1964

1964 Area Sheep Fields Days

Cooperative Extension Service
South Dakota State College

Agricultural Experiment Station
South Dakota State College

AREA SHEEP FIELD DAYS

January 1964

Extension Service
Animal Science Department
Agricultural Experiment Station
South Dakota State College
College Station, Brookings, South Dakota

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INTRODUCTION

The Sheep Industry in South Dakota is one of the three most important meat animal industries in our state. Stock sheep on January 1, 1963, totaled 1,509,000 head, 4% more than year earlier and 6% above 57-61 average. Approximately half of these sheep were produced in east river counties and half in west river counties.

South Dakota is the 5th ranking state in both numbers of "all sheep and lambs" and "lambs on feed." Texas, Wyoming, Colorado, and California lead South Dakota in "all sheep and lamb" numbers.

For a number of years, sheep producers have been faced with increasing flock production cost. This is partly due to the constantly rising level of the general economy. As the production cost increases the producers must then direct their attention toward ways and means of increasing the lamb raising potential of sheep. It is with this in mind that the area sheep field days were planned. Increasing the earning capacity of the farm and ranch flocks could very well be the theme.

The sheep industry in South Dakota will thrive and grow only when the income will carry the burden of production costs and also leave a satisfactory margin of profit. Increase in quantity and quality of lambs and wool and practices which lower production and marketing costs both can have a significant effect on earning capacity and profit. The committee that has arranged this program does not imply that eight area one-day programs and accompanying mimeographed summaries of discussions carry the answers to all problems for all sheep raising ranchers and farmers. The committee hopes that they will provide considerable information and if this information helps in any way toward increased earning capacity of the flock, the meetings will have been worthwhile.

The Sheep Field Days held this year are sponsored by the South Dakota State College Extension Service, The Department of Animal Science, South Dakota Agricultural Experiment Station, in cooperation with the many sheep producers throughout South Dakota.

South Dakota State College
Brookings, South Dakota

Extension Service Marketing Specialist Section

The Sheep Industry - Outlook For 1964

Wayne Schulte

The sheep industry along with some other agricultural enterprises is experiencing some ever increasing problems. Declining demand for both lamb and wool are major sources of difficulty. Lamb faces severe competition from other meats, and wool competes with a number of synthetic fibers. Wool prices and production declined so sharply in the late 40's and 50's that Congress passed the Wool Act in 1954 providing payments to wool producers to insure a needed level of production in the event of a national emergency.

Lamb prices have fallen despite the low and declining per capita production. Before World War II lamb consumption was consistently greater than 6 pounds per person; since 1950, consumption has been between 4 and 5 pounds. (Plate #1 Consumption of Meat) Despite the decreasing amount of lamb available for each consumer, lamb prices to farmers have fallen absolutely and relative to the price of other meat animals. Prior to 1958 lamb prices moved with cattle prices but were nearly always a little higher. These positions were reversed in 1958, and lamb prices have remained below cattle prices almost consistently since then.

The nature of the demand and the make-up of the lamb market partly explain the decline in demand. Sales volume of lamb for most retailers is small compared to other meats. Few people eat lamb regularly and some never do. (Plate #2 Map of U.S.) In many areas of the country only a small proportion of the consumers buy lamb, therefore retailers have little incentive to carry or display it in a prominent place. Many butchers have little experience with lamb and dislike handling it. Most retailers believe that lamb has a shorter shelf life than other meats and that waste is higher. Besides little of it goes into hamburger or other ground meat. These factors have made retailers reluctant to handle lamb.

Modern food retailers favor commodities which have strong consumer demand, are regularly available in large quantities of uniform quality, and have low labor and handling costs. Many characteristics of lamb do not meet these requirements of mass retailing. Consumer and retailer indifference to lamb reinforce each other to the detriment of lamb sales. Therefore, retail lamb prices have not fallen nearly as much as farm prices since 1958. (Plate #3 Retail Meat Prices)

Lamb and wool producers have a big job ahead then, in an attempt to increase demand for their products and keep pace with other meat and fiber producing industries.

Growth of the industry will depend mainly on whether demand for lamb and wool can be increased by reducing some of the factors mentioned earlier.

If demand continues at present levels or declines as it has relative to beef, does not imply that lamb and wool will not be produced profitably. However, profits will largely be determined by the efficiency of production that the individual sheep producer can attain. This would include more efficient feeding practices, a larger percentage lamb crop, more timely marketing and other improved management factors.

We have an idea what some of the problems of the sheep industry are; what is the future outlook in terms of production trends? Before trying to answer this question, some background of the sheep industry should be presented. I will present the lamb situation first and then cover the wool situation.

As most of you are probably aware, national sheep numbers have been declining the past four years. On January 1, 1960 there were 33.2 million head of sheep and lambs in the United States. Numbers have been decreasing since then and on January 1st, 1963 the number had declined to 30.2 million head. (Plate #4 Sheep Numbers) This is an annual average decrease in the national sheep herd of one million head. If the estimates for January 1st, 1964 are correct, we are down by at least another half million head, between 29.3 to 29.7 million head. This is the lowest number of sheep and lambs since records have been kept and only slightly more than half the number of 56.2 million head, the largest number on record in 1942. This is in contrast to the steadily increasing number of cattle which reached an all time high at an estimated 107 million head the first of this month.

We are expecting a different situation here in South Dakota than nationally, however. We had nearly a 4 percent increase in sheep and lamb numbers during 1962, from 1,702 thousand head on January 1, 1962 to 1,774 thousand head on January 1, 1963. Sheep numbers in South Dakota likely will be up again this January. According to the South Dakota Crop and Livestock Reporting Service, breeding ewes 1 year and older were up 3 percent for 1963 and the percentage of lambs saved increased from 104 percent in 1962 to 106 percent in 1963. The western part of the state had the greatest increase in sheep numbers during 1962 and it is interesting to note that five West River counties, Butte, Harding, Perkins, Meade and Fall River account for nearly one-third of the total sheep and lambs in South Dakota. With the trend in decreased numbers of lambs and ewes going to slaughter during 1963, it is likely that lamb production will be up again next year in South Dakota.

Another change that has been occurring is a reversal of the shift of larger numbers of sheep in the Native States compared to the Western States. The 11 Western States, Texas and South Dakota combined (Plate #5 Western U.S. States) have a little more than two-thirds of the U.S. ewes 1 year old and older and produce about two-thirds of the U.S. lamb crop. In the 1950's, these 13 states accounted for somewhat smaller proportions of the U.S. inventory of ewes and the Native States slightly larger proportions. This trend has been reversed, Western States in the past 3 years have accounted for more than 69 percent of the U.S. inventory of ewes. In

1963, 70.7 percent of ewes were in these 13 states. Of significance, too, is the fact that Western States have saved a larger number of lambs per 100 ewes than in the past. While weather conditions at lambing time still affect the lamb crop more in the Western States than in the Native States, the difference in lambs saved between the two areas has narrowed.

This has given us some idea of the trend in sheep numbers in the United States, South Dakota and the shift in production areas. What has been the trend in slaughter prices during the past year?

While the lamb crop was down by 3 percent during 1963, total sheep and lamb slaughter will be down about 6 percent from 1962. (Plate #6 Lamb Slaughter and Prices) During the first 6 months, slaughter was lower than the corresponding month of the previous year. The result was 9 percent less commercial slaughter during these months than in 1962.

As a result prices received for lambs were from $.40 to $2.00 per 100 pounds higher than a year earlier each month of January through June of 1963. Prices dropped to $19.00 in July, the same as a year earlier (Plate #7 Prices of Slaughter Lambs) and have been below during most of the remainder of the year. Slaughter during the last half of 1963 was below year earlier levels but strong competition from beef and other meats held prices at lower levels than similar months in 1962.

What is the Outlook for the remainder of 1964? The size of the national sheep flock may shrink again this year although likely at a slower rate than during 1962 and 1963. It is estimated that ewes added to breeding herds during 1963 did not quite offset death losses and slaughter. Therefore the number of ewes 1 year and older was probably down a little more on January 1, 1964 than a year earlier. If the proportion of lambs saved follows the same relationship to number of ewes as in recent years, the 1964 lamb crop will be about 4 percent smaller than in 1963.

Slaughter will therefore likely be down also but at a decreased rate from 1963. The number of sheep and lambs on feed is down this January 1, from a year earlier and an anticipated reduction in the 1964 lamb crop will account for the lower slaughter rate without further liquidation of the breeding herd.

Although the per capita consumption of red meat for 1964 is expected to remain at the same high level of 170 pounds or slightly higher, lamb and mutton likely will decrease slightly from 1963. Beef will make up the portion lost by veal, mutton and lamb.

Prices will be under stiff competition from beef and other meats and likely will average close to 1963 levels.

What about the Outlook for wool? According to the U.S.D.A.'s Market News Service, some Montana wool was contracted in early December for $1.35 to $1.45 a clean pound on a core test, delivered in the East. Some South Dakota wool was

contracted at $1.25 for 58/60's. Domestic wools are ten to 25 cents higher (on a clean basis) than a year ago. Inventories are low, and world wool prices have gone up sharply this fall.

Use of wool has been a little higher than production for three years. It was believed, however, that production had increased enough so that it would be in balance with consumption during the coming year, and that prices would continue stable. Instead, use by some countries is up and there has been active competition for wool by many countries. The aggressive buying has pushed prices of wool up about 20 cents a pound since the opening of sales early last fall.

The low level of carryover wool stocks, both here and abroad, has contributed to the rapid rise in world wool prices once a number of buyers started pushing prices up.

The United States' manufactures have been caught in a squeeze since the wool top and fabric business, particularly new orders, has been slow. They have been reluctant to buy replacement wools at the going world prices in the face of slack business, and have expected that the world wool market would "cool off" as the buying season went on. This hasn't happened so far, but there will be considerable interest in how the sales go now that the holidays are over.

It appears that wool use is increasing more rapidly in other countries than in the United States. (Plate #8 U.S. Wool Production) United States Wool Production has also been decreasing slightly. Wages have been increasing in many areas of the world, and this may be contributing to the increased consumption of wool. This may be particularly so with the Common Market countries which seem to be quite prosperous. England and some other countries are shifting some of their exports from the United States to the Common Market countries, where the generally high employment levels and the greater purchasing power have stimulated the market for many consumer goods.

Here in the United States, producers have sold practically all of their 1963 wool clip. Trade sources have estimated that inventories of all types of wool in this country are at a low level. There may be only four to five million pounds of domestic wool still available for purchase by top makers and mills. Some trade sources estimate only two million pounds.

A little contracting for 1964 clips has begun in Montana, Wyoming and South Dakota. There is apt to be more contracting than usual this year because of the rising market. This is the reverse of the pattern in the selling of feeder cattle this past fall. In the case of feeder cattle, there was much less advance contracting than a year ago because the prices for feeder cattle were dropping throughout most of the fall. By the time producers began to think that a particular price level was acceptable, the prices had dropped below this level, and producers then would hold a while longer. The buyers of feeder cattle were also less aggressive in searching out cattle and in buying on a market that was moving down. In the case of this

winter's wool prices, the buyers of wool are more active in wanting to get some wool supplies in their hands or tied up, and sellers are more apt to be satisfied with a particular price offer.

While there may be some further rise in the price of wool on world markets, it is not likely that there will be much more of an increase in 1964. The possible use of substitution of synthetic man-made fibers for wool in some uses will tend to set a ceiling on wool prices at some point. (Plate #9 Prices of Selected Fibers) There are many who are already concerned that manufacturers may turn increasingly to synthetics, under the price levels now prevailing on world market.

Domestic wool prices may show some further increase, and in all probability the bulk of the 1964 wool clip will sell at prices considerably above those for the 1963 wool clip. The full increase in world wool trade has not yet been reflected in the domestic United States' wool market at the producer level. This is partly because there was little wool moving during the late fall months, when the southern hemisphere markets are very active. The peak of United States farm price of wool was reached in March at 51 cents per pound, grease basis. The fall prices were mostly around 46 cents, but a sharp increase in farm price can be expected from November to late winter.

The marketing year for wool and mohair for purposes of incentive payments ended December 31, 1963. It is possible to receive incentive payments on wool and unshorn lambs marketed between April 1 and December 31, 1963. In order to obtain such payments, sales documents and applications must be filed with the county Agricultural Stabilization and Conservation Service office by January 31, 1964. Payments will probably be received beginning in April. This is a change from previous payments which has been tied to marketing years ending on March 31.

The shorn wool payments will be equal to a percentage of each producer's cash returns from wool sales, based on the national average selling price. Thus, it is to each producer's advantage to obtain the highest dollar return for his wool. Payments for pulled wool are made to producers who sold lambs that had not been shorn.

The 1964 marketing year will be from January through December. The shorn wool incentive level for the 1964 year will continue at 62 cents per pound, grease basis. This will be the same as during the first nine years of the program.

South Dakota State College
Brookings, South Dakota

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Agricultural Experiment Station

A. S. Mimeo Series 64-1

GENETIC IMPROVEMENT IN SHEEP

J. A. Minyard

The objective in a sheep enterprise is, or should be, the economical production of high-quality meat and wool. How well the producer achieves this objective is determined by a combination of several factors. They can be grouped broadly as (1) breeding, (2) feeding and management, and (3) marketing and servicing for consumption. Animal breeding is the first step in the efficient production of sheep and wool.

For centuries stockmen attempting to produce superior animals have met with variable degrees of success. The fact that their objectives were not always completely achieved indicates that the methods used were not generally the most efficient or constructive. No way has yet been found that can be offered as a sure method to consistently produce superior stock, but a better understanding of the mechanism of inheritance can now be had to suggest more promising methods.

Although the process of reproduction and the transmission of hereditary characteristics from one generation to the next appears vastly complex and so often subject to chance, it does lend itself to some control by man. With our present knowledge of genetics the transmission of hereditary characteristics from parent to offspring is, to some extent, predictable. The accuracy with which these predictions can be made is influenced by the extent to which traits are inherited and by how well the producing ability of the parent animals is known.

The Role of Inheritance

"Like begets like" and "there are no two individuals alike" seem at first to be contradictory statements, but as the laws of inheritance are understood it can be seen that they are not. It is well known that offspring tend to resemble their parents. Not only is there a resemblance between related individuals but there is uniformity in the appearance and development of characters. This resemblance is in part due to the fact that related individuals tend to have more genes alike than do unrelated individuals, simply because some of the genes in each came from the same source--one or more common ancestors.

The laws of inheritance not only seek to account for the resemblance of related animals but they also recognize and seek to explain the lack of similarity between relatives. This can be understood when one recognizes the sampling nature of inheritance. Although related animals have more genes alike than unrelated ones it would be extremely rare for even the closest of relatives (excluding identical twins) to have the same genetic make-up. Heredity, however, does not need to account for all the resemblances of related animals. Likeness among relatives will be partially due to a common environment.

What causes the differences we see in sheep? This question may be raised in attempting to assess the relative importance of heredity and environment. Research by U.S.D.A. and several state experiment stations has provided estimates of the relative influence of heredity and environment on a number of important sheep characteristics. Their findings have generally shown that the effects of the two are quite different among different traits within a flock and a given trait in different flocks (Table 1). Differences observed in type and fertility, including twinning, are due largely to environmental effects. Condition and uniformity would be in this group. In such traits as weaning weight, rate of gain, and mature body weight, heredity will account for 1/4 to 1/3 of the variation. The effects of heredity and environment are near equal for traits such as face cover, wrinkles, fleece weight, staple length, and fineness of wool.

Table 1. Heritability of Important Traits in Sheep

Prolificacy	12-15%
Birth weight	30
Weaning weight	25-30
Type at weaning	10
Finish or condition at weaning	12
Rate of gain	30-40
Wrinkles or skin folds:	
Body wrinkles	50
Neck wrinkles	10-40
Fleece:	
Face covering	50
Yearling grease fleece weight	40
Staple length, weaning	40

Selection

Selection is the only method available to stockmen that can bring about permanent improvement in sheep performance. Deciding which individuals will be allowed to reproduce and permitting some kinds of individuals to produce more offspring than others is selection. Rate of progress in improving sheep performance by selection will be influenced by our ability to recognize genetically superior animals, the number of characters selected for, and the heritability of the traits being considered.

Production records offer the most efficient and effective tools for identifying animals of superior performance. It is very difficult, if not impossible, to look at a prospective breeding animal and tell how he will perform. We can see very little that indicates how the progeny will perform, in terms of growth rate, efficiency and quality. Even in wool production, where we can see something of the amount and quality of wool on the animals, we still can't tell with a great deal of accuracy. Australian workers have reported that selection by visual appraisal is about 30 percent as effective in increasing wool production as selection based on objective measurements. Selection by eye is probably much less accurate for traits such as weaning weight and rate of gain.

Probably the first prerequisite to any selection program based on production records is that each animal be positively identified. This is best done at an early age by ear tag or tattoo. Second, complete production records are necessary if selection is to be successful. Information recorded at birth or shortly after should include birth date, type of birth (single or twin), sex of the lamb, and number of its sire and dam. Any number of record forms are available for recording the above and subsequent performance information. A breeder may select those that best fit his needs or design his own. The important thing in record forms is that they be kept as simple as possible and yet provide space for recording all needed information; recorded in a way that it can be readily found. Performance information recorded should include weaning weight, taken when the lambs average about 120 days in age, and staple length at weaning. The lambs may also be scored for such things as type, face cover, skin folds, uniformity of fleece and density of fleece.

If the lambs are kept past weaning for post-weaning performance records, all lambs of each sex should be fed and handled alike. At least four months should be allowed following weaning to provide an adequate measure of gain and wool growth; from weaning to regular spring shearing would be excellent. Lambs need not be fattened to get good performance records. The level of feed intake should only be high enough to permit normal growth and development.

Some traits, such as weaning weight, fleece weight and staple length, are subject to large variation due to non-genetic causes. Therefore, these records should be adjusted before they are used in selection. Weaning weight should be adjusted for differences in age of the lamb, type of birth, and age of the dam. Fleece weight and staple length should be adjusted for differences in age of the lamb.

The taking of production records in a purebred flock will not be overly burdensome in terms of added labor and equipment. Purebred breeders are required to keep many of the needed records anyway. For commercial range flocks, particularly the large ones, it is a different story. Individual performance records may not be practical. However, considerable progress in sheep improvement can be made without resorting to detailed record keeping in the commercial flock.

Selection on the ram side probably accounts for 75-90 percent of the improvement in sheep. This comes about largely from the fact that, within a flock, about one-half the ewe lambs must be kept as replacements while only 2-4 percent of the ram lambs are needed. This means that intensity of selection among ram lambs can be more than three times that of ewe lambs. This emphasizes the importance of purebred breeders and producers of range rams. Improvement in sheep production will be realized largely through their efforts, since commercial producers must depend on them for high quality rams. Since the opportunity for sheep improvement lies largely with the purebred breeder the importance of complete production records and the use of them in making selections cannot be over-emphasized. Records have little value unless they are used in culling and selecting replacements.

The sheepman, attempting to improve his flock by selection, will find it necessary to consider more than one characteristic in his selection program. Even

though different stockmen may emphasize different characteristics, each will want to give some attention to all traits considered important in his type of operation. Although the "genes" are the units of inheritance, the animal is the smallest unit which can be selected or rejected at any one time. A stockman may cpnsider the different traits of each animal as separately as he cares to. He may like some of its characteristics very much and at the same time he may strongly dislike other characteristics about it. Or, he may give all his attention to only one trait. But what he does with that animal applies to all of its characteristics, the admired ones as well as the disliked ones. An animal is selected or rejected for breeding purposes according to the stockman's opinion of how much his good qualities outweigh his weaknesses.

The decision to select for improvement in a particular trait should be based on the contribution of that trait to net income. The most important trait is probably lamb production--simply pounds of lamb produced. Second would probably be pounds of wool and, next, quality of the two products. Selection should be directed largely to weight and quality of lamb and wool. For the purebred breeder some attention must be given to such traits as breed type, uniformity of fleece cover, face cover and wrinkles. However, the importance of lamb and wool weight should not be overlooked.

The more characteristics selected the slower the progress will be in improving each. Only so much selection can be done and if this is spread over several traits it naturally follows that only a little progress can be made in each one. For example, if equal attention is given to four independent traits the rate of change in any one will be only one-half of that expected if only one trait were considered. Selection for nine characteristics will reduce progress in any one to one-third.

Progress by selection is also influenced by how much of the differences we see and measure are genetic--heritability of the traits. As shown in Table 1., heritability for most traits is less than 50 percent. For some traits it is much less. The more highly heritable characteristics should generally receive more attention than those which are less heritable. It would be a disappointment to attempt to improve a trait by selection that is affected largely by environment. For traits low in heritability, improvement in nutrition, management, health and sanitation would likely be more fruitful.

Selection may be practiced in at least three general ways. The first, normally, referred to as the tandem method, is to select for only one trait at a time until the desired improvement in that particular trait is reached, following which selection is made for another trait, etc. The major disadvantages of this type of selection are that it is usually not possible to select for only one trait and income is usually dependent on several traits. The second method is to establish minimum standards for each characteristic and reject for breeding purposes all animals which fall below these standards. This is probably the most common system of selection. The chief weakness of this method is that an individual may be culled for being below the minimum standard in only one trait, although he may be superior in all other characteristics. The third method is to establish some kind of a total score or selection index to measure net merit. The index method is more effective than the other two because it allows us to select for

more than one trait at a time and permits unusually high merit in one characteristic to make up for slight deficiencies in another.

Mating Systems

Mating systems are concerned with the decision as to which animals within the breeding flock will be mated together. Mating systems may be based on blood relationship or characteristics of the individual animals. The following classification illustrates the kinds and definitions of breeding systems.

Systems of Mating:

1. Mating like to like

   a. by pedigree - inbreeding, including linebreeding, staying within one family, etc.

   b. as individuals - mating big with big, little with little, compact with compact, rangy with rangy, active with active, etc.

2. Random mating - mates no more and no less alike, than if they had been mated by drawing lots from within the group selected to be parents.

3. Mating unlikes together

   a. by pedigree - outbreeding, ranging from species crossing through cross-breeding, to crossing strains within the breed.

   b. as individuals - compensating for defects, crossing extremes to produce intermediates, mating large with small, coarse with refined, etc.

The mating of like to like on the basis of pedigree means that the mates have a closer blood relationship to each other than if mating were at random and is referred to as inbreeding in the broad sense. Inbreeding may vary in degree or intensity depending on how closely the mates are related. The primary effect of inbreeding is increased genetic purity. It increases the proportion of like gene pairs, without regard to their effect. It "fixes" the good as well as the bad traits in direct proportion to their frequency in the flock. This emphasizes the importance of practicing inbreeding only with superior breeding stock. Under certain conditions inbreeding may be an important aid to selection. For inbreeding to be useful as an aid to selection the flock must be superior with relatively few undesirable recessives in their genetic make-up and the level of inbreeding mild enough that the undesirable individuals can be culled as they appear. Otherwise, undesirables will show up much faster than they can be discarded, allowing these traits to become fixed in the flock. Considerable research has been done on inbreeding in sheep and it appears to have promise as an aid to selection, particularly for traits low in heritability. However, the method is still experimental and is not yet proven for sheep. More research is needed before conclusions are

drawn or before practical ways of using inbreeding can be recommended. With the information we have now it would be safe to say that we should do all we can with selection before resorting to inbreeding.

Linebreeding is a mild form of inbreeding and involves the continued mating of descendants from an admired ancestor to keep them closely related to that ancestor. They differ only in that inbreeding does not require the concentration of inheritance from any particular ancestor. The effects are the same as with inbreeding except in degree.

The mating of individuals which tend to have "similar characteristics" has little effect on the flock unless accompanied by selection. This type of mating tends to scatter a population toward the two extremes with respect to each character for which such mating is practiced. It increases the variability of the flock if all animals are kept. The effects of mating like to like are temporary and disappear almost at once when random mating is resumed.

As the name implies outbreeding is the opposite of inbreeding and can be defined using the same basis. In outbreeding the mates are less closely related to each other than they would be under random mating. Outbreeding generally leads to individual excellence but low breeding worth. It tends to make the flock temporarily more uniform than if outbreeding were not practiced.

Crossbreeding is a special form of outbreeding where the parents belong to different breeds. It generally results in increased size, vitality and fertility; but the amount of this increase is variable in different crosses. In a long-term study of cross-breeding, USDA researchers compared two- and three-breed crosses with the average of the parent breeds. The two-breed crosses were made with mutton-type sheep while both mutton-type and fine wool sheep were used in the three-breed crosses. In these studies they found that lamb mortality in the two-breed cross was reduced about one-fourth. In the three-breed cross, it was reduced about one-third. The number of lambs weaned increased about 10 percent with both kinds of crosses. Weaning weight was increased about 11 pounds for the two-breed crosses and about 18 pounds for the three-breed crosses. Fleece weight was increased about 25 percent with the two-breed crosses and about 28 percent with the three-breed crosses.

It should be emphasized that these results were obtained by crossing high quality purebred strains of sheep. Consistent improvement in performance of the magnitude indicated above cannot be expected from indiscriminate crossing of sheep. This would be particularly true in crossbreeding with grade ewe flocks or with ewes of mixed breeding.

Crossbreeding, like any other form of outbreeding, tends to lower the breeding value of the individual, increases the uniformity among crossbred individuals and thereby makes selection among them less effective. When the crossbreds are used for breeding purposes, their offspring tend to be more variable than the crossbred parents were and generally average somewhat lower in individual merit, often below their purebred grandparents in individual merit. Whether crossbreeding is a sound practice for the sheepman should be determined by

weighing the advantages of the extra size, vigor and fertility which is usually gained by crossing against the extra cost of obtaining good quality replacements. For those producers who normally buy replacement ewe lambs, the production of hybrid lambs should be a sound practice for increased sheep productivity.

The mating of unlike individuals on the basis of their individual characteristics is commonly practiced to correct defects by mating each animal to one which is equally extreme but in the opposite direction. This type of mating system, in the absence of selection, generally leads to a more uniform flock. However this increased uniformity reaches its full extent in the first generation. Mating unlikes is most useful when the desired type is an intermediate.

South Dakota State College
Brookings, South Dakota

Extension Service Livestock Specialist Section

Ewe Feeding Based on Nutrient Requirements And Available Feed

Delwyn Dearborn, Extension Livestock Specialist - West River

The importance of the sheep industry to South Dakota is much greater than the concern for proper nutrition would often indicate. Sheep have always been noted for being excellent scavangers and may do quite well where other domestic animals barely exist. However, results obtained by successful sheepmen verify research findings that sheep require certain levels of protein and energy as well as other nutrients for optimum production.

A brief review of some natural characteristics of sheep help to verify their nutritive needs and how these needs vary during the year. Some of the more important natural characteristics include:

1. Sheep are ruminants.

Like cattle, sheep are ruminants which have a four compartment stomach allowing them to utilize large amounts of roughage in their ration. It has been estimated that approximately ninety percent of the total feed consumed by the ewe flock is roughage.

2. Multiple births are possible and should be desired.

Sheep have the natural potential of producing a much higher percentage of twins than do cattle. This characteristic offers a real economic advantage and should be exploited by every progressive sheepman.

3. Fetus growth is quite rapid.

It is not uncommon for a ewe to give birth to lamb(s) weighing the equivalent of ten percent her own body weight following a five month gestation period. This might be compared to a calf weighing approximately seven percent the live weight of the dam following a nine month gestation period. Most of the fetus growth takes place in the latter stages of pregnancy.

4. Lamb growth may be rapid during lactation.

There are known cases where ewes have weaned twin lambs at one hundred days of age with a total weight surpassing the body weight of the ewe. It is very common for a lamb to weigh half as much when weaned at four months of age as the weight of the mature ewe. It is quite rare when a cow will wean a calf at seven months of age weighing half as much as the cow. There is research which indicates lamb growth rate is closely related to milk yield. Likewise, milk yield is affected considerably by nutrition.

5. Ewes have a rather long dry period.

The gestation period (approximately 147 days) and the lactation period (approximately 4-5 months) total about nine or ten months leaving a two or three month dry period between weaning and rebreeding. Only nutrients for body maintenance and wool growth are required during this period.

With these principles in mind it is easy to understand why daily nutrient requirements of ewes vary considerably during the year. Table 1"Daily Nutrient Requirements of Sheep" gives a detailed breakdown dependent upon the stage of reproduction and body size of the ewe.

Table 1. DAILY NUTRIENT REQUIREMENTS OF SHEEP [1]

(Based on air-dry feed containing 90 percent dry matter)

Body Wt.	Gain or Loss Lb.	DF Lb	DP Lb	TDN Lb	CA Gm	P Gm	Salt Gm	Carotene Mg.	Vitamin A I. U.
		EWES - Non-lactating and first 15 weeks of gestation							
100	0.07	2.6	0.11	1.3	3.2	2.5	9.0	1.7	965
120	0.07	3.0	0.13	1.5	3.3	2.6	10.0	2.0	1156
140	0.07	3.4	0.15	1.7	3.4	2.7	11.0	2.4	1350
160	0.07	3.8	0.16	1.9	3.5	2.8	12.0	2.7	1542
		EWES - Last six weeks of gestation							
100	0.37	3.8	0.17	2.0	4.2	3.1	10.0	5.8	2316
120	0.37	4.2	0.18	2.2	4.4	3.3	11.0	6.8	2775
140	0.37	4.6	0.20	2.4	4.6	3.5	12.0	7.9	3240
160	0.37	4.8	0.20	2.5	4.8	3.7	13.0	9.1	3702
		EWES - First 8 - 10 weeks of lactation							
100	-0.08	4.6	0.22	2.7	6.2	4.6	11.0	5.8	2316
120	-0.08	5.0	0.23	2.9	6.5	4.8	12.0	6.8	2775
140	-0.08	5.4	0.25	3.1	6.8	5.0	13.0	7.9	3240
160	-0.08	5.6	0.26	3.2	7.1	5.2	14.0	9.1	3702
		EWES - Last 12 - 14 weeks of lactation							
100	0.07	3.8	0.17	2.0	4.6	3.4	10.0	5.8	2316
120	0.07	4.2	0.18	2.2	4.8	3.6	11.0	6.8	2775
140	0.07	4.6	0.19	2.4	5.0	3.8	12.0	7.9	3240
160	0.07	4.8	0.20	2.5	5.2	4.0	13.0	9.1	3702
		EWES - Replacement Lambs and Yearlings							
60	0.30	2.7	0.16	1.6	2.9	2.6	8.0	1.7	696
80	0.20	3.2	0.15	1.7	3.0	2.7	9.0	2.3	926
100	0.14	3.4	0.14	1.7	3.1	2.8	10.0	2.8	1158
120	0.07	3.4	0.14	1.7	3.2	2.9	11.0	3.4	1388

1 Nutrient Requirements of Sheep, revised 1957, National Research Council

The first column in Table 1 labeled DF refers to the approximate amount of dry feed which will be consumed each day. The designated amounts in this column should be thought of as a maximum requirement. For it is within this amount of feed that all of the individual nutrient requirements must be present. In a case where the feed being fed is low in some nutrient an extra heavy feeding of the same feed is not the answer as the ewe has a natural limitation on the amount of dry feed she will consume. Feed in excess of this amount will normally be used for bedding or wasted.

The column labeled DP refers to the minimum digestible protein requirements. Effects of a protein deficiency include a reduced appetite, lower feed intake and poor feed efficiency. These effects in turn result in reduced reproductive efficiency and reduced wool production. An extreme protein deficiency will cause severe digestive disturbances, nutritional anemia and edema. An Illinois study reports that sheep deposit .15 pounds of protein daily in the production of the fleece for each 1000 pounds of live weight.

It is quite readily understood that digestibility varies considerably with the quality of feed. Research results indicate digestion co-efficients for crude protein in alfalfa vary from 51 to 84 percent. The lower digestibilities are for the stemmy, more mature, poor quality hays.

Protein quality, or the level and balance of the amino acids, is not important in sheep nutrition. It has been reported that the sulphur containing amino acid cystine is necessary in the ration. However, most nutritionists feel that sheep can synthesize this amino acid in sufficient amounts if the ration contains sufficient protein and sulphur. Nitrogen from non-protein sources such as urea may be used to replace up to one-fourth or one-third of the protein equivalent in the ration.

Higher levels of protein than those listed in Table 1 may further stimulate appetite and improve production. However, it is questionable whether the additional gain will pay the extra cost.

The column labeled TDN refers to total digestible nutrients which is the energy portion of a ration and is a very common deficiency. This deficiency may result from either a lack of total feed or consumption of feed which is inferior in quality and therefore the digestibility is low.

Symptoms of a total digestible nutrient deficiency include: slowing or cessation of growth, loss of weight, reproductive failure and increased mortality.

A review of the total digestible nutrient requirements, as listed in Table 1 reveals a relationship between the amount required and the specific purpose that is to be accomplished. Note the requirements for the lactation period are much greater than the maintenance requirements. These requirements increase steadily during the gestation period and reach their peak during the early part of the lactation period.

The column labeled P refers to the daily phosphorus requirement in grams. Calcium deficiencies in ewes being fed rations high in forage are very unlikely. Trace minerals required by sheep include iodine, cobalt, copper and sulphur. Magnesium, manganese and selenium are also believed to be required. Deficiencies of these trace minerals seem to be quite rare. The feeding of trace mineralized salt should be good insurance for preventing such deficiencies.

Phosphorus deficiency symptoms include: slow growth, depraved appetite, unthrifty appearance, listlessness, development of a knock-kneed conformation, weak lambs and poor milk production.

Many rations fed to sheep in South Dakota during the winter can be considered as borderline in furnishing sufficient phosphorus. Most all forages after reaching maturity are deficient in phosphorus or very near the minimum required. Ewes on winter range should definitely have a source of phosphorus made available to them.

Steamed bone meal, diacalcium phosphate, or a commercial mineral supplement containing at least 10 percent phosphorus are recommended sources of supplemental phosphorus.

The next column refers to the salt requirement. This is normally met by feeding loose salt free choice. A salt source should be available in addition to the salt-mineral mixture and also in addition to trace mineralized salt. This will allow sheep to meet their salt requirement without forcing mineral consumption.

The first indications of a salt deficiency include: chewing wood, licking dirt, and other indications of an unsatisfied appetite. Decreased feed consumption and efficiency of utilization may be due to a salt deficiency. It is very important that sheep always have free access to salt. It serves a very necessary purpose in body regulatory functions and helps stimulate appetite. It has been postulated by some that increased consumption of poisonous weeds may be accelerated when salt is not available.

Salt consumption varies considerably from area to area. Range operators have reported as much as one-half pound consumption of salt per ewe per month. Sheep grazing lush pastures or consuming large amounts of silage may require more than one-half pound of salt per ewe per month.

The last two columns refer to carotene and vitamin A. Vitamin A is required and utilized by the ewe. Usually the ewe meets her vitamin A requirement by converting carotene to vitamin A within her own body. Carotene is normally found in very sufficient amounts in green,leafy plants.

Vitamin A is necessary for the maintenance of epithelial tissues. A deficiency of vitamin A allows infections to set in where epithelial tissues are found. Example: eyes and respiratory system.

The initial symptom of a vitamin A deficiency or its precursor, carotene is night blindness. A severe deficiency may cause weak, dead or mal-formed lambs at birth.

The requirements listed in Table 1 are based on the assumption of 17 I.U. of vitamin A or 25 micrograms of carotene required per kilogram of body weight. However, to allow for storage and reproduction, three to five times that amount should be fed. The requirements for late pregnancy and lactation are five times the minimum requirement.

Sheep are believed to be more efficient converters of carotene than cattle, however, they are not capable of storing as large amounts as cattle. Both vitamin A and carotene may be lost by oxidation, however, stabilized synthetic vitamin A does not oxidize readily.

Properly conditioned hays, especially alfalfa, cut early are good sources of carotene. Green pasture is also a very excellent source. It should be noted that carotene oxidizes very easily. Therefore, roughages which have been exposed to excessive moisture and sunshine in the swath or windrow may be deficient. Likewise, roughages stored for extended periods of time should be considered questionable sources. Winter grazing in Western South Dakota is normally deficient in carotene.

In order to correctly formulate a ration, a sheepman must be familiar with the nutritive requirements of sheep. Also he must be aware of the approximate amounts of the required nutrients available in each feed.

EVALUATION OF ROUGHAGES

The four major criteria associated with quality of roughage include: stage of maturity, leafiness, color and freedom from foreign material.

As a hay crop approaches maturity, the level of protein, minerals and vitamins decreases. Meanwhile the fiber level increases and thereby lowers the digestibility of the nutrients that are present. Stage of maturity is highly related to hay quality.

Leaves contain most of the feed value of any hay crop. Approximately 50 percent of the weight of alfalfa hay is leaves. These leaves contain 70 percent of the total protein and 90 percent of the total carotene. The nutrients found in the leaves are about 40 percent more digestible than the nutrients found in the stems. This indicates that leafiness is also highly related to hay quality.

Maturity, sun bleach, dew and rain affect hay color. A bright green hay free from mold and having an attractive fragrance is desired. It is admitted however, that color is not as important as the two factors previously mentioned.

Freedom from foreign materials is a factor which is used by government hay graders in classifying hay. The importance of foreign material depends completely on what it is, how much is present and it's nutritive value. In most cases this factor is not nearly as important to hay quality as maturity and leafiness. Of course if the foreign material is a poisonous plant or if it is present in large amounts, it can have a very detrimental effect on hay quality.

These four criteria are aids in evaluating roughages. It must be recognized, however, that even trained inspectors are not as efficient in determining hay quality as other techniques such as chemical analysis, artificial rumen and actual feeding tests.

Besides the variation which is found in the quality of a particular kind of hay it must be recognized that nutritive content varies considerably between the different kinds of hay. A thorough review of Table 2 will acquaint you with some of these differences.

EVALUATION OF SILAGES

The popularity of silage for sheep feed seems to be increasing. There are two basic factors affecting the preservation of the nutritive value of fresh forage. They are excluding or sufficiently restricting air from the silage during storage and having a relatively high acidity in the silage. These two are greatly influenced by the moisture and sugar content of the silage as well as the type of storage structure.

Kind of crop, growing conditions and stage of cutting affect the nutritive value of silage. Table 2 indicates the average nutritive values for the various silages.

EVALUATION OF GRAINS

Normally, grains do not vary in nutritive content to the extent that roughages do. Usually mature, plump grain contains a higher percentage of total digestible nutrients than immature grain or grain that is shriveled or shrunken due to drought. It is recognized, however, that shriveled grains may have a higher protein content on a percentage basis. Light weight oats and barley normally contain a higher fiber value and therefore a lower digestibility. The factor which normally has the greatest affect on the nutritive value of corn is moisture content. This can vary considerably and since the water content has no nutritive value, the total digestible nutrients will vary accordingly.

Table 2 indicates the variation in nutritive values between the different grains. A thorough knowledge of these values aids in the selection of a particular grain and in determining how much needs to be fed.

EVALUATING COMMERCIAL SUPPLEMENTS

Proper evaluation of commercial supplements is not an easy matter. However, it is best to start by asking yourself why you are buying a commercial supplement. The answer to that question should revolve around the fact that your present ration is deficient in a required nutrient. Assuming this, your goal is to buy the most economical source of this nutrient in a form that is digestible or may be utilized by your sheep. For example, the basic evaluation of a protein supplement is the cost per pound of digestible protein. This information is not available and would not be practical to put on the feed tag. However, chemical analysis is required by law to be stated on the tag and with the list of ingredients which the tag provides and familiarity with the digestion coefficients of the most common feeds, an intelligent estimate of the digestible nutrients may be made.

Other considerations which may affect your selection of a commercial supplement include: value of additional nutrients other than the necessary one previously mentioned, preparation of supplement as it affects waste and ease of feeding, palatability and the reputation of the dealer and the company with whom you are doing business.

Balancing a ration is often considered a difficult task requiring those who have professional knowledge in the field of nutrition. This assumption need not be true. Familiarize yourself with the recommended steps discussed below and work a sample ration. You will find the procedure easy to follow and beneficial in ration formulation and evaluation.

Step 1. Refer to Table 1 and find the classification and size of sheep to be fed. Copy the designated requirements on the line headed minimum requirements at the bottom of Table 2 (digestible protein in column 4, total digestible nutrients in column 6, phosphorus in column 8 and carotene in column 10.

Step 2. In Table 2, locate the kinds of feed to be fed. In column 1 of Table 2 designate the pounds of feed to be fed daily per head of each kind of feed. Make sure the total of all entries does not exceed by more than 20 percent the dry feed requirements listed in Table 1.

Step 3. Calculate pounds of digestible protein and pounds of total digestible nutrients to be supplied by each feed. This is done by multiplying the pounds of feed to be fed by the appropriate percentage composition listed in columns 3 and 5. Calculate total phosphorus and total carotene to be supplied by the feeds. This is done by multiplying the pounds of feed to be fed by the compcsitions listed in columns 7 and 9.

Step 4. After the amounts of nutrients supplied by each feed have been calculated, add the entries in column 4 and enter this total on the line marked "total". Follow the same procedure for columns 6, 8 and 10.

Step 5. Compare your totals with the minimum requirement listed on the line below the total. Calculate the excesses and deficiencies marking them in the appropriate line at the bottom of Table 2.

Your major concern should be that the minimum requirements are met. There will be no entries on the deficiency line if this is true. Should deficiencies appear in the digestible protein column, additional alfalfa hay or commercial protein supplement are likely remedies. If the total digestible nutrients of the ration are deficient, consideration should be given to increasing the level of grain in the ration. A phosphorus deficiency will be taken care of by providing one of the free choice phosphorus mineral supplements discussed previously. If a carotene deficiency is evident, a good green source of this year's hay or cake fortified with vitamin A should be provided.

A sheepman should also be concerned if his ration provides large excesses of digestible protein and total digestible nutrients. Large excesses in either or both of these categories indicate the ration could be cheapened without hindering economical production.

Ration balancing is a guide. The final test of the ration is whether or not it accomplishes the purpose for which it is designed. Observations of the performance of the sheep may indicate necessary changes in the ration. Estimates of the amount of feed fed, the nutritive values of the feed and digestibility of these nutrients provide three areas of possible error.

FEED PREPARATION

Preparation of feeds has received considerable investigation in the past few years. Each of you have read some impressive results concerning pelleting or some other type of feed preparation.

It must be recognized, however, that any mechanical preparation will not change the nutrient content of the feed. Therefore, if mechanical preparation is going to be economically feasible it must do one or more of the following:

1. Improve digestibility
2. Increase consumption
3. Decrease waste
4. Decrease labor.

The kind of sheep being fed, the kind of feed in the ration and the environment in which the sheep are being fed all affect your decision as to whether or not feed preparation would be beneficial.

Sheep are noted for their ability to masticate their feed. Of course, real young lambs and old ewes which are losing their teeth would be exceptions.

Sorghum and other hard grains will show more benefits from preparation than will oats. Waste may be decreased and consumption of poor quality hay increased if ground. You still have to weigh these advantages against the cost.

Pelleting often offers the advantage of less waste and also encourages increased consumption. The high cost of pelleting often times prohibits this practice.

RULE OF THUMB FOR FEEDING EWES

1. Feed your ewes the poorest quality roughage you wish utilized during their dry period between weaning and two weeks before rebreeding.

2. Provide ewes with a ration that will cause them to be gaining weight at breeding time. This ration may be supplemental pasture or a limited feeding of grain. It is much easier to "flush" a thin ewe than it is a fat ewe. This fact is additional evidence for utilizing poor quality feed during the dry period.

3. Provide ewes with a maintenance ration during the early part of the gestation period. This can normally be accomplished with free access to roughage of poor to moderate quality if supplemented with sufficient protein to meet daily requirements.

4. Feed ewes at least one to two pounds of alfalfa hay and one-half to one pound of grain along with other roughage the last month before lambing.

5. Feed ewes at least three pounds of good quality alfalfa hay and one to two pounds of grain following lambing, along with a full feed of other roughage. When lambing late, good quality pasture will replace this recommendation and will come close to meeting the ewe's daily requirements.

6. Keep ewes with twin lambs separate, feeding them the highest quality alfalfa available add at least two pounds of grain per day following lambing.

Table 2. RATION BALANCING WORKSHEET
and
AVERAGE FEED STUFF COMPOSITION

1	2	3	4	5	6	7	8	9	10
Lbs. Feed Daily	Kind of Feed	% Dig. Prot.	Lbs. Dig. Prot.	% Tot. Dig. Nut.	Lbs Tot. Dig. Nut.	Gm Phos. Per Lb.	Tot. Phos.	Mg. Caro. Per Lb.	Tot. Caro.
	Winter Range	1.0		44.0		0.4		--	
	Alfalfa Hay	11.0		51.5		1.1		8.0	
	Alf.-Crested Hay Mix	8.5		51.0		1.0		5.0	
	Crested Wheat-grass Hay	6.0		50.5		0.8		3.0	
	Oat Hay	4.5		48.0		0.9		--	
	Prairie Hay	2.0		45.0		0.5		3.0	
	Corn or Sorghum Silage	1.1		18.0		0.3		--	
	Oat Silage	1.3		17.0		0.4		--	
	Alfalfa Silage	2.8		14.0		0.4		10.0	
	Corn #2	6.6		80.0		1.2		1.0	
	Oats	9.4		70.0		1.5		--	
	Barley	10.0		77.7		1.7		--	
	Sorghum	8.5		79.0		1.3		--	
	Soybean Oil Meal	40.0		78.5		3.0		--	
	Commercial Supplement *								
	TOTALS	XX		XX		XX		XX	
	Minimum Required	XX		XX		XX		XX	
	Excesses	XX		XX		XX		XX	
	Deficiencies	XX		XX		XX		XX	

*Multiply crude protein by .75 for an approximation of the percentage digestible protein.

F.S. 138

Cooperative Extension Service

SOUTH DAKOTA STATE COLLEGE

Feed and Production Costs of the Ewe

Feed and Production Costs of the Ewe

Proper feeding and management of ewes is essential to profitable sheep production. Careful attention to the nutritive requirements of the ewes throughout the year will often mean the difference between profit and loss.

NUTRITIVE NEEDS OF SHEEP

Protein and Energy

Ewes have both a high total nutrient and high protein requirement during the latter 5 or 6 weeks of pregnancy and when suckling lambs. Wool is a protein product; therefore, ewes need feeds containing an adequate supply of this nutrient.

Sheep having access to green grass or a reasonable quantity of legume hay will generally show no deficiency in either the amount or quality of protein and energy needs.

Feeding Urea to Ewes

Ruminant animals such as sheep are capable of utilizing some simple compounds which contain nitrogen to meet their requirement for protein. The chief one used is urea.

Urea should not be considered something necessary to have in a ration. Rather it is one source of an essential nutrient—protein.

The level of urea in protein supplements to be used as the only supplement to low-protein roughage or winter range should be limited to one-third of the protein supplement. This would be about 5.1% urea (13.3% protein equivalent) in a 40% protein supplement. (F.S. 92, *Feeding Urea to Cattle and Sheep,* will provide further information regarding feeding of urea).

By Laverne J. Kortan, Extension livestock specialist and Delwyn Dearborn, assistant Extension livestock specialist

A well planned feeding program is a big step toward insuring that your sheep herd remains healthy and productive—two big factors in determining your profit or loss.

Mineral (calcium, phosphorus, and salt)

Free choice feeding of mineral supplements appears to suit the needs of sheep in most areas of South Dakota.

Providing stabilized iodine salt free choice or in mineral mixtures will take care of the requirements for sodium, chlorine, and iodine.

The amount of calcium and phosphorus in mineral supplements should vary with the type of ration being consumed. *A 40% di-calcium phosphate or bone meal 60% trace mineral salt mixture will meet the requirements.* Additional salt in block form may be advisable because animals would not need to eat the mineral mixtures merely to satisfy their appetite for salt.

Table 1. Average Salt Requirements for Sheep

Breeding Sheep (range)	1 lb./hd./mo.
Breeding Sheep (farm flock)	.9 lb./hd./mo.

Vitamin Needs

Vitamin A is probably the only vitamin that may be deficient in any normal sheep feeding program. The fact that sheep are generally outdoors and exposed to the sunlight much of the time, protects them from any deficiency of vitamin D. The B vitamins as well as vitamins K and C appear to be synthesized in sufficient amounts in the rumen of the sheep; it is therefore not essential to add these to the ration.

When vitamin A deficiency symptoms appear, it is recommended that dehydrated or high quality green alfalfa hay or stabilized vitamin A product be added to the ration.

Feeds normally consumed by sheep, especially well-cured hays and green pastures, contain ample quantities of vitamin E. If there is reason to believe

that vitamin E is short an addition of a vitamin E supplement, such as wheat germ oil, may be desirable.

Water Needs

Water consumption of sheep varies with the climate and type of feed. Sheep consume more water in summer than winter and more when on dry feeds than when eating pasture grass or other succulent feeds. Sheep will go for weeks without water when foraging on grasses of high moisture content. However, under normal production, a plentiful supply of water should be provided daily and ice should be kept out of troughs in winter.

Table 2. Average Daily Water Requirements for Sheep

Breeding ewes before lambing	4 qts./hd./day
Breeding ewes after lambing	6 qts./hd./day

Antibiotics for Ewes

At the present time it appears there is little value in adding antibiotics to the rations of mature ewes.

The basis for a good ration for the ewes is adequate pasture and top quality legume hay.

PASTURE NEEDS

Sheep are the only farm animals that will produce a top quality market product from pasture. Sheep are natural foragers and excel all other animals in ability to utilize pasture plants. If sheep are to be produced on the farm then you must work out your own pasture program to fit your individual situation. Your lambing date, type of lambs produced, pasture available, and other livestock on the farm are a few of the factors that will help determine your best program. To provide satisfactory grazing through-out the season, most growers use rotation and temporary or emergency pasture in addition to their permanent pasture.

Proper rotation of pasture will provide 20% more grazing days during the summer pasture season. Rules to follow under a carefully planned rotation system are:

1. Use at least three permanent pastures in the rotation. Along with the three permanent pastures it is good management to provide a summer temporary pasture.
2. Use only one pasture at a time and start grazing when grass is 5 to 7 inches high.
3. Rotate sheep every 2 weeks or sooner if grass coverage is down to 4 inches.
4. Allow at least 3 inches of growth to remain at end of grazing season. This will help preserve stand, conserve moisture, and aid in parasite control.

Follow these rules in order to obtain maximum sustained sheep production from native range.

1. Utilize no more than 45% of the annual forage production during the summer grazing period.
2. Develop water sources, fence, and distribute salt, mineral, and shades to get even utilization of the entire pasture.
3. If possible, rotate grazing so you graze each pasture during a different season in different years.
4. If possible, provide an early spring tame pasture so that native range will not be grazed early in the spring when range plants are in the most critical stage of growth. At this time, they can be damaged excessively by grazing.
5. Allow each native pasture to rest 1 year out of every 4 to 6.
6. Carry over a plentiful supply of hay and cull heavily so that your range may be maintained in good condition during periods of drought.

The grazing rate during a normal summer and for a particular pasture is used only as a guide. The actual rate will depend upon rainfall received, the kind of pasture mix, and the type of fertility of soil found in the pasture area.

PREPARATION OF FEEDS FOR EWES

Grinding or Rolling Grains

Of all the farm animals, sheep are best able to do their own grinding, and with few exceptions they should be fed whole grain. Exception to the rule is when grains are extremely hard or when ewes' teeth are poor.

Chopping or Grinding Roughage

Whether it will pay to chop, shred, or grind hay will depend on the quality of hay, on the manner in which it is fed, on the price of the hay, and cost of such preparation. If it is processed it will facilitate handling, it can be stored in smaller areas, and can be fed with less waste. This preparation of roughage does not, however, increase the value of the initial product.

Pelleting

Appraise the value of pelleting against the cost. Use as much of your home grown feeds as possible for economical operation. Because of the necessity of utilizing home grown feeds it does not appear feasible to feed ewes a pelleted ration.

Feeding the Ewes

The ewe needs little care and no special feed from the time lambs are weaned until just before breeding time. A pasture program similar to that mentioned earlier will meet the ewe's needs during this period.

Flushing the Ewes

Experimental evidence shows that conditioning the ewe just prior to breeding and for 2 or 3 weeks afterwards may affect the lamb crop. This can be

Table 3. Feed Substitution Table for Sheep (Grains, By-Products, Feeds, Roots, and Tubers)

Feed stuff	Relative feeding value (lb. for lb.) compared with No. 2 corn with a value of 100	Approximate percentage of base feed (or comparable feed or feeds) which it can replace for best results	Remarks
Corn, No. 2	100	100	It is not necessary to grind corn unless it is being fed to ewes with poor teeth or creep feeding lambs under 5 weeks of age.
Barley	88-100	100	It does not pay to grind barley for sheep.
Beet pulp, molasses, dried	95	30 to 50	These have a value of about 80% when used as the only concentrate for fattening lambs.
Beet pulp, wet	25	30 to 50	
Molasses, beet	80-90	20	Used primarily in lamb feeding. Greatest value may be considered when used as an appetizer. Considered to be somewhat laxative because it is high in alkaline salts.
Oats	75-100	10-100	Need not be ground for sheep—may consider rolling when used for starting lambs on creep ration. Lowest value when used as only grain for fattening lambs. Highest value when starting young lambs on feed, and for breeding animals.
Roots (stock beets)	25-35	50	Some feel that high levels of roots over long periods of time may cause urinary calculi. Exercise caution when feeding to rams and wethers.
Rye	83-87	50-100	Rye appears to be more palatable to sheep than to other classes of animals. It is not necessary to grind.
Alfalfa silage	30-50	50-85	When alfalfa silage replaces corn silage, more energy feed must be provided but less protein, unless grain is used as a preservative.
Beet tops, fresh	16-25	30-50	In beet producing areas fresh beet tops are pastured off by sheep and cattle.
Beet tops, wet	70	50	
Beet top silage, sugar	17-25	30-50	Provide dry forage when feeding beet top silage; add 2 ounces of limestone to each 100 lbs. silage.
Bromegrass hay	75	100	
Clover hay, red and crimson	90-100	100	Should be cut at early stages.
Corn fodder	75	100	Utilization improved, if chopped.
Corn silage	30-50	50-85	If corn silage is only forage fed, this ration should be balanced by adding 1/10 to ¼ pound high protein supplement per day. Preference is expressed for the limited use of silage and addition of hay.
Grass-legume mixed hay	80-90	100	Value depends on percentage of alfalfa grains, hay, and stage of maturity at time of cutting.
Grass-legume silage	30-45	50-85	Most feeders prefer to limit the silage and use some hay.
Oat hay	75	50-85	
Prairie hay	65-70	100	
Sorghum, grain	100	100	Similar feeding value found in all varieties. It is not necessary to grind grain sorghum for sheep.
Wheat	90-95	10-30	Not necessary to grind. May cause founder.
Wheat bran	90	10-30	Bran is valuable for young animals, for breeding animals, and for starting animals on feed.

*Roots and tubers are of lower value than grain feeds, due to their higher moisture content.

Table 4. Feed Substitutions for Sheep.

Protein supplements (compared with soybean meal with a value of 100)	Relative feeding value (lb. for lb.)	Approximate percentage of base feed (or comparable feed or feeds) which it can replace for best results	Remarks
Soybean oil meal (44%)	100	100	
Linseed oil meal (33%)	100	100	
Cottonseed oil meal (43%)	100	100	
Soybeans	95-100	100	Not necessary to grind soybeans for sheep.
Dry forages and silages (compared with alfalfa hay with a feeding value of 100)			
Alfalfa hay, all analyses	100	100	
Reed canary grass	70	100	
Sorghum fodder	70	100	
Sorghum silage (grain)*	30-50	50-85	Most feeders prefer to limit the silage and use some hay.
Sorghum silage (forage)*	25-35	50-80	Approximately equal to grain sorghum silage on a per acre basis.
Sudan grass hay	50-75	100	
Sweet clover hay	100	100	First year clover hay most desirable. May cause sweet clover disease.

done by turning ewes on a fresh, luxuriant pasture 2 or 3 weeks before breeding time. For example if ewes are on the normal dry pasture, turn them on Sudan or lush pasture that has not been recently used. If ewes are on dry pasture feed them ½ pound grain (oats, corn, grain, sorghum) 2 weeks before and 2 weeks after the breeding season starts.

Feeding the Pregnant Ewes

After ewes are bred, they should have access to pasture as long as these are available. Pasture at this time of the year may include permanent, temporary, stubble fields, or corn stalks. When sufficient pasture is no longer available, supplemental feeds must be provided. The most satisfactory forage in South Dakota is a good quality alfalfa hay. When it is necessary to feed native hays make every effort to cut it in an early stage of maturity (See South Dakota Agricultural Experiment Station Bulletin 457, *Early-Medium and Late Cut Prairie Hay*) and to have it properly cured. When feeding grass hay it is generally necessary to provide some source of a protein supplement. As was previously mentioned, the value of alfalfa hay from the standpoint of protein quality, minerals, vitamins, and the fact that grass hays are not recognized as being completely balanced in nutrient requirements, means that you must make every effort to supply one-third of the ration of good quality alfalfa hay.

A month to 6 weeks before lambing time, ewes should generally receive a concentrate allowance of ½ to ¾ pound of grain daily. At this time the fetus is developing rapidly and demands being made on the ewe are heavy. Ewes should gain 25 to 35 pounds in weight from breeding to lambing.

Feeding at Lambing Time

Immediately after lambing each ewe should be placed in an individual "holding" or "lambing" pen. At this time reduce the grain allowance. After the reduction it might consist of equal parts of oats and good quality bran and a free choice roughage. About one week after lambing ewes can be placed back on full feed. Provide moderate amounts of water to the ewe soon after lambing.

Feeding the Lactating Ewe

Milk production can be greatly stimulated through proper selection of feeds. The average ewe produced in South Dakota will yield from 1 to 4 quarts of milk per day and will maintain adequate milk production if properly fed for 2½ to 3 months. During the lactation period the ewe is not only feeding her lambs, but is also growing wool and, if young, will be making some growth herself. You can expect the ewe to lose weight during the suckling period. The basis for determining the kind and amount of ration during lactation will depend upon whether ewes are producing twins or a single, the size and condition of ewe, and time of year lambs are born. Ewes producing early lambs prior to the time pasture can be used will generally require ½ to 1 pound of grain daily along with 4 to 6 pounds of alfalfa hay or equivalent. Ewes lambing after adequate pasture is available will generally require no grain.

EWE FEEDING GUIDE

During fall and early winter and before snow fall, use a good pasture, corn stalks and grain stubble.

Feed alfalfa hay (2 pounds) if needed to furnish required protein. Provide minerals and water free choice. The following rations in table 5 may be used for winter feeding.

FEED REQUIREMENTS

Ewes will require more grain in an early lambing program but more pasture if lambs come late in the season. Grain and supplement for late lambs may be nearly similar to that needed for lambs in an early lambing program.

Table 5. Winter Feeding Rations for Ewes

Type of ration	First ¾ of Gestation (lbs. per day)	Last ¼ of Gestation (lbs. per day)	Lactation (lbs. per day)
1. Alfalfa hay	4—5	Add ½ to 1 pound grain daily to any of the rations in column 1	Add ¾ to 1½ pound grain daily. During lactation it is suggested that a ration containing at least 2 pounds of green leafy alfalfa be used.
2. Alfalfa-brome mixed hay	4—5		
3. Alfalfa hay	2		
grass hay	3		
4. Grass hay	4—5		
Protein supplement*	.25—.40		
5. Corn or sorghum† silage	8—10		
Protein supplement*	.35—.50		
6. Corn or sorghum silage	4—6		
Alfalfa or mixed alfalfa-grass hay (good quality)	2—2½		
7. Corn or sorghum silage	3—4		
Grass hay	2—2½		
Protein supplement*	.25—.50		
8. Alfalfa hay	2—2½		
Corn or sorghum fodder (bundle or ground)	2—3		
9. Winter grazing (native pasture)	plentiful supply		
Protein supplement*	.25—.4		
10. Winter grazing (native pasture)	plentiful supply		
Alfalfa hay	1—2		

*Soybean oil meal 44%.
†Whole corn, grain sorghum, oats and/or barley are used.

Table 7. Estimated Cost and Returns Per Ewe Per Year, Itemized Costs Per Ewe and Lamb (Early Lambs, Born in December, January, and February)

Grain
30 days prior to lambing .50 lb./day = 15 lbs.
50 days after lambing 1.00 lb./day = 50 lbs.
Creep feed for lambs (birth till market) = 150 lbs.
Total 215 lbs. at $.02 = $4.03

Hay
50 day feed in corn stalk and stubble
Ewes, 140 days on hay feeding @ 6 lbs. per day = 840 x .$.006 = $5.04
Lambs, 100 days on hay feeding @ 1 lb. per day = 100 x .006 = .60
Total = $5.64

Pasture
5 months—.02 per ewe per day—60c/head/month x 5 months = $3.00

Miscellaneous
Salt—Minerals = $ .80
Breeding charge = .50
Veterinary and drugs = .60
Taxes and insurance on livestock and equipment investment = .45
Depreciation and repairs on equipment $3.00 x 10% = .30
Shearing = .50
Annual ewe depreciation = 3.00
Ewe death loss = .50
Total = $6.65
Total cost = $19.59

Income
140% lamb crop (140 lb. lambs @ .20/lb.) = $28.00
9 lbs. wool x 50c = 4.50
Total estimated returns = $32.50
Total cost = 19.59
Estimated returns over cost per ewe = $12.91

Returns per animal unit
Estimated returns over cost per ewe shown in table = $12.91
1 animal unit sheep = 5 ewes and lambs x $12.91 = $64.55

Table 6. Feed Requirements per Year

Type of stock	Hay	Feed grain	Protein	Pasture
1 ewe and lamb/year	900 lbs.	80-100 lbs.	21 lbs.	6 months pasture, corn stalks, and stubble
100 ewes/year producing early lambs (grain per ewe 90 lbs., grain per lamb 150 lbs., Protein supplement/lamb 14 lbs.)	30-40 ton	500-600 bu.	2,000 lbs.	30 (Pasture tons) hay equivalent
100 ewes/year producing late lambs, (grain per ewe, 40 lbs., grain per lamb, weaning to market 140 lbs., Protein supplement .10 lbs./head/day)	25-35 ton	300-400 bu.	1,600 lbs.	40-50 (Pasture tons) hay equivalent

Published and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914, by the Cooperative Extension Service of the South Dakota State College of Agriculture and Mechanic Arts, Brookings, John T. Stone, Director, U. S. Department of Agriculture, cooperating.
5M—6-62—File: 2.33—10302
5M reprint—3-64—952

South Dakota State College
Brookings, South Dakota
Extension Service Livestock Specialist Section

Management Practices for Increasing Lamb Raising Potential of Sheep

L. J. Kortan[1]

Ram Management Practices for Increased Lamb Numbers

Selection of purebred ram - The ram influences the characteristics of every lamb he sires, hence, he should be a good one. The most rapid and cheapest improvement in a flock can come via careful selection of the ram.

Select for:

(1) Superior meat type characteristics.
(2) Breeding performance of his dam.
(3) Ram Qualities.
(4) Weight for age.
(5) Early finishing qualities.
(6) If possible give preference to rams from a performance tested flock (100 pounds or more of adjusted weight at 120 days of age.)
(7) Body conformation, scale, substance, and constitution.
(8) Fleece should be dense, uniform in length and diameter.

Daughters of rams that are born twins, everything else being equal, are more likely to be prolific. Ewes sired by rams that were born early in the season are usually better ewes than those sired by rams that were lambed late.

Price - A ram is more than half the flock because his genetic contribution is to the performance of all lambs born and not just to one or two as in the case of a particular ewe.

The chances of purchasing an outstanding ram for a low price seems most unlikely. Just how much you can afford to pay for a ram is not easy to determine but pay the price to get a good one. A formula or practice followed by many successful producers is to be willing to pay 3 or 4 times the value of a good market lamb for a ram for commercial lamb production.

Time of Selection - It is advisable always to select rams well in advance of the breeding season. The early buyer has a much larger selection to choose from and has ample time to shear the ram. (Six to eight weeks prior to use and again at breeding time.)

Shearing ram - Effects of exposing rams to 90° F. temperature for one week Kentucky Experiment Station.

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[1]Extension Livestock Specialist - Swine and Sheep

	Five Weeks Later		
	Rectal temperature on last day	Sperm Motility	Abnormality
	°F	%	%
Controls (unheated)	102.2	85	10.0
Sheared (heated)	102.4	80	8.1
Unsheared (heated)	105.0	10	71.0

Marking Harness - Either a marking harness or other device should be used on the ram with color changed every 17 days to make sure he is settling the ewes. Most growers keep rams with ewes from 6 weeks to 2 months or longer. Do not allow ram to run with ewes except during breeding season.

Number of Mating - A ram one year or older should be able to take care of 35 to 50 ewes. It is generally more satisfactory to keep ram penned during day, feed him hay or grain, and turn him with ewes at night. If several groups of rams are used, alternate each group of rams every 24 hours.

A safety factor is usually provided by using more rams than are absolutely essential in serving all the ewes.

Edgar (1961, New Zealand) placed individual rams with flocks of 300 ewes each. Of 40 rams so tested only three settled less than 100 ewes in the first 18 days. One ram settled 250 and the average was 160 per ram.

As we learn to check fertility of rams we probably can increase numbers of ewes per ram.

How to "Hand Breed" - If hand bred, one ram can serve as many as 100 ewes. Tie a piece of heavy cloth, an "apron," to cover the belly of a "teaser" ram. Color his chest. Turn this teaser with ewe flock during day. He will paint ewes in heat. Place only painted ewes with real breeder at night.

Trim Feet - Feet are important to a ram. Trim when necessary and help correct lameness if possible. Avoid all possibilities of a ram going lame.

Feed for Ram - Ten days before breeding, feed 3/4 to 1 1/2 pounds of corn-oat mixture and 1/10 pound protein supplement per day. Allow to run on grass where there is plenty of shade and water.

Ewe Management Practices for Increased Lamb Numbers

Flushing the ewe - before breeding season will stimulate an increased ovulation rate under some conditions.

Hulet (Dubois Laboratory, 1962) and Wallace (New Zealand). In both cases increased number of twins were born from ewes that received additional feed just prior to breeding. California work. When bred on dry range about 20% of ewes gave birth to twins while those fed on green feed produced at least 50% twins. Other tests show that 15 to 20 more lambs may be had per 100 ewes if ewes are flushed.

How to flush - Ewes should be fairly thin and gaining in weight. Feed 1/2 to 1 pound of grain per ewe daily while flushing for 2 weeks before breeding. Continue while ewes are being bred. Oats is a suitable grain for flushing. The grain may be fed in addition to sudden fresh green grazing. Or it may be fed alone while sheep are still on dry roughage. Fresh green grazing alone makes good flushing feed and in several reports results are generally as good or better than when using other feeding programs.

The general consensus seems to be that flushing:

(1) If properly accomplished, will result in a noticeable increase in the proportion of twin birth.
(2) May not be advantageous when applied to either very young or very old ewes, or to poor milking ewes.
(3) Is not likely to result in the desired response when applied to ewes already in fat condition.
(4) May result in an increase in the number of non-pregnant ewes in the flock.
(5) May result in an increase in the incidence of lambing parlysis unless proper feeding precautions for ewes in advanced pregnancy are taken.
(6) May prolong the lambing season.
(7) Is not consistent under all conditions or with all breeds.

Age to breed ewe - Before they are a year old or at around 18 months. In favorable environment ewe lambs may be bred before they are a year of age.

Scotland studies (1962) indicate that by breeding ewe lambs and culling all which do not conceive as lambs, the ewes of low fertility can be eliminated. New Zealand study by Wallace (1958) on selecting for twins found that lambs reared as twins were more likely to be dry as two-year-old ewes. If twin ewe-lambs are to be saved for replacement ewes, they merit special feeding where growing out replacement ewes is a problem.

Age of ewes - Within a breed or type, a flock of ewes will usually increase their lambing percentages rather steadily from their first lambing through the fourth or fifth. After the fifth or sixth lambing the rate of twinning may start to decline.

Temperature - Exposing ewes to high ambient temperature (90°F) before breeding results in a lower fertilization rate and increased early embryonic death. Several studies have been carried out to determine which period of high temperatures are most detrimental to the developing sheep embryo.

Critical period for early embryo mortality in ewes exposed to high temperatures. Dutt (Kentucky Experiment Station).

The effect on embryo mortality in ewes exposed to high ambient temperature (90° F.) at time of breeding (0-day) and on 1, 3, and 5 days was determined in two experiments. Fertility rate (69.2%) in ewes exposed to a high ambient temperature at time of breeding was non-significantly lower than it was in control ewes.

Exposure to heat results in an increase in morphologically abnormal ova. Only 3.7% of ova from control ewes, examined 3 days after breeding, were classified as morphologically abnormal. In the 0-day ewes 46.2% and in the 1-day ewes 30.8% of the ova were classified abnormal.

Embryo loss, estimated as the percent of fertilized ova that failed to survive, was significantly higher in all treated groups and ranged from 61.5% to 100%. Embryo loss for the combined 0- and 1-day groups was significantly higher than in the 3- and the 5-day ewes. The sheep zygote is most sensitive to the harmful effect of high ambient temperature during the initial stage of cleavage while in the oviduct.

Eighty-five percent of the control ewes lambed, compared with 10% of the ewes in the 0- and the 1-day groups. Thirty-five percent of the ewes in the 3-day group lambed, and 40% in the 5-day group lambed.

Other data from this same station indicates that summer temperatures are partly responsible for poor conception rate of ewes bred to Southdown rams early in the breeding season. This same data also pointed out the possibility of improving conception rate early in the breeding season by keeping rams at lower environmental temperatures during the summer months. Reproduction in the yearling ewe as affected by breed. (Foot & Pope, Wisconsin).

Those animals that were better grown out as indicated by greater body weight shed the greater number of ova in each of three years.

Nutrition - Normal reproduction is dependent on a highly complex and very delicate balance on many physiological processes of the ewe. Proper nutrition is essential for all of these processes and therefore can be associated with not only possibility of pregnancy occurring, but also very likely with a possible effect on multiple births.

Early lambing ewes - Some studies have shown that the first half of the ewe flock will drop a higher percentage of twins than the half of the flock that lambs last. This observation may be a direct result of the effect of flushing it still deserves some consideration and is still another characteristic for which we can select.

Genetic background - Some breeds, Merino, as an example, are noted for their inability regularly to produce a high rate of twins. However, one can find individual ewes that never miss twins. Selecting replacement animals of multiple birth can be utilized in an attempt to increase twinning. (Heritability estimates within a flock 10% - 15%.)

At birth - This is a critical time in the life of a little lamb. If he needs help to breathe, provide artificial respiration at this time. An apparatus (tube, paper sack, plastic bag, etc.) can be used which will fit over the lamb's mouth and nose. Breathing in and out of the apparatus by mouth will provide needed respiration. See that the membranes and scum is taken away from the mouth and nose and, during cold weather, make sure that he is dried off and heat is provided, if necessary. It is important that this little fellow receives some milk the first few hours of his life in order to give him the proper start. If too long a time lapses before nourishment is given, the possibility of survival is greatly decreased. A lamb that is completely chilled soon after birth has little chance of survival. Consequently, it is important that a system of heating, brooder, or some protection be provided. A simple brooder with a heat lamp up on the top will generally provide sufficient heat. When lambs are born on the range under favorable climatic conditions, supplemental protection must be provided. The most important management practice for the producer to follow is to be available during lambing and give considerable attention to the lambs for the first week or ten days following birth.

(Montana Data) When do lamb losses occur and what is the reason for this loss? Lamb losses at Montana Experiment Station range flock - 23.5% died between birth and weaning (7191 lambs used). Of this group 72.1% were placed in five categories. Pneumonia, 16%; starvation, 13.8%; no visible lesion, 15.8%; stillbirths, 14.3%; and dysentery, 11.8%. Fifty six percent of lambs died within three days of life and 73% within first five days. To sum up the story on lamb losses, the producer should pay real close attention during the first five days of the lamb's life and if he gets the lamb past this period his chances for weaning this lamb are quite good.

(Ohio Data) The infant mortality in a total lamb crop of 491 was 18.5% of all fetuses born. The rate among purebred lambs was 19.06% and among crossbred lambs was 17.8%. Autopsy of all lambs dying from birth to weaning, including aborted and stillborn, revealed that 24.47% were stillborn, 30.48% died from constitutional weakness and starvation; 18.08% died from pneumonia; 7.45% from physical injury and 5.30% from infection (naval and intestinal). Minor causes leading to death included anomaly, 2.12%; drowning, 1.06%; orphaned, 1.06%; and 6.36% from undetermined cause. Fifty-five percent of the total mortality occurred at birth and during the first three days. A total of 70 percent occurred at birth and during the first ten days thereafter.

Hormones - The use of hormones to increase multiple birth is still in experimental stage.

Production of twins - The importance of twins and triplets in profitable flock operation has been characteristic of high income earning flocks.

One set of data involving two breeds of sheep shows that after deducting infant mortality, the group of ewes of each breed which gave birth to single lambs reared 83.5 and 86.3 percent lamb crop to weaning at 90 days. The ewes that gave birth to twin pairs or triplets in each breed reared 163 and 172 percent lamb crop. The twin bearing groups in each case were approximately double the number raised by the ewes giving birth to single lambs. The influence of this multiple birth factor numberwise in flock economics is plain.

Farm and ranch flock cost and income estimates are given in the following charts. Chart 11 shows estimated increase in income with each increase of 10% lamb crop over 100%.

Chart 1: Production Costs and Returns from Range per 100 Ewes

Feed		Extra Cost for Each 10% Increase of Lambs
Hay and silage	595.	
Pasture (owned)	130.	
Pasture (rented)	70.	
Grain and concentrates	184.	8.00

Chart 2: Other Costs

Labor	350.
Vet and drugs	50.
Taxes and Insurance	67.
Depreciation and repairs	40.
Shearing	47.
Ram purchase, ram sold	42.
	1575.

Chart 3: Returns - 100% Lamb Crop - 25 Lambs Selected for Replacements (20% culled, 5% death loss on ewes)

Lambs	75 x 80 lbs. x 20¢	=	$1200.
Wool (ewes)	95 x 9 lbs. x 50¢	=	428.
(rams)	3 x 12 lbs. x 50¢	=	18.
Cull ewes	20 x 130 lbs. x 5¢	=	130.
			$1776.

Chart 4: Returns Over Estimated Cost

Gross returns	$1776.
Estimated cost	1575.
	$ 201.

Change in gross income for 10% change in lamb crop saved to market age. 10 x 80 lbs. x 20¢ = $160.00 - $8.00 (extra grain charge) = $152.00.

Chart 5:

Farm Flock - South Dakota
100 ewes to begin season
Purchase Replacements and Rams as Needed

Hay

50 day feed in corn stalk and stubble

Ewes 140 days on hay feeding
600 lbs. per day = 84,000 lbs. @ .006 = $504.

Lambs 100 days on hay feeding
100 lbs. per day = 10,000 lbs. @ .006 = 60.

Rams 140 days on hay feeding
18 lbs. per day = 2520 lbs. @ .006 = 15.

$579.

Chart 6:

Pasture

Ewes - 5 months
60¢ per head per month $300.

Rams - 5 months
60¢ per head per month 9.

$309.

Chart 7:

Grain

30 days prior to lambing, .50 lb./day/ewe = 1500 @ .02 = $ 30

50 days after lambing, 1.00 lb./day/ewe = 5000 @ .02 = 100

Creep feed for lambs, 110 lbs. to market/lamb = 11000 @ .02 = 220

15 days prior to breeding .50 to 1.00 lb./day/ram = 45 @ .02 = 1

50 day breeding season, 1.00 lb./day/ram = 3

$354

Chart 8: Miscellaneous Expense

Salt- Minerals 1 lb./hd./mo. @ .665 =	$ 80
Vet and drugs .60/ewe =	60
Taxes and Insurance .45/ewe =	45
Depreciation and repair on equipment .30/ewe =	30
Shearing ewes 95 x 50 =	48
Shearing rams 3 x 60 =	2
Ewe depreciation and death loss $3.50/ewe =	350
Ram depreciation and death loss $ .50/ewe =	50
	$665

Chart 9: Expense Summary

	100 percent lamb crop sold	Change in expense for a 10% increased lamb crop	Change gross income
Hay	579	6.00	
Pasture	309		
Grain	354	30.00	
Miscellaneous	665		200
	1907	36.00	200

Change in returns with 10% lamb crop increase $200 - 36 = $164

Chart 10:

Income (100% lamb crop sold)

100 x 100 lbs. @ 20¢ =	$2000
95 x 9 lbs. wool x 50¢ =	428
3 x 12 lbs. wool x 50¢ =	18
Total estimated returns	$2446

Returns over cost

Gross returns	$2446
Estimated costs	1907
	$ 539

Chart 11:	Total Operating Cost per 100 head	Total Returns per 100	Returns Over Cost
Ranch Operation	$1575	$1776	$201
Farm Flock Operation	$1907	$2446	$539

	Returns per % Increase in Lamb Crops			
	110	120	130	140
Ranch Operation	$152	$304	$456	$608
Farm Flock Operation	$164	$328	$492	$656

Early South Dakota Lambs

SHEEP ARE SUITABLE to the general plan of operation on thousands of South Dakota farms where the land is well drained, acreage can supply the pasture needed, and farmers want to diversify operations.

Producing early spring lambs has been one of the most profitable enterprises on South Dakota farms. Choice spring lambs sold on the late May and early June market have never been in over supply. With good management and careful attention, a flock of ewes bred for early lambs will return an excellent profit from low investment with comparatively little interference with other farm labor.

The two crops—lambs and wool—can add extra dollars to your income and assure more efficient returns on feed and labor.

The following steps, properly carried out, should assure success in early lamb production.

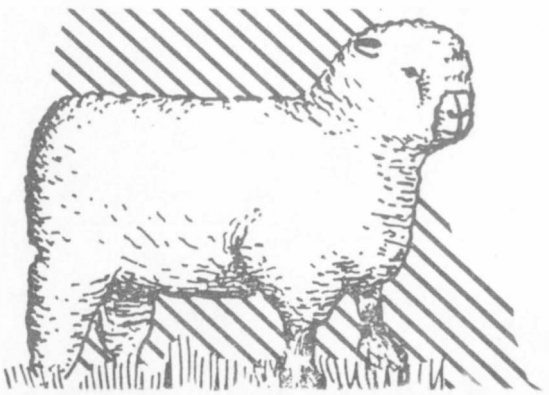
1. Select Breeding Stock Carefully.

All permanent improvement is based on selection of breeding stock and systematic culling. Experiments indicate that large framed ewes (similar to those found throughout Western South Dakota) produce more lambs and suckle them more satisfactorily than small ewes. Weight of ewes as yearlings just before first breeding is a fairly accurate indication of the birth and weaning weights of lambs they will produce. The Agricultural Research Service of the U.S. Department of Agriculture indicates that heavier ewes, regardless of breed or wool type, produce heavier, faster growing lambs than light weight ewes. Recent experiments at Montana and Wyoming stations also indicate that the owner of a farm flock of sheep might make his greatest profit by running medium or fine wool ewes (Rambouillet, Corriedale, Columbia, Shropshire, and Targhee) and breeding them to Hampshire or Suffolk rams.

Cheap rams are not usually a bargain. Select rams carefully and systematically. A ram that has done well under a performance test program should be considered.

Select a thick, deep bodied, well balanced, fast growing purebred yearling ram with a lot of natural meatiness. He will sire lambs that fatten quick and top the late May and June market.

By **LaVerne J. Kortan,** associate Extension livestock specialist



2. Breed in August, or Early September.

Flush ewes by turning them on a good lush green pasture 2 to 3 weeks before breeding. Turn ram with ewes the first of August.

3. Check Ram's Fertility, Obtain Breeding Dates.

High temperature during the summer is detrimental to high fertility and normal semen production of the ram. Shearing rams 6 to 8 weeks in advance of breeding and again at breeding time will generally be very beneficial.

High humidity is as detrimental as high temperatures. If both occur during the breeding season, turn the rams, even though sheared, with the ewes only at night.

Use a marking harness or ochre on the ram with color changed every 17 days. This will give you an indication of the fertility of the ram. If most of the ewes repeat, the ram is probably infertile. Breeding dates can also be obtained by use of a marking harness.

4. Cut Feed Costs With Roughage.

A sheep's stomach is a manufacturing plant designed to utilize roughage. Corn fields and grain stubble during the fall and early winter provide excellent feed. Follow this period by feeding a ration of 4 to 6 pounds of good alfalfa hay daily or similar amounts of prairie or tame hay. If prairie or tame hay is used, a protein supplement (one-tenth to one-fourth

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pound soybean oilmeal or similar protein feeds) will generally be needed to balance this ration. Corn or sorghum silage (8 to 11 pounds daily) may be used but will need to be balanced by using alfalfa hay or protein supplement. Feed one-half to three-fourths pound corn or oats daily during last 30 days before lambing along with roughage rations that are listed above.

Always provide a mineral mixture of equal parts salt and steamed bonemeal or the equivalent for ewes.

5. Ewes Require Good Management.

Pregnant ewes should gain 15 to 30 pounds from breeding to lambing.

Provide for excercise during the winter.

Properly fed ewes which have adequate exercise (½ mile daily) seldom have pregnancy disease. Provide plenty of clean ice-free water.

Several weeks before lambing, crotch out ewes and remove wool from faces. If adequate shelter is available before and during lambing, some producers may wish to complete the entire shearing operation prior to lambing

6. Efficiency is the Key.

Housing for a farm flock need not be expensive. A dry, well ventilated shelter open to the south is quite adequate for wintering ewes.

Provide warm, draft-free quarters for early lambs. Lambing pens 3 x 4 feet or 4 x 4 feet will generally pay for themselves in saved lambs and will prevent trouble with disowned lambs.

Plan your labor program so that you will be available to help ewes during the lambing period. Heat lamps will prevent chilled lambs and must be provided during severe weather.

7. Saved Lambs Increase Returns.

A 140 to 160% lamb crop generally means very favorable returns. Producers must strive to attain or surpass 140% lamb crop.

8. Dock and Castrate Early.

Dock and castrate lambs at 7 to 10 days. Disinfect wounds and check lambs frequently to insure against excessive bleeding.

9. Get Maximum Growth from Birth to Market.

Feed ewes a milk-producing ration until pastures are ready for grazing. A pound to a pound and one-half of a mixture of corn, corn and oats, or oats, and one-tenth to one-fourth pound of soybean oil meal is an adequate daily ration for ewes fed good legume hay.

Graze ewes and lambs on excellent pasture during late May and June.

Many excellent creep rations can be prepared and must be fed for maximum growth.

10. Shear and Handle the Wool Properly.

The manner in which the wool clip is "harvested" and prepared for market has a direct bearing on the price the sheep producer will receive. Do not allow the wool to become matted with mud and manure. Be sure fleeces are dry before shearing and store wool in a dry place. Avoid second cuts when removing the fleece. Shear on a clean floor. Separate black fiber fleeces, burry wool, tags, and sweat locks from the top grade wool. Use only paper twine when tying fleece.

11. Peak Market Comes in May and June.

The 10-year average monthly slaughter lamb prices on Chicago market indicate that May and June are the two peak market months. Sell all lambs that are fat and weigh at least 85 pounds during these months. If lambs are receiving abundant milk and feeds, they will usually be fat and heavy enough to hit these peak market months. Early lambs produced under excellent management and feeding programs should weight 85 to 100 pounds at 4 to 4½ months.

12. Control Parasites.

A year around parasite control program must be established. This program will include the use of recommended drench mixtures (phenothiazine, lead arsenate, or copper-nicotine sulphate) for controlling internal parasites. Each producer must follow a definite systematic program if the flock is to remain free from parasites.

Spray, dust, or dip sheep for lice and ticks. Use any one of the following insecticides: lindane, methoxychlor, toxaphene, Co-Ral (Bayer 21/199), dieldrin. After shearing and between September 1 and November 1 are recommended times to treat for these external parasites.

Tag ewes in the summer to prevent maggots.

Published and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914, by the Agricultural Extension Service of the South Dakota State College of Agriculture and Mechanic Arts, Brookings, John T. Stone, Director, U. S. Department of Agriculture cooperating.
5M—5-60—File: 2.431, Reprint 5M—1-62—9769

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Brookings, South Dakota

Animal Science Department
Agricultural Experiment Station

A.S. Mimeo Series 64-2

Research in Lamb Feeding

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In the business of feeding we have those who "feed" and those who are "feeders". Those who aren't "feeders" in the sense of knowing how, and when, and what, and how much to feed, can no longer expect to remain solvent in the whirlpool of modern agriculture. It is hoped this summary of research in lamb feeding will help you become better "feeders".

Lamb feeding can be divided into two categores: 1) feeding the nursing and growing lamb and 2) feeding the feeder lamb.

Any discussion of research in feeding the nursing and growing lamb involves management of the ewe and lamb. A cardinal principal in feeding the lamb is to keep the lamb growing from birth to market. Stoppage in growth is costly. According to Hammond, an English researcher, lambs which gain rapidly and are pushed from birth to market produce the best carcass. Ewe milk production reaches a peak about 4 to 6 weeks after lambing and in 9 to 12 weeks produces very little milk so that most of the lamb's nutritive requirements must be met with feed other than milk. The correlation between milk production and lamb gain 7 weeks post lambing is low.

Considerable research has been conducted to study the effect of early weaning on lamb performance. Oklahoma workers state that lambs should be 70 days of age and a minimum of 50 pounds in weight before weaning. Their experimental work shows that lighter and younger lambs do not gain as well as those remaining on the ewe. Minnesota workers state that a set back may be expected if lambs are weaned as early as 6 to 8 weeks of age, however, the set back can be minimized if lambs are consuming at least 3/4 pound of creep. Based on 28 day gains, Illinois reported no set back when lambs were weaned at 6 and 9 weeks of age. The 6-week-old weaned lambs gained 0.5 lb. per day while the older group gained 0.58 lb. At the end of the trial daily gain was about the same for both groups.

Since milk production and ewe requirement start decreasing at about 4 weeks after lambing, continued grain feeding of the lactating ewe until weaning time may not be necessary to produce rapid lamb gains. Work at South Dakota showed that when lambs are creep fed feeding the lactating ewe a grain ration more than 60 days affected only slightly gains made by lambs, however the ewes were in better condition.

Daily Feed for Ewe and Lambs for 30-day Period
from 60 - 90 days after Lambing

Feed	Lot 1	Lot 2
Ewes		
alfalfa hay, lbs.	7.0	6.7
concentrate, lbs.	1.26	
Lambs		
creep, lbs.	1.52	2.0
daily gain	.78	.75

Hay was offered free choice to the ewes in both lots. The creep ration was a complete ground mixture of 35% corn, 14% oats, 7% wheat bran, 14% soybean oil meal, and 30% alfalfa hay.

Minnesota experiments have shown similar results. When lambs were 2 to 3 weeks old, ewes and lambs were put on trial. Creep fed lambs from ewes fed grain gained 0.71 lb. per day compared to 0.65 lb. for those from ewes not grain fed. Lambs gain 0.46 lb. per day when ewes were fed grain but lambs not creep fed.

Research has been conducted with different systems of managing lambs for profitable production. Illinois workers reported on several management systems for ewes and lambs. The ewes and lambs were handled in the following manner:

1) lambs weaned at either 6 or 9 weeks of age, self-fed on pasture.
2) lambs self-fed in dry lot, ewes pastured at night returned to lambs during the day.
3) lambs weaned as in 1, self-fed in dry lot.
4) lambs and ewes pastured, lambs either creep fed or no creep.
5) lambs on pasture with ewes for 28 days then weaned and self-fed.

These conclusions were made from the study:

1) The system when lambs do not graze with the ewe is the most effective means of controlling internal parasites.
2) When lambs are weaned or not pastured with dams, twins performed as well or better than singles.
3) Lambs can be grazed with their dams for the first month of pasture season then weaned and self-fed in dry-lot with satisfactory performance.

In 1961 at South Dakota, lambs were weaned at ages from 9 to 17 weeks and fed on alfalfa pasture. Rate of gain increased with age at weaning up to 15 weeks. Lambs weaned at 17 weeks gained slightly slower than those weaned at either 13 or 15 weeks. In 1962 lambs were weaned at 13 weeks and either self-fed in dry-lot or on alfalfa pasture and pastured without creep. These lambs were compared to lambs pastured with dams until a weaning age of 17 weeks. The early weaned lambs self-fed

Lamb Gains and Feed Efficiency

Treatment	Av. Daily Gain	Feed/lb. Gain
1. grass, creep	.413	2.18
2. grass, no creep	.287	
3. legume, creep	.541	0.98
4. legume, no creep	.514	
5. in and out	.554	4.62
6. weaned 28 days after placed on pasture, dry-lot fed	.551	3.16*

* post weaning only

in dry lot made the most rapid gains while weaned lambs on pasture alone gained the least. Lambs weaned at 13 weeks and self-fed on pasture made gains equal to those pastured with dams.

Arkansas reported lambs weaned and fed in dry lot gained 3 times faster than lambs given access to pasture along with dams. Lambs weighed from 48 to 86 lbs. and averaged 106 days of age. The weaned lambs gained .45 lb. per day compared to .23 lb. for lambs pastured with dams and no creep. Creep feeding on pasture increased gains from .23 to .33 lb. per day. Lambs on pasture and creep fed consumed 1.16 lbs. of concentrate per pound gain in addition to grass and milk while lambs in dry lot consumed 4.5 lbs. concentrate and 1.67 lbs. alfalfa hay per pound of gain.

How practical is early weaning and dry-lot feeding? The following items should be considered.

1) Virtual elimination of losses from internal parasites.
2) No need to provide a clean high quality legume pasture.
3) A more uniform group of lambs can be marketed.
4) Ease of handling and observing lambs permit earlier identification and treatment of sick lambs.
5) Since ewes will not be milking they can be fed less feed or placed on pasture.
6) Removing lambs from pasture would increase number of ewes that could be carried on a given acreage.
7) More grain and supplement needed may increase out-of-pocket costs.
8) There may be udder damage as a result of early weaning.
9) More labor and equipment required.
10) Less use of pastures will not provide greatest possible use of this farm product on some farms.

When does it usually pay to creep feed?

1) large percentage of twins

2) lambs have potential to gain rapidly
3) early lambs, born before the first of March
4) ewes are old and thin
5) limited amount of pasture

Good creep management also pays. Self-feeders should be used if possible and the feed kept clean and fresh. Fresh water should be available at all times. The creep should be located in the most comfortable, well protected area of the barn. Lambs should be given access to creep within a week of birth. Be sure all lambs are using the creep. Lights may be used to encourage creep use. Michigan varied light in creep from 4 to 24 hours. The gains at 24 hours of light were almost double gains at 16 and 20 hours. These lambs were eating more feed and thus gaining faster.

Palatability of creep ration is important especially in getting lambs started on feed. Missouri has conducted palatability studies with several rations and feeds. Lambs were given free choice all rations and location of rations were changed regularly. A ration of 60% ground barley, 30% soybean meal, 10% wheat bran was most palatable with 70% ground barley and 30% SBOM next.

Illinois work shows that lambs like the high protein ration at the start but become "less eager eaters" after weaning. The lambs gained .04 lb. per day faster pre-weaning but .01 lb. slower post weaning than those fed a standard ration.

	Rations Used	
	Standard %	High Protein %
Ground corn	60	45
Ground oats	10	10
Wheat bran	10	10
Alfalfa meal	10	10
Soybean meal	10	25
Ground limestone	1	1
Bonemeal	1	1
Trace mineral salt	1	1
Premix[a]	1 lb. per ton	1 lb. per ton

[a] 5000 I.U. Vitamin A, 625 I.U. Vitamin D per gram of premix, 15 grams antibiotic per ton.

Pelleting Creep

In comparing pelleted with non-pelleted rations, Ohio workers found that at 110 days of age, 3/4 of the lambs on pellets reached market weight and only 1/2 of the lambs on the unpelleted ration. The total cost per lamb was increased by 78 cents by using pellets but resulted in 5.4 lbs. more lamb. This would indicate pelleting to be profitable in this test if lamb prices were above $14.40 per cwt. Ohio also compared a complete pelleted ration with corn-oats and alfalfa hay ration and no creep. The lambs on corn-oat - alfalfa hay gained 7 lbs. faster from birth

to 90 days than no-creep lambs while lambs on pellets gained 8.5 lbs. more than those receiving no creep or 1.5 lbs. more than those fed corn-oats - alfalfa hay.

Illinois workers fed the following ration in meal and pelleted form.

Ground corn	600 lbs.
Alfalfa meal	250 lbs.
SBOM	150 lbs.
Bone meal	10 lbs.
Limestone	10 lbs.
Salt	5 lbs.
Premix:	
Vitamin A	1000 I.U. per lb. ration
Vitamin D	200 I.U. per lb. ration
Vitamin B_{12}	10 micrograms per lb. ration
Terramycin	10 mg. per lb. ration

Lamb Performance

	Meal	Pellet
Av. daily feed, lb.	2.47	2.71
Av. daily gain, lb.	0.555	0.569
Feed per lb. gain, lb.	4.43	4.77

Lambs seem to desire high quality legume hay but can't consume enough to make maximum gains. Pelleting would enable the lamb to consume more energy in the form of roughage. Ohio researchers found lambs make excellent gains on alfalfa pellets until they reach 2 to 2½ months of age, then more energy is required than can be consumed in the pellet. The addition of corn and soybean meal provided the energy for continued fast gains.

Raising lambs on slotted floors may help sheep producers obtain maximum gains at least cost according to Arkansas workers. Lambs were weaned at about 55 lbs. and one group fed on slotted floor, another on a conventional floor, while a third group remained with their dams. All groups were fed the following pelleted ration.

Ground corn	1200 lbs.
Ground oats	200 lbs.
Alfalfa meal	500 lbs.
Soybean meal	88 lbs.
Salt	12 lbs.
TM - 50	1 lb.
Vitamin A supplement	15 gms.

TM - 50 - 50 gram of terramycin per pound
Vitamin A supplement - 30,000 I.U. per gram

Gains and feed costs are shown in the following table.

	Weaned Lambs		Unweaned
	On Slots	Conversion pen	Fed in Dry Lot
No. lambs	8	8	8
Av. daily gain	0.45	0.41	0.50
Feed per lb. gain	7.03	7.82	5.38[1]
Feed cost per lb. gain	0.211	0.235	0.325
No. lambs	8	8	
Av. daily gain	0.41	0.33	
Feed per lb. gain	6.73	8.30	
Feed cost per lb. gain	0.202	0.249	

[1] dams of lambs consumed 2.15 lbs. concentrate and 7.90 lbs. alfalfa hay per lb. of lamb gain.

Lambs started on creep before they are 10 days of age will be consuming over 1/4 lb. of creep daily by 3 weeks of age. Average daily consumption for lambs self-fed a complete creep for a period of 10 days to 120 days is about 1½ lbs. Lambs will be eating about 3 lbs. daily at 4 months. About 200 lbs. of feed is required to take a lamb from birth to market.

Daily gains vary considerably. Lambs will gain as much as a pound and as little as .2 lb. per day from birth to market. A summary of Ohio work shows lamb gains averaging about 0.6 lb. during the first two months on creep and then gradually decreasing to a little more than 0.5 lb. daily gain. The rate of gain depends not only on how much the lamb consumes but to a large extent upon his inherent ability to grow rapidly.

Some other good creep rations are:

1. 65% alfalfa meal
   12% ground corn
   9% ground oats
   10% soybean meal
   3% molasses
   1% bone meal
   15 gm./ton aureomycin
   1/2 lb. per ton vitamin supplement furnishing 5000 I.U. Vitamin A and 500 I.U. Vitamin D per gram.

2. 40% ground corn
   40% ground oats
   20% wheat bran
   10% SBOM

3. 20% ground barley
   20% ground corn
   30% ground oats
   20% wheat bran
   10% SBOM

4. 45% ground corn
   45% ground oats
   10% SBCM

High quality legume hay to be fed free choice with rations 2, 3, 4.

Part II:

The feeding of "feeder" lambs has changed considerably in the past few decades and no doubt changes will continue to take place in the future as researchers strive to increase efficiency of production. Let us look back at some recent research in lamb feeding.

Pelleting

Some of the advantages of feeding a pellet are ease of self feeding, saving of labor, reduced death loss, ease of starting lambs on feed, and increase feed efficiency and rate of gain. The main advantage seems to be convenience rather than in the production of lower cost gains. In general pelleting has paid off best in a higher growth rate and lower feed requirement per pound of gain when the feed contains 65% or more of roughage and when roughage is of relatively low quality.

Oregon workers compared pellets containing 70, 80, 90, and 100% alfalfa.

Ration	Rate of gain	Feed/lb. gain
100% alfalfa	0.58	9.0
90% alfalfa, 5% barley, 5% molasses	0.64	8.4
80% alfalfa, 15% barley, 5% molasses	0.65	8.4
70% alfalfa, 25% barley, 5% molasses	0.71	7.4

A South Dakota study compared alfalfa pellet with a 50 - 50 roughage - concentrate meal. In one group of lambs the alfalfa pellet was fed until lambs weighed 90 lbs., then a 60 - 40 pellet was fed.

	Alfalfa Pellet to 90#	Alfalfa Pellet	50 - 50 Meal
Av. daily gain	0.51	0.46	0.51
Av. feed per day	4.61	4.54	3.45
Feed req. per lb. gain	9.39	9.97	6.76
Feed cost per lb. gain	.145	.134	.109
Carcass yield %	51.0	47.6	54.0
Carcass grade score	6.5	5.9	6.7

Score = 7 - choice, 6 low choice

In a 56 day trial Illinois station compared a 50 - 50 ration in a meal or pelleted form.

Ration		Daily Feed Consumed	Feed/lb. Gain	Av. Daily Gain	3 mg. Implant	
					Implant	No
Corn	Meal	4.24	11.9	0.36	.35	.36
	Pellet	4.01	10.5	0.38	.46	.30
Soybean	Meal	5.47	21.3	0.26	.30	.21
	Pellet	3.63	11.9	0.31	.32	.29
Barley	Meal	3.17	12.1	0.26	.33	.20
	Pellet	3.14	10.5	0.30	.35	.29

Utah compared chopped ration with pellets using balck faced and white faced lambs. The lambs fed the chopped ration gained .29 lb., required 9.7 lbs. of feed per pound of gain and consumed 2.79 lbs. feed per day compared to .49 lb. gain, 7.5 lbs. feed efficiency and 3.65 lbs. consumed for the pellet fed lamb. There was very little difference in performance of the two types of lambs.

Minnesota workers report pelled feeds produce 12 to 18 percent more rapid gain and 10 to 20 percent increase in feed efficiency. Feed costs per 100 lbs. of gain was $1.64 to $2.90 less for lambs fed long hay and shelled corn. With each increase of $2.00 in pelleting cost an increase of 8 to 10 percent in efficiency is needed to offset this increase.

High Concentrate Rations

A higher percentage of feeder lambs have been "heavy weight" (over 80 lbs.) in recent years than formerly. These lambs must be fattened quickly. If not they reach market weight lacking condition. Feed high concentrate comes close to providing the answer. At South Dakota light and heavy lambs were fed a ground mixed ration containing 70% corn, 25% alfalfa hay, 3% SBCM, 1% TM salt and 1% dicalcium phosphate. Lambs in both weight groups ate 2.77 lbs. feed per day and gained 0.52 lb. per day. Feed required per pound of gain was 5.35 lbs.

California researchers compared rations containing 5% and 50% alfalfa hay. Lambs fed the low roughage ration gained .51 lb. per day compared to .45 lb. for high roughage ration. Feeding efficiency was improved (5.04 vs. 6.22 lbs.) and dressing percentage was higher (50.9 vs. 48.6).

Implant

A 3 mg. implant of diethylstilbestrol will improve rate and efficiency of gain from 6 to 12%. Pelts come off with more difficulty but lambs just as good to eat as comparable untreated lambs.

Shearing

Lambs field fed should always be faced and crotched. Sheared lambs make more rapid gains. During the coldest part of the winter Colorado researchers sheared lambs twice during the course of a feeding trial. One lot of lambs was fed outside unprotected while the other lot was in a building heated to 90°F. Five lambs were sheared from each lot.

Lamb Gains

Lot No.	Sheared	Unshorn	Feed/lb. Gain
1. unprotected	42.6	37.0	8.49
2. Heated	29.2	26.0	10.62

Antibiotics

Antibiotics (terramycin or aureomycin) have proved to be good additions to lamb rations. They are most effective in relatively high roughage rations and at fairly low levels. (7.5 to 10 mb. per pound of feed.) Antibiotics are helpful in prevention of enterotoxemia.

Vitamin A

This problem does not seem to be as great in sheep as in cattle, perhaps because lambs are fed for shorter periods of time and seem to be able to convert carotene to Vitamin A more efficiently. Illinois workers injected lambs with 100,000 I.U. of Vitamin A weekly during a 60-day trial. Vitamin A injections did not affect the rate of gain. Work at South Dakota has shown no affect on gains made by lambs fed 3000 I.U. daily.

Environmental Effects

Providing shade during summer feeding with snow fencing and aluminum shades increased rate of gain by 22.4% and 18.2% more respectfully than unshaded lambs according to a Missouri study. Lambs fed under shade were also more efficient, being best for snow fence shade. Temperature was from 5 to 9°F. cooler under the shades.

A study of the effect of artificial light on performance of fattening lambs has been conducted at Missouri. Lamb gains were adversely affected by continuous light. These lambs ate considerably more feed and thus had lower feed efficiency. There were no apparent differences in gains between lambs in the natural light and those where the feed only was lighted.

Vaccination

Vaccinating lambs against enterotoxemia is highly desirable unless a complete ration is self-fed. The new type vaccine with toxoid material is suppose to give longer protection with less local reaction to the injection. Lambs should be vaccinated in an area where local reactions will not damage muscle. If "sore mouth" contagious ecthyme has been on the premises recently it is desirable that all lambs be vaccinated upon arrival.

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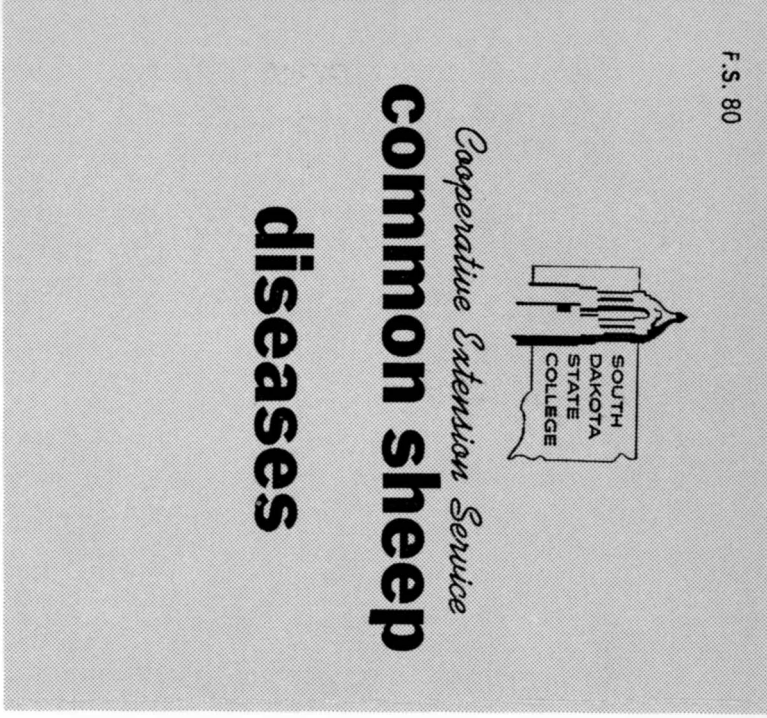

Common Sheep Diseases

The fight against sheep diseases is essentially a matter of prevention rather than treatment.

You must continually be concerned with diseases as they relate to various features of your set-up. And to understand these relationships, you must know some of the distinguishing characteristics of each disease and be alert to the best means of developing management practices that will aid in preventing the disease.

The material in this fact sheet, is presented, therefore, mainly as a guide in selecting the management, breeding and feeding methods that will help keep diseases at a minimum, and to point out common disease symptoms.

Always remember that if your animals do get sick, the best, quickest, and in the long run, the the cheapest way to get an accurate diagnosis is to call a qualified veterinarian.

COCCIDIOSIS

(red diarrhea, bloody scours, or red dysentery)

Cause: This disease is caused by protozoan organisms known as coccidia which live in the cells of the intestinal lining. The infective microorganisms, called oocysts, gain entrance into an animal by being swallowed with feed or water contaminated with the droppings of animals already infected. Coccidiosis is sometimes mistaken for shipping fever.

Symptoms: A severe infection with coccidia produces diarrhea. Often the liquid feces become mixed with blood.

Prevention: Daily removal of manure and soiled bedding and avoiding contamination of feed with manure will help. Eliminate or fence low, wet areas. Prevent overcrowding. It may be helpful to keep lambs that come off the range on cured native hay for 1-2 weeks before starting on feed.

Treatment: Some sulfas may be helpful. Check with your veterinarian.

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ENTEROTOXEMIA

(overeating disease, pulpy kidney disease)

Cause: Overeating disease is caused by a toxin produced in the intestine by an anaerobic bacterium, *Clostridium perfringens* type D. Heavy grazing in lush pastures favors the development of these bacteria.

Symptoms: The first signs of overeating disease are sudden, violent deaths among the fattest, most vigorous sheep. There are often signs of considerable thrashing about and animals may be found lying in a running position. After the first few deaths, you may notice scouring and possible vomiting among some of the other affected animals.

Prevention and Treatment: In case of sheep and lambs on feed, management and feeding practices play an important part in preventing overeating disease. Vaccination by a veterinarian with *Clostridium perfringens* Type D bacterin is recommended for feeder lambs and sheep and lambs over 2 months old that are to be fitted for show. Vaccination should be made in the wool free area in the body side of the arm pit (front leg). Allow 10 to 12 days for immunity to develop before vaccinated animals are placed on full feed.

Losses in unvaccinated animals being fed hay and grain can be controlled by careful hand feeding or by grinding hay and grain together. If lambs are to be fattened in the corn field or allowed to run to a self-feeder, vaccination is highly recommended.

In case of lambs under 2 months of age, or for sheep and lambs on lush pasture, the trouble is not as easily prevented. The young lambs can be given a serum but it does not produce lasting immunity. In some cases it has been necessary to remove the flock from the good pasture to one less palatable and productive until vaccination can be made and

immunity to the toxin developed.

Even proper vaccination, however, does not mean sheep and lambs cannot be overfed. It is no license to throw all precautions away. The vaccination is usually effective for a normal feeding period of from 3 to 6 months.

FOOT ROT

Cause: Foot rot is believed to be caused by a soilborne organism. Muddy, filthy barnyards and water holes, prolonged wet spells, and failure to keep the animal's feet trimmed properly also contribute to the outbreak of the disease.

Symptoms: Lameness is usually the first symptom. In the early stages there is a reddening and swelling of the skin just above the hoof, between the toes, or in the bulb of the heel. Pus and a foul odor are usually evident. Later the joint cavities may be involved, and animals may show fever and depression, lose weight, and even die.

Prevention: Drain muddy pastures. Infected animals should be isolated.

Treatment: Treatment begins by trimming all infected material from the foot. A blacksmith's hoof knife is one of the best tools to use.

Soaking the foot for 1 minute in a solution made by dissolving 2½ pounds of copper sulfate in 1 gallon of water is still effective. Several treatments are needed and cure is not guaranteed. Wooden, earthen, or granite containers must be used.

Mass foot baths by means of a trough through which all animals walk may help prevent trouble but will not cure unless feet are thoroughly trimmed first. A more convenient treatment is made from a mixture of one-third formaldehyde and two-thirds glycerine. Local druggists can mix this material. It can be applied with an oil can and it also is effective only if the infected foot has first been thoroughly trimmed. Antibiotic injections or applications have proven useful treatments in some cases.

LAMB SCOURS (Dysentery)

Cause: Lamb dysentery, a highly fatal disease to young lambs, has no single cause. Some animal breeders believe that *Clostridium perfringens,* the same bacteria that causes overeating disease, is involved; others feel it is caused by a virus. Poor sanitation and chilling are likely to help bring on the disease. Also, lambs born on the range seem to be less susceptible than those born in a lambing shed.

Symptoms: The disease usually develops in lambs in the first few days after birth; it seldom occurs after the first week. Affected lambs are weak, depressed, and do not care to nurse. A profuse diarrhea (scours) that may be tinged with blood is often present. Usually the temperature rises and the lamb becomes gaunt or bloated. Death usually follows within a few hours.

Prevention: Keep lambs clean, warm, and dry, and then get them out on clean pasture or range as soon as possible.

Treatment: Consult a veterinarian for treatment. The sulfas, acidophilus milk (in 2 ounce doses, repeated two or three times daily), and antibiotics have been used with varying degrees of success.

LISTERIOSIS (Circling disease)

Cause: A highly fatal disease of both lambs and older sheep, it is produced by the bacterium *(Listeria monocytogenes),* which invades the brain, causing nervous symptoms. The disease is most common in spring and summer but may occur whenever new sheep are brought in. The danger is that the new sheep may be healthy carriers of the infection; animals in the home flock are thus exposed and may become infected, or the situation may be reversed. The home flock may contain carriers that threaten newly purchased animals.

Symptoms: Affected sheep are sluggish and lag behind others when flock is moved. They may stand off in a corner while the rest of flock feeds; or they may feed restlessly, only partially chewing. Often a sheep will hold his head to one side and move in a circle, always in the same direction. Most of the affected animals will circle this way. When not circling, they may hold their heads against buildings or feedboxes; finally they go down, and are unable to rise. Death usually occurs within 48 to 72 hours, although some animals live as long as a week.

Prevention and Treatment: Promptly isolate sick sheep. Treatment of those affected is of questionable value. Raising all of your replacements, however, is one way to keep from introducing it to the flock.

MASTITIS (Blue Bag)

Cause: Mastitis is a bacterial infection. Contributing causes are bruises, shear cuts, and rough handling.

Symptoms: In acute stages there is a high fever, loss of appetite, stiffness, swollen bluish udder, and sometimes death. Later, in chronic stage,abscess formation in udder is common. Abscesses rupture and heavy scar tissues form, destroying all milk secreting tissue.

Prevention: Maintain strict sanitation in sheds,

corrals, and bed grounds. When additional sheep are purchased, examine udders closely to avoid "buying the disease." Avoid clipping udder while shearing. Remove high door sills or other obstructions which might bruise udders. Remove infected ewes from flock and disinfect the area.

Treatment: Treatment must be immediate. Apply hot packs to infected udder, and lance abscesses. Sulfa drugs and antibiotics usually give good results.

PINKEYE (Infectious Keratitis)

Cause: A nuisance disease caused by bacteria affecting both adult sheep and lambs. It is easily spread by contact and by flies.

Symptoms: One or both eyes appear inflamed with a heavy discharge of tear fluid. Ulcers may form in severe cases. If unchecked, blindness may follow. Infected animals lose weight during attack.

Prevention: Prevention is questionable because of lack of knowledge as to the specific cause. Avoid placing newly purchased animals with the herd for 3 weeks.

Treatment: Segregate affected animals in a dark stall, if possible. Provide good feed and water. Antibiotics and eye pellets are currently effective. Several treatments with these medicines are usually necessary.

PNEUMONIA

Cause: This is one of the most common sheep diseases. Chilling, overexposure, and fatigue play a big part in bringing it on. Exposure connected with dipping and shearing may be enough to allow it to develop. Healthy sheep may carry pneumonia bacteria or viruses of various kinds in their lungs or other parts of the respiratory tract. However, the disease develops only after the animal becomes "rundown" from poor feeding, parasites, or prolonged exposure.

Symptoms: These include fever, labored breathing, and refusal to eat. Later the animal becomes depressed and may have a discharge from the eyes and nose. Sometimes older sheep die without showing any symptoms.

Prevention: Because exposure and chilling are so important in causing pneumonia, do everything possible to prevent these conditions. Provide warm, sanitary lambing pens. Do not dip or shear in cold, raw weather unless you have warm housing. Sound parasite control together with proper feeding and management will also do much toward pneumonia prevention.

Treatment: Watch your flock constantly for signs of the disease. Call your veterinarian early if symptoms in one or a few sheep look suspicious. Early treatment is quite effective. Sulfonamides and antibiotics, like penicillin, aureomycin, or streptomycin, give best results in most cases.

PREGNANCY DISEASE (Lambing Paralysis)

Cause: The disease is a metabolic disorder thought a disturbance in carbohydrate metabolism.

Symptoms: Older ewes carrying twins or triplets are most likely to be affected but younger ewes receiving poor quality roughage may also develop the disease. In early stages, affected ewes are less active than the rest of the flock and walk slowly. Later they weaken, show stiffness and have difficulty getting up. They frequently walk in a circle and stand with their head against a fence or bunk. As trouble progresses, the ewe cannot rise and lies with the head turned around to the side. Other symptoms are rapid breathing, blindness, grinding the teeth.

Prevention: Prevention lies in removing the cause. Check the flock carefully for condition of all ewes. One-half to ¾ pound grain (corn or oats) per day during the last 30 days of the pregnancy period is helpful. Increase quality and quantity of roughage as ewes get near lambing. Separate ewes that are not gaining in weight and feed these more liberally.

Treatment: If given promptly, treatment may be helpful. Affected ewes should be drenched with a cup of cane molasses twice daily. Diluting molasses with warm water makes it easier to give. Sugar solutions can be injected into the blood stream by a veterinarian to hasten recovery in severe cases. The ewe should be offered choice feeds. After the lambs are born, the ewes usually make complete recovery.

SORE MOUTH (Contagious ecthyma)

Cause: This is a virus disease affecting primarily the lips of sheep and lambs.

Symptoms: It is recognized by the formation of pustules and ulcers and the piling up of thick crusts of scabs on the lips and in the mouth. It formerly was considered chiefly a disease of feeder lambs but each year it is found more and more in the breeding flock, especially in younger lambs. It is here that it does the greatest damage, since the infection will be transferred to the udder and teats of the ewe.

With both the mouth of the lamb and udder of the ewe affected, some lambs may die or be seriously

retarded by lack of food. In severe cases the ulcers may spread to the throat and into the digestive tract.

Prevention: Generally, vaccination is considered to give immunity to any animal for 2 years but best results in some flocks are obtained by vaccinating all animals on the premises each year in December.

Some feeders find it advantageous to vaccinate feeder lambs on arrival from the range to avoid an outbreak spreading through the lot.

Treatment: While some flock owners still treat isolated cases with mild disinfectants such as pine oil, the only sure treatment is an effective vaccination administered by a veterinarian. In case of an outbreak at lambing time, vaccination is a "must."

STIFF LAMB OR WHITE MUSCLE DISEASE

Cause: Stiff lamb is probably caused by a metabolic disorder rather than a true deficiency of vitamin E.

The deficiency causes a dystrophy or degeneration of the leg, jaw, or heart muscles resulting in lameness, starvation, or possible heart failure. The symptoms are usually lameness, in one or more legs. The trouble is most frequently observed just before the lambs are turned to pasture. Death may be sudden if vital organs are affected or the lamb may linger several days.

Prevention: It is usually possible to prevent the trouble by using wheat for up to one-half of the ewes' grain ration; feeding young lambs a creep ration containing wheat or bran is also helpful. Recent research indicates that when minute amounts of carefully measured selenium were added to diet of ewes in late pregnancy the disease could be practically eliminated in the young lambs; further research concerning use of selenium is being conducted.

Treatment: The use of Vitamin E capsules is an effective way to treat lambs. These are the same capsules prepared for humans and can be obtained from the local druggist. The 100 mg. size is usually the most economical. Affected lambs can be given from one to three capsules as soon as symptoms are noticed and one capsule daily thereafter until recovery.

Place the ewe and affected lamb in a small pen to prevent excessive exercise and keep the lamb well nourished. In flocks where the trouble is known to occur, lambs may be given one of the 100 mg. capsules soon after birth as a possible preventative.

TETANUS (lock jaw)

Cause: Tetanus is a violent disease caused by an infectious agent widely distributed in soil or manure. Any contaminated wound can bring on tetanus. Puncture wounds are especially dangerous. In sheep, tetanus commonly follows routine operations such as docking, castrating, ear tagging, or shearing. It can also develop from infections of the umbilical cord.

Symptoms: First signs of tetanus in sheep are stiffness of limbs, difficulty in getting up, and walking with a straddling gait. Later the tail and jaw may become rigid and the animal may not be able to open its mouth. Sudden noises may cause spasmodic jerking of muscles. Death usually follows in 3 days to a week.

Prevention and Treatment: Because the germ is always likely to be present, prevention begins with extreme cleanliness in all surgical operations. Sterilize all instruments used in docking, castration, eartagging, or shearing before use by placing them in boiling water for 25 minutes. After the operation, turn the animal out on clean grass, or hold in well-bedded pens. Tetanus can also develop after castration or docking with rubber bands. In fact, it has been observed to occur more frequently when this method is used in place of the surgical method.

Treatment for tetanus is seldom satisfactory.

Good feed and management appear to lessen the incidence, but no sure preventive is known.

URINARY CALCULI (Gravel Stones)

Cause: The cause is unknown, but high incidences occur when there is (1) high potassium intake, (2) an incorrect calcium-phosphorus ratio, or (3) a high proportion of beet pulp or grain sorghum in the ration.

Symptoms: Frequent attempts to urinate, dribbling, or stoppage of the urine; pain and renal colic are good indications. Usually only males are affected; females are usually able to pass the concretions. The bladder may rupture, with death following. Otherwise, uremic poisoning may set in.

Prevention and Treatment: Good feed and management appear to lessen the incidence, but no sure preventative is known.

Once calculi develops, dietary treatment appears to be of little value. Surgery may save the animal.

Published and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914, by the Cooperative Extension Service of the South Dakota State College of Agriculture and Mechanic Arts, Brookings, John T. Stone, Director, U. S. Department of Agriculture cooperating.
5M—6-61—File: 2.32—9123—5M Reprint—4-62—10076

South Dakota State College
Brookings, South Dakota

Extension Service Livestock Specialist Section

Parasite Control

James J. O'Connell[1]

Internal parasites are a constant threat to sheep and are responsible for many of the failures for profits from large or small flocks. Stomach tape and nodular worms are the most troublesome. As with most animal health problems, prevention is the best cure.

Research at the Antelope Range Field Station on parasites, illustrates the part management plays in a control program. The report on that work taken from South Dakota Experiment Station Circular 140 is as follows..

Between 1937 and 1945 many lambs were lost from diarrhea in several counties in Northwestern South Dakota. Many other lambs were light in weight and could not be sold either as market or feeder lambs. This trouble first appeared in July each year and usually continued until the lambs were removed from the range in September or October. The diarrhea did not affect the ewes. On the basis of symptoms and seasonal occurrence, sheepmen blamed internal parasites.

Field observations and studies of this problem were started in 1944 and continued in 1945 and 1946 from a temporary field laboratory at the Newell station. During this time it became evident that lamb losses were mainly associated to faulty management practices. It has long been recognized that management has an important bearing on the acquisition of internal parasites and the injury which will result from worm infestations. By 1945 the sheep population and also the incidence of the diarrhea in lambs had markedly declined.

Establishment of range studies at Antelope Range Field Station offered an opportunity to obtain information on trends in worm infestations throughout the year. From 1950 to 1954 particular attention was given to comparisons of parasite infestations acquired by sheep on different levels of grazing. A number of determinations were also made of parasites of cattle maintained at the station.

During 1947, 1948, and 1949 before pasture fences were completed, the sheep were run together as a single flock. At approximately monthly intervals, fecal samples were collected from 5 to 10% of the ewes and lambs. Examination of these specimens for parasite eggs showed certain trends in the parasite levels for different times of the year.

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During the winter a low level was found in the ewes. In the spring, with the appearance of warmer weather, an increase in the worm load occurred, reaching a peak in May or June. In the next month a sharp decline had again occurred. A second but more moderate rise in the number of worm eggs developed in the ewes during the summer, followed by a decline during the fall to the low level maintained during winter months.

At the time of the peak load of parasites in ewes in the spring, the lambs had not yet acquired an infestation. The first appearance of worm eggs in specimens from lambs occurred in late June or early July. The peak was reached in July or early August, followed by a decline in later samples.

The periods of the year when highest and lowest levels of infestation were detected in ewes and lambs in this flock were the same as had been determined in privately-owned flocks in that area of the state.

During 1948 and 1949 fecal specimens from cattle at the station were also examined for parasite eggs at monthly intervals. No significant degree of infestation was found but the highest average number of eggs was obtained in April and May.

Starting with the 1950 grazing season, after fencing had been completed, pastures accommodating 100 ewes with their lambs provided grazing areas at three different levels:

Lot 1, low level, 580 acres
Lot 2, moderate level, 410 acres
Lot 3, high level, 254 acres

A fourth pasture containing 408 acres (lot 4) was cross fenced to provide four smaller pastures of equal size for weekly rotation. A fifth pasture of 936 acres (lot 5) was stocked with 100 ewes with their lambs and 25 cows. After 2 years lot 5 was discontinued.

The course of parasite infestations in the ewes and lambs of these lots was followed during the grazing seasons by parasite egg counts in fecal samples from 10% of the animals at 28 to 30 day intervals. A similar sampling of the cattle in lot 5 was carried out while they were included in the experiment.

Through each of the five grazing seasons from 1950 to 1954 the infestation in the ewes followed the same pattern. In 1950 and 1951 the lambs on a weekly rotation in the four small pastures reached a higher level of infestation than those of the other lots. In 1952, 1953, and 1954, the highest level of infestation was reached by the lambs in lot 3 on a high grazing level, with those of lot 4 at the next highest.

No treatments for the removal of worms were given the ewes or lambs at any time during these studies. Even so, exceptionally heavy worm infestations did not develop in any of the lots. None of the lambs developed diarrhea, and there was no definite correlation between lamb weight and degree of worm infestation based on the egg counts obtained. The fact that the lambs of lot 4 on rotation at weekly

intervals reached higher levels of infestation than those on free grazing on equal acreage was not surprising. A period of 21 days that any one of the small lots was vacated does not allow time for contaminating worm larvae to be destroyed by natural factors.

Samples collected from the cattle of lot 5 in 1950 and 1951 demonstrated a very low level of parasite infection. The egg counts did not average any higher than counts in samples from cattle pastured separately from sheep at the station.

In the examination of the fecal samples, an attempt was made to identify the different kinds of worm eggs. The eggs of the common stomach worm, Haemonchus contortus, predominated. The eggs of tapeworms were not included in the total counts but the presence of their eggs was noted. At one or more samplings during the summer 82.6, 86.5, and 81.2% of the lambs in 1952, 1953, and 1954, respectively, were eliminating tapeworm eggs.

On the basis of these observations, recommendations can be made regarding the time that the administration of treatment to sheep for removal of worms would be most effective. Since parasite infestations are at a very low level during the winter, treatment of ewes during that period can be expected to accomplish little towards a year-round control program.

Because of the increased infestation in spring months, individual treatment of ewes just prior to turning to summer range should greatly reduce pasture contamination. If the flock has been kept off summer range during winter and spring, pastures should then be relatively clean for the start of grazing. With sufficient summer range so that it is not overgrazed, infestations in lambs would generally not develop to a degree requiring treatment.

Should factors such as limitation of range, failure to treat the ewes, or spring contamination of range occur, it may become necessary to treat the flock during the summer. The time of that treatment should be during the rapid rise in the infestation of the lambs in early July.

While rainfall, plant growth, and perhaps other factors vary from year to year, the observations reported here indicate that at least 4 acres of native pasture to the ewe and lamb are necessary for summer range in the region of this station. With less acreage, the chances of harmful worm infestations are increased.

How to Control Worms in Sheep

There are two chief general principles necessary for the basic understanding of the disease caused by the worm parasites of grazing animals. (1) Every animal in the flock is infected. (2) Contamination of the pastures is continuous.

When one considers the tremendous rate of egg laying by the parasites, it is difficult to understand why there are not more outbreaks of parasitic disease and more severe mortalities. Even a lightly infested sheep may deposit many hundreds of thousands of eggs on the pastures every day for weeks on end. For example,

the female stomach worm lays from 5,000 to 10,000 eggs every 24 hours. If all the eggs from one female in one day developed into larvae and were swallowed by grazing lambs and developed into worms, there would be enough to kill five lambs in a few weeks. It is obvious the number of eggs that may pass from a heavily infested ewe. The chief factors which control the numbers of worms are climate, which restricts the development of the eggs and larvae on pastures, and the occurrence of resistance and immunity which restricts the number of worms in the sheep.

It is clear that there are two sources of infestations for the grazing sheep. First, the larvae already on the pasture and, second, the daily addition of more larvae which develop from the eggs passed by the sheep. These two aspects of the problem have led to two sayings relating to the control of parasitic diseases. (1) "Permanent Pastures Perpetuate Parasites." (2) "Parents Perpetuate Parasites." In permanent pastures it means those that are continuously stocked and the statement stresses the pasture as the reservoir of infective material and a source of reinfestation. The second statement stresses the infested sheep as the reservoir and source of infective material. Both statements are correct and they are complementary not alternatives. The high degree of efficiency of modern worm killing drugs may tend to throw the stress chiefly on the contaminated pasture as the danger. However, even the best drenches are rarely 100 percent effective in every sheep. There is always a residue of worms after treatment. And, as explained above even one female can quickly deposit a large number of eggs on the pasture. The known longevity of the eggs and larvae on pastures tends to stress the importance of the contaminated area as the source of reinfestation. However, it is the mortality of the majority and not the longevity of the few that is important from the point of view of parasitic disease. If they are given shaded situations and moisture, eggs and larvae may live for many months, but under the normal changes of conditions in a pasture, the vast majority are dead in 3 or 4 weeks. If a pasture is rested for 3 weeks most of the eggs and larvae will have died, but an infested sheep will continue to contaminate the pasture for weeks or even months.

Now that some of the general principles have been considered one must decide what approach must be taken to put into operation a sound control program. The operator may ask himself two question. (1) What am I doing to prevent the perpetuation of the parasite now by reducing the adult worm? (2) What changes can be made in my operation so a more effective control can be accomplished?

A full understanding of the life history and habits of the parasite will be helpful, if not necessary, in conducting a successful control program. The life cycle and control measures for common sheep parasites are outlined in the attached leaflet F.S. 135.

F.S. 135

SOUTH DAKOTA STATE COLLEGE

Cooperative Extension Service

common sheep parasites

Common Sheep Parasites

Internal parasites are among the most troublesome problems affecting South Dakota sheep. A heavy infestation of destructive sheep parasites may cause death, and an even greater toll is taken in the form of setbacks in the entire flock. A "wormy" flock, for example, is seldom a profit maker.

Each parasite class includes several species. However, only those species most important to South Dakota will be considered here.

TWISTED STOMACH WORM (common stomach worm, Haemonshus contortus)

The Twisted Stomach Worm is the most destructive South Dakota sheep parasite. Lambs are most seriously affected. These worms are from ¾ to 1½ inches long and about the size of a course hair in diameter. Live females are marked with a spiral striping, resembling a barber pole. In the host animal, the worms are usually confined to the fourth or true stomach (abomasum), though some may be found in the first part of the intestine.

Life History and Habits. The life history and habits of the stomach worm have been well established (see figure 1). The adult females, normally living in the abomasum, lay enormous numbers of microscopic eggs. These pass out with the feces.

By LaVerne J. Kortan, associate Extension livestock specialist

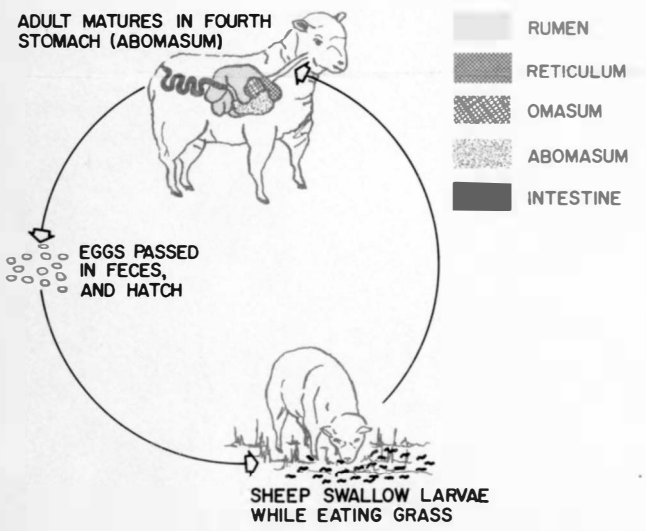


Figure 1. Life Cycle of Twisted Stomach Worm

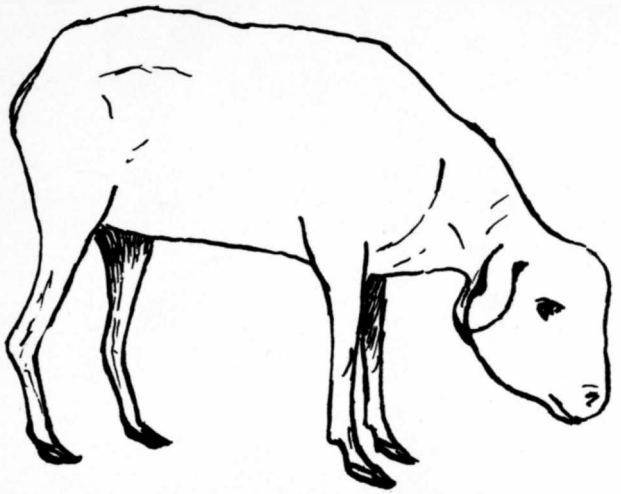
Under favorable temperatures and moisture condition, eggs hatch into larvae within a few hours. Larvae then molt twice and develop into the infective stage. This occurs within 2 weeks after passing from the host. When sufficient moisture is present, the young larvae crawls up on a grass blade, coming to rest with evaporation and moving upward when the grass blade is again moist.

At this stage the larvae is greatly resistant to changes in temperature and moisture. While clinging to a blade of grass, it is in a position to be swallowed by the grazing animal. After being swallowed the larvae travels to the fourth stomach, develops into the adult stage, and lays eggs—thus starting another cycle. Each female can lay about 6,000 eggs daily.

The entire life cycle of the stomach worm may be completed in 21 days, conditions being favorable. Heavily infested sheep may pass as many as 3 million worm eggs in a period of 24 hours.

Symptoms. Sheep infested with stomach worms first become unthrifty and listless and later thin and weak. Membranes of the eyes, nose, and mouth become pale from loss of blood. Diarrhea may be present. The wool on heavily infested animals may eventually become loose and easy to pull out. Also a water swelling under the lower jaw sometimes occurs. This is referred to as "bottle jaw" or "poverty jaw." Swelling along the abdomen will also develop.

No symptom or group of symptoms is a positive clue to the presence of stomach worms. Identical symptoms may be exhibited in other cases of infestation by some other parasites. A correct diagnosis can only be made by post-mortem examination of the intestinal tract or by microscopic examination of the feces and identification of the eggs. In making



This drawing shows how a sheep holds his head when he is suffering with "bottle jaw," or "poverty jaw," a watery swelling under the jaw, caused by a heavy and prolonged infestation of the common stomach worm.

post-mortem examinations, sacrifice a weak animal or obtain an animal immediately after death; otherwise the worms may disintegrate and be difficult to find.

TAPEWORM

Three species of tapeworm are common. These are the Broad tapeworm, *Monieza expansa, M. benedini,* and the Fringed tapeworm, *Thysanosoma actinoides.*

Sheep may harbor several different species of tapeworms, in both adult and larvae stages. The common tapeworm, *Monieza expansa,* and *M. benedini,* are long, flat ribbon-like worms which sometimes reach a length of several yards and a breadth of ¾ inch. Specimens 20 feet long have been found in lambs. The fringed tapeworm, *Thysanosoma actinoides,* derives its common name from the characteristic fringe which appears on the posterier of each of the segments. All species of tapeworms are commonly found in the small intestines of the host animals. But in addition, the fringed tapeworm may occur in the cystic duct, gall bladder, and in the duct of the liver and pancreas.

Sheep in all parts of South Dakota may become infested with one or more species of tapeworms. *Monieza expansa* (broad tapeworm) occur throughout the state. The fringed tapeworm appears to be more prevalent, however, in the range bands of the western part of South Dakota, but it has occasionally been found in eastern sections.

Life History and Habits. The life history of the fringed tapeworm is unknown, but it is thought to require an intermediate invertebrate host through which it must pass before it can infest sheep. The life history of the broad tapeworm and the *M. benedeni* appears to be about as follows. The microscopic eggs and segments containing eggs pass out with the feces. On being infested by a suitable intermediate host, oribatid mites and beetle mites, the eggs develop into an intermediate larvae stage. Sheep become infested by swallowing such larvae.

The larvae travels to the small intestine of the host, where it develops into an adult worm by the growth of segments back of the head. With reproduction, a new life cycle is started.

Symptoms. Diarrhea and retarded growth or loss of condition appear to be chief symptoms of tapeworm infestation of sheep. Infected animals usually have normal appetites. The fringed tapeworm may cause death of the host through blocking the cystic duct, gall bladder, and the ducts of the liver and pancreas. A post-mortem should be considered.

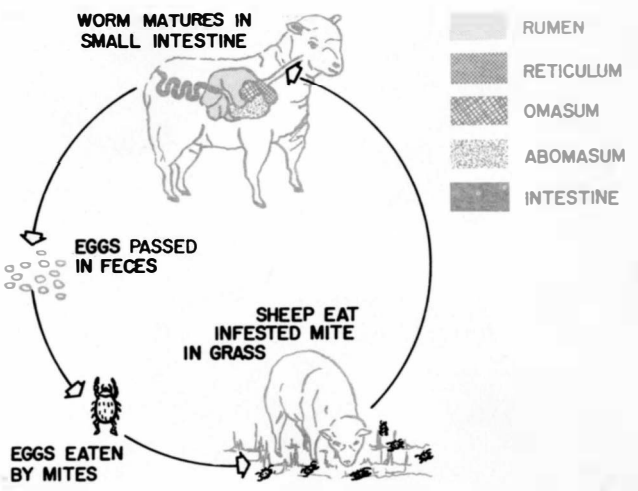
CONTROLLING INTERNAL PARASITES

Common stomach worms, tapeworms and other internal parasites are a constant threat to the health of any flock of sheep. Generally the damage is done before the owner realizes that anything is wrong.

Prevention. Clean pastures do not spread stomach worms. Rotate pastures so that sheep are pastured on one field not for over 3 weeks and then are not back on the same pasture for 3 weeks or a month.

A mixture of one part fine particle phenothiazine and nine parts loose salt is a preventative but *not a cure* for stomach worms. Protect this mixture from sun and rain. It is not recommended during

Figure 2. Life Cycle of Tapeworm



the breeding or gestation season. Research investigators have had good results with a mixture of one part (by weight) fine particle phenothiazine, two parts bone meal or dicalcium phosphate, and six parts trace mineralized salt fed free choice.

Treatment. Drench the ewe flock at least three times during the year.

1. Drench in early spring, 10 to 14 days before turning on pasture, after lambs are born.

2. Treat again in mid-summer or as soon as the lambs are sold or weaned—July 15-August 15.

3. Follow up in early winter, at time of drylotting ewes. Use 1 ounce of fine particle phenothiazine solution per ewe.

4. Drench at any other time when ewes or lambs seem unthrifty. Diarrhea in lambs is an indication. **Caution**—If a lamb dies at any time have a post-mortem examination.

DRENCHING MIXTURES

Cunic Mixture. For common stomach worms and tape worms use the following:

⅓ ounce Copper Sulfate (Blue Vitriol)
⅔ ounces Nicotine Sulfate (Black Leaf 40)
1 gallon distilled or rain water

Use hot water if you are in a hurry. One gallon will treat 30 ewes.

Mix in an earthenware jar. Be sure to wrap the Copper Sulfate in a cloth and hang at the top of the water until it dissolves.

Use the following dosages:

Mature ewe—4 ounces
60 pound lambs—2 ounces

CAUTION—This is a deadly poison if directions are not followed. Have your druggist weigh and measure the ingredients.

Fine Particle Phenothiazine Mixture. Phenothiazine solution is another good drench. It is effective in controling stomach worms and nodular worms. Use the following:

2 pounds wettable fine particle phenothiazine
Enough water to make 1 gallon drench

One gallon will treat 32 ewes. Use the following dosage:

Mature ewe—4 ounces
60 pound lamb—2 ounces

Follow directions on the container if you buy phenothiazine in a liquid mix.

Thiabendazole Mixture. Thiabendazole is designed for use in sheep in treatment of infection with gastrointestinal round worms, including common stomach worms. Infestation with many of the economically important round worms of sheep are effectively treated with thiabendazole.

Always follow directions when using chemicals —it may save a life

Use the mixture and dosage recommendations provided on the packaged drug containers.

Lead Arsenate Mixture. Lead arsenate is an effective treatment against tapeworm. It is administered without fasting.

Give one gram to sheep or lambs weighing 60 lbs. or more. The usual method is to give it in a hard gelatin capsule.

Phenothiazine and Lead Arsenate Mixture. Fine particle phenothiazine is an effective drug for the removal of many different kinds of round worms in sheep. When combined with a small amount of arsenate of lead it is particularly valuable in the control of most round worms and the common tapeworms of sheep as well.

Mixture: Use 64 grams of lead arsenate with a small amount of water. Then thoroughly mix this with 1 gallon of phenothiazine drench.

Dosage. For lambs under 50 lbs. use 1 ounce. Sheep over that weight need 2 ounces. For extremely large sheep use 3 ounces. This mixture is administered without fasting.

DRENCHING PROCEDURE

1. Use a bottle or dosing syringe.

2. Keep the sheep off feed for 12 hours before drenching and 4 hours after drenching. (When copper sulfate-nicotine sulfate is used.)

3. Be sure that the sheep is standing on all four feet.

4. Do not raise the sheep's nose higher than his eyes.

5. Take your time. Don't choke the sheep.

6. Late lambs, thin lambs, and lambs not sold at weaning time should be sheared, drenched, and fed grain until fat.

Lambs on clean pasture, nursing their mothers, gaining ⅔ of a pound or more daily, and sold in May or June, ordinarily do not need drenching.

Published and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914, by the Cooperative Extension Service of the South Dakota State College of Agriculture and Mechanic Arts, Brookings, John T. Stone, Director, U. S. Department of Agriculture cooperating.
5M—6-62—2.311—10168
5M reprint—3-64—951