FEEDING PROBLEMS WITH SHEEP

by Damon A. Spencer

THOUGH this article deals briefly with some of the nutritive requirements of sheep, in the main the author is concerned with practical feeding. He tells about the fattening of lambs, hothouse lamb production, "flushing" ewes, feeding the farm flock, feeding on the range, poisonous plants—and finally, the relation of nutritional research to the problems of the sheepman.

Sheep are naturally adapted to grazing on pastures and ranges that supply a variety of forage plants (fig. 1, A and B, fig. 2, A). They do best on forage that is short and fine rather than high and coarse (238, 749). They will eat considerable quantities of brush, but they prefer chiefly choice grass and legumes and lush, palatable weeds (222). It is seldom profitable to feed grain to breeding sheep or even to suckling lambs when they can have an abundance of succulent grazing forage (751). In some environments flocks can be kept in good thrifty condition and lambs can be raised to the marketing stage without the feeding of any grain (474). One hundred pounds of grain in a year for one ewe and her lambs is the maximum quantity that is likely to be profitable.

Deep snows, extreme droughts, overstocked pastures and ranges, and other conditions that adversely affect grazing make it necessary to feed sheep from the stack, mow, and bin. Sheep are fond of good roughage and they are able to make good use of it. They can obtain most of their needs for protein, calcium, and vitamins, especially vitamins A and D, from an abundance of well-cured legume hay (819). Good legume roughage provides ample nutrients for breeding ewes during the winter up to about a month before lambing time. From that time until pasture is abundant extra nutrients should be provided in the form of concentrates, such as a mixture of equal parts by weight of oats, corn, and bran, together with about 10 percent by weight of cottonseed or linseed meal. The rapid growth of the unborn lambs during the last month of pregnancy may justify a daily allowance of

1 Damon A. Spencer is Senior Animal Husbandman, Bureau of Animal Industry.
2 Italic numbers in parentheses refer to Literature Cited, p. 1075.
Figure 1.—A, Sheep grazing on the high summer ranges of the Targhee National Forest, west of Yellowstone Park, in Idaho. B, A band of sheep at sundown on the spring-fall sagebrush range of the United States Sheep Experiment Station, Idaho. The camp wagon is the sheep herder's home.
one-fourth to one-half pound of this or a similar mixture of concentrates for each ewe until lambing and a gradual increase after lambing up to three-fourths of a pound or possibly 1 pound a day until pasture is abundant. The nutritive requirements of ewes nursing lambs are, in principle, like those of dairy cows in milk (838). The ewes need much more protein and digestible nutrients than before lambing.

Since wool fibers are composed of protein, sheep need feeds that contain a liberal supply of this nutrient to produce a good wool crop. Wool is rich in the sulfur-containing amino acid cystine, but there appears to be sufficient cystine in ordinary rations that are otherwise satisfactory for sheep (819).

In some sheep-producing regions farmers and ranchmen have difficulty in growing adequate supplies of legume hays such as alfalfa, clover, or soybeans, and they are compelled to feed timothy or native grass hay, straw, or corn stover. These nonleguminous roughages may be supplemented with such protein-rich concentrates as linseed meal, cottonseed meal, soybean-oil meal, or soybeans at the rate of about one-quarter to one-half pound per ewe per day. Timothy hay cut in the early stage of maturity or before full bloom is much more satisfactory for sheep than when it is cut fully ripe (90, 91).

Sheep are particularly fond of salt and consume considerably more per 100 pounds of live weight than do cattle. Breeding sheep may consume nearly one-half ounce per head daily and fattening lambs from one-fifth to one-fourth ounce. When sheep are accustomed to salt it is best to let them have access to it in suitable containers so that they may take as much as they desire (198). On western ranges in areas where there is considerable alkali, sheep are allowed no salt other than that which they get in the alkali. This seems to be safe in cases where the alkali contains at least 85 percent of salt.

Calcium supplements must be fed to sheep when their roughage consists only of nonleguminous plants grown on soils low in calcium. They may be fed about one-quarter ounce or more per head daily of ground limestone or some other calcium supplement in the form of a mixture of two parts calcium supplement to one part common salt by weight (382). If the roughage, on the dry basis, is at least a third good legume hay or other legume forage, this third should supply plenty of calcium. If there appears to be need for a supplement containing phosphorus, this may ordinarily be fed in the form of a mixture of 2 parts of bonemeal to 1 part of common salt by weight. In the feed lots, however, phosphorus is less apt to be lacking in the usual sheep rations than is calcium (819).

Iodine may have to be fed to ewes in districts where there is trouble with goiter in newborn lambs (88, 354). In such cases the ewes should be fed iodized salt at least during the last half of pregnancy. An allowance of one-twentieth of a grain of potassium iodide per head daily is enough to prevent goiter. It is safest not to allow more as too large doses may be injurious. Experimental evidence indicates that other minerals, including iron, copper, sulfur, cobalt, and potash salts, need not be added to the usual rations for sheep (225). In some areas not yet important for sheep raising there may be a deficiency of one or more of these minerals in the forage plants great enough to interfere with the normal development of sheep.
The most recent experimental findings on vitamin requirements of sheep indicate that vitamin A is the only one that is likely to be lacking in the usual sheep feeds, and this deficiency is generally found in such roughage as cereal straw, poor-quality hay, or cottonseed hulls. Early-cut, well-cured hay is high in vitamin A, or rather carotene, and if such good hay makes up a substantial part of the ration there should be sufficient vitamin A for sheep (498).

The requirement of sheep for vitamin A is about the same per unit of body weight as that of other farm animals. Experimental results with the usual feeding practices, however, indicate that it is necessary to feed sheep winter roughage of better quality than that sometimes used for breeding cows. This may be due to the fact that sheep have lower reserves of vitamin A than cows when they go into the winter feed lots (87).

Under ordinary conditions it is essential to furnish sheep with plenty of fresh water (271). On dry feed ewes drink from 1 to 1½ gallons a day and fattening lambs slightly more than 1 quart up to 2 quarts a day. When succulent feeds are provided, sheep drink less than when they are on strictly dry feeds, and when the weather is hot they drink more than when it is cool or cold. During late fall, winter, and early spring range sheep often derive their principal water intake from snow.

**THE FATTENING OF LAMBS**

All lamb producers in regions that provide pastures and ranges yielding the abundance of succulent, nutritious forage essential for early fattening (560) desire to produce milk-fat lambs—that is, lambs that are sufficiently finished to be slaughtered at weaning time. Many lambs, however, are raised on pastures and ranges that are not adequate for finishing at the weaning age of 4 to 6 months, and even on the best forage some mutton-type lambs and a large proportion of the lambs of the fine-wool type cannot be finished by weaning time. For these reasons a rather large proportion of the lamb crop of the United States must be fattened to a slaughter finish after weaning (fig. 2, B). The nutritive requirements of these feeder lambs are therefore an important problem in the sheep-feeding enterprise.

Corn is the grain most used in the United States as the chief fattening concentrate for lambs, but in some regions barley or sorghum grain is more readily available and is fed in the place of corn. Oats have been successfully substituted for corn in lamb-fattening rations (631). When available at reasonable prices, corn and alfalfa hay are preferred by most lamb feeders as the basal lamb-fattening ration (968). The primary needs are a fat-producing concentrate rich in carbohydrate and a roughage, such as legume hay, relatively rich in protein (1063).

When silage, especially corn silage, is available at reasonable cost, it may be economical to include it in the lamb-fattening ration together with a protein-rich meal such as cottonseed or linseed (613). Such a ration may consist of 7 parts of corn by weight and 1 part of cottonseed meal, plus corn silage and clover hay (473). If lambs on full feed are fed twice a day as much of the mixture of corn and cottonseed meal as they will clean up by the time they leave the trough, as much
Figure 2.—A, A farm flock on pasture in Virginia; B, lambs in a Colorado feed lot, at grain troughs on the left and at hay racks in other parts of the lot.
of the corn silage as they can clean up in about an hour, and as much hay as they will consume by the next feeding time, the daily allowance per head will be approximately 1½ pounds each of concentrates, silage, and hay, or a total of about 4 pounds of feed a day (631). Such a ration would approximate the requirements of normal lambs entering the feed lot at an initial average body weight of about 60 to 65 pounds and finishing in about 80 to 90 days at average final live weights of 90 to 95 pounds at the feed lot (768, 1196).

Such carbohydrate-rich concentrates as wheat, rye, or beet pulp may be fed as partial substitutes for the more usual corn, barley, oats, or sorghum grains (594, 734). The prices of these various fattening feeds would have to be considered in determining whether it would be economical to feed them (790). Corn is regarded as the most efficient feed for fattening lambs, but normally the other carbohydrate-rich feeds mentioned are at least 80 to 90 percent as efficient as corn when calculated on the basis of dry-matter content.

Fattening lambs can utilize silage made from plants other than corn—for example, silage made from sorghum, peas and oats, pea vines, and corn and soybeans. Plants should be cut when they are not too green and immature if they are to make the best silage for lambs. This is especially true of sorghum. Other succulent feeds suitable for fattening lambs are turnips, mangels, rutabagas, wet beet pulp, beet tops, cabbage, and cull potatoes, but these contain more water and less solids than the silages mentioned (819).

**FEEDING FOR HOTHOUSE LAMB PRODUCTION**

Hothouse lambs are born in the fall or early winter and finished for slaughter as suckling lambs at the age of about 2 to 4 months at live weights of 40 to 60 pounds, or even less than 40 pounds if they are well finished. The term "hothouse" is used because such lambs are produced during an unusual season of the year, though not necessarily in quarters heated by a stove or furnace. If lambs are to be finished at such early ages and light weights, they must have the inherent capacity to develop and fatten rapidly, and their feeds and the feeds for their mothers must be of excellent quality. Hothouse lambs that measure up to the exacting requirements of the enterprise are often the offspring of Southdown rams and Dorset or Dorset-Merino ewes.

The mothers of hothouse lambs require choice legume hay and grain, and it usually pays to include a succulent feed in their rations so that they may produce plenty of milk. A good combination of feeds for such ewes is a concentrate mixture of 5 parts corn, 2 parts oats, 2 parts wheat bran, and 1 part linseed meal by weight, plus corn silage and well-cured, second-cutting alfalfa hay or similar feeds. The daily allowance per ewe varies, but when the lambs are 1 or 2 weeks old the ewes nursing them should be able to use to advantage about 1 to 1½ pounds of the concentrate mixture, 2 to 3 pounds of corn silage, and 2 to 3 pounds of alfalfa hay a day per head. They should be given as much concentrate as they will clean up before they leave the trough, as much silage as they will clean up in about an hour, and as much hay as they will clean up by the next feeding time.

Hothouse lambs should be fed in a creep (216) as soon as they will nibble at grain and roughage, which they will normally begin to do
when they are about 2 weeks old. In order to get them to consume maximum quantities, only the very choicest feed should be offered and there should be nothing but fresh feed in the troughs and racks. The corn for the young lambs should be cracked and the oats crushed. Otherwise the concentrate mixture may be the same as that for the mother; that is, 5 parts cracked corn, 2 parts crushed oats, 2 parts wheat bran, and 1 part linseed meal, by weight. The alfalfa hay should be as leafy, bright, and excellent as possible and the silage the best available and free from any mold. The quantity of the feed consumed by the lambs will naturally increase as they become older. It is safe, however, to let them have as much as they will clean up each day. Any feed left over at the end of the day should be removed from the troughs and racks and fed to the older sheep.

**“FLUSHING” EWES TO INCREASE LAMB YIELDS**

The practice of extra feeding at breeding time to increase the number of twins produced by ewes is called flushing. This has proved to be profitable in the case of ewes, and of lambs through the suckling period, in regions that provide plenty of nutritious and succulent feed at reasonable cost. Good, nutritious pasture, when it is free from excess moisture which would cause it to be “washy,” has been found effective and normally the most economical source of feed for flushing ewes. In case an abundance of such pasture is not available, however, corn, oats, wheat bran, and other grains may be used. Effective flushing has resulted from feeding about one-half to three-fourths of a pound of grain per ewe daily along with rather sparse forage of ordinary quality. Experiments by the Bureau of Animal Industry show that to flush ewes successfully they must be sufficiently well fed to gain at a rate of at least 1 pound a week per ewe during the breeding season.

**FEEDING SHEEP IN FARM FLOCKS**

In the eastern half of the United States and in the irrigated valleys and dry-land farming communities of the West, sheep are kept in small or moderate-sized flocks of about 20 to 100 head, or in some instances as many as 200 to 300. Most farm flocks are maintained under conditions that make it economical and practical for the breeding sheep to glean much of their feed from stubble and stalk fields in the fall before rains injure the feeding value of the gleanings. Normally, after these feeds have been used, clover and grass pastures are grazed. In regions where winters are open a heavy stand of well-cured bluegrass will help considerably to carry the flock through the winter in good condition. Green pastures of rye or wheat in late fall will provide succulent feed and furnish exercise for the flock. In the South, velvetbeans will be found a great help in carrying the flock into January.

In winter the feeding of the farm flock should be such as will produce vigorous lambs and keep the wool strong and in good condition. Leguminous hays, straws, and cornstalks usually form the main part of economical winter rations. Clover, alfalfa, soybean, or cowpea hay, if of good quality, may be used as the sole feed until near lamb-
FEEDING PROBLEMS WITH SHEEP

ing time, from 4 to 5 pounds per ewe daily being sufficient for ewes weighing less than 150 pounds (238). Oat and wheat straw are better than rye or barley straw. Cornstalks placed where the sheep can eat off the leaves may be used as a part of the roughage ration. If the ration is made up largely of cornstalks or straw a protein concentrate should also be used. Timothy hay is not a good sheep feed unless it is cut when immature or just as it is beginning to bloom (89). As timothy hay is more easily grown than legume hays in much of the farm-flock territory many farm sheep are fed timothy either alone or mixed with clover hay. For this reason it is worth while to emphasize the importance of cutting timothy when immature if it is intended for sheep.

Succulent feeds such as silage or roots are desirable to keep ewes in good health, but they should be fed with some hay. When corn silage is fed to sheep it should be from well-matured corn, and great care should be exercised to avoid spoiled, frozen, or moldy silage. It is not advisable to feed ewes more than 3 pounds of silage per head daily. Turnips should be used sparingly for ewes until after lambing (931).

Each of the following rations contains approximately the quantity of the various nutrients required daily for pregnant ewes weighing from 110 to 140 pounds when in the dry lot:

(1) 3 pounds alfalfa or soybean hay
    2 pounds corn silage
    ½ pound shelled corn

(2) 3 pounds alfalfa hay
    2 pounds corn stover (edible portion)

(3) 3½ pounds alfalfa or clover hay
    2 pounds corn silage

(4) 2 pounds oat straw
    2 pounds corn silage
    ¾ pound shelled corn
    ¼ pound linseed meal

Where ewes can run on wheat or rye pasture during the winter they should also receive some dry or concentrated feed. Silage or roots are not desirable when the forage of the pasture is soft or green (90, 91). One-half pound of cottonseed meal contains the daily requirement of protein for a pregnant ewe. When price suggests the heavy use of this concentrate, the other feeds of the ration should be rich in carbohydrates. It is best to limit the quantity of cottonseed meal to one-fourth pound per head daily, with a good selection of other feeds (238).

During late spring, summer, and early fall, farm sheep in most regions can obtain most of their feed requirements from good pasture (208). In the absence of good pasture it may be necessary to feed them as suggested for the winter period. The quantity of feed should be increased for ewes nursing lambs.

Rams may be fed the same kinds of feed as ewes but in slightly larger quantities. They need a good allowance of relatively high-quality feed just before and during the breeding season, when pasture is not available. After the breeding season, even before there is good pasture, they can be fed less grain and more roughage. The roughage does not need to be of more than fair quality to keep vigorous, mature rams in thrifty condition.
FEEDING RANGE SHEEP

In the western half of the United States a large majority of the sheep are produced in range bands varying in size from a few hundred to more than 2,000 head, but usually containing between 1,000 and 2,000 (fig. 3). They subsist largely on the natural forage of the range, but deep snow, drought, and scanty forage on overgrazed or inferior range make it necessary at times to feed hay and concentrates. Mineral deficiencies are serious problems in some areas where phosphorus, calcium, or iodine may be so inadequate as to necessitate the feeding of these minerals with salt as already suggested (198).

Many forage plants of the western range country cure while standing and provide nutritious feed during the fall and winter. For this reason range sheep can subsist on standing forage during the cold weather better than is generally possible for sheep in the farming regions. Range sheep also browse a great deal in cold weather and utilize rougher feed than at any other time of the year. Many range sheep producers make a practice of feeding some concentrate in the winter and provide an extra supply of feed that may be used during extremely cold and stormy periods (222).

Alfalfa hay is the standard winter roughage for western range sheep in feed lots, but some native hay is fed when alfalfa is not available. If mature sheep are in thrifty condition when they are brought into the feed lot, grain is not usually fed with alfalfa hay, but when native hay is fed a protein concentrate, such as cottonseed cake, is desirable (599). Under the usual range conditions protein concentrates can be fed in the form of cake with greater economy and facility than in the form of meal (598). When alfalfa hay is the only feed provided, about 4 or 5 pounds will be required per ewe daily. A little less than this will be sufficient when grain is also fed. When conditions permit it may be desirable and economical to feed a small quantity of hay and let the sheep graze each day.

Breeding rams may be wintered on roughage and a small quantity of grain, as it is unnecessary to fatten them. A daily allowance of 5 to 7 pounds of fair alfalfa hay, depending on the size of the ram, and 1 pound of whole oats makes a good winter ration for rams in the western range country (222).

When shed lambing is practiced and the lambs are to be born before range forage would furnish good grazing, breeding ewes should receive some grain for about 3 weeks or a month before lambing. Whole oats at the rate of one-half pound a ewe per day makes a good grain ration, but corn, wheat, barley, and various grain mixtures have been successfully fed. Some corn silage, beet pulp, and comparable feed may be fed in limited quantities of 1 or 2 pounds daily per ewe before lambing and in more liberal quantities afterwards. These help to stimulate the milk flow. At this time the best quality of hay is needed.

The following rations are suggested for range ewes:

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<th>Ration before lambing</th>
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Figure 3.—A flock of range sheep in Idaho.
These rations are suitable for range ewes of about average size, weighing from 110 to 140 pounds. Ewes with twin lambs may need a little more grain and succulent feed (192). The feeds in the rations are normally grown in the irrigated valleys of the western range country.

POISONOUS PLANTS

Some of the most serious feeding problems encountered by range sheep producers result from poisonous plants that are eaten by sheep while grazing (1093, pp. 263–264). Plants that cause sickness and death among sheep occur in all parts of the United States. However, because of the greater number of sheep on the range and the method of handling them, the losses of economic importance are confined largely to the western range country. Where good forages are plentiful, sheep that are left to themselves or that graze in loose formation seldom eat enough of any poisonous plant to suffer from its effects; but under the system of close herding that prevails in many regions, where sheep eat practically all the vegetation as they move along, they are more liable to poisoning, and sometimes heavy losses occur.

The three groups of plants on the western ranges that are especially destructive to sheep are the species of death camas found in the higher parts of the Great Plains and west to the Pacific; the locoes, especially white loco, found on the Great Plains from Canada to Mexico; and the lupines, which are even more widely distributed than death camas. Lupine leaves rarely, if ever, injure sheep, but the pods and seeds, which are eaten during the summer and fall months, have caused heavy losses.

The laurels and leaves of wild cherries both in the East and in the West, the milk weeds and rayless goldenrod of New Mexico and Texas, the Colorado rubber plant of Colorado and New Mexico, and the coffee bean of Texas are some of the other plants that cause losses. The western sneezeweed is especially harmful in Utah and some parts of the Southwest.

No practical methods have been devised for eradicating most of these poisonous plants. However, a careful herder who is familiar with the plants and the places where they grow can do much to assist in preventing such losses.

LOOKING TOWARD THE FUTURE

Feeding experiments with sheep and lambs have been conducted extensively by experiment stations in some of the more important sheep-producing regions of the United States. Some of these experiments have included fundamental research on nutrition (32), but the majority of them have been conducted as rather practical feeding trials in which the lambs or sheep have been fed in groups of about 20 to 30 animals and occasionally as many as 100 or more. Many of these trials have resulted in information of definite practical value to sheepmen. They have often served as excellent guides for determining the feeds, the combinations of feeds, and the methods of feeding for efficient production of mutton and wool.

Many phases of the sheep production enterprise that involve feeding can still benefit greatly from feeding trials on numerous unsolved
problems. With the increasing need for economy in feeding practices, however, producers of lambs and wool will need more definite information of a type that can be developed only by fundamental research—for example, on the specific roles of minerals, proteins, and vitamins in the nutrition of sheep (169).

It has been proved that the growth of wool can be controlled in large measure by feeding. Factors in the environment of a healthy sheep such as temperature and humidity have much less influence than nutrition on the production of strong, normal wool. The kind of feed provided for growing lambs is so important that even when choice roughages such as clover hay and corn silage have been given as the only feed to weaned lambs in the feed lot, they have failed to gain in weight, whereas the brothers of these lambs gained and developed normally when 1 to 1½ pounds of corn and about one-sixth of a pound of cottonseed meal per lamb per day were added to the roughage (473, 631). Adequate feed is one of the most necessary factors in profitable production of mutton and wool, both for quantity and for quality.

There are great differences in the efficiency with which individual sheep convert feed into meat and wool. The Bureau of Animal Industry has found a difference as great as 38 percent in rate of gain between the slowest and the fastest individuals fed similar rations in the same environment. In terms of total digestible nutrients per pound of gain, there was a difference of 36 percent between the least and the most efficient individuals. Large differences in nutritional efficiency have also been found between families of sheep. It follows that by applying the principles of both nutrition and genetics, breeders should be able to develop strains of sheep that could raise the level of efficiency in the economical use of feed. It is true that such an undertaking is complex and difficult, but it offers such an important reward that the effort seems justified.

Relatively little is known about the exact nutritive value of large numbers of forage plants that are grazed by sheep on pastures and ranges in the United States (1006, 1007). Experiment stations in the future should find definite research to determine these nutritive values one of the most promising ways by which nutrition specialists can serve the sheep industry. So large a part of the feed of sheep is in the form of grazing forage that definite nutritional indices of the important forage plants at various stages of growth should be vital and basic to the development of sound programs in sheep pasture and range improvement.

The pioneer phase of the sheep industry has passed. Free or even cheap grazing is becoming more and more scarce. The need for economy is so great that careless and wasteful methods will lead to failure. Sheep feeding and grazing must now be handled with the utmost care and along the lines of the most scientific thought if the enterprise is to prove profitable.