in Canada*. The ones of significance in the Atlantic region, and the causes of management-related losses, are discussed here.

CAUSES OF LAMB LOSSES DURING FIRST 15 DAYS

Stillbirth

Many farmers tend to regard stillbirths as inevitable. Occasionally an outbreak of infectious abortion may result in stillbirths or in losses of prematurely born lambs or of lambs carried to term but born in such a weakened condition that they do not survive. Poor nutrition of the ewe during late pregnancy is a more common but easily avoided cause of these losses. Inadequate nutrition at this stage of pregnancy may result in death of the fetus before birth or in prolonged parturition, an emaciated ewe being unable to expel the lamb rapidly enough. In the latter case, the lamb may die in the birth canal or it may smother in the membranes of the water bag at birth if the mother is exhausted and unable to stand and clean it.

A fetus that is very large in relation to the ewe's size may also result in a prolonged delivery. The fetus size may be the result of overfeeding the ewe during late pregnancy.

Starvation

Starvation is a problem that is all too common in newborn lambs. The amount of milk in a ewe's udder and the degree of her mothering instinct are major contributing factors in this problem. A ewe with a full udder will stand over her lambs and clean them off, thus helping them to get on their feet quickly and begin feeding. A ewe that has little milk will often drop her lambs and walk away, consequently her lambs fail to make contact and take advantage of whatever milk she has. Immature sheep that are lambing for the first time and certain breeds and strains of sheep may require closer supervision at lambing. Excessive wool on the udder may prevent a lamb from sucking.

An excessive mothering instinct in a ewe may lead to starvation of her own lambs. Such a ewe may steal and nurse lambs before giving birth to her own or she may allow any lamb to suck, thus depleting her milk supply needed for her own offspring.

These conditions may lead to losses from starvation or from other secondary conditions. In examining flock health problems it is seldom possible to point to any single condition as the cause. In most cases, a number of interrelated factors must be corrected before the problems are solved.

Chilling

Serious losses from chilling or exposure may occur under certain circumstances. Generally a lamb from a well-fed ewe, even if born outdoors, will get to its feet very shortly after birth and begin nursing. This avoids prolonged bodily contact with cold or wet ground, which results in rapid loss of body heat and depletion of the energy reserves with which the lamb was born. Thus in a flock where the input of available nutrients is too low in relation to the potential lamb crop, a high proportion of deaths from chilling may occur.

Insufficient colostrum

Antibodies make up one of the most important components of colostrum, the first milk from a ewe after parturition. Because a lamb at birth has no immunity to the bacteria to which it is suddenly exposed, it is dependent on the antibodies in its dam's colostrum for early protection against infection. A lamb quickly loses its ability to absorb the antibodies and, consequently, it is important that it receive adequate colostrum soon after birth. Failure to receive a sufficient amount may result in the lamb's death from scours or pneumonia, or in it becoming unthrifty and more susceptible to infection.

INFECTIOUS DISEASES OF THE NEWBORN

Enteritis This disease is an inflammation of the intestinal tract caused by pathogenic organisms. Inadequate colostrum or a low level of vitamin A in the pregnant ewe may contribute to susceptibility of her lambs to this disease.

Navel-ill A disease of newborn lambs, the name refers to site of entry of the disease-causing organism. The navel itself may or may not be affected. If it is, the usual lesion is a firm abscess with the umbilical vessels transformed into a hard cord. After gaining entry through the navel, the bacteria move through the umbilical blood vessels and enter the lamb's bloodstream, often causing multiple abscesses in the liver, lungs or joints. Delay in nursing, or unhygienic or overcrowded quarters are predisposing conditions. Application of an antiseptic or antibiotic preparation to the navel soon after the lamb's birth will reduce the incidence of this disease.

Lamb dysentery Lamb dysentery, caused by one of the group of bacteria known as Clostridia, is not considered to be of common occurrence in Canada. However, vaccination of young lambs against the disease is recommended as a safeguard. The disease is characterized by loss of lambs from birth to 6 weeks of age, with associated diarrhea. In acute cases, diarrhea may not be evident. Often, as with other forms of enterotoxemia, a dying animal shows signs of severe pain, grits its teeth, and stretches and turns its head back against its flank. Lamb dysentery can affect a high percentage of the lambs if it appears in an unvaccinated flock. Often the disease becomes more acute as the season progresses.

Pneumonia Pneumonia in young lambs may be caused by various types of bacteria and viruses. The infection may develop as a result of lowered vitality and resistance to disease caused by such conditions as chilling, navel-ill or lack of colostrum. Overcrowded, unhygienic conditions and poor ventilation are the major factors in the spread of pneumonia-causing bacteria and viruses among housed lambs. Vaccines are available against certain pneumonia-causing organisms but they are of questionable efficacy. Preventive action by attending to housing and ventilation will likely be more effective.

INFECTIOUS DISEASES OF OLDER LAMBS

Pulpy kidney disease This is another of the enterotoxemias caused by a clostridial organism. The causal organism, present in the soil, on hay and in the intestinal tract of most sheep, under certain circumstances invades the tissues and secretes highly lethal toxins which reach the bloodstream and are carried to the central nervous system. Prior to its death, the affected animal will show extreme incoordination, along with signs of abdominal pain or colic similar to those shown by a younger lamb suffering from lamb dysentery. Losses from pulpy kidney disease, as with other enterotoxemias, can be heavy. However, it can be effectively controlled by vaccination.

Pneumonia Although losses from pneumonia occur in sheep and lambs on pasture, generally they are not of great economic significance. However, losses can be much greater in housed flocks. The conditions contributing to the spread of pneumonia-causing organisms in these flocks are outlined in a previous section.

DISEASES OF MATURE SHEEP

Pregnancy toxemia Also known as twin lamb disease, pregnancy toxemia often is the result of a faulty diet that fails to meet the ewe's needs during the last 6 months of pregnancy. Although the disease may occur in a ewe carrying a single fetus or in a ewe heavily infested with worms, the condition is more common in ewes carrying multiple fetuses whose energy demands may exceed the ewe's ability to meet them if she is receiving poorly balanced rations. The increase in energy demands of the rapidly growing fetuses is accompanied by a reduction in the space available in the ewe's rumen to meet their energy needs. Concentrates for high energy levels should be fed during the last 6 weeks of pregnancy. This will increase the energy intake though the volume of feed intake is reduced.

Loss of appetite, staggering, twitching and blindness, particularly during the final 6 weeks of pregnancy, are symptoms of the disease and result from the ewe's utilization of her own body tissues to try to

meet the energy demands of the developing fetuses. This process affects her musculature and also produces toxic by-products. Expulsion of the fetuses will often result in rapid recovery by the ewe. If the ewe is close to term, removal of the lambs by cesarean section is usually effective.

Enterotoxemia Although generally considered a disease which affects young or feeder lambs, enterotoxemia can cause severe losses in unvaccinated sheep under certain conditions. These are usually related to changes in management methods, shipping or changes in feeding. Since protection of the young lamb is most easily provided by vaccinating the ewe to produce a high antibody level in the colostrum, it follows that such ewes are immune to enterotoxemia. The various enterotoxemias and lockjaw (tetanus) are all caused by Clostridia. Vaccines that give a satisfactory level of immunity to eight species of Clostridia are now available. Since a large part of the cost of vaccination is related to the gathering and handling of the flock, it is logical to use one of the broad-range vaccines even though the per-dose cost is a little higher than that for vaccines that provide protection against fewer species of Clostridia.

Mastitis Early detection of mastitis, an infection of the udder, is difficult and the udder tissue is usually destroyed by the time the disease is discovered. Highly productive ewes are most susceptible and control of the disease is largely related to management skills. Conditions that result in one or both sides of the udder being overstocked increase the chances of mastitis developing. Such conditions may be prolonged separation of the ewe from her lambs during the peak of her lactation, or a lamb that is left behind when the mother is moved to another pasture. An overstocked udder may also result when a ewe avoids nursing her lambs because of sores or injuries to her teats.

When mastitis strikes, the affected gland rapidly becomes hot, swollen and painful. The affected animal walks with a limp, stops eating and may collapse within 2 days. If untreated, the ewe usually dies. Prompt treatment with antibiotics or sulphonamides or both is unlikely to restore the function of the affected gland but should save the ewe. However, the ewe should be marked for culling.

OTHER CAUSES OF FLOCK LOSSES

Deficiency disorders

Certain elements are required in minute amounts by sheep to maintain body processes such as growth, reproduction and resistance to disease. The body's utilization of minerals is often related to availability of vitamins; for example, vitamin D is required for efficient absorption of calcium. Also, a mineral deficiency may predispose an animal to other health risks. An example of this is the link between cobalt deficiency and susceptibility to worm parasites. In this case, it may be difficult to decide whether lambs are thin because of parasitism or whether the parasites developed because of the poor condition of the lambs.

Fortunately, deficiences of copper, cobalt and selenium — which cause specific disorders in lambs — are relatively easy to remedy by supplementary feeding or by injection. Likewise, vitamins A, D and E needed by lambs are easily administered and inexpensive.

Parasites, internal

These are a major cause of loss in sheep flocks and for poor weight gains by growing lambs.

Stomach and bowel worms Sheep and sheep farms are never free of these potentially lethal parasites, although sheep of various ages differ in their susceptibility to them. Control involves one of two measures or a combination of both: the use of clean pastures (those that did not carry sheep and lambs the previous season) for ewes with nursing lambs, and strategic deworming to anticipate times of high levels of worm infestation.

Laboratory examination of fecal samples will give a rapid assessment of the degree of infestation. However, many sheepmen fail to avail themselves of this service. In their case, if they are in doubt about the extent of infestation, it is important that they take the precaution of deworming their ewes and lambs over 3 weeks of age before moving them to new pastures.

Under certain circumstances, adult worms in the intestinal tract of a sheep will result in it developing an immunity, thus inhibiting further development of that particular parasite. This accounts for the fact that old sheep grazing the same pastures as lambs remain relatively free of parasitic problems while the lambs, lacking immunity, succumb.

Sometimes sheep may carry through the winter thousands of immature worms which they ingested during fall grazing. These worms remain dormant until conditions allow them to continue development and to mature. This is the reason why sheep, which were dewormed in the fall and wintered well, suddenly lose condition and even die if the cause is not recognized and treated. Stress is an important factor contributing to lowered resistance in sheep, enabling the

Drenching and vaccinating sheep

worms already within their bodies to develop. The greatest periods of stress occur in mature ewes at lambing time and in lambs when they are put into feedlots. To combat losses under these circumstances, allow time for the worms to develop and then eliminate them before they have a chance to inflict losses. Deworming of the ewe flock should be done about 10 days after lambing and in the case of feeder lambs, 10 to 14 days after going on feed. Medication is available either as a drench or for injection.

Coccidiosis The organism causing this disease is a single-celled parasite which is spread as a result of feed becoming contaminated with infected feces. The parasite invades the lining membranes of the animal's bowels, destroying the tissues and causing hemorrhaging. Many adult sheep carry the organism without apparent harm but their feces can contaminate feed and through this, spread the organism to susceptible lambs. Thus the danger period is when the lambs are about 6 weeks old and beginning to take solid foods. If the ewes are short of milk, their lambs will have lower resistance and because they are hungry they will eat more solid foods, thus increasing their susceptibility and exposure to this disease. The importance of properly designed feed troughs and hay racks and the need for clean bedding and floors cannot be overemphasized.

External parasites

Sheep are vulnerable to attack by various species of insects and the result may be loss of condition, reduced value of the wool clip and, sometimes, death of an animal.

These external parasites range in size from minute lice to sheep keds (commonly but incorrectly called sheep ticks) which are wingless and about the size of a house fly.

Lice and keds These parasites are similar in their life history in that they emerge as fully active miniatures of the adult; the lice emerging from eggs and keds from pupae. Both may cause severe irritation by their biting and sucking and by their movement through the wool and over the skin. Heavily infested sheep are often in poor condition. Newborn lambs often become infested from their dams. A heavy infestation of blood-sucking keds may result in anemia in young lambs.

Greenbottle and blow flies These pests lay their eggs in and around wounds such as those caused by castration, dog bites, shearing nicks and, in mature rams, in head wounds from fighting. Dirty wool around the rump of scoured lambs also attracts egg-laying flies. Occasionally, eggs will be laid in clean fleece. The clusters of yellowish eggs hatch in about 24 hours and the larvae feed first on secretions in the wool and then invade the tissues, causing secondary discharges which in turn attract more egg-laying flies. Without treatment, afflicted sheep are attacked by successive generations of maggots.

A sheep after treatment for blow flies

Restlessness, foot stamping, biting at the affected area, rubbing, getting up and lying down and running in circles are symptoms shown by ''fly blown'' or ''struck'' sheep. Often they will seek shade or dense cover. The wool over the affected area loses its luster and will often appear as if a gray stain had been spilled on the animal's back. Treatment involves clipping closely the affected area, washing out the maggots with a mild disinfectant or sheep dip, and then spraying or treating the affected area with a skin antiseptic and fly repellent combination. If possible, keep the sheep confined until the lesions are healed.

Sheep bot (nose) fly The adult fly of this pest is active from May until the first killing frosts in the fall. On sunny days, it lays its eggs in and around the nostrils of the sheep, causing the animals to shake their heads and often run for shelter. The interrupted grazing results in reduced performance. Although the nose fly is normally classed as a nuisance, occasionally the larvae in the nasal chambers may cause abscesses from which infection spreads to the brain, resulting in fatal meningitis. Control of the pest is difficult. However, darkened sheds or pastures with dense clumps of bush offer some shelter in which sheep can escape from the adult flies.

MANAGEMENT OF THE FLOCK

In a sheep-raising enterprise, sound breeding, feeding, flock health and marketing practices are the essentials of good management. The general objective should be to produce as much high-quality lamb and wool as possible at the least cost.

Each producer must determine the specific management system and market that are best for his operation. Economic studies have shown that producers rated as good managers have consistently made a profit; those rated as average have shown a profit when cost-return ratios were favorable and a loss when the ratios were unfavorable. Those rated as poor managers have consistently shown a loss. Sheep operations, in general, succeed or fail according to their standard of management.

CARE OF THE NEWBORN LAMB

The gestation period of sheep is about 147 days. As her lambing time approaches, a ewe becomes heavy in appearance and shows considerable udder development. A ewe showing definite signs of lambing should be confined alone in a clean, dry pen. Most ewes will give birth within 2 or 3 hours after labor begins. Those that do not should be given assistance.

After birth, remove the mucus from the mouth and nostrils of the newborn lamb and soak the navel with iodine or other disinfectant for a minute. The lamb should be placed near the mother's head. She will usually lick it clean. For the reasons discussed in the section on flock health, it is very important that the lamb get colostrum within an hour of birth. Assist the lamb to nurse, if necessary. Check the mother's udder for milk; if scarce, let the lamb nurse another ewe that has just lambed until the mother's milk starts to flow.

A newborn lamb that has become chilled should be wiped dry and placed in a warm location, such as in a box near a stove, for an hour or so. As an alternative, it can be placed in warm water (as warm as the elbow can bear) for a few minutes, after which it should be rubbed briskly with a burlap bag or cloth. A heat lamp placed 75 cm (30 in.) above a corner of the pen is helpful in very cold weather. In treating a chilled lamb, make sure that it is returned to the mother as soon as it has recovered, otherwise she may disown it.

An orphan lamb or one that has been disowned by its mother is best handled by transferring it to a foster ewe. Ewes identify their lambs initially by sense of smell. To win acceptance of the lamb by the foster mother, try one of the following measures: smear her milk over the lamb; rub the lamb on the ewe's nose; dab turpentine on the ewe's nose; keep ewe and lamb in a pen for a few days; hold the ewe while the lamb nurses a few times; put a dog near the ewe to arouse her maternal instinct; if the foster ewe has lost a lamb, put the dead lamb's pelt over the one that is to be adopted. If for some reason it is necessary to raise the lamb by bottle or other artificial means for the first day or two, feed 15 to 30 ml (0.5 to 1 oz) of milk every 2 hours. Lamb milk replacer is now available for use in larger flocks. In smaller flocks whole, warm cow's milk is adequate. Gradually increase the amount and time between feedings to 22 g (8 oz), three times a day at the end of 10 days.

MANAGEMENT IN THE EARLY GROWING PERIOD

Ewes and lambs should stay in their lambing pens until the lambs are strong and well mothered. They may then be turned out with other ewes that lambed earlier. These groups should be kept small for as long as possible (where the lambing season is prolonged). Separate the ewes with lambs from those without lambs. Preferably, ewes with single lambs should also be separated from ewes with twins. This facilitates a different rate of feeding for each group.

IDENTIFICATION

A lamb should be marked for identification purposes within 3 or 4 days of birth (or before leaving the lambing pen). Such identification is required for purebred lambs. Branding paints or small tags, available from livestock supply firms, are most often used for this purpose. The use of a different tag color each year makes it easier to identify animals by age. Whatever method of identification is used, the lamb's number should be entered in the flock record opposite the dam's number and that of the sire. The record should also show the lamb's sex, birth date and whether it was a single, twin or triplet. Ear notching may be used to distinguish multiple births.

Registration of purebred sheep is administered by Canadian National Livestock Records, Ottawa. Application forms for registration and transfer of ownership are available from CNLR. Flock tattoo letters assigned to the breeder are placed in the right ear, while the individual lamb's own identification number and appropriate year letter (''H'' for 1976, for example) are placed in the left ear (1H, 2H, 3H etc.). When tags are used instead of tattoos the same procedure (flock letters, year letter and lamb number) must be followed. Lambs must be so identified before September 1st of the year of birth to be eligible for registration.

DOCKING

Docking is necessary for cleanliness and to reduce the risk of fly strike and maggots.

Some producers favor the use of an elastic band which is applied by an instrument known as an ''elastrator''. The ring, when put in position on the tail, stops the blood circulation, causing the tail to wither and drop off in from 2 to 3 weeks. This method causes little pain to the lamb if done within the first 24 to 48 hours of life. This method is not advised for late-born lambs since there is a slight risk of infection or fly strike because a small wound may remain for a day or two after the tail drops off.

An instrument known as a ''burdizzo'' is also used for docking. The lamb should be held on its rump, with a helper grasping the lamb's left front and rear legs in one hand and the right legs in his other hand. The skin is pushed slightly toward the body and the burdizzo is then clamped on the lamb's tail, at the second joint from the body. The tail is then cut off inside the closed jaws with a sharp knife. Pine tar smeared on the open would will help to stop bleeding and avoid risk of maggots or infection. The burdizzo should be left clamped on the tail for a few seconds before being released. The lamb should then be set down on all four feet to avoid bumping the wound.

Docking may also be done with a sharp knife.

CASTRATION

There are some good reasons for leaving ram lambs entire. They grow more rapidly and efficiently then wethers; there is no discrimination in slaughter grade when rail graded, and selection of ram lambs to be retained as breeding stock can be made more accurately after rate of gain tests than at birth when castration is practiced. There is considerable evidence that ram lambs will produce a carcass with higher cutability (saleable meat) more efficiently than will either wether or ewe lambs.

If ram lambs are not castrated, they should be separated from the ewes when they reach a weight of 27 to 34 kg (60 to 75 lb), otherwise they will continually worry the ewes and reduce flock gains. Ewes might also be bred by ram lambs.

Though ram lambs gain faster and are more efficient, castration is usually done for the following reasons:

- Castrated lambs are not as restless as ram lambs and fatten more quickly.
- After weaning, wether and ewe lambs can be run together, eliminating the need for two pastures.
- Wether lambs sell at a premium price on some markets, while on some markets ram lambs sell at a reduced price.

Male lambs should be castrated before they are a month old and preferably between 1 and 2 weeks of age. Castration with a burdizzo is bloodless and leaves no open wound. This instrument crushes the testicular cords without rupturing the outer skin. The testicles are then gradually absorbed and will disappear in a few weeks. In using the burdizzo, care must be taken to see that it is positioned well above the testicle because the operation will be unsuccessful if the testicle rather than the cord is crushed. Each cord should be crushed separately and the center area of the scrotum left untouched, otherwise the blood vessels may be damaged and infection may occur which could be fatal. Examine the lambs a few weeks following the operation to make sure that no ''slips'' have occurred.

An elastic band applied on the scrotum close to the body with an elastrator is another method employed in castrating male lambs. If this method is used, castration should be done within 48 hours after birth.

The elastrator can be used to ''short-scrotum'' ram lambs. The procedure causes infertility but does not affect their growth. To short-scrotum a lamb, the testicles are pushed up against the body wall and the rubber ring applied over the scrotum below the testicles.

Many producers still favor the oldest means of castration — a sharp knife. With this method, the lower third of the scrotum is cut off and the testicles are drawn out. This procedure causes bleeding and exposes the animal to the danger of infection and maggot infestation.

FEEDING

Faster growth of lambs at an early age will occur if, from 2 weeks of age, they are provided with a creep feeder accessible to the lambs only. Supplemental grain (creep) feeding of lambs also helps to relieve the strain on the lactating ewe. To encourage consumption, the ration must be fresh and palatable. In addition, before the pasture season, lambs should have access to good, leafy hay or silage, preferably including some legume.

In the Atlantic region, lambs are usually turned out with the ewes when pasture is available. A recommended system is that of rotational creep-grazing, allowing the lambs to graze ahead of the ewes to get the fresh, clean grass. Where cattle are also kept, alternation of cattle and sheep in such a way that ewes and lambs are grazed on land which carried cattle but not sheep the preceding year is an effective way of keeping parasitism at bay. This is done on many community pastures in the Atlantic region where trials have shown that there is little transmission of parasites between sheep and cattle. Thus money spent on fencing to control grazing is generally well spent.

WEANING

Early or late, weaning is best done abruptly. Early weaning serves to decrease the pasture stocking rate and to produce faster, more uniform growth in lambs. Also, early weaning is necessary to dry up ewes that are on an accelerated breeding program. Lambs can be weaned successfully after they reach 11 kg (25 lb) but are usually left with their dams for 8 to 12 weeks.

Lambs on pasture should be weaned shortly after the pasture grass has reached a full-bloom stage of maturity or when it has become dry or scarce. At this time the ewes' milk production will be low and lambs will grow faster and more uniformly either on clean grass, such as hay aftermath, or in a feedlot.

FINISHING LAMBS FOR MARKET

In Atlantic Canada generally, the aim should be to raise as many lambs as possible to market weight on pasture. However, this is not always possible and weaned lambs that are not ready for market and for which no clean, fresh grazing is available should be finished in a feedlot as quickly as possible.

Lambs going into a feedlot should be vaccinated against enterotoxemia. They should be started on good-quality hay and then introduced over a 14-day period to a coarsely ground grain ration, starting with 125 g (4 oz) of grain daily and increased over the 14 days to a full feeding level of 1.3 kg (3 lb) per head. This finishing ration may be lower in protein than any starter ration used earlier but the energy content must be maintained. Adequate trough space is essential. Clean, fresh water should be available at all times.

Finished lamb carcasses should weigh between 16 and 25 kg (36 and 56 lb) for maximum market acceptability. The dressing percentage of grain-finished lambs should range between 48 and 50%, slightly less in grass-finished lambs. Therefore, the optimum shrunk liveweight at slaughter is between 36 and 50 kg (80 and 110 lb). A 3% shrinkage in liveweight should be expected for lambs while in transit to market. However, liveweight cannot be the only criterion of suitability for market. Finish, or fat covering, is also important. This can be estimated by placing the spread hand over the loin and checking the fat covering over the spinal processes. A ''washboard'' feeling when the fingers are moved forwards and backwards indicates inadequate finish. Some experienced buyers also check the covering in the dock or brisket areas.

Purchased feeder lambs may be treated similarly to weaned home-grown lambs, but they may be highly stressed on arrival and some losses may occur. In such circumstances the addition of an antibiotic to the grain ration is warranted.

BREEDING

Ideally ewes should be maintained on a flushing ration (page 15) throughout the breeding period in order to prevent fetal resorption.

To facilitate breeding, the wool and dung locks should be sheared from around the ewe's genital area. If the ewe has not been docked, the tail should also be sheared.

GESTATION

During gestation, hay of reasonable quality will meet the nutrient requirements of the ewe until about 6 weeks before lambing. However, ewe lambs and aged or thin ewes will require supplementation and should therefore be penned separately. Good quality

silage may be substituted for hay at the rate of about 3 or 4 parts silage to 1 part hay, by weight.

During the last 6 weeks of pregnancy, roughage should be supplemented with grain. This ration will supply the ewe's additional energy needs to meet the demands of the rapidly developing fetus. Supplementation reduces the incidence of pregnancy toxemia, increases the ewe's milk production and results in larger, stronger lambs at birth. However, exercise is important to avoid excessive fatness which often leads to lambing problems.

As lambing approaches ewes should be ''crutched''. This involves shearing around the udder and genitalia to reduce risk of infection at lambing and to give the lambs easier access to the teats. Crutching also reduces risk of the lambs ingesting tags of wool which subsequently ball in their stomachs.

CARE OF THE EWE AT LAMBING

When records are kept and ewes are marked at the time of breeding, lambing preparations are simplified; otherwise, signs of lambing must be relied on (nervousness, fullness of the udder and sinking in front of hips) for preparations.

The use of individual lambing pens serves to reduce losses through trampling and mismothering. The ewe and lamb should normally remain in their pen for a day or two. If the lamb is very small and weak or if difficulty is encountered in getting the ewe to accept the lamb, they may remain longer. Where ewes lamb on pasture, the use of lambing pens is restricted to isolated problem cases.

LAMBING DIFFICULTIES[1]

Most sheepmen do not believe in letting a ewe strain for hours before checking the position of the lamb. If she has passed the first ''water bag'' and does not give birth to her young within 30 minutes, she should be caught, thrown and examined.

Before entering a ewe's reproductive tract, trim your fingernails and wash your hands in a disinfectant. Lubricate your hands with raw linseed oil or light mineral oil. In all cases which the sheepman feels to be beyond his capability, he should seek the assistance of his veterinarian.

There are two or three basic situations in lamb delivery. If you know how to handle these situations, you'll be successful in most variations of lamb birth. Here are the main variations and how to handle them:

Case 1: Tight delivery This is the normal birth, but owing to its size or the tightness of the ewe, the lamb probably would die before delivery.

Stand over the ewe, facing the tail. Draw one leg of the lamb to an extended position. Then, while drawing lightly on this leg with the left hand, work the ewe's skin back over the crown (forehead) of the lamb's head with the right hand. Next, span the neck with the right hand and draw the lamb forward 2.5 to 5 cm (1 to 2 in.), still pulling the foreleg with the left hand. Now it is safe to extend the second leg. Complete delivery by drawing both legs and neck.

You'll be tempted to extend both legs at first. However, in this position, the thicker part of the legs come opposite the crown of the head, making delivery more difficult and unnecessarily hard on the ewe.

Case 2: Foreleg turned back This position is like a normal birth except that one foreleg is turned back. If it is the right leg, lay the ewe on her right side. Now the backward leg is uppermost. Take the same position as in Case 1. Extend the one foreleg, work skin back over the head, and draw the lamb about 2.5 cm (1 in.).

Now the shoulder of the backward leg will be caught behind the upper side of the V-shaped bones (pelvic bones) of the ewe. Twist the lamb and pull at the same time. This is done by drawing the leg out and upward, and the head out and downward. A jerk is felt as the shoulder slips past the pelvic bones, after which only a straight pull is necessary.

If the lamb's left leg is turned back, lay the ewe on her left side. Always keep the backward leg uppermost. It is important to learn this method, as it can simplify other cases.

It sometimes happens that the lamb is pushed back into the ewe in order to catch the other leg and the head drops out of the pelvic girdle, making delivery very difficult. (See Case 5)

Case 3: No feet showing If only the head is out, feel to see if one or both legs are doubled back at the knee. It's easy to hook them with the finger. When no legs are felt, both must be doubled back from the shoulder. If the head is of normal size, push it back again past the pelvic bones. Slip the fingers along the neck and over the shoulder, hook the leg and draw it forward.

[1] Source *The Grain Grower*, December 1966

Now straighten the leg at the knee joint, pressing with the fingers and thumb. The leg should now be drawn a little to bring the foot past the pelvic bones. Straighten the head and work it carefully past the bones.

Now that the head is out, draw the leg and proceed as in Case 2.

Case 4: The big lamb If the ewe can't deliver a big lamb because of obstruction at the pelvic bones, it is often because the lamb's head is not lying with its crown against the ewe's spine. It is difficult to straighten if the ewe is on her side with the lamb's head twisted upward.

Remedy: Turn the ewe over so that the lamb's head is down. If both legs are through, turn one leg back and the lamb now should come easily. Proceed as in Case 2.

Often a big-headed and big-shouldered lamb presented properly (front feet alongside his nose) cannot be ejected easily by the ewe. Thin, old and weak ewes, in particular, often need help. In this case, one leg at a time should be stretched out and then both pulled together by one hand, while the first two fingers of the other hand are slipped up the lamb's forehead and in back of its ears, stretching the lips of the vulva. This method may require considerable strength but usually is successful. It is a good practice to let the ewe expel the lamb once its shoulders are out, but if she is unable to, pull it out slowly. Place the newborn lamb at her head where she can clean it. If she does not recognize it and begin cleaning it immediately, force her muzzle against the lamb to get her started.

In pulling a big-shouldered lamb it will be found much easier to pull to the left or right. A straight pull places the two shoulder blades exactly opposite each other and at their widest, so that they must be squeezed severely to allow them to pass through the pelvic girdle. By bending and twisting the lamb as the pull is made, the shoulder-blade positions will be altered so that they can pass through more easily.

Case 5: No head showing The head often is turned along the ribs if the forefeet only are showing. Lay the ewe on her side so that the lamb's head is uppermost. Push the lamb back far enough to straighten its neck and get the head lined up with the ewe's backbone. It is now similar to Case 1.

This can be a most difficult operation, though, and you might want some other ideas. With the legs extended through the pelvic girdle, it is next to impossible many times to straighten out the neck and get the head to pass through. If it starts through and a pull is made on the legs, the usual result is that the head slips back into its original position (or down toward the ewe's udder), and persistent but unsuccessful attempts get more and more irksome. In this case, string nooses should be slipped over each ankle and the leg should be folded back into the womb — making sure, of course, that enough string protrudes. Then, with the lamb's shoulders no longer in the way at the inner mouth of the pelvic girdle, it is possible to draw the head up into the pelvis with the palm of the hand and to bring the front legs along by pulling on the string.

A piece of baling wire is useful in drawing the head out if it cannot be guided in the palm of the hand. The wire should be rather heavy and unrusted. Make a loop and slip it over the lamb's head, positioning the loop behind the ears. Then, when the front legs are pulled by the strings, the head will be guided, chin up, into the pelvis by pulling on the wire. Care should be taken in fitting the loop over the lamb's head. Before pulling, be sure that it has not caught a fold of the uterine wall to avoid rupture of the uterus and loss of the ewe.

Some lambs are so large in relation to the pelvic passageway that even this method of guiding the forepart of the lamb cannot effect a birth. The combination of the large chest, the large head and the straightened-out front legs of the lamb is too much. In this case, it is necessary to turn the lamb around inside the uterus and to remove it, hind legs first. This is usually possible, although it is sometimes difficult to turn the lamb. Assistants may raise the rear end of the ewe to allow the operator to find and secure the hind legs.

Unless the operator is sure that no serious abrasion or tearing of the uterine wall has occurred, the removal of a lamb by such an operation should be followed by an injection of penicillin for the ewe.

Case 6: Hind feet first It's easy to draw the hind legs out, but then the lamb usually sticks. Avoid breaking ribs. Swing legs from side to side while pulling. After the lamb's ribs are exposed, it is easy to get the lamb out. Clear fluid quickly from lamb's nose to prevent drowning.

Case 7: Tail shows Push lamb back past the pelvic bones until you feel the hock joint of the hind leg. Hook fingers over the leg and straighten it with the thumb. Draw the foot up past the pelvic bones. Do the same with the other leg. Proceed as in Case 6.

Case 8: Lying crosswise Sometimes the lamb is positioned crosswise to the entrance to the pelvic bones. Only the back can be felt. Push the lamb back to enable you to feel which way it is lying.

If the head and forelegs are nearest the bones, push the lamb back and deliver as in Case 4. Otherwise, deliver hind feet first as in Case 6.

Case 9: Twins coming together Two to four feet may be showing. Only the feet will be beyond pelvic bones, a complication usually resulting from the first lamb being positioned sideways.

First, locate the legs and head of one of the lambs. Do this by pushing the lambs back far enough to allow the hand to track out a leg. Put a string on the leg to avoid a mixup. Push the second lamb back and deliver the first. In some cases it may be safer to push the second leg back and deliver as in Case 2.

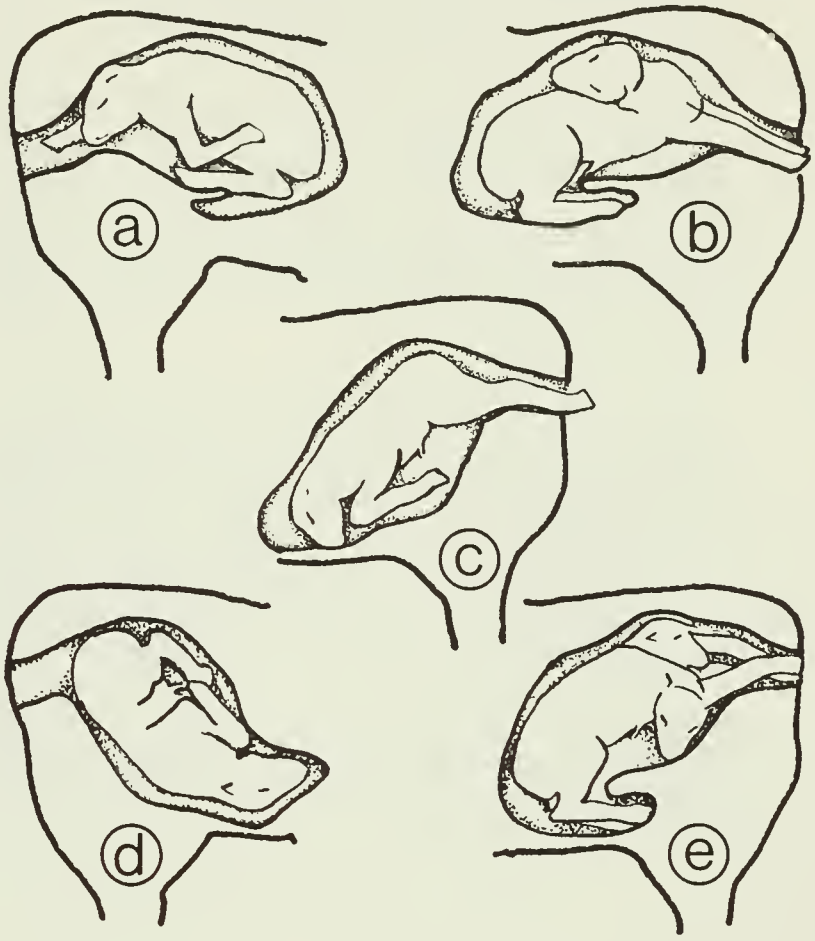
Deliver lambs quickly. Deliver easiest lamb first.

Case 10: Twins with one coming hind feet first Once you are sure of the hind feet, it's usually easier to deliver the reversed one first. Hold the hind feet and push back the head and forefeet.

The sheepman must judge which of the twins will be the easiest to deliver first. Much depends on the lamb's position.

Natural birth is still best. Do not pull any lamb unless the ewe is in distress. If the ewe has strained for an hour and no part of the lamb has appeared or if a problem is evident, enter and assist the ewe.

When pulling, always pull outward and slightly downward. Time your pull to coincide with the ewe's efforts, which occur at intervals.



a Leg turned
b Head turned
c Hind end first
d Upside down, or crosswise
e Twins coming simultaneously

Fig. 5 Some abnormal presentations described in text.

LACTATION

Suckling imposes the heaviest drain on a ewe's reserves, particularly when there are twin lambs. Nursing ewes need hay and clean water ad lib, with access always to a mineral block or loose mineral. In addition, the grain ration that they had received immediately before lambing must be maintained. If facilities permit, give preferential treatment to those ewes nursing twins, both in the early stages when the flock is most likely housed and later at pasture.

AFTER WEANING

From weaning until flushing the ewes may be kept satisfactorily on a maintenance ration. This could be provided by a pasture which, although it would not support the growth of lambs, is adequate for dry ewes. The provision of minerals remains necessary during this interval.

In the fall before rebreeding, the ewe flock should be culled and replacements selected. Accurate and complete records are invaluable at this time. Ewes that are low producers, or have udder problems or broken mouths should be discarded. If progress is to be made, replacements should be potentially more productive than the ewes they replace.

MANAGEMENT OF THE RAM

The ram should be maintained in a thrifty condition and should not be allowed to become fat. He should be turned out with the flock approximately 145 to 150 days before the producer's target date for the start of lambing. The method of breeding will depend on the size of the ewe flock, and on the age and vigor of the ram. Where flock breeding is practiced (that is, where the ram is turned out with the ewe

flock) a well-developed yearling or older ram will breed 40 to 50 ewes a season; a ram lamb (55 kg[1] and up) 15–25 ewes. This is the most commonly used method in the Atlantic Provinces. To conserve the ram, semiflock breeding may be practiced. When this system is followed, the ram is separated from the ewes for about 12 of each 24 hours.

Hand breeding is used in special circumstances. With this method, ewes are brought to the ram and, after breeding, returned to the flock. This is not practical in most instances.

To check the fertility of a ram, his brisket and chest should be marked with ocher mixed with oil before he is turned out with the flock. As an alternative he may be fitted with a ewe-marking harness. After an interval of 16 to 18 days, the marking color should be changed. If many ewes are marked again it is advisable to replace the ram.

After the end of the breeding season, rams should be removed from the flock and maintained in separate quarters.

SHEARING AND WOOL PREPARATION.

The annual wool clip is an additional source of income to the sheep producer, but in most instances it does not receive the attention that is warranted for the returns involved.

The wool produced in the Atlantic Provinces has gained the reputation of having a low percentage of rejects and, due to climatic conditions, there is less grease content and shrinkage in processing than in wool produced elsewhere in Canada.

To produce a good wool clip, a flock must be maintained in a healthy condition. Sheep that are thin and unhealthy are difficult to shear and their wool is usually of poor quality.

A sheep producer can increase the income from his wool marketing through selection of breeding stock from rams and ewes that have produced heavy, clean fleeces that are free from kemp, black and gray fiber.

As a general rule, shearing can be done most easily during the early spring warm weather. At this time the oil or grease content of the fleece is high with the result that it allows the shears to glide more smoothly through the fleece. Shearing in the Atlantic region begins in late March and continues through April and May.

[1] 120 lb

It is recommended that flocks be shorn soon after lambing, depending on climate and available accommodations. A flock should be shorn before it is turned out to summer pasture; the practice of June shearing is not encouraged as the wool begins to fall out and the warm weather makes the sheep uncomfortable. Ewes heavy in lamb should only be shorn by someone with considerable experience in handling sheep. Rough treatment at this stage might cause premature birth or abnormal presentations.

Motor-driven shaft machines or electric clippers of various types are the common means of shearing. Shearing is a skill that can only be acquired through experience and considerable practice.

Many flock owners have their sheep shorn by custom shearers who, as experts, can do the job in the minimum amount of time. The only drawback is that the custom shearers are not as plentiful as they might be and are not always available at a convenient time.

Many flock owners shut their sheep in the barn or shed the night before shearing. This ensures that they remain dry should it rain during the night. Also, if penned closely, the sheep will sweat and the wool tends to stand up, making it easier to remove the fleece.

Proper feeding practice should insure that the fleece is not full of chaff, seed and straw (use recommended feed racks and do not carry hay and bedding over backs of sheep).

The sheep must be dry for shearing and the clipped wool placed in dry storage. If the wool is damp when shorn or if it becomes moist prior to shipment, it will become musty, decrease in value and be graded as defective. Shearing should be carried out on a clean surface free from all matter that could adhere to the fleece.

There are a number of popular methods of shearing; one that appears to be quite practical is the ''New Zealand method''. With any of the methods, however, it is the skill with which the procedure is carried out that is important. In shearing, the aim should be to remove the fleece in one piece. This requires the shearer's control over the sheep at all times through the shearing process. In the New Zealand method, a shearer uses his feet and legs to keep the sheep under control and in position, leaving both hands free to handle the clippers and keep the sheep's skin tight as the wool is being removed. The wool should never be pulled during shearing, otherwise severe cuts may result. Shears should be operated at a 45-degree angle for best results.

Seedy sections, tags, kemp, gray and black fibers and other reject portions should be removed. The off-sorts should be packed separately. After all foreign

material has been removed, the fleece is ready for tying. Fold each side in toward the center and roll from the rear portion toward the neck, keeping the bundle compact and neat with fleshside out. By following this procedure the best-quality wool will form the outer layer of the bundle. Each bundle should be tied with paper twine. Binder twine or sisal cord of any type should never be used; fibers from them become mixed with the wool and cannot be removed in the manufacturing process, thus reducing the value of the fleece. If paper twine is not available, some producers use yarn or tie the fleece with the neck portion.

WOOL GRADING

Wool produced in the Atlantic Provinces is designated as Eastern Domestic and the classification and grade are determined by the diameter, length and strength of the wool fiber, and by the general condition and cleanliness of the fleece.

Eastern wool may be divided into two classes: Special (bright color, little foreign matter and long staple) and regular (darker color, more foreign matter and shorter staple). The grades are Staple and Clothing, according to the length and strength of the fiber. Fibers of staple wool are 5 cm (2 in.) or more in length; those of clothing wool are under 5 cm. Wool that is defective or contains excessive foreign matter is placed in one of the following Defective grades: chaffy; burry — soft and hard cotts; tags, dead and damaged wool; kempy; stained; mothy, and sweepings.

The following are the grades common to the Atlantic region, and the breeds from which wool of these grades is derived:

Canada ⅜ Staple — Suffolk, Hampshire, Shropshire, Dorset

Canada ¼ Staple — Oxford, North Country Cheviot

Canada Low ¼ Staple — Leicester

Canada Coarse — Scottish Blackface

Canada Gray and Black — Suffolk

GRADING OF LAMB AND MUTTON

Federal grading standards assure uniformity in carcass grading operations across Canada. As a result, a buyer in any part of the country can order by grade and be sure of getting carcasses of the quality he wants.

A revised federal lambing grading system was introduced in 1974, establishing five quality grades: Canada A, B and C for lamb, and Canada D and E for mutton. It eliminated the restrictive weight ranges for lamb carcasses which were part of the old regulations, thus permitting producers to raise heavier, meatier lambs without risking a penalty. It also provides four fat levels for Grade A lambs: Canada A1 having the least fat, A4 the most. There are two categories for Grade C lamb and four categories for Grade D mutton, based on muscling and fat content. Canada E grade indicates a carcass from a mature male sheep. Grade specifications for lamb and mutton carcasses are given in Table 4.

The Canada Department of Agriculture provides grading service at all federally inspected plants in Canada. Although regulations do not make grading of lamb carcasses mandatory, they do require that any carcasses that are graded must be done so in accordance with federal grading standards. As a result, carcasses are seldom officially graded and marked except when the retailer requests it or when carcasses of a particular grade are ordered.

TABLE 4. LAMB AND MUTTON CARCASS GRADE SPECIFICATIONS

Grade	Muscling	Flesh		Fat		
		Texture	Color	Texture	Color	Distribution
Lamb						
A1-A4	Excellent; plump legs, wide thick back, thick full shoulders	Fine	Pink to light red	Firm	White	A1: Light external covering; small to moderate amounts of pelvic and kidney fat A2: External surface well covered; kidney and pelvic fat exceeds A1 slightly A3: Carcass completely covered; moderate to large amounts of kidney and pelvic fat A4: Excessive external covering; large to excessive amounts of kidney and pelvic fat
B	Good; moderate thickness, slight narrowness in legs, back, shoulders	Fine grained to moderately coarse	Pink to moderately dark red	Firm to moderately. soft	White to reddish or amber	Light to moderate covering; small to moderate amounts of kidney and pelvic fat. No excess proportion of fat overall
C1	Fair; narrowness through legs, back and shoulders	Coarse	Dark red	Firm to soft	White to yellow	Slight to heavy external covering; internal fat may range in amount from deficient to excessive
C2	Poor; extremely thin with extreme angularity in hips and shoulders	Extremely soft, watery, coarse	Very dark red			There may be no external fat
Mutton						
D1	Excellent; plump legs, wide thick back, thick full shoulders	Firm	Moderately dark red	Firm, brittle	White to cream	Thin external covering; moderate amounts of pelvic and kidney fat but no excess proportion of fat
D2	Good; moderate thickness. Slight thinness in legs, back and shoulders	Firm to soft	Medium to dark red			External covering may be slightly less or greater than D1, but no excess proportion of fat
D3	Fair; thin, concave legs, narrow shoulders	Soft, watery	Dark red			External and internal fat may range in amounts from slight to excessive
D4	Poor; extreme narrowness and angularity	Soft, coarse, watery				There may be no external or internal fat
E		Very coarse	Very dark red			

ECONOMICS AND MARKETING

The major objective of sheep husbandry is the production of the greatest amount of lamb carcass per ewe or per acre compatible with cost. Wool contributes to the income from the sheep enterprise but is a lesser consideration in Atlantic Canada. Sheep may be kept also for the benefit they bring in terms of land improvement in a cropping rotation or even in keeping permanent pasture in good condition. The most important output factors are percentage lamb crop at marketing and growth rate of the lambs. Cost of feedstuffs is the biggest single input item.

A survey of 40 flocks of all sizes in four counties of east-central Nova Scotia, covering a 2-year period from breeding in the fall of 1970 to disposal of the 1971 lamb crop, showed that while average productivity was low, there was great variation from flock to flock, with the best flocks performing extremely well. The degree of success seemed to depend on management rather than on the size of the flock, month of lambing or breed of sheep. A summary of the findings of this survey are shown below:

	Mean of all flocks	Flock with highest gross margin	Highest value in any flock
Lambs born alive / 100 ewes bred	107	132	173
Lambs marketed / 100 ewes bred	90	132	163
Mean return / lamb	$20.20	$27.60	$30.00
Net output[1] / ewe bred	$20.01	$36.00	$38.28
Variable cost / ewe bred	$12.20	$ 9.66	$22.91
Gross margin[2] / ewe bred	$ 7.81	$26.34	$26.34
Net output / forage acre	$27.28	$36 37	$86.05
Variable cost / forage acre	$16.62	$ 9.75	$46.25
Gross margin / forage acre	$10.64	$26.62	$39.80

[1]Value of sales less value of purchases, adjusted to account for inventory changes.

[2]Net output less variable costs.

Study of the data shows how heavily gross margin is dependent on lambing percentage at time of marketing. Although costs and prices have both risen since this survey was done, gross margin figures are probably still applicable.

The producer must do everything possible through selection and flushing to ensure a maximum lamb crop, and through care, proper feeding and routine health precautions to keep lamb losses to the very minimum. In fact, the flock with the highest gross margin per ewe had no lamb losses during the period covered by the study.

Furthermore, the variation in mean return per lamb should be noted. Though there may be an element of bargaining ability reflected, the difference between best and mean values clearly shows the importance of being able to sell most or all lambs as market rather than feeder stock. Weight and quality are important.

In Atlantic Canada the cheapest gains are those made on grass. Variations in the variable cost values show that some flock owners were spending heavily on purchased feeds at noncritical times. The ewe's greatest feed needs occur at flushing, just prior to lambing and while nursing. Supplemental feeding of the ewe at other times is largely wasted.

Perhaps the most significant value is that representing gross margin per ewe in the best flock ($26.34). This shows what is possible under good management. It sets a goal, already attained, which all flock owners should try to reach.

MARKETS IN NOVA SCOTIA

Approximately 18,000 lambs were reared to market age in Nova Scotia in 1975 but only 4,405 lambs were marketed through inspected plants. What about the others?

Approximately 3,500 ewe lambs were kept for flock replacement (assuming a 20% replacement rate). On-farm slaughterings were estimated at 2,800, feeder lamb sales at 1,500, and sales of ewe lambs for breeding purposes at 500. This leaves live sales of market lambs to local butchers and slaughterhouses at approximately 5,300.

From these figures it will be seen that lamb disposal can involve several channels. Sales of feeder lambs in Nova Scotia have developed over the years. Each year the annual feeder lamb sale at Truro attracts buyers from Quebec and Ontario as well as local buyers, and prices in the past have been satisfactory.

The Easter lamb market in Nova Scotia appears to be increasing each year. A small number of these light lambs are sold on the Montreal market while some are sold in the Halifax and Sydney areas of the province.

The sale of breeding stock in Nova Scotia has increased in recent years. In 1975, about 1,000 head were offered at the Nova Scotia Sheep Fair and Sale.

Of this number about 30% were shipped to other parts of Canada and to the United States. In the past, however, lamb marketing in Nova Scotia has been disorganized. Possible reasons include the following:

- Average flock size is small.
- Only a small number of lambs are offered for sale at any one time.
- Lambs are disposed of in a variety of ways (farm slaughter, local slaughter, live selling, and at inspected slaughtering plants).
- Transportation and handling costs can be high.
- There is no central agency for the collection, grouping and selling of lambs.

The marketing of wool in Nova Scotia is carried out through the Nova Scotia Wool Board. The Board acts as a selling agent and arranges for the sale of wool to various mills in the Atlantic area. Nova Scotia wool is sold to Briggs and Little of Harvey Station, N.B.; William Condon and Sons of Charlottetown, and MacAusland's of Bloomfield, P.E.I.; Stanfield's Woolen Mills of Truro, N.S., and Canadian Cooperative Wool Growers, Toronto, Ont.

MARKETS IN NEW BRUNSWICK

It is estimated that about 50% of the lamb produced in New Brunswick in 1975 was purchased by local butchers or drovers or used for home consumption. A few sheep operators butchered their own lambs and sold directly to the consumer. Slaughterings of lamb at federally inspected plants accounted for about 30% of the lamb disposal. About 10% of the total lambs sold for meat went to Quebec. Of these, one-third were for the Easter or spring market in Montreal which requires a lightweight lamb. In effect, this means a meaty, well-covered lamb weighing 18 to 22 kg (40 to 50 lb) and usually from 7 to 10 weeks old. Most are of Suffolk, North Country Cheviot, Dorset or Hampshire breeding or crosses involving these breeds. In New Brunswick, the lambs usually have been picked up at the farm and trucked directly to Montreal.

Approximately 10% of the lambs were sold through community auction sales in Florenceville and Sussex.

A few feeder lambs were sold to buyers from Nova Scotia, Quebec and Ontario but very few breeding stock have left New Brunswick in recent years.

During 1975, a cooperative feedlot for lambs was established in the province and approximately 800 lambs from 25 producers were finished and marketed through this project.

The Briggs and Little mill at Harvey Station has processed most of the wool produced in New Brunswick for many years.

Though no accurate figures are available, the production of raw wool in New Brunswick in the early 1970's would be about 22.6 tonnes (50,000 lb) annually, worth about $35,000 at 1974 prices.

In the past few years there has been considerable interest in locally tanned sheepskins.

MARKETS IN PRINCE EDWARD ISLAND

Traditionally, most of the lambs produced in P.E.I. have been born late in the spring, have nursed on pasture all summer and have been marketed in the fall. The main markets have been local consumers, the Maritime Cattle Market in Truro, N.S.; Montreal, and the French islands of St. Pierre and Miquelon.

Lamb production in P.E.I. was declining for many years up to 1973; however, there was a slight increase from 4,100 lambs in 1973 to 4,600 lambs in 1975. With allowance for the retention of some ewe lambs as replacement breeding stock, there were approximately 4,200 lambs for slaughter in 1975. Of this total, 1,650 lambs were slaughtered at federally inspected plants and another 152 at provincially inspected plants. Approximately 500 to 600 lambs were shipped to the early Montreal market and about 600 lambs were sold to buyers on St. Pierre and Miquelon islands. The remaining lambs were probably accounted for by sales through the Maritime Cattle Market in Truro, by direct sales or by on-farm consumption.

The annual wool clip approximates 12.7 tonnes (14 tons) of grease wool. There are two P.E.I. woolen mills which use local and imported wool but until recent years a substantial proportion of the clip was shipped to mainland woolen mills and to the Canadian Wool Growers Co-operative, Toronto. In 1975 the two P.E.I. plants (Condon's and MacAusland's) purchased virtually the entire wool clip. In 1974, the P.E.I. Sheep Farmers Co-operative was formed. It collected members' wool, had it manufactured into yarn and sold the yarn to various consumers throughout the Atlantic area. This activity gave the producers a greater return on their wool.

MARKETS IN NEWFOUNDLAND

During 1975, approximately 9,000 lambs were raised to market age in the province. Of these, only 900 were kept as replacement ewe lambs.

Because of geographical isolation, only a small percentage of the total lambs marketed went through the federally inspected abattoir in St. John's. Approximately 300 lambs were custom killed in three community slaughterhouses and marketed directly to wholesalers and retailers by producers. These slaughterhouses, which are owned and operated by Newfoundland Farm Products Corporation, a Crown Corporation, do not have federal inspection or grading facilities. Another 300 market lambs and culled ewes were auctioned live to butchers at auctions held at Gaskiers and St. Bridges in 1975. Also, 375 market lambs were shipped to St. Pierre; however, this represented only 12% of the present demand for lambs on the French island.

It is estimated that approximately 60% of all lambs marketed within the province are sold live to butchers. The remaining 40% are either killed in private slaughterhouses or custom killed in community slaughterhouses and marketed by producers.

Newfoundland, with a heavy rainfall, has an extensive acreage of rough natural pasture. However, severe climatic conditions prevent local grain production. Limited roughage production and high prices for imported grains compel sheep producers to finish their lambs on grass.

The economics of limited feed production dictates a late lambing program (April and May) for most producers. Most lambs are marketed directly off grass at a rather light carcass weight of 14 to 20 kg (30 to 45 lb).

At present, there are no woolen mills in Newfoundland. Sheep producers have to market their total wool production to mills outside the province, principally in the Maritimes. In 1973, approximately 17.2 tonnes (19 tons) of wool were shipped to Maritime woolen mills. Additional small shipments were made to the Canadian Co-operative Wool Growers, Carleton Place, Ont. A significant portion of the total provincial wool production is never marketed because of high freight rates and the difficulty of obtaining shipping containers that will meet the approval of the Plant Protection Division of the Canada Department of Agriculture. Because of the presence of golden nematode and potato wart in Newfoundland, measures to prevent their spread to the mainland include the requirement that all commodities exported from Newfoundland must be packed in new containers.

THE SHEEP DOG

A well-trained sheep dog is a valuable asset, making the job of herding or moving a flock a great deal easier for the shepherd. Buying a trained sheep dog is generally recommended as it saves time and effort; but you can save money and enjoy a rewarding experience by purchasing a pup and training it yourself.

All dogs are hunters at heart and it is the hunting instinct, modified by breeding, training and obedience, which is turned to advantage in the working stock dog. It is this same instinct that drives dogs to become savage killers when allowed to run out of control.

Wolves, coyotes and wild dogs habitually hunt in pairs, and domestic dogs share this need for a hunting companion. The need for company is more compelling even than the urge for food. It is by utilizing this powerful need for a companion that you impose your will on the trained dog. By long association the dog learns to interpret your commands, gestures and whistle, and in the same way comes to know when he has incurred displeasure or has pleased you.

SELECTION

Although various breeds of dogs can be trained to herd sheep, the Border Collie is the most popular. This small dog takes its name from the Borders, an area of upland grazings between England and Scotland. Few Border Collies look alike; they vary in size, with coats long or short, black and white or red and white, some with tan markings and others with gray. Their one consistent characteristic is their desire to work livestock and this is precisely what the shepherd is looking for.

When buying a pup you want to know what type of worker it may develop into, so arrange to see the sire and dam and other mature related dogs working with sheep. Once you are satisfied, watch the pups at play and try to startle them with a loud handclap; make your selection from those that hold their ground. Overall appearance is not important, but a short-haired pup picks up less dirt and is more comfortable working in the sun than one with a long, thick, silky coat.

BASIC TRAINING

In any working association there has to be a dominant individual and you must let your dog know from the

outset that you are to occupy the commanding position in the partnership. Establish the bond of companionship early; if necessary, keep the dog penned or tied in the barn to avoid attention from other people, particularly children. Feed him yourself, fuss over him with hand and voice, repeating his name, and take him with you in the truck whenever it is convenient. Your pup will appreciate the contact and will soon learn to admire, respect and obey you.

To communicate with your dog, you should have two voices, one implying affection (cooing) for praising or greeting the dog or calling it in; and the other, more of a growl, used when the dog has incurred displeasure. The first time the puppy is disobedient, pick him up by the scruff of the neck, shake him and growl at him, just as his mother would; after that, with luck and care, no more severe form of punishment will be required. Always balance reprimands with encouragement when the pup does the right thing. In this way you strengthen his joy at obeying your commands.

Use the dog's name as the command for recall. Keep all commands short and clipped, and avoid conflicting rhymes (for example, if the dog's name is Jack, don't try to train him to go away from you to the command ''Back''). Make sure that each lesson is learned thoroughly before the next is started and review constantly.

It is easy to teach a 6-week-old pup to drop on command. With a piece of baler twine as a convenient lead, give the command ''Down''. At the same time, stand on the twine and pull up the free end. With your free hand, apply a gentle pressure on the shoulders to force the pup to the ground. Then pat the pup and praise him by cooing ''Good dog''. When the pup tries to jump up, growl ''Down'' and keep the baler twine taut to make sure he remains anchored to the ground.

You can use the same piece of baler twine to teach the dog to walk to heel. When the pup hangs back or pulls, growl a harsh ''Heel'' and jerk the twine, then don't forget the pat and praise when he stays to heel. It is best not to bother with the command ''Stay'' as ''Down'' performs the same function.

To train the pup to come directly in on recall, put him down and walk backwards slowly, repeating the ''Down'' and, if necessary, growling the command if the pup is about to move. After a few feet and a pause of a few seconds, give a cooing ''Come,'' along with his name, and run backwards. This should bring the pup in full tilt. When he reaches your feet, say ''Down'' and a reassuring ''Good dog.''

Once the pup has learned these commands, he can be allowed to take an interest in stock. If he starts to work sheep, chickens or heifers, let him find out what fun work is. But if he gets into difficulties or makes a nuisance of himself, command ''Down,'' then pause and say ''Come''. Do not scold him for trying to help with stock when it is inconvenient; just take him away and tie him up, as you do not want to discourage him from working.

HERDING LESSONS

A group of about 20 quiet old ewes in a paddock are ideal for the dog's first herding lesson. With the dog on a leash, walk behind the sheep and keep them moving around the paddock. Soon the dog will start to weave or 'wear' the flock, swinging from one flank to the other. When you feel that he can be stopped on command, slip the leash and allow him the joy of working free. Do not let him get too excited; a periodic ''Down'' and ''Come'' should keep him from getting out of hand. Let him work about 10 minutes a day like this and then, after a few days, start teaching him his 'sides' and you will have the makings of a worker.

WORKING A FLOCK

To work a flock, the dog has only three additional commands to learn — ''Come bye'', ''Away'' and ''Get up'', which can be taught as he wears the flock around the paddock. When he has run to the 3 o'clock position (see diagram), give the command ''Down''; then, anticipating his move past 6 o'clock through to 9 o'clock, call ''Come bye'' with the stress on ''Bye''; at 9 o'clock, call ''Down'' again and, anticipating his change in direction, call ''Away'' stressing the new sound ''Way''. Thus, with you as the fulcrum, the dog swings from side to side like a pendulum to the rhythm of ''Away'' ... ''Down'' ... ''Come bye'' ... ''Down'', etc. Sooner or later the dog will run to 12 o'clock and at this point often drops without command. An encouraging ''Get up, Get up'' becomes the command for driving the sheep towards you.

By now the dog is keen for his lessons and by the time he reaches the paddock gate is literally on his toes awaiting the flanking commands. Provided he is not making mistakes, gradually he can be sent for sheep at greater distances, but always be ready to stop him with ''Down'' and don't let him get into the habit of hustling the sheep.

12 O'CLOCK

9 O'CLOCK

3 O'CLOCK

6 O'CLOCK

CONVERSION FACTORS FOR METRIC SYSTEM

Imperial units	Approximate conversion factor	Results in:	
LINEAR			
inch	x 25	**millimetre**	**(mm)**
foot	x 30	**centimetre**	**(cm)**
yard	x 0.9	**metre**	**(m)**
mile	x 1.6	**kilometre**	**(km)**
AREA			
square inch	x 6.5	**square centimetre**	**(cm^2)**
square foot	x 0.09	**square metre**	**(m^2)**
acre	x 0.40	**hectare**	**(ha)**
VOLUME			
cubic inch	x 16	**cubic centimetre**	**(cm^3)**
cubic foot	x 28	**cubic decimetre**	**(dm^3)**
cubic yard	x 0.8	**cubic metre**	**(m^3)**
fluid ounce	x 28	**millilitre**	**(ml)**
pint	x 0.57	**litre**	**(ℓ)**
quart	x 1.1	**litre**	**(ℓ)**
gallon	x 4.5	**litre**	**(ℓ)**
WEIGHT			
ounce	x 28	**gram**	**(g)**
pound	x 0.45	**kilogram**	**(kg)**
short ton (2000 lb)	x 0.9	**tonne**	**(t)**
TEMPERATURE			
degrees Fahrenheit	(°F-32) x 0.56 or (°F-32) x 5/9	**degrees Celsius**	**(°C)**
PRESSURE			
pounds per square inch	x 6.9	**kilopascal**	**(kPa)**
POWER			
horsepower	x 746	**watt**	**(W)**
	x 0.75	**kilowatt**	**(kW)**
SPEED			
feet per second	x 0.30	**metres per second**	**(m/s)**
miles per hour	x 1.6	**kilometres per hour**	**(km/h)**
AGRICULTURE			
gallons per acre	x 11.23	**litres per hectare**	**(ℓ/ha)**
quarts per acre	x 2.8	**litres per hectare**	**(ℓ/ha)**
pints per acre	x 1.4	**litres per hectare**	**(ℓ/ha)**
fluid ounces per acre	x 70	**millilitres per hectare**	**(ml/ha)**
tons per acre	x 2.24	**tonnes per hectare**	**(t/ha)**
pounds per acre	x 1.12	**kilograms per hectare**	**(kg/ha)**
ounces per acre	x 70	**grams per hectare**	**(g/ha)**
plants per acre	x 2.47	**plants per hectare**	**(plants/ha)**