Recommendations
For Profitable Sheep Production

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CIRCULAR 1126  UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
COLLEGE OF AGRICULTURE  COOPERATIVE EXTENSION SERVICE
CONTENTS

Systems of sheep production .............................................. 3
Specializing in sheep production ........................................ 4
Crossbreeding for commercial lamb production ..................... 6
Selection of ewes and rams ............................................... 8
Production records for a more profitable flock ..................... 12
Evaluating sire performance .............................................. 16
Breeding season considerations .......................................... 16
Feeding the stud ram ..................................................... 25
Feeding the ewe flock .................................................... 26
Ewe management during gestation ....................................... 32
Ewe management during lambing and lactation ..................... 34
Feeding and management of lambs to weaning ....................... 37
Feeding from weaning to market ....................................... 44
Developing lambs into yearlings ....................................... 45
Artificial rearing of lambs ............................................... 46
Common lamb diseases .................................................... 49
Management on pasture .................................................. 54
Parasite control ............................................................ 54
Foot health ........................................................................ 57
Lamb marketing .............................................................. 60
Lamb carcass shows ......................................................... 61
Wool production and marketing .......................................... 64

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Urbana, Illinois September, 1976

Issued in furtherance of Cooperative Extension Work, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture. JOHN B. CLAAR, Director, Cooperative Extension Service, University of Illinois at Urbana-Champaign.
Good management is the key to an efficient and highly profitable ewe flock. Flocks cannot realize their maximum potential if they are used and managed merely as fencerow scavengers.

Most Illinois farm flocks are supplemental farm operations, but there are farms on which sheep are the major livestock enterprise. Sheep economically convert available pasture and roughage into pounds of lamb and wool and provide a more even distribution of farm labor requirements. Ewe flocks call for a smaller investment and show a greater return per animal unit than a beef cow herd.

Sheep are ideally suited to grassland agriculture, but there has been an increasing interest in partially confined or drylot operations, especially in the Midwest. Many of these operations include some automation.

There is a wide range in gross return and net return per ewe in midwest ewe flocks. What is needed to get the highest gross return per ewe? A study of production-record summaries indicates that (1) all ewes should lamb, (2) there should be a high percentage of multiple births, (3) lamb mortality must be kept low, (4) lambs must be marketed at desirable weights and when prices are highest, (5) longevity should be emphasized, (6) ewes and rams should be heavy-shearing, and (7) wool must be marketed in a desirable condition and at the highest possible price per pound. Essentially, it all boils down to good management in all phases of the sheep enterprise.

Highly productive commercial flocks have grossed $75 to $85 per ewe per year on once-a-year lambing. The potential is even higher if the lambing program is successfully accelerated; or new breeds such as the Finnish Landrace, noted for high lambing rate, are utilized; or greater selection pressure for multiple births is exerted in our existing breeds. In England the top flocks consistently wean near or above a 200 percent lamb crop on once-a-year lambing, even with flocks of over 400 ewes. The 1974 winner of the Shepherd of the Year Award in England marketed a 170 percent lamb crop from 2,000 ewes; the work force was the shepherd and his wife plus occasional student help. Certainly we need to become more production conscious in this country.

**SYSTEMS OF SHEEP PRODUCTION**

Most Illinois farm flocks are commercial operations, used primarily to produce market lambs and wool. The most important factors in market lamb production are the number of lambs raised per ewe and the ability of lambs to gain rapidly and efficiently from birth to marketing.
Commercial flocks use western ewes, native ewes, or both. Flock owners who use western ewes feel these sheep have several advantages over native ewes. They are available in larger numbers, can be obtained in more uniform groups, have fewer parasites, are usually hardier, and usually have heavier, more uniform fleeces.

Native ewes generally cost less per head, often show more desirable mutton conformation, and are often more productive. Many flock owners with native ewes also produce their own replacements.

Mature ewes with solid mouths are available on the market each fall. If these are ewes that have been sold in order to decrease flock numbers, they may be a good investment. However, many of these marketed ewes have been culled because they did not lamb, did not raise a lamb, raised lightweight or inferior-quality lambs, or have unsound udders.

Broken-mouth ewes and gummers are also available. Most of them have been good producers or they would not have been retained so long in the original flock. These ewes generally require extra care and management. A person buying these ewes should count on only one or two lamb crops and then sell the ewes. He should also be prepared to raise some lambs on milk replacer.

The main purpose of maintaining purebred flocks is the production of breeding stock for commercial flocks and for other purebred flocks. It takes good individual sheep but does not require a large flock. The purebred flock owner must be a good sheepman and must be able to merchandise his sheep. He must also be honest in his dealings and have breed improvement as his major goal. He should realize the value of good production records and use them in his breeding and selection programs. When selecting a breed, consider the market for breeding stock and the availability of breeding stock in your area. If there is a demand for several breeds, the choice of breed can be based on personal preference and availability.

**SPECIALIZING IN SHEEP PRODUCTION**

The downward trend in the number of sheep has been going on for some time. However, lamb prices have been relatively strong for several years. This could mean that many farmers and sheepmen have not been serious enough about sheep production. Many flocks are too small for economical production and should be enlarged to contribute a greater percentage of the livestock income. Such enlargement would also consequently warrant more management attention. Instead of 25 or 30 ewes in the flock, many flock owners should be thinking in terms of at least 100 ewes, preferably more.
In this age of specialization, very few midwestern farmers specialize in sheep production. This is unfortunate because there is a great potential for large, specialized ewe flock operations in the grassland areas as well as right in the heart of the cash-grain areas. Production can be intensified on a pasture system or in drylot, or the two systems can be combined.

Sheepmen who plan to specialize in sheep production may want to consider some automation, especially where feeding and feed handling are concerned. Automation increases the overall cost of the operation, but it greatly reduces the total labor requirement.

In general, sheepmen have been slow to accept new ideas, and this has hurt the sheep industry. There is a great deal of information available today that can help people do a better job of production and to receive a greater profit from their flocks. Why shouldn’t we see flocks with 500 to 1,000 ewes here in the Midwest? We should and we will in the not too distant future.

There continues to be a growing interest in the possibilities of using slotted floors in sheep production, and Illinois is one of the leaders in conducting research in this area. Some large commercial sheep operations in Virginia have been using slotted floors for several years, and some

![Slotted floor units are becoming more popular in Illinois. This unit, built on the running gears of a wagon, is 12 feet wide and 24 feet long and can hold seventy-two 100-pound lambs.](image-url)
Illinois sheepmen are now using slotted floors successfully. Some of the advantages of slotted floors are the elimination of bedding, great reduction or elimination of internal parasites, improved performance of lambs during warm weather, reduction of floor space requirement per animal, and improved control of foot rot.

The information compiled in recent years concerning ewe and ram fertility, confinement rearing, early weaning, creep feeding, slotted floors, accelerated lambing, synchronization, ewe feeding and management, production testing, and carcass evaluation is available to help you profitably expand your sheep operation. There is no good reason why our sheep industry cannot take advantage of these advances.

CROSSBREEDING FOR COMMERCIAL LAMB PRODUCTION

Crossbreeding has some very definite advantages for commercial lamb production. Crossbred lambs from straightbred parents usually gain more rapidly than the average of the performances of the parent breeds. Moreover, crossbred lambs are usually more hardy and vigorous and have a lower death loss. Mating crossbred ewes to a growthy ram of a third

Slotted floors have been used successfully in sheep production at the Dixon Springs Agricultural Center.
breed can offer still more advantages. Crossbred ewes are usually more fertile and raise a higher percentage of their lambs than straightbred ewes. In addition, lambing percentage and milk production of crossbred ewes are greater than the average of the breeds involved in the cross.

In evaluating breeds for crossbreeding, one usually divides the breeds into ewe and ram breeds. In the ewe breeds you should stress early lambing ability, lambing rate, milk production, maternal instinct, and longevity, as well as wool quality and quantity. For the ram breeds, growthiness, carcass merit, sexual aggressiveness, and male fertility need to be stressed.

Rambouillet, Merino, Corriedale, Columbia, and Targhee are usually considered ewe breeds. Ram breeds are the Suffolk, Hampshire, Shropshire, Oxford, and Southdown; Suffolk and Hampshire are the most widely used at the present. Dorsets and Montadales can fit into either category. Finnish Landrace must be considered a strong ewe breed because of their high lambing rate, even though fleece quality and quantity are a serious weakness of the breed. Finnish Landrace crossbred lambs, though small at birth, are extremely hardy. Finnish Landrace crossed with any of the other ewe breeds produce excellent F1 ewes, which can be bred to Suffolk or Hampshire rams for market lamb production. Mature crossbred ewes that are half Finnish Landrace commonly give birth to a 200 to 250 percent lamb crop. Dorset-Rambouillet crossbred ewes also make excellent F1 ewes, especially for sheepmen who plan to follow an accelerated lambing program.

Following a crossbreeding program does have a major problem. You have to either buy crossbred ewes or produce your own. If you buy crossbred replacement ewes, you don’t have your own production records to help with the selection process. If you produce your own F1 ewes, you will need some straightbreds around to produce the desired crosses.

One way to simplify a crossbreeding program in which you keep your own replacements is to follow a two-breed or three-breed rotational crossing program, the latter being the most desirable. A two-breed rotational crossing program is possible where ewes of breed A are bred to a ram of breed B. The replacement ewes from this cross are bred to a ram of breed A and so the cycle continues. This will work well for small flocks but does not provide as much benefit from heterosis (hybrid vigor) as does the three-breed rotational cross.

A good example of a three-breed rotational cross is as follows, using Rambouillets, Dorsets, and Suffolks. Rambouillet ewes would be bred to a Dorset ram. The replacement ewes from this cross would be bred to a Suffolk ram. The replacement ewes from this cross would be bred to a Rambouillet ram, with the resulting replacement ewes being bred to a Dorset ram and so on, continuing to rotate the three breeds.
For a crossbreeding program to be highly successful, it must be well planned, use superior rams (preferably performance tested), and be well managed. In addition, an excellent set of records is required if you are to measure the results of your crossing program.

**SELECTION OF EWES AND RAMS**

Selecting good breeding stock to start or expand an operation, whether purebred or commercial, is an extremely important part of livestock management. To make the most rapid progress in flock improvement, you must use outstanding stud rams, and it is here that many producers are most negligent. Selection of a stud ram is a major decision and not something to be done on the spur of the moment. You can’t expect to buy an outstanding sire for market price. Neither can you expect outstanding results from a scrub. Give some time and thought to the selection and management of your stud ram.

When you select breeding stock, consider these criteria:

1. **Growthiness (size for age)**. Select rapid-gaining sheep that meet your other standards. Rapid-gaining animals usually make the most efficient use of feed and can be marketed at a younger age. A slow-growing lamb is not so profitable as a fast-growing lamb. Set as your goal to have twin lambs weighing at least 70 pounds and single lambs weighing at least 80 pounds at 90 days of age (if creep-fed), then select breeding stock with the gaining ability to produce such lambs. Many lambs of the larger breeds will exceed 90 pounds at 90 days (if creep-fed).

   ![This ram indicates the growthiness, ruggedness, muscling, soundness, length of body, balance, and masculinity that are desirable in a stud ram.](image)
2. Soundness.
   a. Feet and legs. When their feet are well trimmed, sheep should be able to stand squarely on them. Select sheep that have strong pasterns and straight legs with plenty of width between them. Crooked legs and weak pasterns can decrease an animal's ability to move and perform normally and can decrease its years of reproductive usefulness.
   b. Mouth. Check the sheep’s mouth for age, condition of the eight incisors, and jaw malformations like monkey mouth or parrot mouth.
   c. Udder. If ewes have produced at least one lamb crop, check their udders to be sure that both teats are present and functional and that there are no lumps or hard areas.
   d. Testicles. Check the ram to be sure both testicles are present, fully descended, sound, and at least average in size.

3. Conformation. The ideal conformation probably varies from one breed to another. However, there are times when you can find about as much variation between animals of the same breed as you can between different breeds. In general, a sheep with desirable conformation has the following qualities: (a) adequate frame; (b) smooth shoulders; (c) fullness through the heart area and the spring of ribs; (d) long body, with major emphasis on length from the last rib to the dock; (e) wide and straight top; (f) long, wide, and level rump; (g) deep, thick, and full leg of lamb or mutton; and (h) overall balance (blending together of body parts).

4. Condition of birth (single, twin, or triplet). Your first choice should always be ewes and rams of multiple birth from highly productive ewes. Progress can be made in increasing lambing percentage by selecting for twinning. Under midwestern conditions, a good set of twins is more profitable than a good single lamb. The idea that twinning is economically important is not new; in 1837 Youatt wrote: “Ewes yearly by twinning/Rich masters do make;/The lambs from such twinners/For breeders go take.”

Your second choice should be single ewes and rams from highly productive ewes. In general, a single-born ewe whose mother has given birth to and weaned ten lambs from six lambings will be more highly productive than a twin-born ewe whose mother has given birth to and weaned only seven lambs from six lambings.

5. Previous performance. When you buy breeding stock, get all the performance information you can—such factors as weight at 60, 90, or 120 days and weight at one year of age. Find out the performance of
their progeny, if any, and check the performance of sires and dams. Some breeders have carcass information available, so check on this also.

6. Substance (amount of bone). Select heavy-boned sheep. In general, heavy-boned animals do better than fine-boned ones.

7. Wool. Select heavy-shearing sheep that have dense, uniform, high-quality fleeces with no dark fiber. This factor is often neglected in sheep selection but should not be since wool makes a sizable contribution to the gross income from a sheep enterprise.

8. Age. There are several things to consider in deciding what age ewes to buy: the quality of the various age groups, the soundness of older ewes, price differences, the amount of production data available, and the years of expected production. Ewes generally reach peak productivity at four to six years of age. Even though yearlings cost more than older ewes, they have sounder udders, more productive years ahead of them, and a lower death loss. Some sheepmen prefer to buy a mixed age group with equal numbers of yearlings and older ewes.
In starting into purebred production, sometimes the best investment may be to use highly productive older ewes with several years of production still left rather than to start with a group of high-priced yearling ewes. Here also a mixed age group may have some advantages.

It has been traditional for most sheepmen to lamb ewes first at two years of age. However, there is increased interest in breeding ewe lambs to lamb as yearlings, which can be done successfully. The ewe lambs must be well grown and must be fed well during pregnancy and lactation. Special attention must also be given to their nutrition after they wean their first lambs. Yearling ewes should be handled as a separate unit, not mixed with the older ewes. If well managed, their mature size will not be affected by lambing them as yearlings.

The age of the ram will determine how many ewes he can service. Under normal field mating conditions a ram lamb can be used on about 15 ewes, a yearling ram on 25 to 35, and an aged ram on 35 to 45. A good rule of thumb is 3 mature rams for every 100 ewes in the breeding flock.

The age of sheep can be determined by their teeth. Lambs are born with eight milk teeth, or incisors, arranged in four pairs in the lower jaw. The center pair is shed at approximately one year of age and replaced by larger, permanent teeth. When the sheep is two years old, the second pair of permanent teeth replace the second pair of milk teeth; and at three and four years the third and fourth pairs of permanent teeth appear. At four years of age the sheep has a “full mouth.” When a ewe loses part of her incisor teeth, she is called a “broken mouth” ewe. Ewes with no incisors are called “gummers.”

9. Sex character. Ewes should look feminine and rams should look masculine. Masculine rams are generally more rugged, active, and aggressive than rams which lack this quality.

The age of sheep can be determined by their teeth, as is illustrated here.
10. **Breed type.** Breed type is an important consideration in purebred livestock; without it, breed identity is lost. Even so, do not get carried away to the point where you forget all else. Breed type should be appraised along with the other factors listed here.

**PRODUCTION RECORDS FOR A MORE PROFITABLE FLOCK**

It is hard to determine anything specific about the productivity of a commercial or purebred ewe flock unless you have some accurate production records on hand to evaluate. Yet, many purebred and commercial sheepmen show no interest at all in keeping production records on their flocks, and some purebred breeders prefer to let show-ring winnings be the only criterion for flock evaluation. True, the show ring is one system of evaluation, but it is not the only way, and it is not the best way. A state fair champion ram has not really "won his spurs" until he has proved to be a highly fertile ram; has settled a high percentage of ewes during their first two heat cycles; has sired vigorous, fast-growing, well-muscled lambs that are acceptable to the industry; and has sired highly productive sons and daughters. All flock owners, regardless of the breeds or breed crosses they raise, should be striving to develop more productive animals. Why be satisfied with a good single lamb when a good set of twins will make you more money?

Production records have the following uses:

1. To measure flock productivity.
2. To provide permanent records.
3. To identify top-producing ewes so their lambs can be kept for breeding stock.
4. To help cull low producers.
5. To evaluate ram performance.
6. To show differences in gaining ability of lambs.
7. To supplement what can be seen with the naked eye.

Tables 1 and 2 point out the large differences in ewe productivity and lamb gains that can exist within a flock. This information was taken from the production records of a flock containing 105 ewes. Male lambs were castrated at 10 days of age and all lambs were weaned at 90 days of age.

Without some sort of production records, it is difficult to determine if progress is being made in flock improvement. Such factors as weaning weights, fleece weights, lambing percentage, and percentage of death loss have a direct effect on income and profit from the enterprise.
Table 1. — Pounds of Lamb Weaned at 90 Days From High- and Low-Producing Ewes

<table>
<thead>
<tr>
<th>Ewes raising singles</th>
<th></th>
<th>Ewes raising twins</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td></td>
<td>Low</td>
<td></td>
</tr>
<tr>
<td>87.1</td>
<td>44.6</td>
<td>148.2</td>
<td>77.7</td>
</tr>
<tr>
<td>85.2</td>
<td>46.9</td>
<td>143.1</td>
<td>86.6</td>
</tr>
<tr>
<td>84.2</td>
<td>47.5</td>
<td>142.7</td>
<td>92.2</td>
</tr>
</tbody>
</table>

Table 2. — Daily Gains From 0 to 90 Days (Weaning) for Fast- and Slow-Gaining Lambs

<table>
<thead>
<tr>
<th>Single lambs</th>
<th>Twin lambs</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>.81</td>
<td>.35</td>
</tr>
<tr>
<td>.80</td>
<td>.38</td>
</tr>
<tr>
<td>.79</td>
<td>.42</td>
</tr>
</tbody>
</table>

A producer checks the yearling weight of a ewe. Weaning weights and yearling weights are essential parts of production records.
Records can be very simple or quite complex, depending on the needs and goals of the producer. Some say that they don’t have time to keep records, but you really can’t afford not to take the time. Why guess about the overall productivity of your flock and of the individual ewes in the flock when there is a more accurate way of doing it?

Probably the simplest record system for commercial sheepmen to use is to earnotch lambs at birth, using a coding system for type of birth in one ear and week of birth in the other. This helps evaluate lambs for size and weight, based on their approximate age and type of birth, but does not, however, identify lambs with their mothers or with specific sires.

Ideally, it would be best to have all ewes and lambs permanently identified so that you could evaluate each ewe’s production and each ram used in the flock. Lambs should be weighed at weaning time and their weights adjusted to a standard age such as 60, 90, or 120 days. Weaning weights should also be adjusted for sex, age of dam, type of birth, and type of rearing. Recommended adjustment factors are given in Table 3.

### Table 3. — Recommended Weight Adjustment Factors

<table>
<thead>
<tr>
<th>Age of dam (years)</th>
<th>3 to 6</th>
<th>2 or over 6</th>
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<tr>
<td>Ewe lamb</td>
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<td></td>
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<tr>
<td>Single</td>
<td>1.00</td>
<td>1.09</td>
<td>1.22</td>
</tr>
<tr>
<td>Twin — raised as twin</td>
<td>1.11</td>
<td>1.20</td>
<td>1.33</td>
</tr>
<tr>
<td>Twin — raised as single</td>
<td>1.05</td>
<td>1.14</td>
<td>1.28</td>
</tr>
<tr>
<td>Triplet — raised as triplet</td>
<td>1.22</td>
<td>1.33</td>
<td>1.46</td>
</tr>
<tr>
<td>Triplet — raised as twin</td>
<td>1.17</td>
<td>1.28</td>
<td>1.42</td>
</tr>
<tr>
<td>Triplet — raised as single</td>
<td>1.11</td>
<td>1.21</td>
<td>1.36</td>
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<tr>
<td>Wether</td>
<td></td>
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<tr>
<td>Single</td>
<td>.97</td>
<td>1.06</td>
<td>1.19</td>
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<td>Twin — raised as twin</td>
<td>1.08</td>
<td>1.17</td>
<td>1.30</td>
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<tr>
<td>Twin — raised as single</td>
<td>1.02</td>
<td>1.11</td>
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<tr>
<td>Triplet — raised as triplet</td>
<td>1.19</td>
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<td>1.43</td>
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<td>Triplet — raised as twin</td>
<td>1.14</td>
<td>1.25</td>
<td>1.39</td>
</tr>
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<td>Triplet — raised as single</td>
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<tr>
<td>Ram lamb</td>
<td></td>
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<td>Single</td>
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<td>.98</td>
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<tr>
<td>Twin — raised as twin</td>
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<td>1.22</td>
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<tr>
<td>Twin — raised as single</td>
<td>.94</td>
<td>1.03</td>
<td>1.17</td>
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<tr>
<td>Triplet — raised as triplet</td>
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<td>1.35</td>
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<td>Triplet — raised as twin</td>
<td>1.06</td>
<td>1.17</td>
<td>1.31</td>
</tr>
<tr>
<td>Triplet — raised as single</td>
<td>1.00</td>
<td>1.10</td>
<td>1.25</td>
</tr>
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</table>

* Multiply the 60-, 90-, or 120-day weight by the appropriate adjustment factor. For example, a three-year-old ewe raises twins with the ram lamb weighing 80 pounds at 90 days and the ewe lamb weighing 70 pounds at 90 days. To determine the 90-day adjusted weight of the ram lamb, multiply 80 times 1.11 (88 pounds). For the ewe lamb, multiply 70 times 1.11 (77.7 pounds). Remember that all weights are adjusted on the basis of a single ewe lamb from a mature ewe.

Source: 1968 National Sheep Extension Committee Report, "Recommendations for Uniform Sheep Selection Programs."
After weaning, you may want to feed all of the ram lambs together or by sire groups and determine average daily gain for the next 60 or 90 days (depending on age weaned). If the lambs are fed by sire groups, you could check for feed efficiency differences as well as average daily gain differences between sire groups. The average daily gain for this postweaning period is more highly heritable than gain from birth to weaning, because you have eliminated the influence of the ewe's milk production.

Although very few people obtain yearling weights on rams and ewes, those are important data because yearling weight is a highly heritable trait. This information will be very valuable in your selection program.

Table 4. — Age in Days Tabulation Chart

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</table>

(a) For example, assume that a lamb is born on February 1 and weighed on May 12. Use the day-of-month column to find the first day under February; the figure found is 93. Do the same for May 12; this figure is 193. Subtract, 193 minus 93, for the age of the lamb in days. The result is 100 days.

(b) In leap years, for a lamb born after February 28 add 1 day to the tabulated number.
Fleece weights are also part of a total evaluation program and should be obtained for each breeding animal in the flock. You should also obtain carcass information on some of your lambs to determine whether you are producing desirable meat-type lambs.

Copies of three production record forms are shown on pages 17, 18, and 19. Notice that on the Barn Record and the Individual Ewe Production Record you can calculate either average daily gain from birth to weaning or calculate a weight per day of age at weaning. Weaning weights can be adjusted to 60, 90, or 120 days of age. Example records have been placed on the forms for illustrative purposes.

The production record forms and copies of Tables 3 and 4 are available from the Livestock Extension Office, 326 Mumford Hall, Urbana, Illinois 61801. Information about the computerized Ohio Sheep Production Testing Program, in which some Illinois flocks are enrolled, is also available from this office.

EVALUATING SIRE PERFORMANCE

Records indicate that there is a great deal of variability in sire performance within each breed and within many flocks. This means that you should evaluate sire performance as well as individual ewe performance. The following data guidelines will be helpful in making this evaluation:

1. Percent of exposed ewes that actually lamb.
2. Percent of ewes that settle during the first two cycles.
3. Percent lamb crop born per ewe exposed.
4. Percent lamb crop born per ewe lambing.
5. Percent lamb crop weaned per ewe exposed.
6. Percent lamb crop weaned per ewe lambing.
7. Percent mortality from birth to weaning.
8. Percent of ewes that have little or no difficulty lambing.
9. Average 60-, 90-, or 120-day adjusted weight of weaned lambs.
10. Complete carcass evaluation for at least 5 lambs per sire, preferably for 10.
11. Average 365-day weights of yearling ewes and rams.

BREEDING SEASON CONSIDERATIONS

Lambing Season

One of the major decisions a flock owner must make is whether to plan an early-lambing program (late December to early March) or a
## BARN RECORD

**Owner**  
John Doe  
**Breed**  
Hampshire  
**Year**  
1975

**Lambing data**  
**Weaning data**

<table>
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<th>Ewe no.</th>
<th>Sire</th>
<th>Date</th>
<th>No.</th>
<th>Sex</th>
<th>Wt.</th>
<th>Date</th>
<th>Wt.</th>
<th>Age</th>
<th>ADG or wt./day of age</th>
<th>60-90. or 120-day wt.</th>
<th>Wool wt.</th>
<th>Remarks</th>
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* Use adjustment factors from Table 3.
## INDIVIDUAL EWE PRODUCTION RECORD

**Ewe No.:** 70-64  
**Reg. No.:** 208409  
**Birthdate:** 1-21-20  
**Single**

**Breed:** Hampshire  
**Sire:** H1209  
**Dam:** H1494  
**Twin:** ✓  
**Triplet:**

- **60-, 90-, or 120-day adj. wt.:** 55#  
- **365-day weight:** 125#

### Lambing Data

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<th>Date</th>
<th>Wt.</th>
<th>Age</th>
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### Weaning Data

- **Wool wt.**  
- **Ewe index**

- **Remarks:** pulled 22-11

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1. Determine from Table 4.
2. Use adjustment factors from Table 3.
3. To determine the ewe index, add the 60-, 90-, or 120-day adjusted weight of her lamb or lambs, plus wool credit (wool weight × 3).
## YEARLING WEIGHT RECORD

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### Lambs

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<th>Wt.</th>
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<th>1976 Date</th>
<th>Wt.</th>
<th>Age</th>
<th>ADG or Wt./day of age</th>
<th>365-*d2 day wt.</th>
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* 365-days weight may be calculated in any of these ways:
1. (ADG from birth to yearling weigh date × 365) + birth weight.
2. ADG from weaning to yearling weigh date × (365 - weaning age) + weaning weight.
3. Weight per day of age × 365.
late-lambing program (starting in late March). Early lambing has these advantages: lambs usually are sold on a higher market; lambs gain more rapidly; hot weather and internal parasites are not major problems; lambs can be sold without putting them on pasture; and labor requirements for lambing come at a slack time of the year.

Late lambing has the following advantages: building and equipment requirements are less; feed costs per ewe are lower; and lambs can make maximum use of pasture forage and be marketed directly from pasture with a minimum amount of grain feeding.

In recent years there has been increased interest in fall lambing (September 1 to December 1) and in accelerated lambing. The advantages of fall lambing are favorable weather; better use of equipment; lower feed and labor requirements; good prices for lambs; and the possibility for accelerated lambing. Disadvantages are a higher percentage of ewes that fail to lamb; smaller birth weights; lower lambing percentages; and at times poorer milking ewes.

### Accelerated Lambing

Two relatively new management practices are currently being developed by some sheepmen: accelerated lambing (three lamb crops in two years) and synchronized breeding and lambing (lambings grouped into three- to seven-day intervals). Most sheepmen who practice accelerated lambing combine synchronization with it.

Accelerated lambing is a must for those who go to a drylot or semi-confinement type of operation. Certain breeds are more adapted to fall lambing, and therefore accelerated lambing, than others. Sheep of Rambouillet and Dorset breeding seem to have the lead in this respect. Many Hampshire and Corriedale flocks also have quite a few fall lambs.

In order to lamb every eight months, the lambs must be weaned at 60 days or less, thus leaving 30 days in which to rebreed the ewe. Controlling the estrous cycle of a ewe or stimulating the ewe to cycle during the anestrous period begins with progesterone hormone treatments for a period of approximately 14 days. Feed additives, vaginal tampons, and silastic implants impregnated with progesterone or progesterone-like substances have been used for this purpose. Withdrawal of these progesterone sources during the normal breeding season will result in a large percentage of the ewes coming into heat within one to three days following withdrawal. During the anestrous period, the progesterone treatment should be followed by an additional hormone treatment to insure follicular development and subsequent ovulation. Pregnant mare’s serum (PMS), which contains follicle-stimulating hormones, is often used for this follow-up treatment.
A successful accelerated lambing program requires careful management. Many of the problems encountered with accelerated lambing may center around the low fertility of many rams in the spring and early summer. Moreover, when ewes are synchronized, there is generally a need for more rams than would be required for a conventional pasture mating system.

**Flushing the Ewes**

Feeding a ewe so that it rapidly improves in condition from ten days to two weeks before breeding (commonly known as flushing) may increase the lambing percentage by 10 to 20 percent. However, this increase will not occur if ewes are already in a high condition before breeding. Ewes that become too fat may not breed at all. To flush ewes, let them graze better pasture or feed them ½ to ¾ pound of corn or oats or a mixture of the two per head per day. Use some caution if flushing ewes by turning them onto lush legume pastures; during years of heavy rainfall, such pastures may contain a high level of coumestrol, a plant estrogen that can cause delayed conception.

**Tagging the Ewes**

All ewes that are in long fleece or that have a lot of manure around the rear end should be tagged before the ram is turned in. Tagging means trimming the wool around the dock area so it will be easier for the ram to mate with the ewes.

**Effect of the Ram on Ewe Fertility**

Although the ram formerly was considered to have no effect on lambing percentage, research reports indicate that some rams consistently sire more multiple births than other rams. According to an Ohio report, the ram exerts a highly significant influence on both the number of lambs born per ewe exposed and the number of lambs born per ewe lambing. And an Idaho report indicates that over a six-year period one particular ram sired an average of 32.8 percent more single lambs each year than did other rams used in the same flock.

Data from the Dixon Springs Agricultural Center also indicate that there is a great difference in ram breeding performance. A study of the breeding data for 23 rams shows that some rams settled only 25 percent or less of the ewes during the first two heat periods. Other rams, however, settled over 90 percent of the ewes during the first two heat periods.

The following paragraph, based on material from *The Sheepman's Production Handbook*, indicates that rams also have other effects on ewe performance.

21
The presence of a ram appears to have some psychological stimulus from sight, sound, or smell on ovulation and estrual activity. This stimulus is not as pronounced when the ram is constantly associated with the ewes. Introducing a ram (fertile or surgically sterilized) near the end of the anestrous period can induce estrus and ovulation earlier than would normally occur without the presence of a ram. Ewes in the transitional stage, between the nonbreeding and breeding season, have been shown to ovulate without showing estrus (silent estrus) within six days after being placed with or near a ram. Estrus accompanied by ovulation then occurs one estrous cycle later. This effect is not seen if the rams are placed with the ewes earlier in the anestrous period and simply left with the ewes. They must be introduced at the critical time of transition. Smell, sight, and sound are sufficient stimuli to bring about these responses; direct contact with the rams is not necessary. The result is a grouping of breeding (and probably lambing) dates rather than an increase in the number of fertilized eggs. No increase in lambing percentage should be expected from teased ewes. Nonteased ewes tend to breed one heat period later than properly teased ewes and their breeding season tends to be longer. Since the nonteased ewes lamb later, lambing percentage may be greater than with teased ewes. Teaser rams should be aggressive, surgically sterilized rams. They should be left with the ewes 10 to 14 days, then replaced with the rested, fertile rams that are intended to sire the lamb crop.

**Ram Management and Breeding Records**

Shear the rams six to eight weeks before the breeding season if you expect maximum breeding results. Rams in long fleece during hot weather may become infertile because of high body temperature, and it may take six weeks or longer for them to regain their fertility. Some flock owners have improved breeding performance and their lamb crops by turning rams in with the ewes only at night and keeping the rams in cool quarters during the day.

New rams should not be turned in with the ewes as soon as they arrive at the farm but should be allowed at least one or two weeks to become familiar with their new environment. The same is also true of show rams. Gradually lower the condition of these rams and give them plenty of exercise for several weeks before turning them in with the ewes.

It is advisable to use some system of marking so you will know when the ewes are bred and whether the ram is doing an effective job. A marking harness with crayons can be used for the ram, or his brisket can be smeared with a marking pigment. In either case, whenever a ewe is bred her rump will be marked. Change the marking crayons or the brisket
The use of a marking harness is a very satisfactory means of determining when the ewes are being bred and whether or not the ram is doing an effective job of breeding. Notice the proper position of the harness as shown here and the fact that the ram has been shorn prior to the breeding season.

smear pigments every 17 days. For the smear pigment, you can use yellow ochre and old crankcase oil, venetian red and crankcase oil, or lamp black. Apply it to the brisket every second or third day.

It will be easier to keep an accurate breeding record if you paint-brand the ewes. Use any good scourable paint-branding fluid. The ewes can be paint-branded in several places such as the side, back, or shoulder; however, the back is most commonly used. In this way when a ewe is marked by the ram she can be easily and quickly identified.

Close observation during the breeding season is essential so you know whether the ram is serving the ewes normally and whether a high percentage are being settled on first service. If a high percentage of the ewes have not been settled after two heat periods, the ram should be replaced.

**Effects of Light, Temperature, and Relative Humidity on Reproductive Performance**

Light, temperature, and possibly relative humidity affect the season when ewes will exhibit estrus, the relative ovulation rate, and embryo survival. Since there is some interaction among these three factors, they must be considered together.

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1 This section and Table 5 are based on material in *The Sheepman's Production Handbook*. 

23
Table 5. — Performance of Rambouillet Ewes Bred During Four Different Seasons in Texas

<table>
<thead>
<tr>
<th>Breeding intervals</th>
<th>March 21-May 2</th>
<th>June 21-Aug. 2</th>
<th>Sept. 21-Nov. 2</th>
<th>Dec. 21-Jan. 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ovulation rate</td>
<td>106</td>
<td>141</td>
<td>175</td>
<td>152</td>
</tr>
<tr>
<td>percent</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lamb production</td>
<td>84</td>
<td>97</td>
<td>127</td>
<td>135</td>
</tr>
</tbody>
</table>

* Higher lamb production in December is believed to be due to better embryo survival at cooler temperatures.

Sexual activity in sheep is primarily controlled by the light-dark ratio. The incidence of estrus increases as the days become shorter. Because of individual and breed differences, breeding activity occurs in all months of the year, but fertility is generally the highest and most efficient in September, October, and November, when light exposure is 10 to 12 hours. In many parts of the United States cooler temperatures are common during this period, making embryo survival more probable. Ovulation rate and lamb production do change with the season of the year as shown in Table 5.

Similar differences might be expected in ovulation rate in fine-wool ewes in other sections of the United States. The lamb production pattern might differ with variation in temperature during the breeding season. Ovulation rate in the yearling ewe has been found to be related to subsequent lamb production. Under some conditions, observed ovulation rate by means of the laparotomy technique in yearling ewes could be used as a method of selecting for increased fertility.

Temperature has a marked effect on fertility, embryo survival, and fetal development. Experimentally, air temperatures higher than 100° F. for periods of three months or longer almost eliminate reproduction in sheep. Constant temperatures of 90° F. reduced fertility by 50 percent with no embryo survival. In ewes exposed to continuous 90° F. temperature on the day of breeding, none of the embryos survived. Seventy percent of the embryos were lost if the ewes were exposed to this temperature one day after breeding. Exposure to heat three, five, and eight days after breeding had progressively less effect on embryo survival. Very little embryo loss occurred later than 25 days after mating.

These results were obtained with a constant relative humidity of 60 to 65 percent. Heat stress with much lower relative humidity may not be as harmful. Temperatures of 90° F. for short periods of time (4 hours) may not greatly reduce fertility or survival rate. Heat stress during gesta-
tion also has an adverse effect on fetal development, resulting in significantly smaller lambs at birth.

Activity of the ewe may affect the body temperature and fertility. Ewes required to walk long distances for feed and water during hot weather may show sufficient increase in body temperature to be detrimental to reproductive efficiency. Excessive feed consumption in extremely warm weather also may increase body temperature. Excessively fat ewes are more susceptible to heat stress than ewes in moderate breeding condition.

Control of light and temperature is of little significance to most range sheep producers in the northern half of the United States. When ewes are mated during the months of September to December, producers in the southern portion of the United States may find it advantageous to provide as much shade as possible and to limit exposure to direct sunlight as much as is economically feasible.

Ewes in farm flock areas may be sheared, kept in cool buildings or shaded areas during the day, and pastured only at night in an attempt to reduce heat stress. In range flocks, where ewes cannot be housed or shaded during the day, wool should be retained on the ewes. Body temperature in direct sunlight will be lower in sheep with 1 to 2 inches of wool than in freshly shorn sheep, as the fleece acts as an insulator to both heat and cold.

**FEEDING THE STUD RAM**

Even though there has been very little research work dealing with nutrition of the stud ram, some general recommendations can be made. The stud ram, like the brood ewe, requires adequate nutrition in order to perform efficiently. Poor nutrition can result in lowered fertility or even infertility, as well as loss of vigor and strength. For best results the ram should be in moderate condition at breeding time.

In the summer and just before the breeding season the ram can receive all of his nutrient requirements from pasture. If the ram begins to lose weight during the breeding season or if he is thin before the breeding season, he should receive from 1 to 1½ pounds per day of shelled corn or a concentrate mixture similar to that recommended for ewes. If a ram lamb is being used, he should be fed more than this amount.

During the winter months feed the ram so that he gains some weight but does not become excessively fat. One pound of a concentrate mixture and 3½ to 4 pounds of legume or mixed hay per day should be enough for a 180-pound ram. Feed a 240- to 250-pound ram the same level of concentrate and 4½ to 5 pounds of hay per day. When silage is fed, substitute 2 to 3 pounds of silage for each pound of hay replaced.
FEEDING THE EWE FLOCK

In developing a feeding program for your ewe flock, take advantage of their ability to efficiently use large quantities of roughage and pasture. A sound feeding program should include maximum use of high-quality hay (legume or mixed), silage (corn, grass, or legume), or haylage. Silage for sheep should be chopped finer than for cattle in order to minimize spoilage and obtain the most efficient utilization.

Two of the most critical periods of the year, so far as nutrition is concerned, are late pregnancy and early lactation. If a ewe is expected to deliver large, strong, healthy lambs and provide a heavy flow of milk, adequate nutrition must be provided before and after lambing. Trace-mineralized salt or a salt-mineral mixture should be fed free-choice throughout the year. In areas where copper toxicity is a problem, use plain salt instead of trace-mineralized salt.

Sheep should have plenty of clean, fresh water available at all times. During cold weather, use water heaters to keep water from freezing so that water intake is adequate.

Automated feeding of brood ewes may become more common in large intensified sheep operations.
Concentrate Mixtures

The concentrate mixture can be very simple. Make maximum use of home-grown grains. If a high-quality legume or mixed hay or haylage is fed, no protein supplement is needed during gestation or lactation. Corn, oats, and barley are excellent cereal grains for feeding sheep, and the combination of any two or all three can make up the concentrate mixture. A commonly used mixture is a combination of half oats and half shelled corn; however, shelled corn alone will work satisfactorily. Sometimes bran is used to make up 10 percent of the mixture, primarily because of its laxative properties. When poor-quality hay or haylage is fed, approximately 15 percent of the concentrate mixture should be a protein supplement (soybean meal, linseed meal, or a commercial protein supplement).

Feeding During Gestation

Whether you should give ewes supplemental feed during early pregnancy depends on the availability of feed in the form of pasture, stubble fields, and stalk fields. If the roughage supply in the fields is not adequate and the ewes are not at least maintaining their weight, feed 1 or 2 pounds of legume hay per head per day.

Feed a concentrate ration during the last six weeks of pregnancy to provide an additional supply of energy to meet the demands of the rapidly developing fetus. About two-thirds of the birth weight of a developing fetus is gained during the last six weeks of pregnancy. It is usually thought that a ewe should gain from 20 to 30 pounds during pregnancy.

Inadequate nutrition during the last six weeks of pregnancy may have the following results:

1. A higher percentage of ewes with pregnancy disease.
2. A decrease in birth weights.
3. Weaker lambs at birth.
4. An increase in infant lamb mortality.
5. Slower gaining lambs.

The information in Table 6 will serve as a guide in determining how much feed your ewes will need in late pregnancy. Several different roughages are listed in combination with shelled corn. Remember that the amounts of feed listed in Table 6 are for ewes of two different weights, so pick the column that best fits your situation.

The exact amount to feed depends on the weight and condition of the ewes. Silage can be substituted for hay at the approximate rate of 2 to 3
Table 6. — Pounds of Daily Feed Consumption Required To Meet Nutrient Requirements\(^a\) When Shelled Corn and Various Roughages Are Fed to Ewes in Late Pregnancy

<table>
<thead>
<tr>
<th>Feed combinations</th>
<th>Ewe weights(^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>130 pounds</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>3.75</td>
</tr>
<tr>
<td>Shelled corn</td>
<td>.75</td>
</tr>
<tr>
<td>Clover-timothy hay (50-50)</td>
<td>3.75</td>
</tr>
<tr>
<td>Shelled corn</td>
<td>.75</td>
</tr>
<tr>
<td>Orchardgrass hay</td>
<td>4.00</td>
</tr>
<tr>
<td>Shelled corn</td>
<td>.75</td>
</tr>
<tr>
<td>Alfalfa silage (30% DM)</td>
<td>6.5</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>1.0</td>
</tr>
<tr>
<td>Shelled corn</td>
<td>1.0</td>
</tr>
<tr>
<td>Alfalfa haylage (50% DM)</td>
<td>6.5</td>
</tr>
<tr>
<td>Shelled corn</td>
<td>.75</td>
</tr>
<tr>
<td>Corn silage (30% DM)</td>
<td>6.75</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>1.0</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>.25</td>
</tr>
<tr>
<td>Shelled corn</td>
<td>.50</td>
</tr>
</tbody>
</table>

\(^a\) Assuming that a salt-mineral mixture is fed free-choice.
\(^b\) Weights at breeding time with ewes in average condition.

pounds of silage for each pound of hay replaced, depending of course on the moisture content of the silage. Keep in mind that corn silage is low in protein and calcium, so a protein-mineral supplement must be added unless half of your roughage is legume hay.

In Wisconsin, ewes that ate 8 pounds daily of grass silage (50 percent moisture content) during late gestation and 12 pounds daily in early lactation produced as well as ewes that received 5 pounds of legume hay and 1 pound of grain daily through both periods.

Even fall-lambing ewes that are on good pasture should receive from \(\frac{1}{2}\) to 1 pound of grain during at least the last four weeks of pregnancy.

**Self-Feeding Brood Ewes**

In recent years, there has been increased interest in self-feeding complete ground mixed rations to pregnant and lactating ewes. Two main advantages of self-feeding a ground mixed ration are reduced labor in feeding and more efficient use of lower-quality roughages. One of the major problems in self-feeding has been to keep ewes from becoming too fat. However, research at the University of Illinois indicates that ewes can be satisfactorily self-fed.

Consumption of a self-fed ration can be controlled by limiting the time the ewes have access to the self-feeders.
Table 7. — Two Satisfactory Rations for Self-Feeding Ewes

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Corncob ration</th>
<th>Oat hay ration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Early gestation</td>
<td>Late gestation</td>
</tr>
<tr>
<td></td>
<td>pounds</td>
<td>pounds</td>
</tr>
<tr>
<td>Corncobs, ground</td>
<td>70</td>
<td>65</td>
</tr>
<tr>
<td>Oat hay, ground*</td>
<td>80</td>
<td>75</td>
</tr>
<tr>
<td>Alfalfa meal</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Corn, ground</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Steamed bone meal</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Salt, trace-mineralized</td>
<td>1</td>
<td>.5</td>
</tr>
</tbody>
</table>

* Medium- to low-quality hay can be used in a similar manner as the oat hay.

Table 7 gives two self-fed rations that have given satisfactory results in studies at the University of Illinois. A high percentage of roughage is used in self-fed rations.

A self-fed ration that has been used successfully at the Dixon Springs Agricultural Center consists of 34 percent ground ear corn and 66 percent ground grass-legume hay. Self-feeding this ration can begin a month before lambing and should extend for no more than 60 days after lambing. If you have a large number of multiple births, ground shelled corn can be substituted for ground ear corn. If high-quality legume hay is used, then a ration of 80 to 85 percent hay and 15 to 20 percent grain should work during late pregnancy. The grain portion could be increased to 20 to 25 percent after lambing.

Some producers have asked whether some straw can be utilized in a self-fed ration. It can be. For late pregnancy, combine 37.5 percent straw, 37.5 percent high-quality legume hay, and 25 percent shelled corn. During lactation, combine 29 percent straw, 29 percent high-quality legume hay, 35 percent shelled corn, and 7 percent soybean meal.

Self-fed ewes nursing twins will require a higher percentage of grain in the ration than self-fed ewes raising only singles.

Dixon Springs Agricultural Center research indicates that large-framed ewe lambs that are to be bred to lamb at approximately a year of age can be self-fed a 50:50 hay-grain ration from market weight through lactation with good results.

Researchers in Minnesota have reported satisfactory results from feeding ewes three times a week. This practice would appear to be very practical during early gestation and following weaning. However, extreme caution should be used in trying to follow this program during late gestation and early lactation.
Use of Antibiotics in Ewe Rations

If you have been having a high lamb mortality rate, you may be interested in the results of a three-year (1964-1966) South Dakota study in which 531 western ewes of mixed breeding were used to evaluate the influence of antibiotic supplementation to pregnant ewes on lamb survival and performance.

Supplementing pregnant ewes with 60 milligrams of aureomycin per head daily for 80 days starting six weeks before lambing substantially reduced lamb mortality. Average lamb mortality rate for the three-year period was 3.9 percent in the aureomycin-supplemented group compared with 14.5 percent in the control group. The antibiotic treatment did not influence weight change of the ewes or lamb gains from birth to weaning.

Feeding During Lactation

Lactation places a greater demand on the ewe than pregnancy and increases the level of nutrients needed (see Table 8). After about 60 to 70 days of lactation, the nutrient requirements are less because of declining milk production, so the amount of concentrate fed can be decreased at this time.

During the first 60 days of the lactation period, feed according to the amounts recommended in Table 9 for small and large ewes, nursing singles or twins. Separate the ewes with twins from the ewes with singles and feed accordingly. Keep in mind that the actual amount fed depends on the weight and condition of the ewes and that the feeding value of 2 to 3 pounds of silage is about the same as 1 pound of hay.

By the time lambs are between one and two months of age, they will be eating quite a bit of the ewes' feed; you must allow for this to adequately meet the ewes' requirements.

After the first 60 days of lactation reduce the amount of feed to the amount the ewes were being fed during late pregnancy. Additional feed

Table 8. — Changes in Daily Total Digestible Nutrients (TDN) and Protein Requirements as a Ewe Progresses From Early Pregnancy Through Early Lactation

<table>
<thead>
<tr>
<th>Stage of production</th>
<th>TDN</th>
<th>Protein</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early pregnancy</td>
<td>1.69</td>
<td>.28</td>
</tr>
<tr>
<td>Late pregnancy</td>
<td>2.68</td>
<td>.43</td>
</tr>
<tr>
<td>Early lactation, single</td>
<td>3.59</td>
<td>.57</td>
</tr>
<tr>
<td>Early lactation, twins</td>
<td>4.00</td>
<td>.71</td>
</tr>
</tbody>
</table>

* Based on ewe weight at breeding time of 154 pounds.
Table 9. — Pounds of Daily Feed Consumption Required To Meet Nutrient Requirementsa When Shelled Corn and Various Roughages Are Fed to Ewes in Early Lactation

<table>
<thead>
<tr>
<th>Feed combinations</th>
<th>Ewe weightsb</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Nursing twins</td>
<td>Nursing a single</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>180 lbs.</td>
<td>130 lbs.</td>
<td>180 lbs.</td>
<td>130 lbs.</td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td></td>
<td>5.0</td>
<td>4.0</td>
<td>5.0</td>
<td>4.0</td>
</tr>
<tr>
<td>Shelled corn</td>
<td>2.25</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Clover-timothy hay (50-50)</td>
<td>5.0</td>
<td>4.0</td>
<td>5.0</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Soybean meal</td>
<td>.1</td>
<td>.1</td>
<td>0</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Shelled corn</td>
<td>2.25</td>
<td>2.9</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Orchardgrass hay</td>
<td>5.0</td>
<td>4.0</td>
<td>5.0</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td>Soybean meal</td>
<td>.2</td>
<td>.2</td>
<td>.1</td>
<td>.1</td>
<td></td>
</tr>
<tr>
<td>Shelled corn</td>
<td>2.25</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Alfalfa silage (30% DM)</td>
<td>10.0</td>
<td>7.5</td>
<td>10.0</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Shelled corn</td>
<td>2.25</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Alfalfa haylage (50% DM)</td>
<td>8.5</td>
<td>7.0</td>
<td>8.5</td>
<td>7.0</td>
<td></td>
</tr>
<tr>
<td>Shelled corn</td>
<td>2.25</td>
<td>2.0</td>
<td>1.5</td>
<td>1.5</td>
<td></td>
</tr>
<tr>
<td>Corn silage</td>
<td>9.5</td>
<td>7.5</td>
<td>9.5</td>
<td>7.5</td>
<td></td>
</tr>
<tr>
<td>Alfalfa hay</td>
<td>1.5</td>
<td>1.5</td>
<td>1.0</td>
<td>1.0</td>
<td></td>
</tr>
<tr>
<td>Soybean meal</td>
<td>.30</td>
<td>.25</td>
<td>.25</td>
<td>.25</td>
<td></td>
</tr>
<tr>
<td>Shelled corn</td>
<td>1.75</td>
<td>1.50</td>
<td>1.25</td>
<td>1.25</td>
<td></td>
</tr>
</tbody>
</table>

---

* Assuming that a salt-mineral mixture is fed free-choice.

b Weights at breeding time with ewes in average condition.

Note the thrifty condition of these fall-born lambs, indicating that the ewes are good milkers and have been well fed.
at this time will only allow the ewes to put on excess fat and will increase the cost of production.

Five or six days before weaning, greatly reduce the feed and water intake of the ewes. This will help to dry the ewes up more rapidly, force the lambs to eat more creep, and get the lambs on feed more easily after weaning.

As soon as the ewes can be turned out to pasture full time, no additional roughage or grain is needed as long as there is sufficient pasture. To be a good shepherd you must use your eyes, your hands, and a scale, if one is available, to keep track of how the ewes are doing in terms of changes in weight and condition. By keeping up to date on the changes in your flock, you can alter your feeding program accordingly.

**EWE MANAGEMENT DURING GESTATION**

**Exercise**

Pregnant ewes should have plenty of exercise. Some flock owners feed hay or grain some distance from the barn so the ewes will be forced to exercise. The last month of pregnancy may present the most problems. Ewes that are extremely fat or carrying twins or triplets may become very sluggish. Watch them carefully and force them to exercise. Many of these ewes will eat less than they should; they are the ones that may develop pregnancy disease (pregnancy toxemia or ketosis).

**Pregnancy Disease**

Pregnancy disease commonly occurs a few weeks before lambing. Most of the affected ewes are carrying twins or triplets. The disease is related to the metabolism of carbohydrates late in pregnancy. Because of the large amount of abdominal space occupied by the rapidly developing fetuses, the ewe may have difficulty eating enough to supply both her needs and those of the unborn lambs, especially if only roughage is fed.

In the early stages of the disease the ewes are less active than the rest of the flock and walk very slowly. Later they become weaker, walk stiffly, have difficulty rising, and may stand with their heads against some object. As the disease progresses, they cannot rise and they lie with their heads turned to the side. Other symptoms are rapid breathing, blindness, and grinding of the teeth. In advanced stages the breath may have a characteristic sweetish odor that helps to identify this disease. If affected ewes are not treated as soon as the disease is noticed, a high percentage of them will die unless lambing is only a few days away. They will generally recover after lambing if their condition is not critical at lambing time.
Treatment.¹ Treatment during the early stages of pregnancy toxemia is essential to be effective. If treatment is delayed, the brain, liver, and kidneys may be damaged severely, making recovery impossible. Glycerol (glycerine) and glycerol plus insulin are recommended in treating affected ewes. Two hundred milliliters of glycerol given as a drench twice daily is the recommended dosage.

Insulin with the glycerol may help stimulate glucose metabolism. If insulin is used, glycerol should be administered every eight hours. Intravenous administration of glucose may be effective in early stages of the disease; however, this glucose is used up rapidly and frequent injections are necessary. Propylene glycol (2 ounces, 3 to 4 times daily) is also an effective treatment for affected ewes. The most successful treatment is intravenous glucose (100 ml of 40 percent glucose) plus glycerol as a drench and insulin (as recommended by your veterinarian).

Other treatments that can be used are ½ pint of molasses twice daily or ½ pint of a 25- to 50-percent fructose solution twice daily.

Preparing the Lambing Quarters

Sheep do not need elaborate or expensive housing and equipment. Whether you are following an early- or late-lambing program will determine how tight and free from drafts the building should be. Lambing

¹ Most of this section is based on material from The Sheepman’s Production Handbook.
pens (4' x 4' or 5' x 5', depending on ewe size and the number of lambs she has) should be set up before the lambing season in a draft-free area of the barn. Even though the average length of gestation is 147 to 148 days, some ewes may lamb a week early, so it pays to be prepared.

Shearing Before or After Lambing

Many flock owners shear their ewes several weeks before lambing, a practice that has several advantages:
1. It eliminates the need for crutching.
2. It is easier for lambs to nurse and is more sanitary.
3. Fleeces contain less dirt and manure.
4. More ewes can be put into a limited space.
5. It is easier to spot ewes that are close to lambing and those with udder problems.
6. The barn is dryer and less bedding is needed.

There are also disadvantages:
1. A good, warm building is needed.
2. If ewes are sheared too near lambing time and are handled roughly, some lambs may be born prematurely.

Crutching

If you do not shear ewes before they lamb, at least crutch them out. Crutching means to shear around the udder, between the legs, and around the dock. If there is extensive wool covering on the face, it would be a good idea to shear the head also.

EWE MANAGEMENT DURING LAMBING AND LACTATION

Lambing time is a very critical period of the year, because at this time you can “make or break” the future productivity of your flock. The higher the percentage of lambs born alive and reared to marketing time, the greater the gross returns from the enterprise.

Lambing Time Suggestions

1. Watch ewes closely and give assistance if needed.
2. When a ewe has difficulty, find out whether the lamb is being delivered in normal position (head between and slightly above the front feet). If not, proceed cautiously. Difficult lambing may be caused by any of the following conditions:
a. The lamb is extra large, especially its head and shoulders.
b. The ewe has small pelvic area.
c. The ewe fails to dilate.
d. The lamb comes backwards (breech birth).
e. One or both front legs are bent back.
f. The head is bent back.
g. The lamb comes hocks first.
h. If the ewe is carrying two lambs, their legs may become tangled; or, if the two lambs are side by side, the ewe may try to deliver both at the same time.

3. Just before or, preferably, after the ewe lambs, place her in a lambing pen.

4. Check the udder to see if colostrum is available, and check the teats to be sure they are open.

5. Be sure the ewe owns her lambs and allows them to nurse before you leave.

6. If lambs are weak, help them nurse or use a stomach tube to ensure adequate colostrum intake.

7. If it is extremely cold, provide a heat lamp for each lambing pen. However, use the lamp only long enough to get the lamb dry and off to a good start. Prolonged use of a heat lamp in the lambing pen may increase a lamb's susceptibility to pneumonia.

8. Ear-tag lambs and record information on your barn records.

9. Ewes with healthy single lambs can be removed from lambing pens after one day, and ewes with healthy twins after two days.

**Value of Colostrum**

The first milk the ewe produces after lambing is called colostrum. It differs a great deal in chemical composition and biological properties from the milk secreted several days after lambing. It is highly essential for lambs to get some colostrum as soon as possible after birth, because it provides energy, protein, vitamins, and minerals, as well as antibodies that help them resist infection. For example, lambs are born with a low level of vitamin A. Colostrum is rich in vitamin A and is essential to build up lambs' vitamin A reserves. Ohio studies indicate that ewes delivering twins have approximately 46 percent more vitamin A in their colostrum than ewes delivering singles.

Some flock owners freeze the colostrum from ewes that deliver dead lambs or those that lose their lambs. They then use it for orphan lambs or for lambs from ewes that have no colostrum available soon after lambing.
Udder Problems

The need to keep the ewe's udder working well cannot be overemphasized, because milk is the lamb's main food for at least the first 30 days. There is a close relationship between milk yield and lamb growth and development, especially during the first part of the lactation period. The capacity of the offspring to consume milk is one of the principal factors that govern the amount of milk produced by the dam. Ewes with twins produce about 50 percent more milk than comparable ewes with singles.

Sound, well-shaped udders are extremely important. Ewes with pendulous udders, extremely large teats, or hard spots in the udder should be watched carefully after lambing. Sometimes it is hard to get lambs started nursing on ewes that have low-hanging udders, since their natural instinct is to go up under the flank. You may have to help lambs whose mother has extremely large teats (balloon teats). It may take as long as a week for these teats to reduce in size so the lambs can nurse without assistance. Ewes with these problems are good candidates for culling if you have much difficulty with them.

You may want to consider rearing the lambs from problem ewes artificially rather than take a chance of losing some lambs by leaving them with their mothers.

Observe ewes and lambs carefully throughout the lactation period to detect sickness or other disorders before they become major problems. One of the potential trouble spots is the udder. If it becomes injured or infected and the condition is not treated early, the ewe may lose the milk-producing ability of one or both sides of the udder.

Mastitis can become a serious problem and may even cause death. One form is so toxic that, if not treated at once, ewes may die within two or three days after the infection starts. When a case of mastitis occurs, isolate the ewe and her lambs from the rest of the flock until the infection is under control. Udder infections can be spread when lambs that belong to infected ewes nurse other ewes.

Lambs can also injure the udder with their sharp teeth. If these injuries are not treated early, they may become so painful when the lambs nurse that the ewe will automatically wean them. Udder sores provide excellent avenues for harmful bacteria to enter the body. Keeping the barn well bedded will help cut down udder problems.

Helping Ewes Own Their Lambs

Persuading a ewe to claim her lamb or lambs can sometimes be a real headache. This is generally more of a problem with ewes lambing for the first time than it is with older ewes. If you have trouble with a ewe two years in a row, it would be best to sell her.
There is no clear-cut answer to why ewes fail to claim their offspring. Some of the following situations may cause an ewe to disown one or all of her lambs:

1. A ewe may deliver one lamb in one part of the barn and a second lamb in another part of the barn.
2. One of a set of twins may wander away from its mother before she has fully recovered from delivery.
3. The ewe may have a very painful udder because of swelling, caking, or infection.
4. The teats may be cut or chapped, causing the ewe a great deal of discomfort.
5. A ewe that has been in labor for a long time may not be interested in her lamb for quite a while after delivery.
6. Sometimes a ewe may run a high temperature for several days after lambing and not show much interest in her lambs.
7. Sometimes ewes that are very nervous and flighty may present problems.
8. Some young ewes lambing for the first time may be frightened by the lambs they have given birth to.

It takes a lot of patience to work effectively with an ewe that disowns her lamb. Keep in mind that it is much easier for the ewe to raise her lamb than for you to raise an orphan. There is no guaranteed method of getting an ewe to claim her offspring, but flock owners have reported satisfactory results with one or a combination of the following measures:

1. Tie the ewe in the pen until she allows the lamb to nurse.
2. Put a dog near the pen with the ewe and lamb.
3. Rub the ewe’s nose and the lamb with some of the ewe’s milk or with kerosene or oil.
4. Household deodorizer sprays may be sprayed on the lamb and on the ewe’s nose.
5. Blindfolding the ewe is also helpful at times.

**FEEDING AND MANAGEMENT OF LAMBS TO WEANING**

**Lamb Mortality**

Lamb survival and performance determine to a large extent how profitable a sheep enterprise will be. Lamb mortality studies show that 50 to 70 percent of lamb death losses occur in the first three to five days
after birth, and 80 to 90 percent occur during the first month. These figures indicate that it is extremely important for each lamb to get a good start and that the first few days are critical ones. These studies also show that the four main causes of lamb losses have been weak lambs, starvation, stillbirths, and pneumonia. Male lambs are reported to have a higher mortality rate than females, and twins have a higher mortality rate than singles. In many flocks a higher death loss occurs among lambs born in the second half of the lambing season.

**Disinfecting the Navel**

It is a good practice to disinfect the navel cord of all lambs soon after birth with tincture of iodine or another good antiseptic to prevent navel ill (joint disease), which is caused by bacterial infection. The disease causes a stiffness and swelling of the joints of the legs. Sometimes the navel area also becomes infected.

**Inverted Eyelids**

If not corrected, inverted eyelids (entropion) can lead to total blindness. Sometimes lambs have this condition at birth; others may not be affected until they are one or two weeks old. Unless severe, this condition can usually be corrected by catching the lamb several times a day and working the eyelid outward. Use an eye ointment or powder to help eliminate infection caused by irritation. If the condition is severe and does not respond to this treatment, try one of these remedies: use adhesive tape to hold the eyelid in place for several days, use metal clips (surgical type) to hold the eyelid back, clamp the excess fold of skin below the eyelash with a small burdizzo to hold the eyelid in proper position, or stitch a fold of skin in the lower lid to keep the eyelid from rolling under. Inverted eyelids are an heritable trait that should be discriminated against in the selection of breeding stock.

**Docking**

Lambs should be docked between 3 and 10 days of age. Several pieces of equipment can be used for this job including a pocketknife, burdizzo (emasculatome), elastrator (rubber rings), emasculator, “all-in-one,” and an electric docker. Cut off the tail 1 to 1½ inches from the body. A good place is the junction or end of the caudal folds on the underside of the tail. Try to push the skin on the tail toward the body before cutting to allow enough loose skin to cover the stub and not expose the bone. Docking gives lambs a better appearance and decreases the chances of maggot infestation. Leaving tails on ewes can pose problems at breeding time and at lambing.
Be sure to vaccinate lambs for tetanus if you now have or ever have had horses on your farm (see page 49).

**Castration**

Ram lambs that are to be fed for maximum growth and marketed under five months of age need not be castrated. Late-born ram lambs and ram lambs that will not be fed for maximum growth and will be over five months old when marketed should be castrated, preferably at an early age (two weeks or less). Normally, wether lambs will not gain as fast as ram lambs; however, one of the major problems with ram lambs is that they continually pester the rest of the sheep and may settle some of the ewes if left with them too long (5 or 6 months). Wether lambs also usually have higher carcass grades and dressing percentages than ram lambs. Castration can be done with an elastrator, pocketknife, burdizzo, or “all-in-one.”

Be sure to vaccinate the lambs for tetanus if you now have or ever have had horses on your farm (see page 49).

**Creep Feeding the Lambs**

Creep feeding is a means of providing supplemental feed for the lambs during the nursing period. It is essential with an early weaning program and, under conventional management, is usually more advantageous with an early-lambing program than with a late-lambing program. Advantages of creep feeding are (1) it increases gains, especially for lambs from multiple births; (2) the lambs use supplemental feed more efficiently at this time than after weaning; (3) lambs can be marketed at a younger age; (4) earlier marketing usually means higher prices for lambs born early in

The above equipment can be used for castrating and docking. From left to right is the “all-in-one,” elastrator (rubber rings), pocket knife, emasculator, and burdizzo (emasculatome). An electric docker can also be used for docking.
the lambing period; and (5) early lambs can be sold without being put on pasture, thus permitting more ewes to be carried on available pasture and reducing internal parasite problems.

Lambs will begin to nibble at grain and hay very early and at least by the time they are about a week old. However, they will not eat much supplemental feed until they are about four weeks old. Set up the creep when your first lambs are 7 to 10 days old, and put it in a convenient location close to the brood flock. Provide water in the creep or as close to it as possible. A heat lamp placed over the creep will help attract the lambs, especially at night. Sunlight shining into a creep during the day will also attract the lambs. The creep area should be kept well bedded and the feeders should be kept clean.

Make maximum use of home-grown grains and roughage when formulating the creep ration. Corn and oats as well as leafy, high-quality legume hay make excellent feed for young lambs. Barley can also be used but may not be quite as palatable as corn and oats for the first couple of weeks.

Here is a good creep that has been kept clean and well bedded. It provides grain, hay, and water and has a light, which helps to attract lambs into the creep. The grain feeder should be covered, however, to keep lambs from getting their feet into it.
Until the lambs are six weeks old, the grain used in the creep ration should be cracked, crimped, or rolled, unless fed as a pelleted ration. After the lambs are six weeks old, whole grain can be used unless it is extremely hard, in which case the grain should be cracked, crimped, or rolled for several more weeks. Many people are using complete pelleted rations for creep feeding.

Although rolled oats are often too expensive to use, they are excellent in the creep ration or as a starter for lambs. Molasses is sometimes used in the creep ration, primarily as an appetizer and to hold down dust. If molasses is to be used, it should make up 5 percent — certainly no more than 10 percent — of the ration. Bran can also be included, making up 10 to 15 percent of the ration. Many people include bran in the creep ration because of its high palatability and laxative properties.

The creep ration should contain 15 to 16 percent crude protein, while rations for early-weaned lambs (60 days or less) should contain about 18 percent crude protein. High-quality legume hay may be self-fed in either the long or the pelleted form in addition to the concentrate mixture.

Tables 10 and 11 present suggested creep rations that contain 15 to 16 percent crude protein. Table 10 rations are for situations where hay is fed free-choice; Table 11 presents complete rations combining roughage and grain. Linseed meal or other protein supplements can be used in place of soybean meal as long as you balance the ration to contain the desired protein level. If you plan to use a high-urea supplement, it would be best to do so after weaning rather than before weaning. Moreover, the protein supplement with urea should be introduced gradually for best results. For optimum performance, have no more than 25 percent roughage in the complete ration.

**Table 10. — Suggested Creep Rations With Hay Fed Free-Choice**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Rations a,b</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>percent</td>
<td></td>
</tr>
<tr>
<td>Shelled corn</td>
<td>85</td>
</tr>
<tr>
<td>Oats</td>
<td>0</td>
</tr>
<tr>
<td>Barley</td>
<td>0</td>
</tr>
<tr>
<td>Wheat</td>
<td>0</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>15</td>
</tr>
<tr>
<td>Wheat bran</td>
<td>0</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>+</td>
</tr>
</tbody>
</table>

a If molasses is desired, it should not be used at more than 5 percent of the ration; at that level it can be substituted for any of the grain on a pound-for-pound basis.

b If urinary calculi has been a problem, replace one pound of grain with one pound of feeding-grade limestone in each 100 pounds of feed. See also page 53 for a discussion of urinary calculi.

c Assuming that a salt-mineral mixture is fed free-choice.
Table 11. — Suggested Creep Rations With Hay Included at the 10 or 25 Percent Level\textsuperscript{a,b}

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Rations\textsuperscript{e}</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Shelled corn</td>
<td>74</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>14.5</td>
</tr>
<tr>
<td>Alfalfa hay, ground</td>
<td>10</td>
</tr>
<tr>
<td>Alfalfa-orchardgrass hay, ground</td>
<td>0</td>
</tr>
<tr>
<td>Orchardgrass hay, ground</td>
<td>0</td>
</tr>
<tr>
<td>Feeding-grade limestone</td>
<td>1</td>
</tr>
<tr>
<td>Trace-mineralized salt</td>
<td>.5</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>+</td>
</tr>
</tbody>
</table>

\textsuperscript{a} The rations with higher roughage levels are safer to use, although lamb gain and feed efficiency may be better on the low-roughage rations.

\textsuperscript{b} If oats are substituted for part of the corn, 1 pound of soybean meal can be removed for each 25 pounds of corn replaced. If barley or wheat is substituted for part of the corn, 1 pound of soybean meal can be removed for each 20 pounds of corn replaced.

\textsuperscript{e} A salt-mineral mixture should not be fed free-choice; however, iodized salt can be fed free-choice.

It is usually recommended that antibiotics be included in the creep ration at the rate of 15 to 20 grams per ton, which is the equivalent of 7.5 to 10 milligrams per pound of feed. In some cases antibiotic levels twice that high have been beneficial. Aureomycin (chlortetracycline) and terramycin (oxytetracycline) are the two most commonly used antibiotics in creep rations.

Creep rations do not have to be complex to be good. Research work in various states has indicated that lambs will perform as well on simple creep rations as on complex rations. However, there are times when a variety of ingredients or a change in ingredients may be beneficial if lambs go off feed. This is not as big a problem with creep-fed lambs as it is with weaned lambs.

Creep rations can be hand-fed or self-fed. Many sheepmen hand-feed until the lambs begin to eat regularly from the creep, and self-feed from then until weaning or marketing. The creep feeder must be kept clean at all times to get the largest consumption of the ration.

**Individual Performance Differences**

The period of greatest performance difference between single lambs and lambs of multiple birth is within the first 30 days, when the lambs are relying primarily on the ewe for their source of food. As lambs begin to eat supplemental feed, the differences in gain decrease, and somewhere between 60 and 90 days of age twins usually catch up with singles in rate of gain. The data in Table 12 help point out this tendency. Wether lambs
Table 12. — Performance Differences for Lambs According to Specific Period of Days After Birth

<table>
<thead>
<tr>
<th>Item</th>
<th>No. of lambs</th>
<th>Average daily gain (lb.) by period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>0-10</td>
</tr>
<tr>
<td>All lambs</td>
<td>72</td>
<td>.372</td>
</tr>
<tr>
<td>Singles</td>
<td>27</td>
<td>.464</td>
</tr>
<tr>
<td>Twins raised single</td>
<td>11</td>
<td>.387</td>
</tr>
<tr>
<td>Twins raised twins</td>
<td>34</td>
<td>.265</td>
</tr>
</tbody>
</table>

usually gain at about the same rate as ewe lambs from birth to 90 days of age; ram lambs normally gain from 5 to 10 pounds more during the same period.

"In-and-Out" System of Lamb Management

If lambs are not sold before going to pasture, the "in-and-out" system of lamb management may be practical. There are several alternative procedures in this system:

1. Keep ewes and lambs together in drylot at night, but place them on separate pastures during the day.
2. Keep ewes and lambs together in drylot during the day, but place them on separate pastures at night.
3. Keep ewes and lambs together in drylot at night, place ewes on pasture during the day, and keep lambs in the barn on creep feeders.
4. Keep ewes and lambs together in drylot during the day, place ewes on pasture at night, and keep lambs in the barn on creep feeders.

The "in-and-out" system tends to cut down internal parasite problems and improves lamb performance during the pasture season.

Weaning

The proper age to wean lambs depends primarily on the system of management. The following factors influence the age at which lambs are weaned: when the lambs are born (early or late), percentage of multiple births, creep feeding, availability of grain or pasture, parasite problems, predator problems, type of sheep raised, and market prices and price outlook.

Most lambs in the midwestern states are weaned between two and four months of age. Late lambs that reach market weight on pasture are usually weaned at an older age than early lambs that are creep-fed. In recent years there has been more interest in earlier weaning. One reason is that milk production usually reaches a peak three or four weeks after
lambing and decreases thereafter. Three or four months after lambing most ewes will be producing very little milk, and it would be more economical to wean the lambs and turn the ewes out to pasture or at least decrease their daily ration. Many flock owners now wean at 90 days of age or less with good results, and some research done on weaning at 30 to 60 days of age has had good results. Successful early weaning is dependent upon how well the lambs are eating supplemental feed (creep) at the time they are weaned.

FEEDING FROM WEANING TO MARKET

Whether feeding an early weaned lamb or a late weaned lamb (which is very similar to a feeder lamb), a key to success is to use high-quality feeds and not change rations rapidly. Make any necessary changes in rations gradually by blending greater and greater proportions of the new feed with the old feed; take six to eight days. The ration of the early weaned lamb should be high in digestible energy and fairly high in crude protein. For optimum performance, rations if self-fed should contain no more than 25 percent roughage (ground hay) and could contain as little as 10 percent. Although all-concentrate rations can be successfully self-fed, this should be done only when very careful management and close observation are possible. Poor management may result in a serious feedlot disease — overeating disease or enterotoxemia — when lambs eat too much of a ration high in grain (see also page 51).

Protein needs of rapidly growing young lambs are best met by natural proteins (from corn, hay, soybean meal, and other feeds). The protein should be at least 15 percent of the ration. Although research indicates lamb gains will be greater on protein levels higher than 15 percent, it is often found that the cost of the additional protein isn’t paid for by the additional gain.

It is recommended that you continue feeding the rations given in Tables 10 and 11 from weaning to market weight. If desired, adjustments in the crude protein level of rations for lambs within 25 pounds of market weight can be made by substituting 5 pounds of grain for 5 pounds of soybean meal for every 100 pounds of ration. This will reduce the protein content of the ration by approximately 2 percent. Performance should not be greatly influenced by this because the protein requirement for lambs close to market weight is less than for younger, rapidly growing lambs.

What about replacing part of the natural protein with nonprotein nitrogen such as urea? Urea is most effectively used as a replacement for natural protein when lambs are within 25 pounds of market weight. It
is likely that replacing natural protein with urea before this stage will not allow for optimum performance.

Take care in meeting the mineral needs of weaned lambs. Calcium and phosphorus are essential minerals in bone formation but can cause urinary calculi (water belly) when not in the proper balance (ratio of Ca to P). The ratio of calcium to phosphorus should be at least 1½:1 and preferably closer to 2:1. (See page 53 for further discussion of urinary calculi.)

Another important mineral is copper. Copper is an essential element for sheep; however, if it is at too high a level in the ration, it may accumulate in the liver and become toxic. In selecting trace mineral mixtures be extremely careful that the levels of minerals (especially copper) in the finished feed do not exceed recommended levels.

Recent experience has shown that using trace mineral mixtures developed for hogs at levels recommended for hogs can result in serious toxicity problems in sheep. At the Dixon Springs Agricultural Center, copper toxicity has been produced when trace mineral mixtures containing copper were fed free-choice to sheep in confinement. Since there may be little control over the consumption of feeds offered free-choice, it is best, if possible, to control the intake of trace minerals through either intermittent free-choice offering or mixing with the daily ration (no more than 5 parts per million). It is doubtful that trace-mineralized salt blocks will allow overconsumption of minerals.

**DEVELOPING LAMBS INTO YEARLINGS**

Ideally, yearlings should be well grown and in good condition but not excessively fat. Excessive finish is costly to put on and detrimental to reproductive performance.

There are many ideas as to the best way to develop lambs from market weight to yearlings. There is some research information about the development of ewes but practically nothing about the development of rams. There is no ideal way to develop lambs into yearlings that will work for all sheepmen under all management conditions.

In determining what type of a feeding program to follow, one must answer several questions. What is the genetic potential of my flock for yearling size? How hard do I want to push them? How much condition do I want on them? At what age do I want to use them for breeding purposes (both ewes and rams)? And lastly, will I be entering some of them in shows or sales? The development of lambs into yearlings is one of many areas of management where the “eye of the master” reigns.
supreme. One must keep a close watch on the animals to know when to change the kind of ration, the amount being fed, or both.

Lambs that are to be bred and show lambs should continue to be well fed after they reach market weight. Lambs that will not be used for breeding purposes until they are yearlings can be developed more slowly after they reach market weight; however, they do need to be well fed over the winter so they will be well developed yearlings that have adequate size in relation to their genetic potential.

Two items that should not be forgotten when growing out replacement animals are to keep the feet well trimmed and to follow a good parasite-control program. Internal parasites can greatly cut down on the performance of these young growing animals. Refer to page 55, which deals with internal parasites.

When lambs are pushed hard for maximum growth, some may have rectal prolapses. Those that do should not be kept for breeding purposes but should be marketed.

Research at the Dixon Springs Agricultural Center has indicated that large-framed ewe lambs that are to be bred to lamb at approximately a year of age can be self-fed a 50:50 hay-grain ration from market weight through lactation with good results. This proportion of hay to grain can be altered to meet the needs of the individual breeder. This ration will also be affected by the quality of hay. Some breeders may find that $\frac{3}{5}$ roughage and $\frac{1}{5}$ grain may work more satisfactorily, particularly if the ewe lambs are not being bred.

For rams that are to be pushed hard, the 50:50 hay-grain ratio should work. However, if you prefer to develop your rams more slowly, the $\frac{3}{5}$ : $\frac{1}{5}$ hay-grain ration may be more satisfactory. In all cases keep a close watch over your animals so that the proportion of hay to grain is changed before the animals become too fat, not afterwards.

The NRC requirements indicate that a 220-pound ram gaining 0.22 pounds per day would require $5\frac{3}{4}$ to $5\frac{1}{2}$ pounds per day of a 50:50 alfalfa hay-shelled corn ration. A 130-pound ram gaining 0.44 pounds per day would require 4$\frac{1}{2}$ pounds per day of the same ration. If rams have the potential to gain more rapidly than this at the weights indicated, and you want them to gain more rapidly, then obviously you will have to feed more per day, or use a ration with a higher proportion of grain.

**ARTIFICIAL REARING OF LAMBS**

Extra or orphaned lambs occur in most flocks at lambing time. They result from ewe losses at lambing, rejection, or the production of multiple births beyond the ewe's nursing capability. It has been estimated that at
least 10 percent of the nation’s lamb crop dies from starvation during the first week after birth. The number will vary according to the health, age, and productivity of the ewe flock. Extra lambs can be reared, however, if good management is practiced.

**Colostrum Feeding**

Newborn lambs must receive colostrum milk or a substitute soon after birth or their chances of survival are poor. The colostrum can come from the mother or another ewe that has lambed about the same time. Collect colostrum by milking one side of good milking ewes with single lambs or ewes that have lost lambs within 24 hours of birth.

If ewe colostrum is not available, cow colostrum can be fed. The supply of colostrum can be frozen in paper cups or plastic bags (4 to 6 ounces per container). When needed, it should be thawed and fed at room temperature. Heating above normal body temperature may destroy antibodies. Feed 4 to 6 ounces of colostrum per head every 4 hours during the first 12 to 18 hours.

Various suggestions have been made on selecting the lamb or lambs to remove from the ewe. A small or weak lamb may not be able to compete when left with the ewe. If the lambs in a litter are equal, one practical method of selection is to offer the bottle to all of them. The lamb or lambs who take it the most easily will require the least labor when removed from the ewe.

Some shepherds find it beneficial to give lambs 1 cc of a vitamin E-selenium compound such as BO-SE. If lambs are to be housed on elevated slotted floors, they should also have an iron supplement in either oral or injectable form. This is usually given at the rate recommended for a baby pig. Some oral iron supplements contain copper and should be avoided (see page 45).

**Milk Replacer**

Lambs can be raised on cow’s milk but it should not be diluted or skimmed — most cow’s milk is too low in fat, compared to ewe’s milk. Good commercial milk replacers designed for lambs are now available and work well. These should contain 30 to 32 percent fat, 22 to 24 percent crude protein, and 22 to 25 percent lactose (dry-matter basis). Calf milk replacers should only be used in an emergency and must be made more concentrated than recommended for calves.

It is often suggested that the milk replacer is one of the most important factors contributing to the success of rearing extra lambs. The milk replacer that gives good growth rate and lamb health with the least digestive disorders will prove to be the most economical.
Since a good lamb milk replacer is high in fat, it mixes more readily in warm water than in cold. Premix the powder with a small part of the water, making a paste, then add the rest of the water and mix well. Rapidly cooling the liquid mix to 33° to 40° F. tends to reduce the problem of ingredient separation during storage or in feeding containers.

**Equipment**

The number of lambs to be reared and the degree of automation desired will determine the type and amount of equipment used. The equipment should be simple to use, easily cleaned, and as inexpensive as possible. Lambs can be fed from a bottle if labor is available. They will need feeding to appetite about every 4 hours during the first week and then every 6 to 8 hours until weaned.

If several lambs are to be raised, some type of milk dispenser is essential to reduce labor. Several are available, including some with self-priming nipples. They are useful in training new lambs but are somewhat more difficult to clean. Dispensers with the nipple at the top will reduce milk wastage. Good sanitation is easier and digestive disorders generally are reduced if the milk is fed cold. Under most winter conditions the milk will not sour over a 24-hour period if transferred directly from the refrigerator to the milk dispenser. In warm weather the milk may be kept cold by placing plastic jugs full of ice in the feeding unit.

Under most conditions the feeding unit should be cleaned well every day; however, some research workers have mixed 1 cc of formalin with each gallon of formula and report a sufficient reduction in bacterial and mold growth to reduce cleaning to once a week.

If lambs are to be raised on self-dispensing units, starve them for 8 to 12 hours after the last colostrum feeding, then introduce them to the unit with cold milk. A training pen should be set up where lambs are taught to use the dispenser. Lambs need to be put on the nipples several times before they learn to nurse independently. When they can nurse independently, move them from the training pen to a self-sufficient pen. Leaving an older lamb who has learned to use the unit in the training pen will help the younger lambs to learn more rapidly. It is advisable to pen the lambs by age and to have a nipple available for each three to five lambs.

**Housing**

The lambs should be well protected from cold and drafts when being trained to use a milk dispenser; however, good ventilation is necessary. Pens should be kept dry and well bedded. An elevated slotted floor made with ¾” wire mesh will be the easiest to keep clean and dry. In severe
weather heat lamps will be necessary in the training pen. Provide one lamp for each 10 to 12 lambs.

Creep feed should be offered to the lambs soon after they are started on liquid milk replacer. The physical form and palatability will influence consumption. Soybean meal is an excellent feed for the very young lamb. The starter creep feed should contain 17 to 20 percent protein. Lambs develop faster if they have access to a small amount of high-quality roughage such as alfalfa hay. Usually, lambs will consume only a small amount of solid feeds during the period that milk is offered free choice. Yet, having the solid feeds around will familiarize the lambs with dry feed and encourage development of the rumen, which are essential if lambs are to be weaned from milk replacer at four to six weeks.

Trace-mineralized salt and a clean water supply should be available at all times. After weaning, replace the trace-mineralized salt with plain salt. Water buckets, salt boxes, and feed troughs for dry feed should be located outside the pen so lambs have to reach through a panel to eat and drink. This will keep their feet out of the feeders and waterers, reducing contamination and the occurrence of digestive disorders.

COMMON LAMB DISEASES¹

Tetanus (Lockjaw)

Tetanus is a disease caused by Clostridium tetani, an organism commonly found in soil and horse manure. It is much more prevalent on some farms than others. The spores will live in the soil for years and thus present a continuing disease problem on some premises. Converted horse barns may be particularly troublesome. The organism may gain entrance to the body through wounds from shearing, docking, castration, and vaccination. The organism may also be introduced to the reproductive tract if ewes are assisted during lambing without using proper sanitary precautions.

Stiffness of limbs and difficulty in moving or walking are commonly the first symptoms of tetanus. These early symptoms are very similar to those seen with white muscle disease (see page 52), polyarthritis, erysipelas, and navel ill (see page 38). Animals are easily excited and may show spasmodic jerking of the muscles. Later the jaw may become rigid and the animal is unable to open its mouth. Spasms of the neck and back muscles cause extension of the head and neck. The hind legs are normally rigid and extended backward. Affected lambs may fall to the ground when excited.

¹This discussion of diseases is based on material from The Sheepman's Production Handbook.
Control and Treatment. Very few affected lambs recover and there is no satisfactory treatment. Where tetanus is a problem, preventive measures must be used. Elastrator bands are not recommended for docking and castration in areas where tetanus is an annual problem. All surgical procedures should be carried out in a strictly sanitary manner. If infection is likely, injection of 200 to 300 units of tetanus antitoxin will provide protection for about two weeks. When tetanus is an annual problem, immunization of the entire flock with the toxoid will give the best protection. Ewes can be immunized with two injections 30 to 60 days apart. Give an annual booster just before lambing.

Hemorrhagic Enterotoxemia (Hemorrhagic Enteritis, Overeating Disease, Bloody Scours)

Hemorrhagic enterotoxemia is an acute, highly fatal disease of young lambs caused by the bacterial organism Clostridium perfringens Type C. The disease usually affects young lambs one to four weeks of age. Most frequently, the disease attacks vigorous, single lambs whose mothers are giving an abundance of milk. Small, weak lambs are seldom affected. This disease may affect feeder lambs and older sheep and should be given consideration in acute death losses in animals known to be properly immunized against Type D enterotoxemia (see next section).

The symptoms associated with this disease are variable. Seemingly vigorous lambs may die suddenly without obvious cause. In other cases, the lamb becomes dull and refuses to nurse; it may shiver, bleat, and show signs of colic. Often this occurs during the first few days after birth. Straining may be observed and black or bloody diarrhea may appear, along with fever and depression. As the disease progresses, the lamb may develop spasms before death. The course of the disease may vary from 2 to 24 hours.

Post mortem examination shows a spotted or hemorrhagic condition of the small intestines and stomach. The abomasum, or true stomach, frequently contains a large quantity of milk, only a portion of which may be coagulated.

Treatment. Due to the sudden onset of the disease and early death, drugs have been found to have little effect on the disease. The Clostridium perfringens Type C antitoxin is effective as a treatment, as well as a preventive measure, when given to new-born lambs. The preventive dose is 3 cc; the curative dose is 7 cc.

The most effective means of prevention is the vaccination of the ewe during pregnancy. Ewes should be vaccinated twice, two to four weeks apart, and the second vaccination should be given two to four weeks prior
to lambing. An immunity is developed in the ewe that is passed on to the lamb. Vaccination with Type D bacterin or toxoid does not render the animal immune to the Type C infection. Vaccination of sheep with both Types C and D toxoid or bacterin can be done concurrently where indicated.

This disease has been reported most frequently during periods of cold, wet, or chilling weather. Clean, dry, draft-free lambing sheds help prevent the disease. Crutching or shearing ewes before lambing may also be helpful.

**Enterotoxemia (Overeating Disease, Pulpy Kidney, Apoplexy)**

Enterotoxemia of sheep is a highly fatal intoxication resulting from the sudden release of toxin by the bacteria *Clostridium perfringens* Type D in the digestive tract of sheep.

Enterotoxemia affects sheep of all ages (from birth to several years of age). It is most common in lambs under six weeks of age nursing heavy-milking ewes and in weaned lambs on lush pasture or in feedlots. Creep-fed lambs and sheep being fitted for show are also often affected. Frequently, the large, single, most vigorous lambs in the flock are lost.

Enterotoxemia is one of the most common causes of death in feedlot lambs. In “explosive” outbreaks, losses may range from 10 to 40 percent. In unvaccinated feedlot lambs you can expect a minimum of 1 percent of the lambs to die from this disease; the average death loss is 2 to 3 percent.

*Clostridium perfringens* Type D is normally present in the bowel of most sheep. Under circumstances brought about by heavy feeding, it grows rapidly, enters the small bowel, and produces a powerful poison (toxin) that is absorbed through the intestinal wall, causing death in a few hours. In many instances deaths occur so quickly that owners do not observe sick animals.

The organism responsible for this disease may be present in the intestine of normal sheep with no harmful effects until certain digestive disturbances occur. When normal conditions within the digestive tract are altered, it may provide the causal organism a favorable environment in which to grow and produce its toxin.

The most important predisposing factor is a sluggishness of intestinal movement created by digestive disturbances related to diet, lack of exercise, or excessive feed intake. Occasionally, the disease may be brought about by run-down conditions associated with poor nutrition, other diseases, or parasitism.

Deaths from enterotoxemia usually occur suddenly and without warning. Occasionally, animals may be observed sick for several hours, or even
a day or longer, before they die. Lambs frequently exhibit nervous symptoms; the head is drawn back and the animal shows convulsive movements, grinding of teeth, congestion of mucous membrane of the eye, and frothing at the mouth. Sometimes the animal falls into a coma with death taking place quietly. Diarrhea may be present shortly before death.

Fast-gaining lambs on pasture or creep may require vaccination at six to eight weeks of age. If they continue on high concentrate rations, re-vaccination is recommended after weaning.

Losses may be prevented in young lambs (up to six weeks old) by vaccination of the ewe during pregnancy. Ewes that have not been vaccinated previously should be vaccinated twice, two to four weeks apart with the second vaccination being given two to four weeks before lambing. An annual booster two to four weeks before lambing is advisable.

**White Muscle Disease (Stiff Lamb Disease, Muscular Dystrophy)**

Nutritional muscular dystrophy (white muscle disease) is a degeneration of the skeletal and cardiac muscles of lambs. White muscle disease occurs in a wide range of climates and on many different types of soils and pastures. It is most common in areas of good rainfall or irrigated areas, and the incidence is much higher on legume pasture and in lambs being creep-fed or on other high-quality diets. Pastures heavily fertilized with superphosphate may cause a higher incidence of the disease. A low level of selenium is normally found in the forage. The condition is due to a selenium or vitamin E deficiency. A selenium deficiency may interfere with the transport of vitamin E. Cull beans contain a vitamin E antagonist and should not make up more than 25 percent of the ration fed to ewes during gestation or lactation. It has been reported that alfalfa hay may contain a substance that interferes with the proper utilization of vitamin E.

White muscle disease may be present at birth and may result in death by starvation or exposure, since the affected lambs are unable to suckle. Affected lambs are also more susceptible to scours and acute pneumonia. The disease is more common in lambs three to eight weeks of age but may be seen in older lambs. Skeletal muscles are affected, causing symptoms of progressive paralysis. The back is arched and the lambs are unable to move properly, particularly the rear quarters. They may have an "open-shouldered" appearance because of the relaxing of the muscles of the shoulder girdle, and the forelegs may be spread excessively.

Muscles of the heart, diaphragm, tongue, and esophagus are also commonly affected. Some lambs die suddenly from heart involvement without prior clinical symptoms, usually brought on by increased physical activity. More often, a slow progressive cardiac failure results. This leads to passive
lung edema and slow death from suffocation. Such lambs often breathe very rapidly, and the condition may be confused with pneumonia.

**Prevention and Treatment.** Studies have been conducted along three routes of treatment and prevention — oral, injections, and fertilization of pastures with selenium. Selenium cannot presently be included in animal rations. When experience indicates white muscle disease is an annual problem, best results are obtained by injecting ewes with selenium-tocophoral 1 to 4 weeks before lambing. When white muscle disease is diagnosed in a flock, it is recommended all lambs be treated at birth. Affected lambs will respond to selenium or selenium and vitamin E injection. Wheat and linseed oil meal in the ration of pregnant ewes and linseed oil meal in creep rations may be effective in reducing the incidence of this disease.

**Urinary Calculi (Urolithiasis, Water Belly, Kidney Stones)**

The occurrence of urinary calculi in sheep is rather widespread. The incidence may be quite high in some areas while relatively low in other areas. Rams and wethers in feedlots or on high-concentrate rations are most often affected, but the condition can occur in sheep being grazed on succulent pastures or on grain stubble. Rations high in phosphorus content or rations with a phosphorus-calcium imbalance are often associated with a high incidence in feedlot lambs. There is some indication there is a higher incidence in diethylstilbestrol-implanted lambs than in nonimplanted lambs in the feedlot.

Salts normally excreted in the urine are precipitated and form calculi (stones) that may lodge in the pelvis of the kidney, in ureters, the bladder, or the urethra. The composition of the stones may vary, depending on the ration fed.

Affected animals stand with the back arched and strain to pass urine. The animal may kick at the belly, prefer to lie down, become rather dull, and be disinterested in feed or water. In severe cases of some duration, watery swellings (edema) of the lower abdomen may develop.

**Prevention and Treatment.** Prevention of the disease by proper management is essential, as treatment is often ineffective. A clean, constant source of water should be available to sheep. During winter months water should be heated to prevent freezing and to encourage greater water consumption. Avoid excess phosphorus content in the ration. When concentrate rations high in phosphorus are fed, it may be advisable to add feeding-grade limestone to the ration in sufficient quantities to increase the calcium level above the phosphorus level of the diet. The calcium-phosphorus ratio in the ration should be at least 1½:1 and preferably closer to 2:1.
Ammonium chloride added to the ration at the rate of 0.5 percent (8 to 10 lb./ton) or about 0.25 ounce per head per day will give almost complete control. In areas where there is a history of urinary calculi, ammonium chloride should be included in the pelleted or ground concentrate ration during the entire feeding period. Ammonium chloride cannot be effectively mixed with whole grain rations, as it settles out and will not be consumed. Ammonium chloride is also rather unpalatable. It may be mixed with liquid molasses or other more palatable substances and applied to the grain ration. Ammonium chloride acidifies the urine, thus keeping the calculi-forming material in solution.

Ammonium chloride may also be used as a drench for affected animals. Doses up to 1½ ounces per head can be used but should be administered only once at that level. Smooth muscle relaxants may aid in the passage of lodged calculi. If the stone is lodged near the tip of the penis, the condition may be relieved by cutting off the urethral process. Calculi also may be removed by surgery but this method is rather impractical.

**MANAGEMENT ON PASTURE**

Your sheep will get the most out of pastures if you do as follows:

1. Wait until pastures are ready before turning in the flock. Most forage should be 6 to 8 inches high before being grazed. Sorghum-sudangrass hybrids should be approximately 18 inches high before being grazed.

2. Use a moderate stocking rate to prevent close grazing. Stocking rates will vary with pasture forage used, season, and fertility level. If pastures become short because of drouth or overstocking, wean all lambs that are old enough and put them on feed and drylot.

3. If possible, rotate pastures at two- to three-week intervals. Clip pastures at the end of each grazing period to encourage new growth, retain legumes in the pasture mixture, and control weeds. Grazing with cattle will increase pasture productivity, as measured by animal gains.

4. Provide clean water and shade.

5. Fertilize and lime your pasture regularly for maximum forage production.

**PARASITE CONTROL**

Failure to effectively control internal and external parasites can result in greatly decreased performances of ewes and lambs. Severe cases of
parasitism often cause death. Good parasite control is one of the management practices that pays big dividends.

**Internal Parasites**

Parasite control programs are directed primarily toward the control of the stomach worm (the most common internal parasite), tapeworms, and lung worms. Other internal parasites, such as smaller round worms, nodular worms, whip worms, and liver flukes, are occasionally reported. If you suspect your sheep have these internal parasites, your veterinarian can identify them and suggest proper treatment.

For the most effective control of internal parasites, drench the brood flock and replacement stock at least three or four times a year: once before turning sheep out to pasture in the spring, once or twice during the summer and early fall, and again when the sheep are brought into the barn for the winter. Lambs that are born early and are marketed without going to pasture will usually not need drenching. Those that are to go on pasture should be drenched regularly, the same as the brood flock.

Don’t use the same drench throughout the year, but alternate at least two different ones. If you use only one product, the parasites that are not eliminated may become at least partly immune to it. Common drenching materials are Phenothiazine, Phenothiazine-arsenate of lead, Tramisol, Loxon, and Thiabendazole. Allow sheep free access to a Phenothiazine-salt mixture during the pasture season if you wish, but don’t use this as a replacement for a routine worming program.

This picture indicates the proper method of drenching. Note that the nose and jaws have been clamped shut.
Providing rotation pasture or rotating sheep on permanent pasture is also an effective means of reducing internal parasite problems.

**External Parasites**

External parasites can be controlled best by following a yearly dipping program. Use a toxaphene solution or other dipping preparations recommended for livestock use and recognized by the USDA and the Illinois Department of Agriculture. Ticks, lice, and mites can be very detrimental to the performance of sheep of all ages, especially to the quality and value of the wool produced.

Ticks are probably the most common external sheep parasites. They are brown, have six legs, are about 3/16 to 1/4 inch long, and can be easily seen when the fleece is parted. By sucking blood from the skin of sheep, ticks cause irritation, restlessness, rubbing, and loss of wool.

There are two kinds of sheep lice, the biting louse and the sucking louse. The more common is the red-headed biting louse. It is very small — seldom more than 1/25 of an inch long — and looks much like a timothy seed. You can see lice either in the wool or on the skin. The damages to sheep are mainly an irritation of the skin, which causes sheep to rub off their wool, and an unthrifty condition caused by restlessness.

Four species of mites affect sheep: the psoroptic or scab mite, the chorioptic or foot scab mite, the sarcoptic or head scab mite, and the
psorergates mite, which lives between the layers of skin. The scab mite causes the greatest damage to flocks. It is one of the most destructive external parasites and also one of the most difficult to control. This parasite is only 1/50 of an inch long and burrows into the skin. The sheep rubs itself and pulls at the wool to relieve the irritation and itching. Hard scabs form in the affected areas and the sheep loses condition rapidly. Since sheep scab is such a highly infectious disease, treatment must be prompt and effective. Federal and state programs have practically eliminated scabies from the United States.

Dipping should be done on a bright, sunny day if possible, but do not wait for the ideal day if scab has been diagnosed. Few farms have permanent dipping vats, but portable dipping vats are available throughout much of the state. If neither type is available, the sheep may be sprayed. Spraying calls for more material and is usually not so effective as dipping. Dusting is a difficult and dirty job and is less effective than either dipping or spraying. The operator should wear a respirator for protection when he is dusting.

**FOOT HEALTH**

It is very important to keep the feet of all sheep well trimmed. Foot problems keep sheep from performing at the highest level. These problems are much easier to prevent than to cure.

*Suggestions for Foot Care*

1. Trim the feet of all sheep twice a year. Use a sharp knife, pruning shears, or foot rot shears.
2. Isolate all new sheep until their feet have been carefully inspected and trimmed.
3. Do not allow sheep to travel through deep mud or manure.
4. Catch lame sheep and examine their feet as soon as you notice the lameness.
5. To minimize pasture contamination, isolate all sheep that have any type of foot infection.
6. Sell for slaughter all sheep that do not respond to treatment.

Foot problems may be caused by foot rot, foot abscess, and foot scald; lack of timely and proper foot care; poor foot development caused by tissue abnormalities, nutrition, and genetics; injury from cinders, gravel, and plant stubbles; and lip and foot diseases, such as contagious ecthyma.
**Foot Rot**

Foot rot is a highly contagious disease; in severe outbreaks it may affect up to 75 percent of a flock at a time. The infection may persist for years in the feet of sheep but dies in soil, usually within 14 days. Although the mortality rate from foot rot is low, loss of condition of adult sheep and nursing lambs and the increased labor, equipment, and materials to treat the disease make it one of the most costly sheep diseases. Foot rot is infrequently seen in areas of sandy, well-drained soils and in regions of low rainfall but may be a major problem on irrigated pastures, wet lowland pasture, and areas of high rainfall.

Foot rot of sheep commences with inflammation of the skin at the skin-hoof junction, a progressive necrosis of the deeper layers of the epidermis with underrunning of the horn, inflammation of the sensitive laminae of the foot, and severe lameness. Foot rot is primarily an invasion of the horny hoof, and the infection spreads rapidly throughout the horny tissue. There is a foul characteristic discharge but no abscesses are formed. The hoof growth often becomes distorted, and frequently sheep will put little or no weight on an affected foot. The organisms causing foot rot require an oxygen-deficient environment for growth. Therefore, overgrown, rolled-under hooves in wet, muddy, unsanitary conditions provide an excellent environment for these organisms. The well-worn or trimmed hoof is seldom affected.

There is great variation in the incidence of the disease, which is influenced greatly by weather and temperature. Concentration of large numbers of sheep in small areas contributes to the rapid spread of the infection. Walking over contaminated pastures or areas where infected sheep have been is the principal method of transmission. Complete control can seldom be accomplished in one season but requires a carefully planned inspection program for several years.

**Control.** To effectively control foot rot, all feet of all sheep in the flock must be inspected. Where foot rot is a problem, a control program should be initiated during the dry season and strictly adhered to regardless of weather conditions or development of foot rot problems.

1. Trim all feet of every sheep and treat in a foot bath. If hooves are dry and hard, soaking feet in foot bath or wetting the holding corral will facilitate trimming.

2. Identify affected sheep and isolate as a hospital band.

3. Retreat affected sheep a minimum of every three days for at least four treatments.

4. Inspect affected sheep every two weeks.

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1 Based on material from *The Sheepman’s Production Handbook.*
5. Place recovered sheep in a convalescent band.

6. Sheep in the convalescent band that pass two clean inspections 30 days apart and are treated at the time of each inspection may be returned to the clean band.

7. The infected band should have treatment continued as the individuals require.

8. The clean band must pass two inspections 30 days apart with no affected sheep being discovered. Inspect the clean flock twice yearly.

9. New sheep must be isolated and pass inspections 30 days apart before being introduced into the flock.

10. When the flock is inspected, clean sheep must go to a pasture that has had no sheep on it for at least two weeks.

Foot Abscess

Foot abscess is a widespread disease that is sporadic in occurrence. It is infectious but not contagious like foot rot or foot scald. Foot abscess is a disease of the soft structures of the foot. The conditions under which foot abscess occurs may be varied and are related to several contributing factors. Foot abscess may occur under extremely wet or muddy conditions; after severe trimming in wet weather; after sheep have been placed on stubble, particularly barley or safflower stubble; and in conjunction with severe outbreaks of foot rot.

The infection may gain entry in the toe or sole, causing no visible swelling, or between the heels, producing an area of granulation tissue followed by severe swelling. In the toe type the foot becomes hot and tender. Frequently, a sore spot can be located. If drainage can be established, the foot will rapidly return to normal. When the infection invades the heel, small areas of granulation tissue may develop. The foot is painful to the animal and frequently is swollen above the coronet. Joints and tendons may become involved and permanent lameness may result.

Foot Scald

Foot scald is a contagious disease caused by the same organisms, or perhaps a different strain of the same organisms, that cause foot rot. Foot scald may actually be an early superficial form of foot rot. Foot scald is rather sporadic in its occurrence but is found mostly during periods of extremely wet weather.

In early stages, foot scald resembles foot rot but in later stages is much less severe. Foot scald commences with inflammation of the skin between the claws and progresses to the rear portion of the heels, causing separa-

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\(^1\) Based on material from The Sheepman's Production Handbook.

59
tion from the hoof. Sheep may be slightly to moderately lame, depending on the stage of infection. Apparently, the forefeet are more often affected than the rear feet.

**Footbath Solutions**

If a footbath is needed, use a solution of 20 to 25 percent copper sulfate, 5 to 10 percent formalin, or 10 percent quaternary ammonia. You can also use 2, hydroxymethyl-2-nitro 1, 3-propanediol diluted 1:17 with water or an iodophor concentrate diluted 2 ounces per gallon. Let sheep stand in a footbath for at least 3 to 4 minutes, and treat every second or third day for four treatments. Follow a sound yearly foot-health program to minimize foot troubles.

**LAMB MARKETING**

Even though lamb prices have continued to be relatively strong during recent years, they often hit a high in late spring and early summer.

Large-framed, rapid-gaining lambs that will grade choice or prime should be marketed at approximately 100 to 115 pounds, or even 5 or 10 pounds heavier if they will not be penalized in price. Small-framed lambs that finish out at light weights should be marketed at approximately 90 pounds.

Lambs should be pushed for an early market. If they are carried through the summer, they often gain more slowly and less efficiently, have more parasites, grade lower, and have a higher death loss.

Suckling lambs will shrink a great deal en route to market. To reduce this loss, you should sort, transport, and weigh them in as short a time as possible. Try to sort spring lambs for shipment the day they are to be sold.

Most Illinois lambs are sold through terminal markets, local pools, and auctions. However, some large commercial flocks move lambs on a direct basis by selling to either a packer representative or an order buyer. Your choice of a market will depend on current prices, markets in your area, numbers of lambs you have to sell, and available transportation.

Easter lambs are milk-fat lambs weighing 40 to 45 pounds. They are sold to meet the demand during the Easter season. Although the price per pound for Easter lambs may seem high, the most important consideration in selling to this specialty market is the number of dollars you will receive per head. Lambs that are ready for the Easter market in late March or April will probably weigh 90 to 100 pounds in June, the normal peak in spring lamb prices, so you must figure carefully to see what will be the most profitable way to market such lambs.
LAMB CARCASS SHOWS

When asked by a city person, "What are lambs used for?" an enthusiastic young sheep showman replied, "To show!" More realistically, lamb shows, especially lamb carcass shows, provide the sheep producer an opportunity to evaluate the product he is producing and thereby guide his decisions in management, breeding, and feeding. A show does not in itself represent the endpoint of lamb production but is merely a means to improve the efficiency of production in terms of lean, high-quality meat.

Continued efforts must be made toward carcass improvement in order to make progress. Consider the following summation of the results of the Illinois Spring Lamb Carcass Show for 1972 through 1976:

<table>
<thead>
<tr>
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<td>97</td>
<td>110</td>
<td>66</td>
<td>65</td>
<td>109</td>
</tr>
<tr>
<td>Number failing to grade Ave. Choice</td>
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<td>3</td>
<td>5</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Number failing to have 0.1&quot; loin fat</td>
<td>11</td>
<td>10</td>
<td>11</td>
<td>8</td>
<td>4</td>
</tr>
<tr>
<td>Number failing to have 40 lb. HCW</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Number failing to meet LEA requirements ¹</td>
<td>42</td>
<td>65</td>
<td>48</td>
<td>44</td>
<td>62</td>
</tr>
<tr>
<td>Number of ram lambs</td>
<td>23</td>
<td>23</td>
<td>17</td>
<td>19</td>
<td>20</td>
</tr>
<tr>
<td>Number of ram lambs qualified</td>
<td>15</td>
<td>10</td>
<td>3</td>
<td>4</td>
<td>11</td>
</tr>
</tbody>
</table>

¹ LEA requirements (based on hot carcass weight):

<table>
<thead>
<tr>
<th>Hot carcass weight (lb.)</th>
<th>Minimum LEA</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-45</td>
<td>2.2</td>
</tr>
<tr>
<td>46-50</td>
<td>2.3</td>
</tr>
<tr>
<td>51-55</td>
<td>2.4</td>
</tr>
<tr>
<td>56-60</td>
<td>2.5</td>
</tr>
<tr>
<td>61-65</td>
<td>2.6</td>
</tr>
<tr>
<td>66+</td>
<td>2.7</td>
</tr>
</tbody>
</table>

It is evident that more work in testing and selection must be done for lamb producers to move lamb into the competitive consumer market for high-quality nutritious meat.

Special notice should be made by all in the sheep industry to the carcass data from ram lambs. Certainly this is a progressive way to increase efficiency of food production through animals as evidenced by their rapid rates of gain and their lean, meaty, yet high-quality, carcasses. The one disadvantage for ram lambs, according to well-known and documented experiences by lamb slaughterers is the difficulty with which their pelts are removed.

Details concerning lamb carcass evaluation procedures are given in mimeograph AS668, *Lamb Carcass Information: Collection and Interpretation*. This is available from your local county adviser or directly from the University of Illinois Animal Science Department.
The production of fast-gaining lambs that have trim, heavy-muscled carcasses should be one of the goals of all sheep producers. The carcass (left) and loin eyes (below) are from such a lamb. Carcass data are given on the facing page.
The detailed carcass cut-out information that follows is from the Champion Lamb On-Foot at the 1975 Illinois State Fair, pictured on page 62. This lamb had an excellent set of carcass data and would have provided strong competition in the carcass show.

Live weight at the fair (8/9/75) ........................................... 91 pounds
Slaughter weight at U of I (8/19/75) ................................. 92 pounds
Hot carcass weight .......................................................... 53.5 pounds
Dressing percent ............................................................... 58.2
Conformation ................................................................. Average Prime
Maturity ............................................................................. A
USDA quality grade ......................................................... High Choice
Fat thickness:
   Top of loin ................................................................. 0.1 inches
   Lower rib .................................................................... 0.3 inches
Loin eye area ................................................................. 2.69 square inches
Percent kidney fat .......................................................... 1.5
USDA yield grade .......................................................... 2.0

Carcass Cutout

<table>
<thead>
<tr>
<th></th>
<th>Weight (pounds)</th>
<th>Percent of carcass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hindsaddle</td>
<td>26.1</td>
<td>50.2</td>
</tr>
<tr>
<td>Hindsaddle less kidney fat</td>
<td>25.3</td>
<td>48.7</td>
</tr>
<tr>
<td>Frenched legs</td>
<td>15.6</td>
<td>30.0</td>
</tr>
<tr>
<td>American legs</td>
<td>14.1</td>
<td>27.1</td>
</tr>
<tr>
<td>Boneless legs</td>
<td>11.75</td>
<td>22.6</td>
</tr>
<tr>
<td>Loins, bone-in</td>
<td>4.75</td>
<td>9.1</td>
</tr>
<tr>
<td>Loins, boneless</td>
<td>4.0</td>
<td>7.7</td>
</tr>
<tr>
<td>Racks, bone-in</td>
<td>3.9</td>
<td>7.5</td>
</tr>
<tr>
<td>Racks, boneless</td>
<td>2.6</td>
<td>5.0</td>
</tr>
<tr>
<td>Shoulders, boneless</td>
<td>9.9</td>
<td>19.0</td>
</tr>
<tr>
<td>Roasts and chops (boneless legs and shoulders, bone-in loins and racks)</td>
<td>30.3</td>
<td>58.2</td>
</tr>
<tr>
<td>Lean trim</td>
<td>8.5</td>
<td>16.3</td>
</tr>
<tr>
<td>Total retail product</td>
<td>38.8</td>
<td>74.5</td>
</tr>
<tr>
<td>Boneless primals (leg, loin, rack, shoulder)</td>
<td>28.3</td>
<td>54.3</td>
</tr>
<tr>
<td>Fat trim</td>
<td>3.4</td>
<td>6.5</td>
</tr>
<tr>
<td>Bone</td>
<td>10.2</td>
<td>19.6</td>
</tr>
</tbody>
</table>

All who enter carcass shows are most heartily congratulated. You are setting the pace for industry improvement through your interest in carcass evaluation.
WOOL PRODUCTION AND MARKETING

Value of Wool

Harvest the wool crop carefully, for it is a valuable product. Wool is one of the highest priced products sold from the farm, and in many cases it is one of the most poorly managed. It accounts for 10 to 25 percent of the gross returns from sheep.

Fleece weights of brood ewes and rams are important. For example, take two extremes, one ewe shearing 7 pounds and another shearing 14 pounds. With wool, including incentive payment, at 72 cents a pound and lamb at 42 cents a pound, the light-shearing ewe would have to raise 12 pounds more lamb than the heavy-shearing ewe in order to produce the same gross income. It may be well worth your time to pay more attention to the fleece weights of your breeding stock.

Care and Marketing of Fleeces

Working at a wool pool and watching wool come in to be graded show that wool is one of the most poorly handled farm products marketed. Some sheepmen get only half of what their wool should have been worth, because they have marketed fleeces that are full of hay, straw, burrs, manure, mud, or other foreign material. Fleeces are often tied with everything from baling wire to binder twine. Paper twine is the only acceptable product for tying fleeces.

When you shear sheep and handle fleeces, there are certain important procedures to follow:

1. Shear only when the wool is dry.
2. Clean the straw off the belly and legs before starting to shear.
3. Shear on a clean, dry surface.
4. Avoid second cuts; remove the fleece in one piece.
5. Remove all tags, dung locks, and stained wool from the fleece, and bag them separately.
6. If there is a lot of hay, chaff, or other material in the neck area, remove this section of the fleece and bag it separately.
7. Bag separately black fleeces or fleeces with a large amount of black in them. Remove black leg and face wool from the fleece and bag with black fleece wool.
8. Roll fleece with the flesh side out and tie securely, but not too tightly, into a neat package.
9. Tie fleeces with paper twine only.
Here a properly tied fleece is being inspected for staple length and grade. Note the wool bag in the background where the fleece will be stored until sold.

10. Store the tied fleeces in a wool bag in a clean, dry area that is protected from dust, dirt, and rodents. Don't store in plastic bags (the kind used for garbage or lawn clippings) or paper bags.

If you live in an area that holds a wool pool, it may be to your advantage to market through the pool. At least check present wool prices before you sell to local buyers so you will have an idea what your wool is worth.

**Wool Grades**

The current U.S. standards for grades of wool have been in effect since January 1, 1966. These standards designate 16 numerical grades designed to give the wool industry a more precise and objective means of evaluating wool grades. The grades still retain their traditional numbers, which originally reflected spinning count. Spinning count is based on the number of hanks of yarn (each hank is 560 yards in length) that can be spun from one pound of wool top.

Present standards specify average fiber diameter limits for each grade in terms of microns (1/25,400 of an inch). Each grade also contains limits on the variation in diameter allowed among the individual fibers in the lot. If the variability of the individual fibers is greater than the limits specified in the standards, the wool will be graded at the next lower grade.
These standards also provide for the grading of wool by both visual appraisal and actual measurement of fiber diameter.

Before January 1, 1966, the American or blood system and the numerical system were both commonly used; however, producers generally refer to the blood system when discussing wool grades. In the blood system, wool is placed into one of seven major grades based on diameter of fiber. A comparison of the official U.S. grades and the blood system follows.

<table>
<thead>
<tr>
<th>Official U.S. grades</th>
<th>Average fiber diameter (microns)</th>
<th>American or blood system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finer than 80's</td>
<td>17.69 or less</td>
<td>Fine</td>
</tr>
<tr>
<td>80's</td>
<td>17.70-19.14</td>
<td>½ blood</td>
</tr>
<tr>
<td>70's</td>
<td>19.15-20.59</td>
<td>¾ blood</td>
</tr>
<tr>
<td>64's</td>
<td>20.60-22.04</td>
<td>¼ blood</td>
</tr>
<tr>
<td>62's</td>
<td>22.05-23.49</td>
<td>Low ¼ blood</td>
</tr>
<tr>
<td>60's</td>
<td>23.50-24.94</td>
<td>Common</td>
</tr>
<tr>
<td>58's</td>
<td>24.95-26.39</td>
<td>Braid</td>
</tr>
<tr>
<td>56's</td>
<td>26.40-27.84</td>
<td></td>
</tr>
<tr>
<td>54's</td>
<td>27.85-29.29</td>
<td></td>
</tr>
<tr>
<td>50's</td>
<td>29.30-30.99</td>
<td></td>
</tr>
<tr>
<td>48's</td>
<td>31.00-32.69</td>
<td></td>
</tr>
<tr>
<td>46's</td>
<td>32.70-34.39</td>
<td></td>
</tr>
<tr>
<td>44's</td>
<td>34.40-36.19</td>
<td></td>
</tr>
<tr>
<td>40's</td>
<td>36.20-38.09</td>
<td></td>
</tr>
<tr>
<td>36's</td>
<td>38.10-40.20</td>
<td></td>
</tr>
<tr>
<td>Coarser than 36's</td>
<td>40.21 or more</td>
<td></td>
</tr>
</tbody>
</table>

**Marketing Wool**

Selling your wool for the best possible price is important. A higher price per pound means not only a larger check when sold but also a larger wool incentive payment. Most Illinois wool clips are marketed through area wool pools, consigned to wool marketing cooperatives in neighboring states, or sold to wool buyers or their representatives.

When wool is delivered to area wool pools, each fleece is graded according to fineness, length, color, and cleanness. Each producer’s clip is weighed by grade and stored with other fleeces of the same grade. At the end of the pool, the wool is sold by grade on a sealed bid basis. Each consignor is paid for his consignment on the basis of grade and sales price.
Wool cooperatives from several neighboring states are accepting wool on a consignment basis through Illinois points. Wool delivered to one of these points is weighed and a cash advance or partial payment is made. The wool is shipped to the cooperative's warehouse to be fleece-graded. Each grade is weighed and stored or shipped with other wool of the same grade. The consignor receives final settlement on the basis of grade and price received for that grade, minus the amount of the cash advance.

Wool sold to local dealers is usually sold on a cash basis. Many shearers also buy wool on this basis. These outlets may or may not pay a price differential for various grades.

This circular was prepared by G. E. Ricketts, Extension Specialist in Sheep and Beef Performance Testing, and F. C. Hinds, Professor, both of the Department of Animal Science, University of Illinois at Urbana-Champaign; and by J. M. Lewis, Associate Professor of Animal Science, Dixon Springs Agricultural Center. The authors express their appreciation to J. R. Romans, T. R. Carr, M. E. Mansfield, A. R. Cobb, and M. H. Wallace for their contributions to this publication. Some parts of this circular are based on material in The Sheepman's Production Handbook (revised edition, 1975) and are used with permission of the Sheep Industry Development Program, Incorporated, Denver, Colorado.