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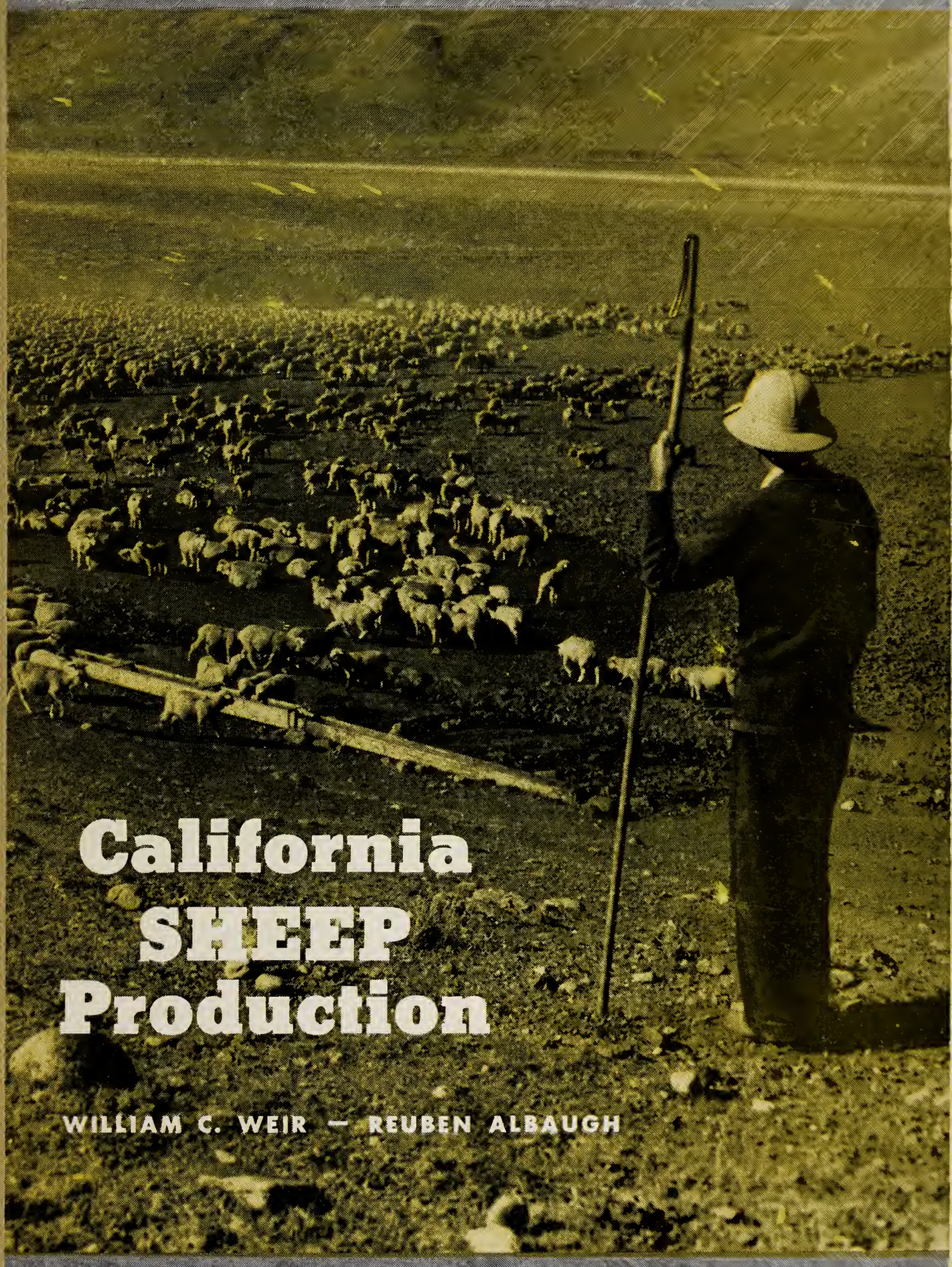

# California SHEEP Production

WILLIAM C. WEIR — REUBEN ALBAUGH

CALIFORNIA AGRICULTURAL
Experiment Station
Extension Service

MANUAL 16

# California SHEEP Production

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UNIVERSITY OF CALIFORNIA COLLEGE OF AGRICULTURE
Agricultural Experiment Station and Extension Service

# CONTENTS

SHEPHERDING is one of the oldest professions known to mankind. Dating back to biblical times, the care of sheep is often used in song and story as a symbol of the simple life. But the sheep business as it exists today in California is a complex enterprise.

This manual will acquaint you with the principal aspects of sheep production—the breeds raised in the state; sheep as a business; equipment you will need; feeding sheep; and a calendar of operations for a typical year.

There is also a list of reference books, in case you wish to read further on any particular phase of sheep raising.

This manual replaces Extension Circular 49.

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**OCTOBER, 1954**

# California SHEEP Production

WILLIAM C. WEIR — REUBEN ALBAUGH

## DISTRIBUTION, BREEDING, and SELECTION for wool production or for meat

### A brief history of their introduction into the state

DOMESTIC SHEEP were first introduced into California in 1769. They were brought here by the Franciscan fathers, who were then establishing their chain of missions along El Camino Real. These sheep, of Spanish origin, were low-grade, of the coarse-wool type. They were used by the mission fathers as a teaching aid in missionary work with the natives. The men were taught the care and management of the flocks, and the women learned the art of making clothing from the wool. Sheep also supplied food and fiber to the colonists.

In 1825 about one million head of sheep were kept by the seventeen missions, and a like number were owned by ranchers. This indicates that in the early days the coastal district of California was a great sheep-producing region. Besides clothing and blankets made by the women of the mission, large numbers of pelts and quantities of tallow processed and sold to trading ships were economically important.

During the period of 1832–1848 the disposal of livestock was placed in the hands of Government officers. By their ruling much of the livestock property was sold to interests outside the missions.

With the discovery of gold in California in 1848 and the influx of fortune-seekers from all parts of the country, there was a great demand for fresh meat. Lambs brought $12 and wethers $15 per head. Large numbers of sheep were slaughtered, and by 1850 only 17,514 head of sheep remained—less than 1 per cent of the number roaming the ranges of California 25 years before. During the period of 1852–1857, because of the demand for meat 551,000 sheep were imported into California by the trail route from New Mexico.

Following the gold-rush days many enterprising and progressive sheepmen began to improve their flocks. They imported purebred sheep from Vermont, New York, Ohio, and Pennsylvania. Spanish Merinos were first brought to California by Curtis and McConnell of Sacramento. Besides importations from other states, large numbers of high-priced sheep were brought into California from Australia. It is reported that during the period of 1856–1860 as many as 200 purebred sheep were exhibited at fairs as a single exhibit.

The first California sheep and wool growers association was organized on September 24, 1860, its purpose being to foster and promote sheep breeding and

wool growing in all its branches and to take steps to prevent a monopoly on the wool market of the state. The California Woolgrowers Association is the state's oldest agricultural organization.

Sheep numbers increased rapidly from 1860 to 1876. Over 6 million head were reported in the state in 1876, producing a wool clip of 56,550,970 pounds. During the period 1880–1890 there was a gradual decrease in sheep numbers, due mainly to the low price of wool and the competition for grazing lands from other agricultural industries. According to E. J. Wickson in a book entitled "Rural California," over 225,000 sheep were trailed eastward in 1881. During the nineties sheep numbers still continued to decline, and the farm value reached an all-time low of $1.50 per head.

In the decade 1900–1910 conditions for raising sheep remained adverse. In 1906 the U.S.D.A. placed a grazing fee on domestic livestock grazed on the National Forests. Public policy appeared to be against the wool producer.

New interest was awakened in mutton sheep with the outbreak of the World War in 1914, and sheep values increased. In spite of this, during the period 1914–1920 numbers did not expand. After the war a national depression was experienced, and many believe that the sheep business withstood this economic disorder better than did some other industries.

During these different periods in the sheep industry, a gradual change took place in breeding, feeding, management, and marketing. Four- to six-months-old milk-fat lambs of good breeding replaced the aged wether, which had been kept mainly for its wool. With the aid of scientific data sheepmen began selective breeding for wool and lamb production. Although the American people do not favor mutton, they like lamb. The demand for lambs is such that about 65 per cent of the sheepman's income in California is from this source, while 35 per cent is from wool.

## Sheep population in California is now on the increase

Sheep numbers in the state from 1920 to 1944 fluctuated from slightly over 2,000,000 head to about 3,500,000 head, the peak year coming in 1934. From 1944 to 1950 the numbers showed a gradual decrease, reaching a low point in 1950 of only 1,756,000; but by the beginning of 1954 there were again 2,034,000 sheep in California.

Several factors are responsible for the decline from the 1934 peak of production. Lands formerly used for sheep have gone into other crops. More profit has been realized from other enterprises. Skilled sheep labor has been difficult to secure. Wool prices have been relatively low. Grazing allotments have been reduced. Predatory animals and uncontrolled dogs have been a problem. There has been increased competition by wildlife, especially deer, for range forage. Brush encroachment has reduced the forage available to sheep in the range area.

It is generally agreed that if sheep numbers are to be materially increased more farm flocks must be established.

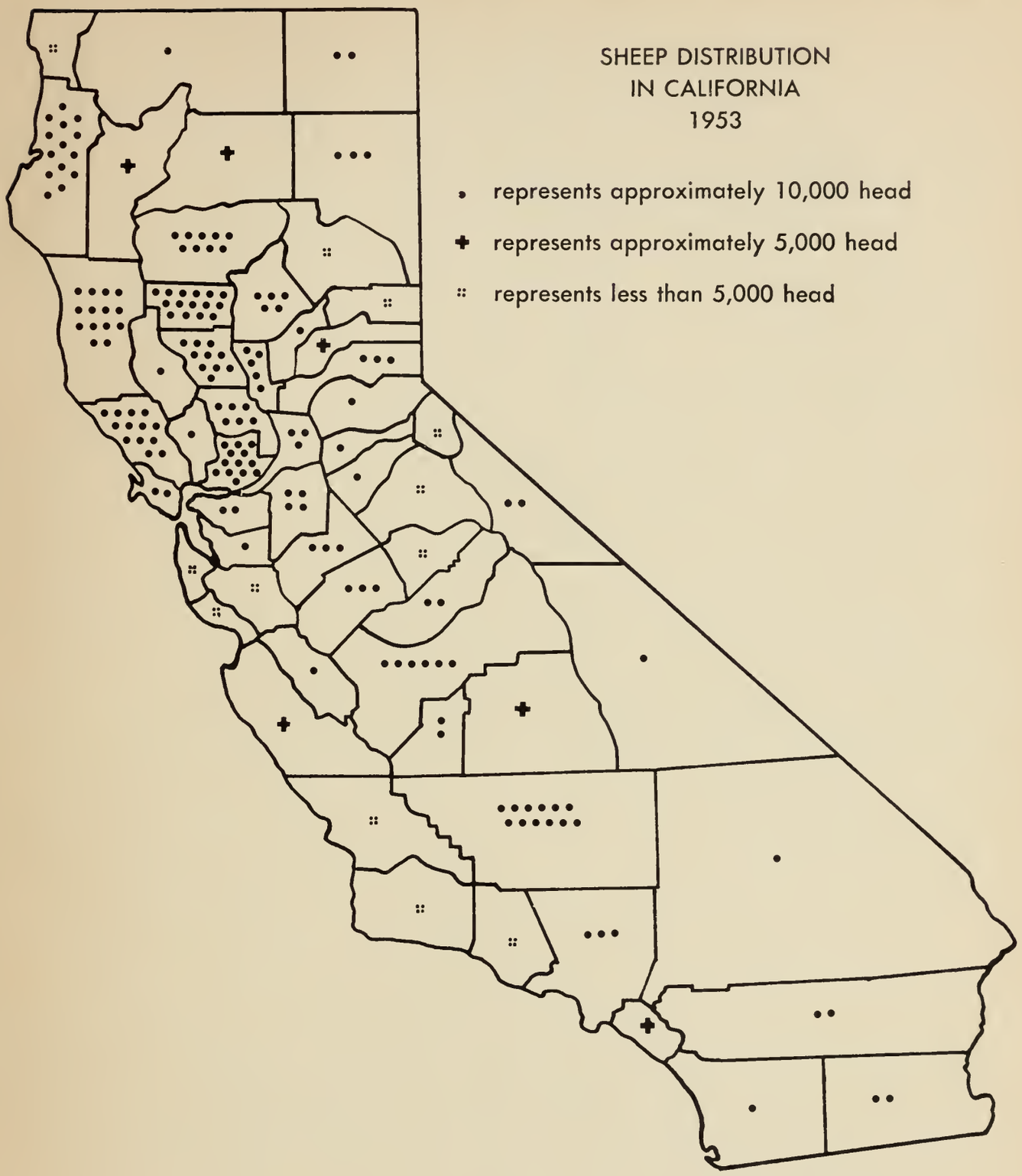
## How the present sheep population is distributed

Before entering the sheep-production business, make a careful study of your area to determine if it is suitable for such an enterprise. Although sheep raising is carried on in most sections of the state, the largest population is found in the great interior valleys—Sacramento and San Joaquin.

On January 1, 1953, the Sacramento Valley area had 671,000 sheep. The San Joaquin Valley section reported the same year 321,500 head.

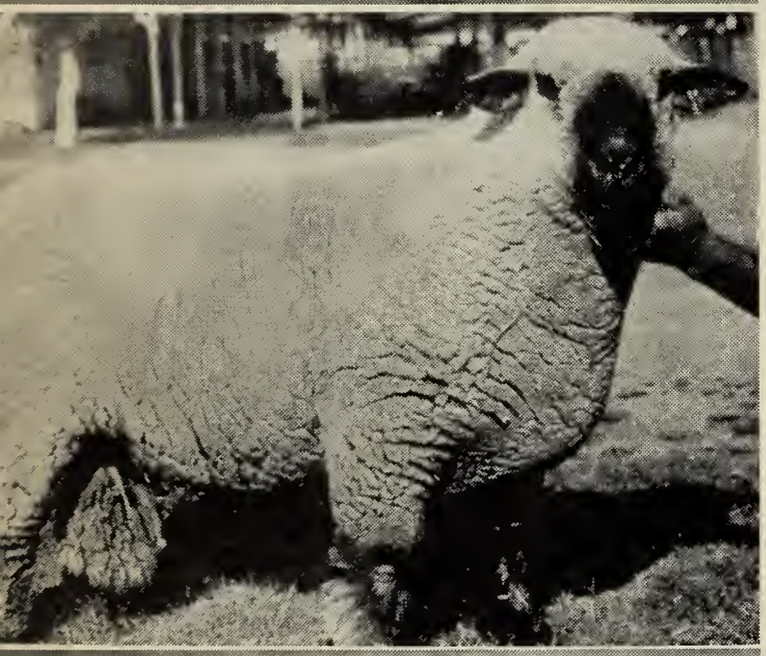
Commercial and farm flocks make up the largest percentage of sheep population in California. However, in some areas the purebred business is highly developed.

## WHERE SHEEP ARE RAISED IN CALIFORNIA




### THE TEN LEADING COUNTIES IN 1953:

| | | | |
|---|---|---|---|
| Glenn | 150,300 | Kern | 116,700 |
| Humboldt | 140,500 | Colusa | 98,000 |
| Mendocino | 138,000 | Tehama | 88,600 |
| Sonoma | 134,800 | Fresno | 61,100 |
| Solano | 130,800 | Yolo | 61,000 |



## Most breeds fall into four general groups

These are fine wools, long wools, medium wool dual-purpose, and medium wool mutton breeds. Instead of discussing each breed in detail, this section gives the principal use, advantages, and disadvantages of each group.

**The fine wools** were selected from the original Spanish Merino and have been the basic breed for range-sheep production. Their advantages and disadvantages are contrasted below.

***Advantages.*** 1) They are rugged—can stand extremes of heat and cold and can exist under unfavorable feed conditions. 2) They produce a desirable clip of wool. Fine wool normally sells for the highest price per pound on a clean basis. 3) They possess herding instinct—will band together under range-herding conditions. 4) They breed early—will breed in April, May, June, and July to lamb in the fall. This is important under California conditions. 5) They are long-lived. Many ewes will live to be 10 to 12 years of age.

***Disadvantages.*** 1) Fine-wool sheep lack mutton conformation. With more and more emphasis on the income from lamb, the importance of mutton conformation increases. 2) Ewes are not such good milk producers as ewes of the other groups, and in consequence do not produce such rapidly growing or high grading lambs. 3) Fine-wool sheep are more subject to fly-strike (maggots resulting from fly eggs) because of the wrinkles and wool close to the anus and vulva. 4) Some of the wool is too short in staple to bring the best price. 5) Shrinkage is relatively high.

**The long-wool breeds** of sheep were developed in England under cool, moist

**RAMS . . .**

of these breeds are used for producing cross-bred fat lambs. Top to bottom: Shropshire, Hampshire, Southdown, Suffolk.

**EWES . . .**

of these breeds are used to produce commercial lambs. Left, top to bottom: Australasian Merino, Columbia, Corriedale, Rambouillet. Below: Targhee, Romeldale and Romney.

**Breeds of Sheep Grouped According to Wool and Mutton Type**

(Breeds most common in California in italics)

| Fine wools | Long wools | Medium wool dual-purpose | Medium wool mutton breeds |
|---|---|---|---|
| *Rambouillet* | *Romney* | *Columbia* | *Hampshire* |
| Merino | Lincoln | *Corriedale* | *Suffolk* |
| | Cotswold | *Romeldale* | Shropshire |
| | Leicester | Targhee | Southdown |
| | Border Leicester | Panama | Dorset |
| | | | Cheviot |
| | | | Oxford |

conditions, where feed supplies are favorable. They are not well adapted to most California conditions.

***Advantages.*** 1) The largest sheep belong to long-wool breeds. 2) The sheep are rapid-growing (but late-maturing). 3) Long-wool breeds, particularly the Lincoln, cross well with fine-wool breeds to produce intermediate or dual-purpose sheep. 4) Ewes are good milk producers. 5) Long-wool breeds can stand wet weather, and the claim is made that the Romney breed is more resistant to foot-rot than other breeds. 6) They produce a heavy clip of wool, low shrinking and coarse in texture.

***Disadvantages.*** 1) They are not adapted to hot, dry climate. This limits their usefulness to only a small section of the North Coast area of California. 2) They must have an adequate feed supply, and are not so rugged as fine-wool sheep. 3) They do not produce such a desirable carcass as mutton breeds. 4) Their wool sells for a lower price because coarse wool is not in such demand as fine wool (but the increased yield may compensate for the lower selling price). 5) They lack the herding instinct.

**The medium-wool dual-purpose breeds** have been developed by crossing the long-wool breeds with the fine-wool breeds in an attempt to combine the desirable characters of both groups and eliminate as many of the bad points as possible. All these breeds except the Targhee are essentially half long-wool and half fine-wool breeding. The Targhee is approximately three fourths fine wool and one fourth long wool. The bulk of the commercial ewes in California are some mixture of the fine-, medium-, and long-wool whiteface breeds.

***Advantages.*** 1) Mutton conformation and milk production are improved over the fine-wool breeds; as a result, lambs produced by these medium-wool ewes reach market weight at a younger age and are more desirable from the standpoint of conformation and carcass. 2) The length of staple and the clean weight of wool clip are increased over the fine-wool breeds, but the wool is still fine enough to receive a good price per pound. 3) Wool produced is free of black fibers and has desirable quality. 4) These breeds maintain the herding instinct of fine-wool sheep.

***Disadvantages.*** 1) They are less rugged than fine-wool sheep. 2) They are generally smaller than long-wool sheep. 3) They will not usually breed so early as fine-wool breeds.

**The mutton breeds** were developed primarily for their lamb-producing ability. Their principal use under California conditions is to furnish sires for the production of market lambs.

Tests conducted at this station have shown that Hampshire and Suffolk rams sire lambs that weigh more at marketing and return the greatest income per ewe bred. Southdown rams produce lambs of the highest carcass quality, but the lambs are small. Lambs sired by the Shropshire rams are intermediate in size and quality. Romney-sired and Rambouillet-sired lambs are inferior in carcass quality to lambs sired by the mutton-type rams. See also "Cross-breeding Investigations" by R. F. Miller, referred to among Source Books, on page 59.

Because of the increased size of the lambs produced, most commercial lambs in California are sired by Hampshire or Suffolk rams.

***Advantages.*** 1) Lambs of excellent quality and grade can be produced. 2) Ewes are prolific, good milkers, and good mothers.

***Disadvantages.*** 1) Ewes breed late. Very few lambs are born in the fall. Most lambs will be born from December through March. 2) Ewes are short-lived. 3) Wool clip is light in weight and may be contaminated with black fiber. 4) Mutton breeds will not herd; they do not have the banding instinct.

For these reasons it is not recommended that mutton-breed ewes or mutton-breed crossbred ewes be used as commercial breeding ewes.

## Shall the sheepman breed his own replacement ewes or buy them?

As most commercial ewes are bred to mutton-breed rams, all the lambs, both ewes and wethers, should be sent to market. The sheepman must then replace his breeding ewes from some other source.

Historically California sheepmen have found it economical to buy replacement ewes from out-of-state breeders. Recently, as good replacement ewes become harder to find, considerable interest is being shown in raising their own replacement stock.

Here are the reasons some sheepmen have taken to producing their own breeding ewes:

The flock can be improved by a selective breeding program under the direct supervision of the sheepman.

Records can be kept on the sheep and replacements saved from only the most productive lines. The sheepman can select for twins, good milkers, desirable fleece, etc.

Breeding ewes are acclimated; that is, they will be producing in the same environment in which they were born and reared.

Breeding ewes are lambing at the same season in which they themselves were born, whereas a ewe from the Rocky Mountain area born in April may be expected in California to lamb in November.

By not bringing new sheep onto the ranch each year, the sheepman can avoid the possibility of introducing diseases or parasites.

California-bred replacement ewes can be bred as lambs under good management and feed conditions.

On the other hand there are good reasons why some sheepmen prefer not to produce their own breeding ewes:

The sheepman must use two kinds of rams, whiteface rams of the desired breed to produce his replacement ewes and blackface rams to produce market lambs. The best ewes should be bred to the whiteface rams.

Lambs marketed are of two types—whiteface wethers and blackface ewes and wethers. Most sheepmen agree the whiteface wethers will weigh slightly less than the blackface wethers, but reliable data are not available on this difference.

Replacement ewe lambs should be cared for in a separate group from the main breeding band. (The breeding of ewe lambs will be discussed on page 42.)

The cost of breeding replacements on the ranch is probably greater than that of buying them.

## How to select your breeding stock

**Ewes.** Breeding ewes, irrespective of breed, should be large and deep-bodied, standing on straight legs with ample bone and showing some femininity and breediness. Ewes should be free of wool around the eyes to avoid wool-blindness. Wool should be characteristic of the breed, dense, long staple, and moderately fine.

Age of ewes should be determined by examination of the teeth. At the same time "overshot" and "undershot" mouths can be detected. This is a condition where the incisors fail to meet the dental pad at the correct place. Ewes that have previously lambed should be checked for sound udders; those showing pendulous udders or udders with hard spots may not be able to raise another lamb.

Aged ewes, sometimes called "broken-mouthed" ewes (with some teeth missing), can often be bought cheaply, but they will require extra care and attention in order to raise another lamb crop. Since a rather high death rate is to be expected among them, it is risky for a beginner to start in the sheep business with such ewes.

**Rams** should be purebreds of the breed desired. Each should be medium-to-large for the breed, with ample bone, sound feet and legs, wide chest, straight back, and thick hindquarters, and should show masculinity (indicated by a thick, muscular neck, a broad muzzle, and a bright, alert eye). The wool of rams to sire replacement ewes should be carefully examined. It should be typical of the breed (rams' wool may be slightly


How to determine age of sheep by their teeth. 1.—lamb shows four pairs of incisors; 2.—one-year-old shows one pair of permanent incisors; 3.—two-year-old shows two pairs of permanent incisors; 4.—three-year-old shows three pairs of permanent incisors; 5.—four-year-old shows four pairs of permanent incisors; 6.—teeth have all dropped out. This usually happens at seven to twelve years of age and the animal is then known as a "gummer."

# CHOOSE YOUR BREEDING STOCK CAREFULLY

Photo at right shows a desirable and an undesirable ewe.

Photo at left shows a sheep with an overshot jaw—a condition to be avoided.

Aged ewes, such as those shown above, no longer able to "rough it" on the range, will usually produce another crop or two of lambs under the more favorable conditions of farm flocks.

more coarse than ewes'), and should show length, density, and uniformity of diameter (fineness) over the entire body. The wool on mutton-breed rams is of little concern to the sheepman because all the lambs produced by these rams will be marketed as fat or feeder lambs.

## Keep records of performance and grading

Sheepmen interested in practical, systematic methods for improving the production and quality of their flock should ask their local farm advisor for an Extension Circular entitled "A Guide for Sheep Improvement Programs" (See Source Books listed on page 59).

This guide discusses the grading system used by University of California specialists in evaluating sheep for conformation, type, quality, and character. The grading program also considers quality, density, and staple length of fleece. Its main purpose is to evaluate sheep uniformly in comparison to the sheep population as a whole. It is very similar to the system used for grading feeder and fat lambs and to the grading method employed in beef-cattle improvement work.

In addition to evaluating the sheep for conformation and wool, the guide affords the owner an opportunity to keep accurate records on the production of each individual ewe and ram. Fleece weights, birth weights, and weaning weights of lambs may be recorded. With data of this kind available, it is possible for a sheepman to cull his flock more effectively.

Here are the things necessary in conducting such a program: 1) A suitable scale for weighing sheep. 2) An accurate breeding and lambing record. 3) A flock book with separate record sheet for each ewe (Ask your farm advisor). 4) A uniform system of grading each animal. 5) Standard record forms to assure uniformity.

The owner must have an interest in the program and a willingness to keep records in cooperation with the farm advisor. The best time to start a record of performance and a grading project is in the spring, usually before shearing.

On pages 11 and 12 are score cards and grading guides for grading sheep in California. These score cards are not those of any particular breed, but they are believed by the authors to be a reasonable guide for selecting good sheep of any breed.

# SCORE CARDS USED IN GRADING SHEEP

## WHITEFACED DUAL-PURPOSE SHEEP

### CONFORMATION, 65 PER CENT

| | |
|---|---|
| Weight for age and scale | 10 |
| General appearance and breed type | 8 |
| Head and mouth | 5 |
| Shoulders, chest, and spring of ribs | 8 |
| Back and loin | 8 |
| Twist and leg of mutton | 8 |
| Rump | 5 |
| Feet and legs | 7 |
| Natural fleshing | 5 |
| Scrotum or udder | 1 |

### FLEECE, 35 PER CENT

| | |
|---|---|
| Density | 8 |
| Length of staple | 12 |
| Spinning count (breed considered) and uniformity (all parts of body) | 10 |
| Character (crimp, color of secretions, freedom from hair) | 5 |
| | 100 |

## BLACKFACED MUTTON SHEEP

### CONFORMATION, 90 PER CENT

| | |
|---|---|
| Weight for age and scale | 10 |
| General appearance and breed type | 10 |
| Head and mouth | 8 |
| Shoulders, chest, and spring of ribs | 10 |
| Back and loin | 10 |
| Twist and leg of mutton | 10 |
| Rump | 5 |
| Feet and legs | 15 |
| Natural fleshing | 10 |
| Scrotum or udder | 2 |

### FLEECE, 10 PER CENT

| | |
|---|---|
| Density | 2 |
| Length of staple | 4 |
| Freedom from black fiber | 2 |
| Belly wool | 2 |
| | 100 |

## Grading Guide Used in Sheep Records of Performance

| DESCRIPTION | Grade designation | Per cent value | Market sheep | |
|---|---|---|---|---|
| Breeding sheep | | | Feeders | Slaughter |
| Outstanding animals, tops in strong show competition. Stud prospects. Excellent breeding animals, from the standpoint of type, conformation, quality, character, and fleece. | 1 +<br>1 av.<br>1 – | 98–100<br>95–97<br>92–94 | Strictly fancy or select | Top prime; capable of creditable showing in strong single competition |
| Ewes in this grade will qualify for breeding tests in purebred flocks. Would be considered tops for commercial sheep. This grade will represent best in range rams. Sheep falling in this grade would probably not place very high in the money in strong competition. | 2 +<br>2 av.<br>2 – | 89–91<br>86–88<br>83–85 | Top choice<br>Choice<br>Low choice | Prime<br>to<br>low prime |
| Ewes in this grade should usually be culled from purebred flocks. They are good commercial ewes. Rams in this grade are rarely capable of making much improvement in good commercial flocks. Usually they should be culled. | 3 +<br>3 av.<br>3 – | 80–82<br>77–79<br>74–76 | Top good<br>Good<br>Low good | Top choice<br>to<br>low choice |
| Animals in this grade should be culled. They have serious defects in conformation and fleece, lack quality, are off-type. They are unusually slow-maturing, thin, plain, and shallow. | 4 +<br>4 av.<br>4 – | 71–73<br>68–70<br>67 | Medium<br>Common<br>Inferior | Good<br><br>Utility |

## SHEEP RAISING AS A BUSINESS . . . some things the beginner should know or consider

### Before you begin, study the pros and cons

Sheep perform the primary function of converting grass and other products of the plant world—largely of no use to man in such form—into food and fiber for human use. You should clearly understand how they differ from other livestock before you go into the business of raising sheep. You will want to study the costs of production (See pages 16 to 18) and the possible income on farm flocks and range flocks.

Consider also these points on the credit side of sheep-raising as a business:

Sheep produce two crops each year—lamb and wool.

Returns come relatively rapidly. Ewe lambs can be bred to lamb as yearlings. Lambs are marketed young—at four to seven months.

Sheep utilize roughages as their primary feed supply. They do not need large amounts of purchased feeds.

Lambs will fatten on good pasture alone, without any supplemental feed.

Sheep are easily handled and moved.

Equipment and shelter can be relatively simple and inexpensive.

Sheep can aid in a weed-control program and reduce the fire hazard on the ranch or farm.

On the other hand, there are certain adverse considerations:

Sheep are naturally defenseless, and so man must protect them against their enemies. Severe losses will otherwise occur from stray dogs and predatory animals, such as coyotes, bobcats, and bear.

Furthermore, sheep are subject to both external and internal parasites. The shepherd must be alert and watchful to prevent losses from these dangers.

Sheep must either be watched continually by a herder or pastured in fields that are fenced "sheep-tight" (with a woven-wire fence, which is expensive to construct).

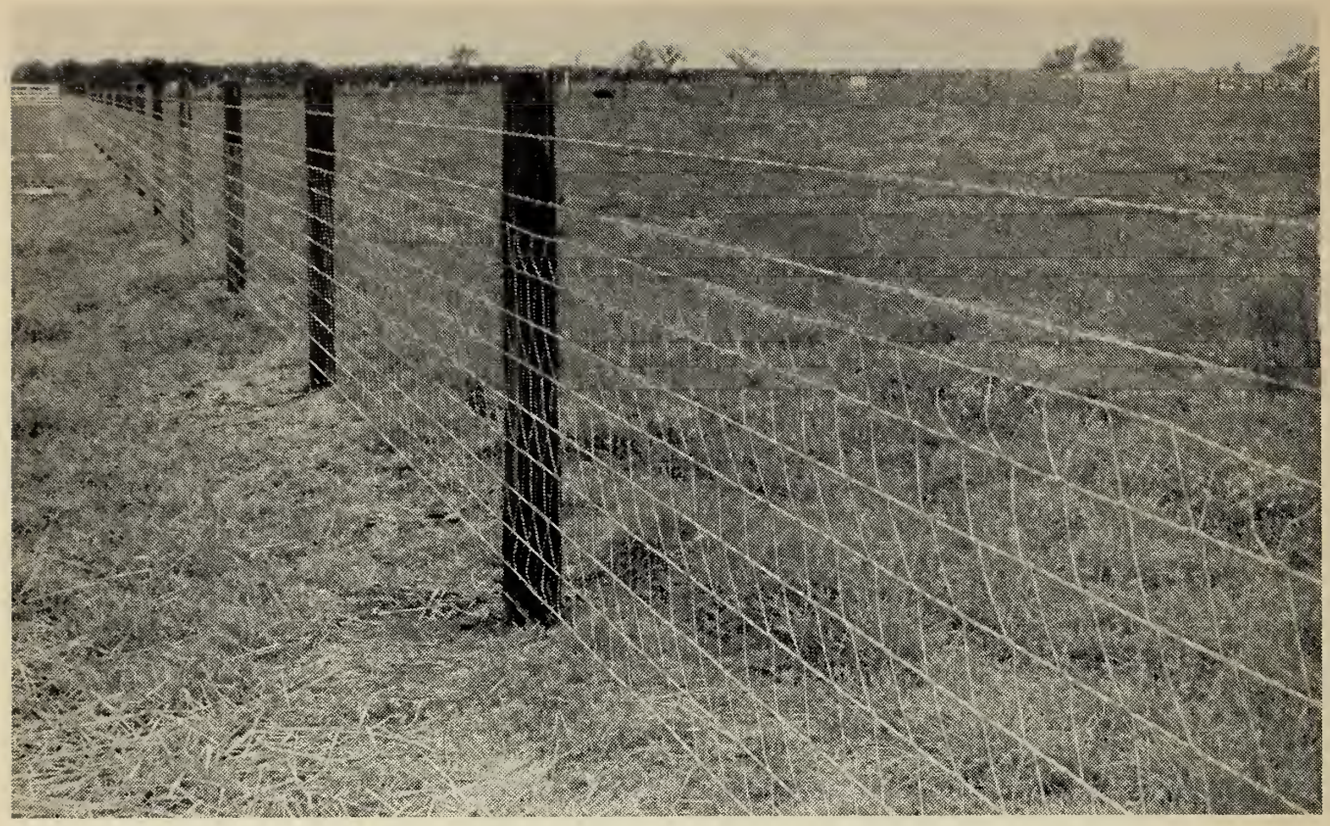
Foot troubles will occur if sheep are forced to stay on muddy, wet ground.

In general, they require more attention and labor than do cattle.

### In California there are five types of sheep operations.

**1. Range commercial sheep—herded.** Sheep are operated in bands of from 500 to 2,000 and are constantly

Photos before and after pasturing sheep on an irrigation ditch. The sheep not only save expense in keeping the ditch clean, but keep the banks well trampled so that gophers are less troublesome.



"Sheep-tight" fences such as that shown above should be made of woven wire, with barbed wire above to protect the woven wire.

under the care of a sheep herder. They utilize desert and mountain ranges and may pasture alfalfa, irrigated pasture, grain fields, and beet tops. Available range is nearly all utilized by present operators.

(This is a specialized business requiring experience and skilful management.)

**2. Range commercial sheep—fenced pastures.** Sheep are grazed in fenced fields of varying size. The land is owned or on long-term lease. This operation requires large initial investment, but a comparatively lower cost of operation.

**3. Purebred sheep.** The primary source of income from a purebred flock is through the sale of rams to commercial sheepmen. This enterprise requires the ability to select desirable breeding stock and facilities, particularly feed supply, and to keep animals in desirable condition at all times. Commercial sheepmen demand high-quality, well-grown rams. A beginner should not start in the purebred business. It is much better to gain experience first with commercial sheep.

**4. The farm flock.** This may vary from a few head to a few hundred sheep on a farm. In this case sheep are usually only one source of income. Thirty to forty breeding ewes is considered a minimum economic unit.

**5. Fattening feeder lambs.** Most feeder lambs are fattened on irrigated pastures in the Sacramento, San Joaquin, and Imperial Valleys. This operation will be discussed under lamb fattening, on pages 56–58. A smaller number of lambs are fattened in feed lots on dry feeds.

## How to start a sheep enterprise

First answer the following questions:

1. Is a source of feed available for every month of the year?

2. Are fences "sheep-tight"?

3. Are there facilities for caring for sheep at lambing? At shearing?

4. Can the sheep be kept out of mud during wet weather?

5. Are dogs and predators likely to be a serious menace?

6. Do you like sheep?

7. Have you had adequate sheep experience?

You can establish a farm flock in several ways. From a start with bummer lambs (young orphans) from some recognized breeder, it is possible to begin with a very small investment. Fair-sized enterprises have eventually developed from bummer lambs used in projects by 4-H Club and FFA members. The care and feeding of these is discussed in Section 5.

Healthy, thrifty, well-bred, broken-mouth ewes can also be used to start a farm flock. Ewes of this kind, culled from range bands, are sometimes available on the market at reasonable prices. If given proper feed and care, such ewes will often raise another lamb crop or two. Care should be taken not to buy ewes that are too old, because the death loss is apt to be high.

A small flock of well-bred ewe lambs, yearlings, or two-year-old grade ewes will need less care and attention than the above groups. The initial cost will be greater, but in the long run they may be the cheapest buy.

## Handling sheep

Whenever it is necessary to handle individual sheep, the flock or band should be enclosed in a small corral. A beginner often makes the mistake of placing a few sheep in a big enclosure. This is hard on both the sheep and the sheepman.

Do not catch individual sheep by the hind leg. The animal will fight in this position, and there is real danger of crippling it by pulling the hip out of the socket. It should be caught by grasping the rear flank just in front of the stifle joint. By lifting slightly, you can immobilize the animal without any great struggle. The other correct way is to catch the sheep by the head.

A sheep hook or shepherd's crook may be used in large bands for catching ewes on the open range. It should be used only when absolutely necessary, as there is danger of crippling the sheep by careless handling.

Once the sheep is caught, it can be held by placing one hand under the jaw near the mouth and the other hand behind the head or on the rump just above the dock. If the sheep tries to go forward, lift up on the chin and place your knee in front of the brisket. If it tries to back up, put pressure on the end of the dock.

Never under any circumstance pull on the wool! This results in pain to the sheep and will only cause it to fight more.

## Predator and dog control

Agencies responsible for controlling predatory animals and sheep-killing dogs are numerous in California. For example, a large number of counties have cooperative predatory-animal agreements with the United States Fish and Wild Life Service and the State Department of Agriculture. A check in 1953 showed that 41 California counties were operating under this cooperative agreement with these two agencies.

In a few counties, predatory-animal control is handled directly by the county government through the Board of Supervisors. In other areas the work is under the direction of the County Agricultural Commissioner. Some counties do not work under a paid hunter and trapper system. In these counties funds are appropriated on a county basis for the payment of bounties on predators.

Where sheep losses have occurred from sheep-killing dogs, a few counties have organized strong, workable dog ordinances. Under this control system an efficient, alert poundmaster is employed. His job is to see that all dogs are licensed each year, to impound unlicensed dogs, and to determine the ownership of dogs that are found worrying, wounding, or killing sheep.

The headquarters of the poundmaster vary. Some work out of the county sheriff's office, others with the agricultural commissioner. Some have their own offices within the county government.

California has a fine dog law, and all sheepmen should be familiar with its provisions. A copy of this law can be had by writing to the California Wool Growers Association, 151 Mission Street, San Francisco.

Besides the state and county government program for predatory-animal control, individual sheepmen may hire capable hunters and trappers. In some areas several sheepmen employ hunters and trappers cooperatively. Other sheepmen may pay bounties to hunters for animals that kill sheep. Still others do their own hunting and trapping.

If you suspect sheep losses to be from predatory animals or dogs, get in touch with your local trapper, hunter, or poundmaster. In case you do not know how to reach these agents, you can contact your local farm advisor or local wool growers association for information.

## Marketing your lambs

California is in a favorable position for marketing her lamb crop. Because of mild winters, growers are able to finish and market lambs during the months of April, May, and June. As lambs are usually in short supply at this season, the price is generally higher than after July 1.

During these spring months, California lambs are exported to eastern markets to relieve the surplus. A total of 285,000 head were shipped in 1952. During the remainder of the year, California is a deficit area, and large numbers of lambs are shipped into the state, both for immediate slaughter and for fattening before slaughter. In 1953, 1,180,000 head were shipped in from out of state.

## Production costs

Since sheep return two incomes per year (wool and lamb) many people may become overenthusiastic about the profit in sheep raising. Before investing in the sheep business, you had better become familiar with certain costs of production and expected returns.

Successful sheep raising is largely dependent on sound, progressive management such as correct breeding, feeding, and marketing practices. The chief profit-determining factors are: 1) quality and quantity of lambs and wool; 2) prices

California spring lambs such as these are usually marketed in April, May, and June.

received for lambs and wool; and 3) annual costs per sheep.

Since the cost of production and the returns from a sheep operation both vary, not only within each sheep-producing area but also from ranch to ranch, it is difficult to present definite cost-and-return data.

The information on costs and income outlined below has been developed by A. D. Reed, Extension Economist, at the University of California at Berkeley, and can be used as a guide (using current and local prices) when figuring costs, incomes, and investments. If an income falls below these estimates, then a careful analysis of the management should be made.

## TABLE 1—Farm Sheep Flocks

**Production Data**

Ewes—5 per cent mortality, 15 per cent culled
Lambs—100 per cent raised
Rams—One per 25–50 ewes. Purchase replacements as necessary.

### SAMPLE INCOME AND EXPENSE PER 100 EWES

| | | |
|---|---|---|
| **Income** | | |
| Lambs sold, 80 head @ 90 lb.—7,200 lb. @ 20 cents | | $1,440 |
| Ewes sold, 15 head @ 120 lb.—1,800 lb. @ 10 cents | | 180 |
| Buck sold, 1 head @ 150 lb.—150 lb. @ 10 cents | | 15 |
| Wool, 1,000 lb. @ 50 cents | | 500 |
| | | $ 2,135 |
| **Expense** | | |
| Replacement buck, one | | 100 |
| Pasture: | | |
| Natural range 50 acres—400 hd. mo. | $ 240 | |
| Irrigated pasture 15 acres—500 hd. mo. | 600 | |
| Stubble 25 acres—200 hd. mo. | 80 | |
| Total pasture | $ 920 | |
| Hay, 60 days @ 3 lb.—9.0 tons @ $20 | 180 | |
| Grain for lambs, 30 days @ ¼ lb.—750 lb. @ $3.50 | 26 | |
| Salt and mineral, 600 lb. @ $0.02 | 12 | |
| Total feed | | $1,138 |
| Shearing and wool bags, 103 hd. @ $0.60 | | 62 |
| Taxes and miscellaneous | | 50 |
| Labor, 300 hr. @ $1.00 | | 300 |

**Investment and Depreciation**

| | Original cost | Depreciation | |
|---|---|---|---|
| Buildings and fences | $ 800 | 40 | |
| Equipment | 300 | 30 | |
| Stock—100 ewes and 3 rams | 2,300 | | |
| Land for corrals and sheds | 500 | — | 70 |
| Interest, 5 per cent on $3,350 | | | 168 |
| Total cost | | | 1,888 |
| Net profit | | | $ 247 |

In studying the "input" and "output" statement you can readily see that the big cost item is feed, which includes both raised and purchased. Next largest cost is labor. On the other hand, the largest income is from lamb, followed by wool. Therefore, if net income is to be materially increased, effort should be made to

**TABLE 2—Range Sheep Flock**

Production Data
- Ewes—7 per cent mortality, 13 per cent culled
- Lambs—80 per cent raised
- Rams—one per 30 ewes

SAMPLE INCOME AND EXPENSE PER 1,000 EWES

| | | |
|---|---|---|
| **Income** | | |
| Lambs sold, 600 head @ 80 lb.—48,000 lb. @ 20 cents | | $ 9,600 |
| Ewes sold, 130 head @ 110 lb.—14,300 lb. @ 10 cents | | 1,430 |
| Bucks sold, 6 head @ 135 lb.—810 lb. @ 10 cents | | 81 |
| Wool, 10,000 lb. @ 50 cents | | 5,000 |
| | | 16,111 |
| **Expense** | | |
| Replacement bucks, 7 @ $75 | | 525 |
| Feed: | | |
| Range, 3,000 acres—10,000 hd. mo. @ $0.60 | $ 6,000 | |
| Stubble, 250 acres—2,000 hd. mo. @ $0.40 | 800 | |
| Hay, 30 days @ 3 lb.—45 tons @ $20 | 900 | |
| Cake, 90 days @ ¼ lb.—11.5 tons @ $100 | 1,150 | |
| Grain for rams, 30 days @ ½ lb.—500 lb. @ $3.50 cwt. | 18 | |
| Salt and mineral, 3 tons @ $35 | 105 | |
| Total feed | | 8,973 |
| Horses, 2 @ $100 | | 200 |
| Dogs, 2 @ $15 | | 30 |
| Truck, 2,000 miles @ 7 cents | | 140 |
| Taxes and miscellaneous | | 500 |
| Spraying, 1,030 hd. @ 8 cents | | 82 |
| Shearing and wool bags, 1,030 hd. @ $0.60 | | 618 |
| Labor, 2,500 hours @ $1 | | 2,500 |

Investment and Depreciation

| | Original cost | Depreciation | |
|---|---|---|---|
| Buildings | $ 5,000 | $ 250 | |
| Equipment | 2,000 | 200 | |
| Stock: Ewes, 1,000 @ $20 | 20,000 | | |
| Bucks, 33 @ $75 | 2,475 | | |
| Land for corrals | 1,000 | | 450 |
| Interest @ 5 per cent on $26,975 | | | 1,349 |
| Total expense | | | $15,367 |
| Net profit | | | 744 |

5 per cent interest is based on ½ of original cost of buildings and equipment and on original costs of other items.

keep feed and labor costs as low as possible, at the same time increasing the quality and quantity of lamb and wool produced.

### How do sheep prices compare with those for cattle?

Prices are favorable for sheep production, as compared to cattle. For example, it is usually assumed that a beef steer will put on 300 pounds of gain during a pasture season. If at least four ewes can be managed on the same amount of pasture as one steer, the four ewes on good feed comparable to the feed producing 300 pounds of beef should produce four 90-pound lambs, or 360 pounds of meat.

There is another factor that must not be overlooked. These four ewes should also produce at least 32 pounds of wool. This would be, according to present-day estimates, equivalent in value to 80 pounds of lamb. Therefore, while

1 steer produces 300 pounds gain,
4 ewes produce 440 pounds gain.

At present, prices of grass-fed cattle and lamb are about the same. According to a cost study prepared by Arthur Shultis, Extension Economist of the University of California at Berkeley, it costs 16.3¢ to produce a pound live weight of beef and 12.4¢ to produce a pound live weight of lamb under average California conditions—based on probable "in-line" long-time average costs. (See The Relative Economy of Meat Production in California by Several Types of Farm Animals, referred to on page 59.)

## EQUIPMENT FOR SHEEP PRODUCTION . . . some of it is easy to build from available plans

### Develop an over-all sheep-handling plan

Well-planned sheep equipment such as corrals and other handling devices saves labor, cuts shrinkage to a minimum, and is among the best investments a sheepman can make. No one plan is suitable for all ranches. However, certain features and construction details might be usable on any ranch.

A good, practical set of corrals and equipment should make it possible to sort, brand, mark, load, unload, weigh, spray, shear, and treat sheep. Drinking water should be in or near the corrals. Shade and weather shelters are desirable in some areas. Valuable equipment should be strongly built, and painted to preserve the material.

Corrals and structures should not only be arranged for convenience but should also be laid out and planned for economy and serviceability. In selecting a site for corrals and equipment, choose a location, if possible, in the center of the ranch operation. This will reduce the distance of movement of stock. The area should be well drained and the soil of sandy texture.

In building sheep structures and equipment, plans and blueprint details must be followed closely. Equipment built from plans discussed below has been found workable and practical.

### Plans are available

The Agricultural Engineering and Animal Husbandry Departments have developed the plans and specifications which are listed on page 20. Ask your farm advisor for any that are of interest to you, or write to Agricultural Publications, 22 Giannini Hall, University of California, Berkeley 4, California.

### The loading chute

It is important that this be located so that large trucks and trailers can reach it easily at any time of year. After you have selected the site for the loading chute, the corral and other equipment can be built around it. For ease in working sheep through chutes, they should if

## PLANS DEVELOPED BY THE UNIVERSITY OF CALIFORNIA

| PLAN NUMBER | | PRICE |
|---|---|---|
| 50 | Salt feeder for sheep. Self feeder type, 4′ long, 2′ wide. Salt protected from weather | $ .15 |
| 72 | Portable self-feeder for sheep. Eight feet long; capacity about 28 cu. ft. Suitable for feeding salt-concentrate mixtures | .25 |
| 73 | Wool sacking windlass. For installation on sacking stand or in wool loft. One man operation | .25 |
| 74 | Sheep parting chutes. Two types | .15 |
| 75 | Loading chute for sheep | .15 |
| 112 | Barn. 2 units. 2-story. 32′ x 42′. 1-story shed attached 30′ x 48′. Shed part has eight 12′ x 12′ pens. Mow over 2-story section | 1.00 |
| 114 | Lambing panel, hinged near center | .05 |
| 115 | Trough for grain, portable. 12′ long. Similar to 117, except one end of trough is hinged for easy cleaning, and a piece 1″ x 6″ prevents sheep from climbing in trough | .15 |
| 116 | Hay rack. On skids. Suitable for feeding long hay in feed lot | .15 |
| 117 | Trough for grain, portable. 12′ long. Widespread legs to prevent tipping | .15 |
| 118 | Feed rack. Combination hay and grain. 12′ long. Troughs both sides | .15 |
| 177 | Sheep drafting yards. Two types. Indicates all chutes, parting gates, and pens | .25 |
| 185 | Feeder for range sheep. Chopped hay. Feed section 10′ x 48′. Gable roof extends over feed troughs on each side to protect both feed and sheep | .25 |
| 191 | Shearing shed. 8 men | 1.00 |
| 192 | Creep feed equipment for lambs. 3 types of feed troughs; 2 types of hay mangers; 2 types of feeding panels | .25 |
| 198 | Shearing shed. 4 men. 24′ x 32′. Gable roof. Includes sacking pit and wool platform; 4 catching pens; wool storage area | .75 |
| 199 | Sheep barn, 48′ x 56′. Capacity 150 ewes. Center section for hay, 20′ x 40′ | .25 |
| 5019 | Shed. Enclosed. 16′ x 24′. Height to eaves 6′. Gable roof | .25 |
| 5025 | Shed. Open. 16′ x 24′. Open on one side. Shed roof | .25 |

possible face the north and run up hill. Sheep do not drive well toward the sun.

### Scales

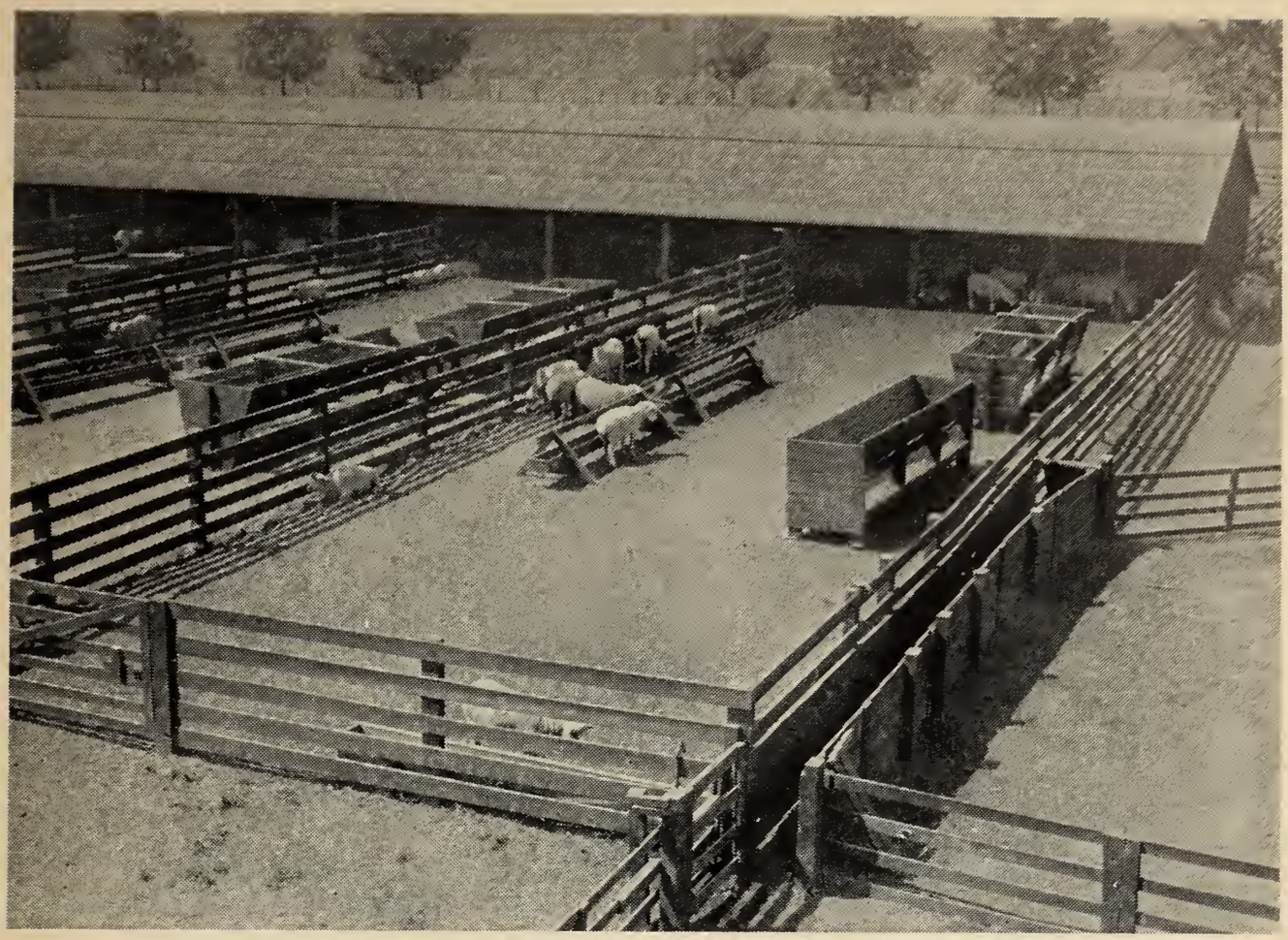
Scales are essential for many sheep ranches. Operators say they pay for themselves the first year. A good pit-type scale can be installed for about $700.

Locate scales so that movement of sheep is cut to a minimum. Arrange the plan in such a way that sheep can be worked in adjoining corrals without passing over the scales. The only time animals should cross the scales is when they are being weighed. The scale pen should be slightly smaller and attached to the weighing platform.

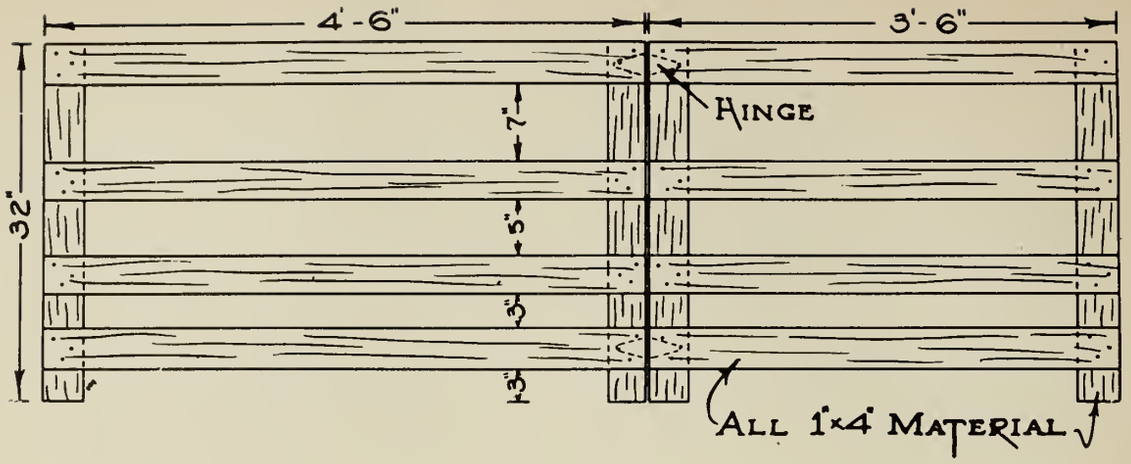
### The feed yard

The feed yard should provide labor efficiency, good drainage, and protection for both feed and animals from weather.

Gates should be large enough to allow the use of mechanized equipment for feeding animals, and for cleaning corrals and equipment. Allow 20 square feet of corral space and one foot of manger space for each lamb.

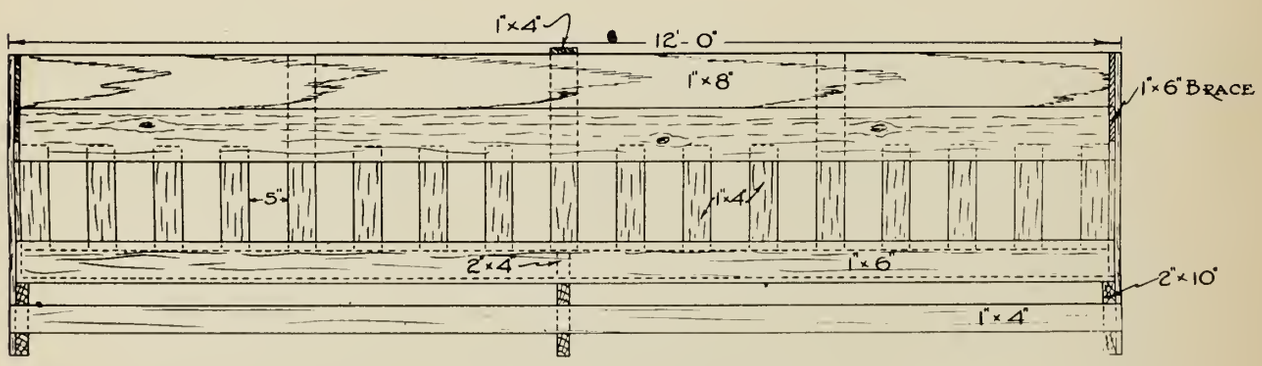


The parting chute (lower right in photo above) can be used to cut sheep into four groups. The shearing shed (below) was built from University of California Plan 191. It is an 8-man shed.

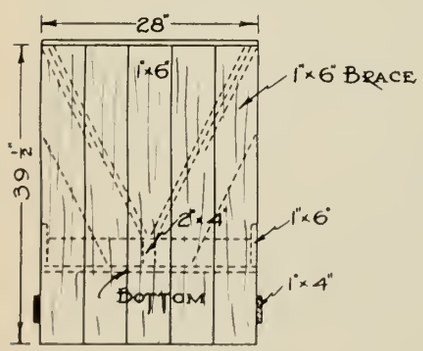



This hinged panel can be used for making a lambing jail. Details are given in Plan 114.

## HANDY SHEEP EQUIPMENT . . .

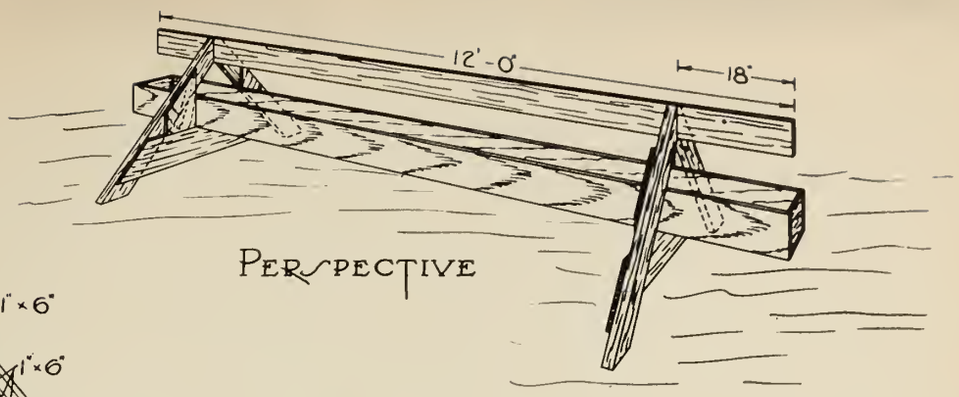



SIDE ELEVATION

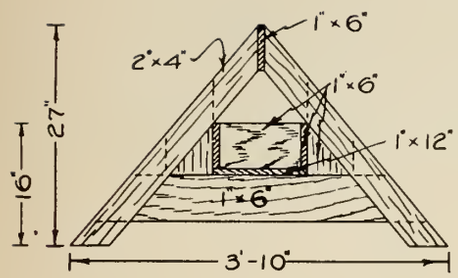



END ELEVATION

This combination hay and grain rack may be conveniently set across pens in a barn to serve as a partition. It can be made from Plan 118.



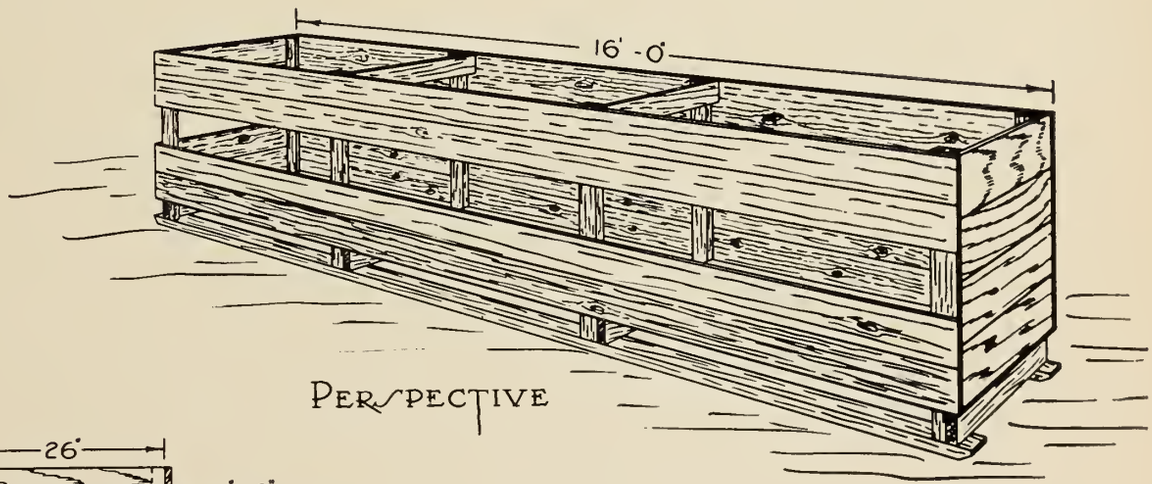

PERSPECTIVE



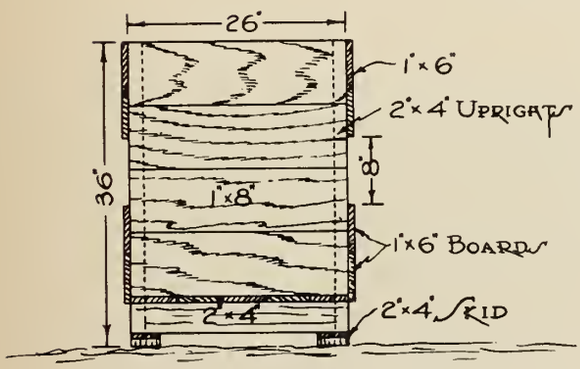

END ELEVATION

A simple grain trough for sheep.

## ...YOU CAN BUILD FOR YOURSELF




PERSPECTIVE




END ELEVATION

This hay rack for sheep may be built with or without a floor. It is set on 2 x 6" skids for easy moving. It can be built from Plan 116.

Left: Plan 72; a self-feeder for feeding salt mixes. Right: Plan 185; hay storage and feeding shed for supplementing sheep on pasture. When sheep need supplemental feed, feed doors are lifted; overhanging roof provides protection from weather.

## Sheep dogs

One of the most important single items of equipment on a sheep ranch is a well-trained dog. It is difficult to operate a sheep enterprise of any appreciable size without such help. When moving a flock of woollies, a dog well schooled in the fundamentals of working and handling sheep is more valuable than several men. On the other hand, a poorly trained dog, one that will not respond to commands, or one that lacks the natural ability for working sheep, is useless and can cause much damage and loss to the flock.

Training sheep dogs is a highly skilled profession. Several books available on the subject are listed in the Source Books.

There are several ways of acquiring ownership of a good sheep dog. Start by buying a well-bred pup of any of the recognized breeds of sheep dogs. At present, the Border Collie seems to be the most popular. However, many breeds and types are used in the sheep business.

In training the pup, patience plus some knowledge of dog training are essential; observing experienced trainers in action may also be helpful. If you do not have the time or knowledge required for training a dog, employ a good trainer. It is also possible to buy a dog already schooled in handling sheep.

Treat the dog with kindness, yet insist that he obey commands. When he does a good job reward him. A little petting at the proper time will keep the dog interested in his work, and he will respond more readily to commands.

A Border Collie—an excellent sheep dog.

Sheep depend almost entirely upon the plant world for their feed. Among our farm and range animals the sheep is outstanding in its ability to produce efficiently upon cheap feeds such as grass, legumes, browse, and hay. For greatest efficiency, however, the sheep must receive all of the nutrients it requires. Not only must these feed constituents be adequate, but the animal will use the various nutrients to better advantage if they are available in the proper balance.

Since sheep receive much of their feed in the form of pasture or range feeds, the sheepman must be the judge of the feed value they are obtaining from this vegetation. If you understand the fundamental requirements for the proper nutrition of your animals, you can much more intelligently assess their need for supplemental feed. It is especially important to know when to use it and how much you can use and still operate soundly from an economic standpoint.

### Requirements

The nutritive requirements shown in Tables A and B were prepared by the subcommittee on sheep nutrition of the National Research Council. In these tables the needs are grouped as follows: total feed, digestible protein, total digestible nutrients, calcium, phosphorus, salt, and carotene. Table A gives the requirement per animal daily, while Table B gives the requirements in terms of the percentage composition needed in the total feed of the animal. This latter table is particularly valuable when computing feed mixtures or in comparing the feeding value of a specific feed to the need of a particular class of sheep. An explanation of the various parts of the tables is given below.

### Total feed

The figures given for the various classes and weights of sheep may be used as a guide as to how much feed to allow each animal per day. This figure may be regarded as a "governor" to regulate the bulkiness of the daily feed. For example, the other requirements given in the table for a breeding ewe might be met by feeding her one pound of barley and one pound of cottonseed meal per day. However, the ewe would go off feed unless she had access to some bulky feed such as hay or straw. On the other hand, the requirements of a fattening lamb might be met by feeding him 4 or 5 pounds of alfalfa hay. As the lamb would not have the room in his digestive tract to handle this much bulk, he would not eat all of this hay. He would grow, but he would not fatten to suitable market condition. By following the recommendations of the table, we find that in order to stay within the limitations for dry matter and yet furnish enough energy (TDN) we must feed the lamb a fairly large proportion of a concentrated feed such as barley or corn.

### Digestible protein

This refers to that portion of the protein furnished by the feed that is actually digested and available in the body proper for use by the animal. Protein is the part of the feed that contains nitrogen. It is essential to the sheep for growth, for body maintenance and repair, and for wool development; to the pregnant ewe for proper development of her unborn lamb; and to the lactating ewe for secreting milk. The animal must have an adequte supply of protein in order to use efficiently the other nutrients provided by the feed. A deficiency of protein will result in reduced body and wool growth, poor development, and inefficient use of the feed.

Animals such as pigs and poultry are very exacting in the kind as well as the

## Table A. Recommended Daily Nutrient Allowance per Animal

| Age and condition of animal | Live weight | Expected daily gain or loss | Total feed, air dry basis | Total digestible protein | Total digestible nutrients | Calcium | Phosphorus | Salt | Carotene |
|---|---|---|---|---|---|---|---|---|---|
| | lb. | lb. | lb. | lb. | lb. | gm. | gm. | lb. | mg. |
| Bred ewes, first 100 days of gestation | 100 | 0.12 | 3.5 | 0.17 | 1.7 | 3.2 | 2.5 | 0.03 | 6.0 |
| | 110 | 0.12 | 3.6 | 0.18 | 1.8 | 3.2 | 2.6 | 0.03 | 6.6 |
| | 120 | 0.12 | 3.7 | 0.19 | 1.9 | 3.3 | 2.7 | 0.03 | 7.2 |
| | 130 | 0.12 | 3.8 | 0.20 | 2.0 | 3.4 | 2.7 | 0.03 | 7.8 |
| Bred ewes, last 6 weeks before lambing | 110 | 0.25 | 4.0 | 0.21 | 2.1 | 4.3 | 3.2 | 0.03 | 6.6 |
| | 120 | 0.25 | 4.1 | 0.22 | 2.2 | 4.4 | 3.3 | 0.03 | 7.2 |
| | 130 | 0.25 | 4.2 | 0.23 | 2.3 | 4.5 | 3.4 | 0.03 | 7.8 |
| | 140 | 0.25 | 4.3 | 0.24 | 2.4 | 4.7 | 3.5 | 0.03 | 8.4 |
| | 150 | 0.25 | 4.4 | 0.25 | 2.5 | 4.8 | 3.6 | 0.03 | 9.0 |
| Ewes in lactation | 100 | −0.10 | 4.5 | 0.27 | 2.5 | 6.1 | 4.5 | 0.03 | 6.0 |
| | 110 | −0.10 | 4.6 | 0.28 | 2.6 | 6.2 | 4.6 | 0.03 | 7.1 |
| | 120 | −0.10 | 4.7 | 0.28 | 2.7 | 6.4 | 4.7 | 0.03 | 7.8 |
| | 130 | −0.10 | 4.8 | 0.30 | 2.8 | 6.5 | 4.8 | 0.03 | 8.4 |
| | 140 | −0.10 | 4.9 | 0.30 | 2.9 | 6.6 | 4.9 | 0.03 | 9.1 |
| | 150 | −0.10 | 5.0 | 0.31 | 3.0 | 6.8 | 5.0 | 0.03 | 9.7 |
| Ewes—lambs and yearlings | 70 | 0.35 | 3.0 | 0.22 | 1.8 | 3.0 | 2.7 | 0.02 | 3.8 |
| | 90 | 0.30 | 3.2 | 0.22 | 1.9 | 3.0 | 2.7 | 0.02 | 5.0 |
| | 110 | 0.20 | 3.5 | 0.20 | 1.9 | 3.2 | 2.8 | 0.03 | 6.0 |
| | 130 | 0.10 | 3.8 | 0.20 | 2.0 | 3.1 | 2.7 | 0.03 | 7.1 |
| Rams—lambs and yearlings | 75 | 0.45 | 3.5 | 0.24 | 2.1 | 3.8 | 3.2 | 0.02 | 4.1 |
| | 100 | 0.40 | 4.0 | 0.24 | 2.3 | 4.0 | 3.4 | 0.03 | 5.5 |
| | 125 | 0.35 | 4.0 | 0.24 | 2.4 | 3.6 | 3.3 | 0.03 | 6.9 |
| | 150 | 0.30 | 4.3 | 0.23 | 2.6 | 3.7 | 3.3 | 0.03 | 8.2 |
| | 175 | 0.20 | 4.5 | 0.23 | 2.6 | 3.7 | 3.3 | 0.03 | 9.6 |
| Fattening lambs | 50 | 0.25 | 2.1 | 0.17 | 1.2 | 2.5 | 2.1 | 0.02 | 3.0 |
| | 60 | 0.30 | 2.3 | 0.18 | 1.4 | 2.6 | 2.2 | 0.02 | 3.6 |
| | 70 | 0.35 | 2.7 | 0.19 | 1.7 | 2.9 | 2.4 | 0.02 | 4.2 |
| | 80 | 0.35 | 2.9 | 0.20 | 1.9 | 2.9 | 2.4 | 0.02 | 4.2 |
| | 90 | 0.25 | 3.0 | 0.20 | 2.0 | 2.7 | 2.3 | 0.02 | 5.4 |

## Table B. Recommended Nutrient Allowances (In per cent or per pound of feed)

| Age and condition of animal | Live weight | Expected daily gain or loss | Total feed, air dry basis | Total digestible protein in ration | Total digestible nutrients in ration | Calcium 90 per cent dry matter | Phosphorus 90 per cent dry matter | Carotene mg. /lb. ration |
|---|---|---|---|---|---|---|---|---|
| | lb. | lb. | lb. | per cent | per cent | per cent | per cent | per cent |
| Bred ewes, first 100 days of gestation | 100 | 0.12 | 3.5 | 5.0 | 50 | 0.20 | 0.16 | 1.7 |
| | 110 | 0.12 | 3.6 | 5.0 | 50 | 0.20 | 0.16 | 1.8 |
| | 120 | 0.12 | 3.7 | 5.0 | 50 | 0.20 | 0.16 | 1.9 |
| | 130 | 0.12 | 3.8 | 5.0 | 50 | 0.20 | 0.16 | 2.0 |
| Bred ewes, last 6 weeks before lambing | 110 | 0.25 | 4.0 | 5.0 | 53 | 0.24 | 0.18 | 1.6 |
| | 120 | 0.25 | 4.1 | 5.0 | 54 | 0.24 | 0.18 | 1.7 |
| | 130 | 0.25 | 4.2 | 5.0 | 54 | 0.24 | 0.18 | 1.8 |
| | 140 | 0.25 | 4.3 | 5.0 | 55 | 0.24 | 0.18 | 1.9 |
| | 150 | 0.25 | 4.4 | 5.0 | 55 | 0.24 | 0.18 | 2.0 |
| Ewes in lactation | 100 | −0.10 | 4.5 | 6.0 | 58 | 0.30 | 0.22 | 1.3 |
| | 110 | −0.10 | 4.6 | 6.0 | 58 | 0.30 | 0.22 | 1.5 |
| | 120 | −0.10 | 4.7 | 6.0 | 58 | 0.30 | 0.22 | 1.6 |
| | 130 | −0.10 | 4.8 | 6.2 | 58 | 0.30 | 0.22 | 1.7 |
| | 140 | −0.10 | 4.9 | 6.1 | 58 | 0.30 | 0.22 | 1.8 |
| | 150 | −0.10 | 5.0 | 6.1 | 58 | 0.30 | 0.22 | 1.9 |
| Ewes—lambs and yearlings | 70 | 0.35 | 3.0 | 7.3 | 58 | 0.22 | 0.20 | 1.2 |
| | 90 | 0.30 | 3.2 | 6.9 | 58 | 0.21 | 0.19 | 1.6 |
| | 110 | 0.20 | 3.5 | 5.7 | 54 | 0.20 | 0.18 | 1.7 |
| | 130 | 0.10 | 3.8 | 5.3 | 54 | 0.18 | 0.16 | 1.9 |
| Rams—lambs and yearlings | 75 | 0.45 | 3.5 | 6.8 | 58 | 0.24 | 0.20 | 1.2 |
| | 100 | 0.40 | 4.0 | 6.0 | 60 | 0.22 | 0.19 | 1.4 |
| | 125 | 0.35 | 4.0 | 6.0 | 60 | 0.20 | 0.18 | 1.7 |
| | 150 | 0.30 | 4.3 | 5.3 | 60 | 0.19 | 0.17 | 1.9 |
| | 175 | 0.20 | 4.5 | 5.1 | 58 | 0.18 | 0.16 | 2.1 |
| Fattening lambs | 50 | 0.25 | 2.1 | 8.1 | 57 | 0.26 | 0.22 | 1.4 |
| | 60 | 0.30 | 2.3 | 7.8 | 60 | 0.25 | 0.21 | 1.6 |
| | 70 | 0.35 | 2.7 | 7.0 | 63 | 0.24 | 0.20 | 1.5 |
| | 80 | 0.35 | 2.9 | 6.9 | 65 | 0.22 | 0.18 | 1.4 |
| | 90 | 0.25 | 3.0 | 6.7 | 66 | 0.20 | 0.17 | 1.8 |

amount of protein they require. For example, pigs should have a source of animal protein such as skimmilk or meat scraps in their ration. Such proteins are referred to as good-quality protein. Sheep, however, are fortunate in that if they are provided with enough protein of any kind, the bacteria and protozoa (microorganisms) that live in the rumen or paunch will convert this protein into a form that can be utilized by the sheep. Thus our main concern about protein in sheep feeding is that the animal receive an adequate supply. Growing lambs and pregnant and nursing ewes have a relatively high protein requirement.

### Total digestible nutrients

This unit (often abbreviated TDN) is used to describe the energy value of a feed. It is useful in that it gives the comparative value for the different feedstuffs. For example, corn has a TDN value of 80.0, while oat straw has a TDN of only 44.7. This means that one pound of corn will furnish almost twice as much energy to an animal as will one pound of oat straw.

The total digestible nutrients (or energy) are the fuel upon which the animal body functions, just as gasoline is the fuel that furnishes the energy for an automobile. Sheep need energy to maintain the body functions, grow wool, and store fat; and in the case of the ewe, to nourish the unborn lamb or produce milk for the suckling lamb.

A lack of energy is probably the most common deficiency encountered in sheep production. Sheep often do not get *enough* to eat, or the feed they do eat does not contain enough energy to meet their needs. When sheep are on good feed and receiving more energy than they require, some of this excess energy is stored in the form of fat. When the feed is poor and the energy needs are not being met, the sheep will draw upon fat stores to make up for the energy deficiency. The sheepman says his sheep are "losing condition." Unless sheep are on very poor feed, the wool will continue to grow. As a result an inexperienced sheepman may not notice that the sheep are losing condition, because the wool will cover some of this loss. If an energy deficiency continues long enough, the sheep will become weak and eventually die of starvation.

### Minerals

Those known to be essential for animal life are calcium, phosphorus, sodium, chlorine, iodine, iron, copper, cobalt, manganese, zinc, potassium, sulphur, and magnesium. Some of these elements (such as potassium, magnesium, and zinc) are always present in such large quantities that we need not give them any consideration. Others such as sodium and chlorine must always be provided, while the remainder are usually present in adequate amounts but may be limited in certain soil areas or in some combinations of feeds.

**Calcium and phosphorus** are the main minerals found in bones. Young, growing lambs and pregnant and milking ewes have a high calcium and phosphorus requirement. In general, roughages, especially alfalfa, have a high calcium content. Sheep usually receive enough roughage so that there is little likelihood of their suffering from a calcium deficiency. Concentrates—that is, grains and especially the high-protein concentrates such as cottonseed meal—are high in phosphorus. Roughages, however, may be low in phosphorus, especially when grown on soils that are low or borderline in this mineral. As sheep depend primarily on roughages for their feed supply, a phosphorus deficiency is much more likely than a deficiency of calcium. Phosphorus is likely to be deficient in dry range feed. This may be indicated by slow growth, unthrifty appearance, or listlessness. In extreme cases sheep may have a depraved appetite; that is, they will chew on bones, fences, or

rocks. Lambs on a phosphorus-deficient ration may develop crooked legs.

**Sodium and chlorine** must be furnished sheep as ordinary salt. Salt should be available to sheep at all times. If they do not have it, they will crave it and will eat less feed and use what they do eat to poor advantage. Salt is ordinarily supplied sheep as half-ground salt or block salt. In addition to the requirements listed in the table, other nutrients discussed below may be of importance in sheep feeding.

**Iodine** is needed in the animal body for the proper functioning of the thyroid gland. When an animal does not receive enough iodine the thyroid gland enlarges and is commonly known as goiter. If sheep are deficient in iodine, lambs will be born with a characteristic enlargement of the throat. These lambs are usually born dead or die soon after birth. An iodine deficiency has been observed in a few localities in California but is not widespread. Iodine may be most economically and safely furnished to sheep by feeding iodized salt. Although this salt contains only 0.0076 per cent iodine, it will furnish adequate iodine for the sheep.

**Iron** is necessary for proper blood formation in the animal body. An iron deficiency has never been demonstrated in sheep. Therefore it can be assumed that they ordinarily receive plenty of iron in their feed.

**Copper** is needed for normal wool growth and for the prevention of a condition of lambs referred to as "sway-back" of "enzootic ataxia." In a copper deficiency the wool loses its crimp and is referred to as "steely" wool. When sheep are suffering from a low copper intake the lambs are born weak, lack muscular coordination, and soon die. This condition has never been observed in the United States, but is of considerable importance in Australia. It appears unlikely that sheep in California ever lack copper unless the area is high in molybdenum.

A deficiency of certain minerals will cause trouble:

- phosphorus—depraved appetite; poor gains
- sodium and chlorine (supplied in salt)—reduced gains
- iodine—goiter; weak and dead lambs
- copper—swayback and steely wool
- cobalt—loss of condition and appetite; eventual death
- sulphur—poor appetite; reduced gains

An excess of these minerals will cause trouble:

- fluorine—differential wear of teeth
- molybdenum—scouring, gray or white wool in black sheep
- selenium—sloughed hoofs and stiff joints

**Cobalt,** although needed in only minute amounts, is essential for the production of thrifty sheep. Cobalt-deficient areas have been found in many parts of the world, including Australia, Scotland, and some areas of the United States. To date, no cobalt-deficient areas have been detected in California. Sheep suffering from a lack of cobalt go off feed, lose condition, become weak and anemic, and eventually die. It has been shown that cobalt must be present for the micro-organisms in the rumen to produce vitamin $B_{12}$, which is essential to the sheep.

**Sulphur** deficiency in sheep has recently been demonstrated at the University of Illinois. Investigations currently under way at the California Experiment Station indicate that on certain soils the forage produced is low in sulphur. Fertilizing such areas with gypsum will generally increase plant growth and also increase the sulphur content of the forage.

**Manganese, zinc, potassium, and magnesium** deficiencies have never been demonstrated in practical sheep feeding; hence we need not consider these elements in planning our sheep-feeding program.

**Fluorine** may cause poisoning if it is present in large amounts. Raw rock phosphate should never be used as a phosphorus supplement because it carries enough fluorine to be toxic to sheep.

**Molybdenum** is another chemical element that is important because an excess is poisonous. In some areas of California sheep and cattle will scour because of an excess of molybdenum in the forage. Sheep receiving a high molybdenum ration will scour and lose weight. Wool that is normally black will grow in gray or white if the feed contains a high level of molybdenum. If copper is fed in addition to the molybdenum, the wool will grow in black again. This problem is not completely understood, but if you suspect molybdenum poisoning, consult your local Farm Advisor.

**Selenium** is another element that causes poisoning when it is present in excess. The most characteristic symptom is the soreness and sloughing of the hoofs and stiffness of the joints. This condition has been found in South Dakota and Wyoming. There is no evidence that it occurs in California.

### *Mineral mixtures for sheep*

Although sheep are known to require the several essential mineral elements, feeds commonly available will furnish these minerals except in unusual cases. Other than in the case of iodized salt, the California Experiment Station has no evidence of a need for the feeding of complex mineral mixtures to sheep. If there is any question of a phosphorus deficiency, steamed bone meal or other phosphorus supplements can be provided quite economically. It appears that money commonly spent for minerals for sheep could be used to better advantage by buying supplemental feed to correct the more fundamental deficiencies of energy and protein encountered in range sheep.

### The vitamins

**Carotene-vitamin A** is the most important vitamin for sheep production. Sheep obtain vitamin A from carotene present in green plants. Certain yellow feeds such as yellow corn, carrots, and sweet potatoes also furnish carotene. The degree of green color is a practical guide to the carotene content of roughages. Sheep may suffer a vitamin A deficiency when they are kept on dry, mature, and weathered forage for long periods. Pregnant ewes low in vitamin A will give birth to weak or dead lambs. Lambs are always born with too small a storage of vitamin A; therefore it is essential that they receive colostrum milk from the ewe, which is rich in this vitamin.

**Vitamin D** is normally obtained by sheep through the action of sunlight on a substance present in the sheep's skin. If sheep do not receive sunlight, lambs may develop rickets from a lack of vitamin D. Under usual farm and range conditions of California, there is no evidence to indicate that sheep ever lack vitamin D.

**The vitamin B complex** is not believed to be of importance in a sheep diet. It has been shown that mature sheep are able to synthesize these factors in the rumen. Young lambs require the B vitamins in their feed, but these are normally supplied in the ewes' milk.

**Vitamin E** is important in prevention of muscular dystrophy or white muscle disease in suckling lambs. Lambs suffering from this disease become stiff and unable to rise to nurse. They will eventually die of starvation. As the colostrum milk is high in vitamin E, this is another reason for making sure that the newborn lamb gets a good fill of it. The deficiency may also be prevented by properly feeding the ewe so that her milk will provide

## Table C. Composition of Feeds

| Feeds | Dry matter, per cent | Digestible protein, per cent | Total digestible nutrients | Calcium | | Phosphorus | | Carotene, milligrams per pound | Approximate relative productive value (barley = 100) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Per cent | Grams per pound | Per cent | Grams per pound | | |
| Air-dry forages: | | | | | | | | | |
| Alfalfa hay, average | 92.8 | 10.8 | 50.4 | 1.51 | 6.85 | 0.21 | 0.95 | 11.4 | 57.4 |
| Alfalfa hay, very leafy* | 90.5 | 12.6 | 52.7 | 1.73 | 7.85 | 0.25 | 1.14 | 19.4 | 60.9 |
| Asparagus butts, dried | 91.0 | 9.7 | 47.1 | .... | .... | .... | .... | .... | .... |
| Barley hay* | 90.8 | 4.0 | 51.9 | 0.26 | 1.18 | 0.23 | 1.04 | .... | 56.7 |
| Barley straw | 89.5 | 1.0 | 44.0 | 0.09 | 0.41 | 0.06 | 0.27 | 0.14 | 31.4 |
| Bean straw, field* | 89.1 | 3.0 | 45.2 | 1.67 | 7.54 | 0.13 | 0.59 | .... | 28.7 |
| Bean straw, lima | 90.0 | 6.0 | 48.0 | .... | .... | .... | .... | .... | .... |
| Beet tops | 80.0 | 7.7 | 47.5 | 0.45 | 2.08 | 0.19 | 0.86 | .... | .... |
| Cottonseed hulls | 90.7 | 0.0 | 43.7 | 0.14 | 0.64 | 0.07 | 0.32 | .... | 42.8 |
| Oat hay, moderately green | 88.2 | 3.3 | 48.1 | 0.27 | 1.22 | 0.22 | 1.00 | 8.00 | 54.3 |
| Oat straw | 91.9 | 1.5 | 45.5 | 0.23 | 1.04 | 0.13 | 0.59 | 0.14 | 32.6 |
| Sudan grass hay, before bloom | 90.0 | 6.7 | 50.0 | 0.47 | 2.13 | 0.24 | 1.09 | 2.9 | 54.1 |
| Vetch and oat hay, half vetch | 90.0 | 7.0 | 50.0 | 0.55 | 2.50 | 0.26 | 1.20 | .... | 56.9 |
| Winery pomace | 89.3 | 1.9 | 30.7 | .... | .... | .... | .... | .... | .... |
| Wild oat hay | 92.5 | 3.6 | 48.7 | 0.22 | 1.00 | 0.25 | 1.13 | .... | .... |
| Range forages: | | | | | | | | | |
| Annual grasses, mostly soft chess, seed stage, nearly mature | 90.6 | .... | 46.0 | 0.35 | 1.59 | 0.20 | 0.91 | .... | .... |
| Annual grasses, soft chess and fescue, mature dry | 90.0 | .... | 39.5 | 0.30 | 1.36 | 0.20 | 0.91 | .... | .... |
| Bur-clover, green, seed stage | 90.0 | 11.8 | 56.2 | 0.86 | 3.90 | 0.31 | 1.40 | .... | .... |
| Bur-clover, seed stage, dry leached by 0.3 inch rain | 90.0 | 10.6 | 50.8 | 0.89 | 4.00 | 0.30 | 1.36 | .... | .... |
| Bur-clover, seed stage, dry leached by 0.8 inch rain | 90.0 | 10.3 | 48.5 | 0.93 | 4.20 | 0.29 | 1.32 | .... | .... |
| Broad-leaf filaree, mature dry | 90.0 | .... | 43.3 | 1.70 | 7.70 | 0.13 | 0.59 | .... | .... |
| Broad-leaf and red-stemmed filaree, mixed, mature, dry, leached | 90.0 | .... | 37.0 | 2.3 | 10.40 | 0.10 | 0.45 | .... | .... |
| Broad-leaf filaree-grass mixture as grazed by cattle | 90.0 | 0.0–2.0 | 40.0 | .... | .... | .... | .... | .... | .... |

## Table C. Composition of Feeds—*Continued*

| Feeds | Dry matter, per cent | Digestible protein, per cent | Total digestible nutrients | Calcium | | Phosphorus | | Carotene, milligrams per pound | Approximate relative productive value (barley =100) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Per cent | Grams per pound | Per cent | Grams per pound | | |
| Pasture forages: | | | | | | | | | |
| Alfalfa, before bloom* | 19.8 | 3.2 | 12.0 | 0.48 | 2.18 | 0.07 | 0.32 | 28.3 | .... |
| Alfalfa, in bloom* | 26.3 | 3.4 | 15.6 | 0.37 | 1.68 | 0.07 | 0.32 | 28.3 | .... |
| Beet tops, green* | 17.8 | 1.7 | 10.4 | 0.18 | 0.82 | 0.04 | 0.18 | .... | 12.3 |
| Clover, bur* | 20.8 | 3.8 | 15.1 | 0.20 | 0.91 | 0.07 | 0.32 | .... | .... |
| Clover, ladino* | 16.3 | 3.7 | 11.4 | 0.20 | 0.91 | 0.07 | 0.32 | 25.2 | .... |
| Clover, ladino and grass pasture, much ladino* | 20.0 | 2.9 | 13.8 | 0.30 | 1.36 | 0.08 | 0.36 | .... | .... |
| Clover, ladino and grass pasture, mostly grass* | 20.0 | 2.0 | 13.1 | 0.16 | 0.73 | 0.07 | 0.32 | .... | .... |
| Oats, wild* | 36.6 | 1.9 | 19.3 | 0.09 | 0.41 | 0.10 | 0.45 | .... | .... |
| Orchard grass pasture* | 23.9 | 2.2 | 12.1 | 0.14 | 0.64 | 0.12 | 0.54 | 26.6 | 14.7 |
| Sudan grass, pasture stage* | 21.6 | 2.4 | 14.3 | 0.12 | 0.54 | 0.10 | 0.45 | 21.5 | 17.1 |
| Rye grass, Italian, pasture* | 20.0 | 1.6 | 10.0 | 0.13 | 0.49 | 0.08 | 0.36 | 21.5 | 16.1 |
| Silages, roots, and tubers: | | | | | | | | | |
| Alfalfa silage, slightly wilted | 31.1 | 4.0 | 18.8 | 0.38 | 1.72 | 0.06 | 0.27 | 14.9 | 25.4 |
| Carrots | 12.0 | 0.8 | 9.6 | 0.06 | 0.27 | 0.06 | 0.27 | 10.5 | 14.4 |
| Corn silage, well matured, average | 29.1 | 1.0 | 19.0 | 0.08 | 0.36 | 0.08 | 0.36 | 4.0 | 25.4 |
| Mangels | 9.2 | 0.7 | 6.6 | 0.02 | 0.09 | 0.02 | 0.09 | .... | 9.8 |
| Potatoes | 21.1 | 0.7 | 17.0 | 0.01 | 0.05 | 0.06 | 0.27 | .... | 25.1 |
| Potatoes, dried | 90.0 | 3.0 | 72.6 | 0.04 | 0.18 | 0.26 | 1.16 | .... | .... |
| Sorghum silage, sweet | 25.3 | 0.7 | 16.1 | 0.09 | 0.41 | 0.04 | 0.18 | .... | 17.1 |
| Sugar beets* | 16.4 | 1.2 | 13.7 | 0.04 | 0.18 | 0.04 | 0.18 | .... | 19.2 |
| Concentrates: | | | | | | | | | |
| Almond hulls, IXL | 90.0 | 0.0 | 72.0 | .... | .... | .... | .... | .... | .... |
| Almond hulls, Mission | 90.0 | 0.0 | 53.0 | .... | .... | .... | .... | .... | .... |
| Apple pomace, dried* | 89.4 | 1.7 | 64.0 | 0.10 | 0.45 | 0.09 | 0.41 | .... | .... |
| Babassu meal | 92.7 | 21.3 | 79.7 | .... | .... | .... | .... | .... | .... |
| Barley, California feed | 90.0 | 7.8 | 78.0 | 0.05 | 0.23 | 0.39 | 1.77 | .... | 100 |
| Beans, field* | 90.0 | 20.2 | 78.7 | 0.15 | 0.68 | 0.57 | 2.58 | .... | .... |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Beans, lima* | 89.7 | 18.7 | 77.8 | 0.09 | 0.41 | 0.37 | 1.68 | .... | .... |
| Beet pulp, molasses, dried | 92.0 | 7.7 | 74.0 | 0.59 | 2.68 | 0.09 | 0.41 | .... | .... |
| Beet pulp, wet | 12.3 | 1.1 | 9.4 | 0.09 | 0.41 | 0.01 | 0.05 | .... | .... |
| Brewers' grains, dried, from California barley* | 91.1 | 14.4 | 59.6 | 0.16 | 0.73 | 0.47 | 2.13 | .... | .... |
| Brewers' grains, wet* | 23.7 | 4.2 | 16.1 | 0.07 | 0.32 | 0.12 | 0.55 | .... | 21.1 |
| Coconut oil meal, old process | 92.7 | 17.5 | 83.8 | 0.28 | 1.27 | 0.58 | 2.63 | .... | .... |
| Corn, dent, No. 2 | 85.0 | 7.0 | 80.0 | 0.01 | 0.05 | 0.25 | 1.14 | 2.2 | 112.2 |
| Cottonseed, whole* | 92.7 | 17.1 | 90.8 | 0.14 | 0.64 | 0.70 | 3.18 | .... | 107.3 |
| Cottonseed meal, cold pressed (28 per cent protein) | 93.5 | 23.4 | 59.8 | 0.17 | 0.77 | 0.64 | 2.90 | .... | 81.8 |
| Cottonseed meal (43 per cent protein) | 93.5 | 35.0 | 75.5 | 0.24 | 1.10 | 1.11 | 5.00 | .... | 107.7 |
| Cottonseed meal (41 per cent protein) | 92.8 | 33.9 | 73.6 | 0.20 | 0.91 | 1.19 | 5.40 | .... | 98.9 |
| Distillers' corn grain, dried | 93.2 | 20.1 | 81.6 | 0.04 | 0.18 | 0.29 | 1.32 | .... | 113.3 |
| Figs, dried | .... | 4.0 | 69.0 | .... | .... | .... | .... | .... | .... |
| Fish meal (over 63 per cent protein)* | 92.7 | 60.1 | 73.8 | 4.14 | 18.80 | 2.67 | 12.12 | .... | 101.9 |
| Hominy feed | 90.5 | 8.2 | 88.3 | 0.03 | 0.14 | 0.44 | 2.00 | .... | 118.3 |
| Kafir | 88.1 | 9.0 | 79.7 | 0.01 | 0.05 | 0.25 | 1.13 | .... | 109 |
| Linseed meal, Pacific Coast (28 to 30 per cent protein) | 90.0 | 25.0 | 77.2 | 0.34 | 1.54 | 0.92 | 4.17 | .... | 109.4 |
| Milo | 90.7 | 8.3 | 80.0 | 0.04 | 0.18 | 0.25 | 1.13 | .... | 109.1 |
| Milo heads, ground | 89.6 | 8.1 | 76.0 | 0.08 | 0.36 | 0.24 | 1.09 | .... | 99.3 |
| Molasses, cane | 76.0 | 0.9 | 57.0 | 0.35 | 1.59 | 0.06 | 0.27 | .... | 95.4 |
| Oats, Pacific coast | 90.0 | 7.6 | 72.0 | 0.09 | 0.41 | 0.33 | 1.50 | .... | 112.2 |
| Peanut oil meal (38 to 43 per cent protein) | 93.6 | 37.0 | 78.8 | 0.10 | 0.45 | 0.50 | 2.27 | .... | 117.1 |
| Rice bran | 91.2 | 8.3 | 67.5 | 0.10 | 0.45 | 1.84 | 8.35 | .... | 79.4 |
| Rice polish | 90.0 | 8.2 | 81.0 | 0.03 | 0.14 | 1.54 | 6.89 | .... | 98.6 |
| Rye | 90.5 | 9.3 | 76.1 | 0.04 | 0.18 | 0.37 | 1.68 | .... | 98.7 |
| Soybean oil meal | 92.2 | 37.5 | 80.5 | 0.29 | 1.32 | 0.67 | 3.04 | .... | 109.8 |
| Wheat, Pacific coast | 90.0 | 9.3 | 84.0 | 0.03 | 0.14 | 0.43 | 1.95 | .... | 112.0 |
| Wheat bran | 90.6 | 13.1 | 70.0 | 0.10 | 0.45 | 0.14 | 5.17 | .... | 80 |

Sources of data:

Data for feeds marked with an asterisk (*) are taken from Morrison, F. B., Feeds and Feeding 1,083 p., 21st Ed. The Morrison Publishing Company, Ithaca, N. Y. 1948. Other data are from Guilbert, H. R., and G. H. Hart, California Beef Production, California Agricultural Experiment Station and Extension Service, Manual 2, Section III, 1951.

## Table D. The Use of Recommended Nutrient Allowances and Feed Composition Table for Determining the Needs of a Pregnant and Nursing Ewe

| | Feed | Total feed, lb. | Digestible protein, lb. | Total digestible nutrients, lb. | Calcium, gm. | Phosphorus, gm. | Salt, lb. | Carotene, mg. |
|---|---|---|---|---|---|---|---|---|
| For a 110-pound ewe for the first 100 days after breeding | Recommended allowance table — | 3.6 | 0.18 | 1.8 | 3.2 | 2.6 | 0.03 | 6.6 |
| | 3.6 pounds alfalfa hay furnishes | 3.6 | 0.38 | 1.81 | 24.7 | 3.4 | .... | 41.04 |
| | Salt | ½ oz. | .... | .... | .... | .... | 0.031 | .... |
| For the same ewe (now weighing 120 pounds) the last six weeks before lambing | Recommended allowance | 4.1 | 0.22 | 2.2 | 4.4 | 3.3 | 0.03 | 7.2 |
| | Alfalfa hay | 4.0 | 0.43 | 2.02 | 27.4 | 3.8 | .... | 45.6 |
| | Barley | 0.25 | 0.02 | 0.20 | .06 | .44 | .... | .... |
| | Salt | ½ oz. | .... | .... | .... | .... | 0.031 | .... |
| | Total | 4.25 | 0.45 | 2.22 | 27.46 | 4.24 | 0.031 | 45.6 |
| For the same ewe (now weighing 110 pounds) nursing lambs | Recommended allowance | 4.6 | 0.28 | 2.6 | 6.2 | 4.6 | 0.03 | 7.1 |
| | Alfalfa hay | 4.0 | 0.43 | 2.02 | 27.4 | 3.8 | .... | 45.6 |
| | Barley | 0.75 | 0.06 | 0.58 | 0.17 | 1.3 | .... | .... |
| | Salt | ½ oz. | .... | .... | .... | .... | 0.031 | .... |
| | Total | 4.75 | 0.49 | 2.60 | 27.57 | 5.1 | 0.031 | 45.6 |

## Table E. Computation of a Self-Feeding Mixture for Fattening Lambs

### Using Table A, a ration must first be computed for an average lamb in the lot.

### Recommended Daily Nutrient Allowance per Animal

| Requirements for 70-pound lamb (expected daily gain 0.35 lb.) | Total feed, air dry basis, 2.7 lb. | Total digestible protein 0.19 lb. | Total digestible nutrients, 1.7 lb. | Calcium, 2.9 gm. | Phosphorus, 2.4 gm. | Salt .02 lb. | Carotene, 4.2 mg. |
|---|---|---|---|---|---|---|---|
| Ration: | | | | | | | |
| Alfalfa hay | 1.4 | .15 | .71 | 9.59 | 1.23 | .... | 16.0 |
| Barley | .7 | .05 | .55 | .16 | 1.24 | .... | .... |
| Molasses dried beet pulp | .6 | .05 | .44 | 1.61 | .25 | .... | .... |
| Salt | ⅓ oz. | .... | .... | .... | .... | .02 | .... |
| Total | 2.7 | 0.25 | 1.70 | 11.36 | 2.72 | .02 | 16.0 |

To obtain the mixture on a percentage or 100-pound basis, it is necessary to convert the above ration to percentage, as in Table F.

$\frac{1.4}{2.8}$ = 51.5 per cent alfalfa

$\frac{.7}{2.8}$ = 26.0 per cent barley

$\frac{.6}{2.8}$ = 22.0 per cent molasses dried beet pulp

.5 per cent salt

100.0

an adequate supply of vitamin E for the nursing lamb.

Wheat-germ meal, wheat-germ oil, and high-quality dehydrated roughages are all good sources of vitamin E.

## Composition of feeds

The average composition of feeds commonly used for sheep feed in California is shown in Table C. Bear in mind that this table, while representing the best available information, does not always reflect the exact analysis of all feeds. For example, high-quality alfalfa hay may contain more than 10.8 per cent digestible protein and 19.4 milligrams of carotene per pound; but on the other hand, badly weathered alfalfa may contain considerably less of these nutrients.

**How to compute rations.** The examples in tables D, E, and F show how the tables of recommended allowances and the feed-composition tables may be used for computing rations for sheep that are receiving all of their feed in the form of harvested roughages and concentrates.

## Supplemental feeding

As sheep spend most of the year on range or pasture, it is important to estimate the nutrients the animal is able to obtain in grazing and to detect any deficiencies. To aid in estimating the principal nutrients, data are presented in the range-forage sections of Table C on some of the more common California range and pasture plants.

The stage of maturity of these plants is very important in assessing their value to the animal. At the beginning of the growing season, especially when rainfall is frequent and heavy, forage plants may contain as high as 90 per cent moisture, and only 10 per cent dry matter. At this season it may not be possible for a sheep to eat enough of this watery feed to meet its energy requirements. If it is assumed that the ewe will not eat over 20 pounds of this forage per day, it is apparent that she is suffering from an energy deficiency (see table E). The feed should be supplemented with grain or hay to get enough energy to care for her needs.

As the feed "hardens" (that is, as the dry matter increases) the ewe is able to get her needs from the native forage.

Table H shows the changes that take place in range forage as it matures and dries. Of importance nutritionally is the fact that the protein, phosphorus, and

**Table F. Using Table B, the computation is simplified, particularly for formulating more complex mixtures.**
**Recommended Nutrient Allowance in Per Cent or Per Pound of Feed**

| Requirements for 70-pound lamb, expected daily gain 0.35 lb. | Total feed, air dry basis, lb. | Total digestible protein, 7.0 per cent | Total digestible nutrients, 63 per cent | Calcium, 0.24 per cent | Phosphorus, 0.20 per cent | Carotene, 1.5 mg. /lb. |
|---|---|---|---|---|---|---|
| Formula for mixed feed | | | | | | |
| Alfalfa hay ..... 51.5% | .... | 5.56 | 26.0 | 0.78 | 0.11 | 5.9 |
| Barley ..... 26.0 | .... | 2.03 | 20.3 | 0.01 | 0.10 | ... |
| Molasses dried beet pulp ..... 22.0 | .... | 1.69 | 16.3 | 0.13 | 0.02 | .... |
| Salt ..... 0.5 | .... | .... | .... | .... | .... | .... |
| 100.0% | 2.7* | 9.28 | 62.6 | 0.92 | 0.23 | 5.9 |

* Obtained from Table B.

## Table G. Effect of the Dry-Matter Content of Pasture Forage on the Amount Needed for a Ewe to Balance Her Ration

| Recommended nutrient allowance for a 120-pound ewe nursing a lamb | Total feed, air-dry basis, 4.6 lb. | Total digestible protein, 0.28 lb. | Total digestible nutrients, 2.7 lb. | Calcium, 6.4 gm. | Phosphorus, 4.7 gm. |
|---|---|---|---|---|---|
| One pound of rye grass containing 10 per cent dry matter would furnish | .1 | .008 | 0.05 | .... | .... |
| To balance her ration a ewe would have to eat 54 pounds of grass per day, which would furnish | 5.4 | 0.43 | 2.7 | .... | .... |
| In contrast, one pound of bur clover at the seed stage would furnish | .9 | .118 | .562 | 3.9 | 1.4 |
| Therefore to balance her ration the ewe would need to eat only 4.9 pounds, which would furnish | 4.4 | .58 | 2.75 | 16.2 | 3.0 |

## Table H. Seasonal Changes in the Composition of Representative Annual Forage Species*

| Forage species | Crude protein | Nitrogen-free extract and fat | Crude fiber | Total minerals† | Calcium | Phosphorus |
|---|---|---|---|---|---|---|
| Bur clover: | | | | | | |
| Early green stage | 32.9 | 44.7 | 12.8 | 9.7 | 1.1 | 0.45 |
| Bloom stage | 24.2 | 49.2 | 18.2 | 8.4 | 1.5 | .40 |
| Seed stage | 22.8 | 47.5 | 22.2 | 7.4 | 1.2 | .32 |
| Mature, dry | 16.7 | 46.4 | 30.7 | 7.1 | 1.5 | .24 |
| Soft chess: | | | | | | |
| Bloom stage | 13.6 | 53.6 | 28.2 | 4.6 | 0.35 | .37 |
| Seed stage | 11.5 | 59.1 | 26.1 | 3.3 | 0.31 | .33 |
| Mature dry | 7.7 | 60.9 | 28.0 | 3.4 | 0.35 | .26 |
| Dry, leached | 6.9 | 60.5 | 30.1 | 2.5 | 0.41 | .14 |
| Broad-leaf filaree: | | | | | | |
| Early green stage | 25.0 | 52.1 | 12.1 | 10.8 | 1.7 | .39 |
| Bloom stage | 14.6 | 55.1 | 22.1 | 8.2 | 1.4 | .35 |
| Seed stage | 11.2 | 54.0 | 27.0 | 7.9 | 1.4 | .32 |
| Mature dry | 6.4 | 57.2 | 28.3 | 7.9 | 1.7 | .13 |
| Dry, leached | 5.9 | 58.6 | 30.0 | 5.9 | 1.9 | 0.08 |

* All figures are expressed on the basis of moisture-free samples.
† Total minerals represent silica-free ash.
Reference: Guilbert, H. R., and G. H. Hart, California Beef Production, California Agricultural Experiment Station and Extension Service Manual 2, p. 17, section III.

**Table I. Deficiencies of Dry Summer and Fall Range**

| | Total feed, lb. | Digestible protein, lb. | Total digestible nutrients, lb. | Calcium, gm. | Phosphorus, gm. | Salt, lb. | Carotene, mg. |
|---|---|---|---|---|---|---|---|
| Recommended daily allowance for a bred ewe weighing 110 pounds | 3.6 | 0.18 | 1.8 | 3.2 | 2.6 | 0.03 | 6.6 |
| Annual grasses, soft chess, and fescue, mature and dry, provide | 3.6 | 0.00 | 1.42 | 4.9 | 3.3 | .... | .... |
| Deficiencies | .... | 0.18 | 0.38 | .... | .... | 0.03 | 6.6 |
| Supplement needed | | | | | | | |
| Cottonseed meal | 0.5 | 0.175 | 0.38 | 0.55 | 2.5 | .... | .... |
| Salt | ½ oz. | .... | .... | .... | .... | 0.03 | .... |

carotene decrease and the fiber increases. As the fiber increases, the digestibility and thus the feeding value of the feed decreases. Bur-clover is one of the best range plants in that it contains a high level of protein and phosphorus. It retains a relatively high level of these nutrients when dry and mature, whereas most dry range plants are very low in these nutrients. The table on this page shows the deficiencies a ewe would be subject to during the summer and fall months, when grazing on a range consisting of annual grasses such as soft chess and fescue that are mature and dry. One-half pound per day of 43 per cent protein cottonseed meal will balance all of the deficiencies except that of carotene.

Fortunately the sheep is able to store quite a large supply of vitamin A in the liver, which will carry it through reasonable periods of vitamin A or carotene deficiency. However, sheep on dry feed for long periods should be supplemented with alfalfa hay of good quality or alfalfa pellets, which will furnish adequate carotene. A new product available commercially containing stabilized vitamin A may prove very useful in providing vitamin A in a dry form that can be mixed with supplemental feeds.

Browse plants that stay green through the summer months are valuable as a supply of protein and carotene for range sheep. The brush must be low enough for the sheep to reach and open enough so that they can move through it easily if they are to obtain any feed from it.

**Salt mixes as supplemental feed.** Recently mixtures containing 25 per cent salt and 75 per cent cottonseed meal have been tested at the Hopland Field Station as a supplement for range sheep. Further tests are under way using variable percentages of salt mixed with equal parts of barley and cottonseed meal. These supplements are provided in self-feeders on the range. In a trial with pregnant and lactating ewes, the average daily intake per ewe ranged from 0.073 pounds of

cottonseed meal and 0.024 pounds of salt to 0.347 pounds of cottonseed meal and 0.116 pounds of salt. By varying the percentage of salt in the mix the intake of supplemental feed can be controlled. From observations of this method of feeding, the following advantages and disadvantages have been noted.

***Advantages:*** Sheep do not need to be fed every day. Each sheep has an opportunity to take as much supplement as it desires. Sheep can increase their intake as the supply of other feed decreases. Less feeder space is required—one foot of feeder space per five sheep or less. All the sheep do not have to be at the feeding grounds at feeding time to get their share of the supplemental feed. Little feed is wasted as there is little crowding around the feeder.

***Disadvantages:*** Sheep may not be seen so often as is usually considered good management. There is the additional cost of the salt and the cost of providing covered self-feeders. Water must be plentiful. Range sheep may need some training before they will eat from a self-feeder.

## CALENDAR OF OPERATIONS . . . during a typical year certain things happen with regularity

To aid novice sheepmen in organizing their work, this section will carry a group of sheep through a complete yearly cycle.

### Breeding season

The date that rams are placed with ewes will depend, naturally, upon when the lambing season is desired. The gestation period of the ewe is approximately 147 days, varying from 142 to 152 (about 5 months). Choose the lambing season after considering several factors. It is usually most important to have the lambs born early so that they are old enough to utilize the spring growth of natural feed and be sold as "fats" before the feed dries. Other considerations are (1) marketing the lambs early in spring to receive the higher price usually paid before July 1; (2) weather during lambing; (3) feed available for lambing; (4) shelter for ewes at lambing time; and (5) the pressure of other work.

The normal breeding season of sheep is autumn, but in California it is usually desirable to breed ewes in late spring and summer. Since the ewes are breeding out of season, the rams must be left with them for at least three months, and even then there may be some ewes that will not breed. Where early fall lambs are desired, it is especially important that the ewes carry some fine-wool blood. Dorset Horn ewes also commonly breed early.

**Number of rams needed.** Under range-breeding conditions, three rams are commonly used per hundred ewes bred. Under pasture conditions, one yearling ram may settle up to 50 ewes. Beyond two years of age, rams are usually not so active. Ram lambs, if well grown, may be bred to as many as 20 ewes.

**Care of ewes before breeding.** Usually the previous crop of lambs will be weaned a few weeks before the breeding season. After the lambs are removed, it is a good plan to hold the ewes on dry feed until a few days before turning in the rams. Ewes should not be overly fat when placed with rams.

**Drenching the ewes** to reduce the load of internal parasites should be done at this time. (The parasites will have increased during the green-feed season, and if their number is reduced by drenching at the beginning of the dry-feed season, the ewes will probably not be reinfected while on dry feed.)

Phenothiazine should be kept in the salt (1 part phenothiazine to 9 parts salt

by weight) and provided the sheep throughout the year.

**Dipping.** If the sheep are infested with any external parasites, such as ticks or lice, they should be sprayed or dipped at this time. A mixture of rotenone, D.D.T., and benzene hexachloride has been found effective. This spraying will also reduce for a few weeks the danger from fly strike.

**Flushing the ewe.** This is the practice of feeding the ewe so that she is gaining weight at the time she is bred. It is normally accomplished by keeping the ewe on poor feed from the time the lamb is weaned until just before breeding. Then the breeding ewes are placed on the best feed available so that they are gaining rapidly when exposed to the ram. This practice is generally believed to increase the number of eggs shed by the ewe, resulting in an increased number of twins at lambing time.

**Care of rams before breeding season.** Rams should be bought well in advance. If possible, they should be on the ranch for a few weeks before being turned in with the ewes and should be well fed during this period. Rams lacking in condition may be fed as much as a pound of grain per day for about a month.

If the rams are carrying much wool, it is desirable to shear them before turning them in with the ewes. Some sheepmen shear only the belly and scrotum before the breeding season.

**Care of rams during breeding season.** Active rams running with a large number of ewes over a long period will lose condition. One way to insure that they are well cared for is to turn the rams in with ewes only at night, separate them in the morning, and keep the rams in a corral on a good feed of hay and grain during the day. This system is only practical where the sheep can be brought to a separating corral every night and morning.

Another practice, more applicable to most sheep ranches, is to turn in only half the rams at one time. After a week or two these rams can be removed, rested,

Ewe at right-center has recently been bred by a ram with a painted brisket.

and fed well while the other half of the rams are in with the ewes. By rotating the rams it is possible to keep fresh, well-conditioned rams in with the ewes during the entire breeding season.

**Check fertility of the ram.** In pure-bred flocks and in one-ram flocks, it is essential that the ram used be fertile; otherwise a complete lamb-crop failure may result. The most common method of checking on the fertility of the ram is to use a ewe-marking harness or paint the brisket of the ram with a solution of paint pigment in a non-drying oil. Then when the ram breeds the ewe, he will leave a colored mark on her rump. The color of the paint (or of the crayon in the ewe-marking harness) should be changed every 15 days. It is well to start with a light-colored paint or crayon and change to darker colors as the breeding season progresses.

If all or most of the ewes that are marked during the first period are marked again during the second period, it means that the ewes were not settled at the first mating; this throws the fertility of the ram in doubt. Even with highly fertile rams a few ewes may return to service; but if a large proportion have not conceived, the ram should be replaced.

If facilities are available, some sterile rams may be detected early by examining the semen under a microscope. After the ram is bred to a ewe, tip the ewe up on her tail and, using a small, smooth spatula, take a drop or two of the semen from the vagina and place it on a slide. Examine the slide immediately under a microscope. There should be large numbers of active, normally-shaped sperm.

**Artificial insemination.** Although the techniques of practicing artificial insemination in sheep have been carefully developed, so much labor is involved that under farm or ranch conditions it is not practical. One of the major problems is that estrus or heat can be detected in the ewe only by a ram.

**The use of hormones.** The reproductive processes of sheep are known to be controlled by hormones secreted by the ductless glands. Much research work has been done on these substances in recent years.

Possible uses of hormones are (1) to breed ewes out of season early in the summer; (2) to produce two lamb crops per year; and (3) to increase the percentage of twin births.

***To breed ewes early in summer.*** The use of hormones for this purpose has been studied for many years by the University of California Department of Animal Husbandry, under the leadership of Dr. H. H. Cole. Occasionally a high degree of success was obtained by injecting gonadotrophin, a hormone that stimulates the ovaries. This is obtained from the pituitary gland located at the base of the brain. In most instances, however, results were unsatisfactory. On the average, no more than 10 per cent of the treated ewes became pregnant following breeding.

Recently sensational results have been reported from the use of ECP (Estradiol cyclopentylpropionate). This is one of a group of chemically related substances called estrogens. ECP has been reported to be almost 100 per cent effective in bringing ewes into heat shortly after injection; furthermore, the ewes were reported to become pregnant after breeding.

These reports were received with skepticism by experts in this field because previous experiments had shown that estrogens inhibit rather than stimulate the ovaries. To test the effectiveness of this new material, field tests have been conducted by farm advisors supervised by Dr. Cole. In one such test, 50 Columbia x Rambouillet ewes were injected with 2 milligrams of ECP. Forty-eight of these ewes had come in heat and bred by the fifth day after treatment. Unfortunately, however, not one became pregnant to the early mating following the injection. Five

and one half months after injection, none of these ewes had lambed. Results in other trials have been similar. Our conclusion is that ECP is entirely valueless in stimulating the breeding of ewes during early summer. In fact, its use may well be detrimental because the rams are overworked breeding ewes that do not conceive.

***To produce two lamb crops per year.*** Wide publicity has attended the use of hormones for this purpose. Unfortunately, the workers who issued the original report have not to date disclosed the hormones used nor the amounts injected. Unless it can be clearly demonstrated by controlled experiments conducted by scientists that such a hormone will consistently produce two lamb crops per year, sheepmen should not attempt to use any such system.

***To increase the percentage of twins born.*** English research workers have clearly shown that it is possible to increase the number of eggs shed by the ewe at breeding time by injecting one of the hormone preparations (pregnant-mare serum, PMS). The difficulty from the practical standpoint, however, is that too many eggs may be shed, resulting in the production of as many as five or more lambs. Such lambs are of no practical value, as they are too small and weak to survive after birth.

***Hormones are not recommended.*** It appears at this time that there is *no* advantage of treating sheep with hormones to improve their reproductive ability. Early lambs can best be obtained by using a breed of sheep that normally breeds early and then selecting within the flock for the ewes that consistently drop early lambs.

**Breeding ewe lambs.** The common practice among sheepmen is to breed ewes for the first time when they are 18 to 19 months, to give birth to their first lamb when they are approximately two years of age. Under this system the only return received from the ewe during her first year is her wool clip.

Where a good feed supply is available for the ewe lambs, they can be bred at 9 to 11 months of age, to lamb when they are 14 to 16 months. For example, a ewe lamb born in November, 1952, might be bred in August, September, or October, 1953, to lamb in January, February, or March, 1954. Size is a better criterion than age in deciding when to breed a ewe lamb. She should weigh a minimum of 80 pounds when bred, preferably 90. These lambs should be well fed continuously to insure steady growth during pregnancy. As lactation is a more severe drain on the ewe than is pregnancy, the yearling ewes should be kept on excellent feed while nursing the lambs. If good pasture is not available, the ewes should receive a grain supplement.

The lambs produced by these young ewes should be weaned young—usually by 3 months—to allow the ewe to regain condition for the following breeding season. That is, in the above example, lambs should all be weaned by June 15, 1954, so that the ewes can be rebred, to lamb early in the season they are two years of age.

This practice of breeding ewe lambs is gaining in popularity in sections of California where a good supply of summer feed is available, particularly in irrigated-pasture areas. Records kept by the Extension Service of cooperative tests with sheepmen involving more than 13,000 ewes indicate that a lamb crop of from 60 to 85 per cent has been obtained using this system of breeding, and the average return per ewe bred was $16.60 (1951–52). This practice is not recommended to sheepmen who do not have a plentiful supply of feed for the ewes during the entire season.

## Shearing, branding, and hoof-trimming

Shear in the spring, late enough so that there is little danger of a cold storm. (For

a detailed description of wool and shearing, see "California Wool Production" by J. F. Wilson, listed among Source Books on page 59.) In California this period will vary from February in the extreme south to July in the mountain areas.

Shearing is generally done by professional shearers, who furnish their own tools and power supply. Usually the sheep owner must provide facilities for penning the sheep, as well as a shearing floor and a sacking stand for the wool; but some crews will also provide the pens. Shearing-shed plans are available as discussed on page 20 in Section 3 on Equipment.

Carefully tie the fleeces with paper twine and pack them in regular wool bags, which will hold 20 to 40 fleeces with a weight of 250 to 350 pounds. Tags (See p. 45), black wool, and buck wool should be sacked separate from the ewe fleeces. Keep dung locks out of the wool bag.

Sheep, other than ewes nursing lambs, should be kept off feed for a few hours before shearing. Sheep full of lush feed when shorn are hard to shear, and some losses may occur.

**Summer shearing.** In most of California the usual time for shearing is March or April, but it may vary, as stated above, from February to July. Some sheepmen, particularly in Yolo, Solano, and Sonoma counties, shear again in late summer or early fall. This shearing must be done before the nights become too cold in the fall, or trouble with pneumonia may be encountered.

Experimental results show that there is little difference in the actual weight of clean wool produced in twelve months when shearing once or twice a year. The chief disadvantage of this summer-shearing program is the increased cost. Shearing costs will be doubled since the price per head for each shearing is the same whether the ewes are shorn once or twice a year. Furthermore, the length of staple of the wool is reduced. The fall clip having been grown for only 4 to 5 months will be too short to comb and will sell for a reduced price. The spring clip grown for 7 to 8 months will also sell for less per pound than a 12-month clip.

You will want to weigh these considerations against the advantages of shearing twice before coming to your decision: 1) Ewes that are shorn will thrive better through the winter. 2) Fewer ewes are lost from getting down on their backs and being unable to get up. A ewe with a long fleece is forced when wet to carry considerable additional weight. 3) Less trouble is encountered with fly strike. The ewe that has been summer-shorn is less likely to get dirty around the rear quarters. If ewes are not summer-shorn, they should be tagged before lambing. 4) The spring clip will be cleaner. Through late spring and summer sheep will pick up bur clover, foxtail, and other weed seeds that cling to the wool. These seeds irritate the skin and cause discomfort to the sheep. Summer shearing removes these seeds, relieves the sheep of irritation, and results in a spring clip free of seed defect. 5) The heat load of the ewes is relieved. By summer shearing in early August, discomfort due to high temperatures is reduced. Some sheepmen believe that ewes breed better after the wool is removed.

**Branding.** Sheep are commonly branded with the owner's brand. Such a brand is essential for separating sheep, in case of a mixup with others. Only branding fluid that will scour out of the wool should be used. The brand may be carved out of wood or made of heavy wire or metal that will hold its shape. It should be not over 6 inches in diameter. Larger brands will become so large as to prove unreadable as the wool grows. The brand should be placed on the back of the sheep so that it is easily seen by the operator of a parting gate in a chute.

**Hoof trimming.** Unless sheep are traveling over rocky and gravelly terrain,

Sheep with long, ill-shaped feet due to neglect. The front feet were trimmed before photo was taken.

the feet should be trimmed at least once each year. If the feet are not trimmed the toes grow very long and the wall of the hoof turns in, producing deformed feet. Such untrimmed feet may produce lameness and even permanent weakness and crooked legs and pasterns. Neglected feet often break unevenly and are subject to foot rot and foot abscess. A good practice is to trim the feet of all sheep every fall. The hoofs will be softer after the ground is damp following the first fall rains.

## Care of ewes from breeding to lambing

After the ewes are bred, they are usually put on whatever pasture is available. Grain stubble and other crop aftermath is good for such ewes. If they are kept continually on irrigated pasture they may become overly fat. On the other hand, ewes pastured on native ranges may become too thin. In general, pregnant ewes should not be allowed to lose weight but should gain enough to be in good condition at lambing time.

Beginners may be misled about the condition of ewes at this time of year, because as the wool grows longer they appear to be gaining weight. Their actual condition can be readily determined by catching a few ewes and feeling through the wool along the back and ribs to determine the fat covering.

**Feed well for health.** One good reason for feeding the ewes well before lambing is to avoid the disorder known variously as "pregnancy paralysis," "twinning disease," "lambing paralysis," and "pregnancy toxemia." This ailment mainly occurs in ewes far advanced in pregnancy that are carrying twin or triplet lambs. An affected ewe will appear

Grain stubble provides an important source of feed for breeding flocks in California. The sheep will clean up weeds, remaining grain, and some straw but should not be forced to eat all of the latter.

dull and listless, refuse to eat, eventually become blind and unable to rise, and will finally die.

It is generally believed that the condition is caused by a lack of readily available carbohydrate in the ration of the ewe. In order to meet the demands of her body and of the unborn lambs, the ewe is forced to draw upon her fat stores for energy. As a result a toxic condition, known as "ketosis," occurs. Sheepmen who have encountered this trouble have found that it could usually be avoided by the following program:

1) Feed the ewes a generous ration before lambing. 2) Feed regularly. 3) Make sure every ewe gets her share of the feed every day. Adequate rack space is essential. 4) Force the ewes to get some exercise every day.

Molasses fed to pregnant ewes has been found particularly effective in avoiding lambing paralysis. It may be necessary to thin the molasses with water and pour it over the hay for a few days to get the sheep accustomed to it. It may then be safely fed free-choice from a trough.

If a ewe is noticed in the early stages of the disorder, drenching with a cup of molasses or concentrated sugar solution twice daily will sometimes be helpful. Veterinarians have recently been successful in saving affected ewes by removing the unborn lambs by Caesarean operation if the operation is performed early in the disease.

**Increase feed six weeks before lambing.** (For rations for pregnant and lactating ewes see page 34 in Section 4 on Feeding Sheep.) It is very important that the ewes be well fed the last six weeks of pregnancy, when the lambs are developing rapidly as is also the udder. British workers have clearly shown that ewes on a high plane of nutrition during the last six weeks of pregnancy will give birth to stronger lambs and produce more milk than will ewes that have been on a low plane of nutrition before lambing. This difference is striking, even though the ewes are fed the same after lambing.

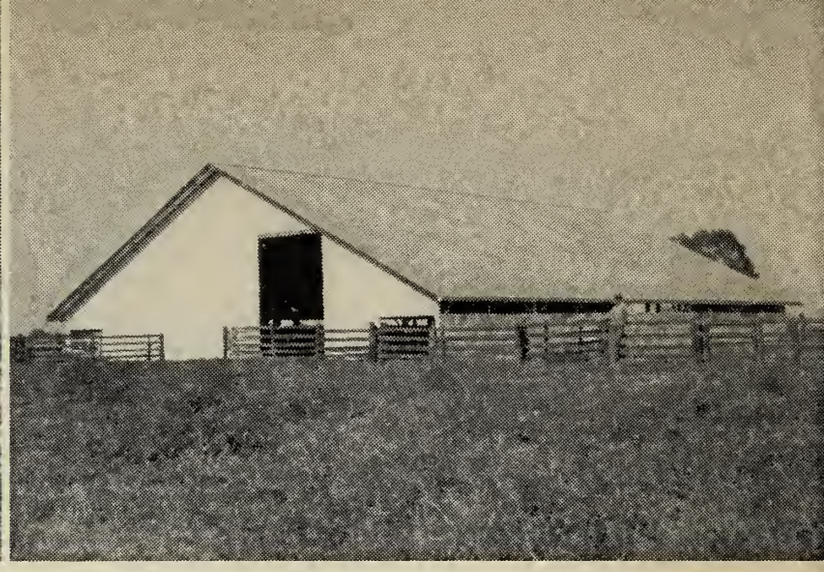
**Tagging.** This is the term applied to shearing the wool from the inside of the hind legs, the udder, and around the anus and vulva. This operation is particularly desirable a few weeks before lambing. The udder is then easily observed, and thus some indication is given as to how soon the ewe will lamb. Furthermore, the teats are easily found by the newborn lamb, whereas if the ewe is not tagged the lamb may attempt to suck a lock of wool. Tagging also reduces the danger of fly strike as the rear end of the ewe remains cleaner.

**Sorting the ewes before lambing.** Where the lambing facilities are limited, it is often desirable to separate out the group of ewes that is expected to lamb early in the season and to give these special attention. This is commonly called "bagging out the heavies." In other words, the ewes that have a well-developed udder are judged to be those that will lamb within a few days. The development of the udder is not always an accurate means of predicting lambing date, however; hence the main flock should always be watched for unexpected arrivals.

**Care of the drop band.** The ewes expected to lamb soon are run in a separate group referred to as the "drop band." These ewes should be kept in a convenient field or pasture during the daytime and in a corral near the barn at night. An open shed to provide some shelter is desirable in this corral. It is best not to confine the ewes in an enclosed barn except in bad weather.

## Care of the ewe at lambing time

Lambing is the harvest time for the sheepman. All the other care, feeding, and breeding are largely wasted if the ewe loses her lamb or lambs. The percentage of lambs saved will largely deter-



Breeding ewes on irrigated pasture (left). Center ewe has recently been tagged to reduce danger of fly strike. Photo at right shows a good type of lambing shed for use in California.

mine the success or failure of a sheep operation.

Ewes are lambed with all degrees of care depending on the type of operation. Some ewes are pasture- or range-lambed without any help from man. Others are watched by men night and day through the lambing season. Usually the percentage of lambs saved will be directly proportional to the time, effort, and skill of a shepherd at lambing time. This section covers some of the basic operations carried out where ewes are lambed through a barn.

Just before lambing, the ewe seems restless and appears sunken in front of the hips. She should be given every opportunity to deliver the lamb unassisted; but if she has been straining for one hour or more, the shepherd should then assist.

The normal presentation of a lamb at birth is with the forelegs extended, the head resting between them. Usually a lamb in this position will be born without assistance. If the lamb is not in proper position, the shepherd must correct it by inserting his hand and arm into the birth canal and straightening out the lamb. Before entering the ewe, however, the shepherd should thoroughly cleanse his hands with soap and water, then lubricate his hand and arm with mineral oil or vaseline. In delivering the lamb a gentle pull should be exerted on both the front legs.

After the lamb is delivered, make sure that it starts breathing immediately. The membrane should be wiped from the nostril. If the lamb does not start to breathe, pat the ribs gently for artificial respiration. Rubbing the lamb vigorously, blowing into the mouth, and swinging the lamb like a pendulum by the hind legs (to clear fluid from the throat) are other treatments that sometimes help to start breathing. After the lamb is breathing, place it near the ewe's head so that she will begin licking it.

A strong, vigorous lamb will usually stand up and nurse in 15 or 20 minutes. Weak lambs must sometimes be helped to nurse the first time. The seal on the teats should be broken for these weak lambs by milking a few drops from each teat. This also serves as a check on the milk available for the lamb. Watch the udder carefully for a few days to make sure that the lamb is nursing from both sides. If one side becomes swollen, it should be milked out until the lamb starts nursing from that side also.

An occasional ewe will have such abnormally large teats that the lamb has trouble nursing. A ewe unable to nurse her lamb for any reason should be marked at lambing time so that she can be culled from the flock.

## Care of ewes after lambing

**Udder troubles.** Occasionally a ewe will develop mastitis, with a resulting swollen udder, and the milk may become stringy or bloody. In severe cases the udder will become caked and hard and turn blue. This condition is commonly spoken of as "bluebag." Injury to the teat by the lamb or some mechanical injury may be responsible. Mastitis is presumably caused by a bacterial infection. A variety of organisms have been found to be present in affected udders.

If this infection is caught in the early stages, some of the antibiotics have proved effective in clearing it up. A veterinarian should be called to treat the ewes, as mortality is otherwise likely to be high. Ewes that recover from severe infections should be culled because it is unlikely the affected portion of the udder will ever become functional again.

**Feeding ewes after lambing.** Lactating ewes should be liberally fed, but feed grain sparingly for a few days after lambing. In addition to a generous feeding of good alfalfa hay, the ewe may be fed up to one pound of grain per day during the suckling period. If possible, separate the ewes raising twins and feed them more grain than the ewes raising single lambs. Pasture or other succulent feed such as silage are excellent for milking ewes.

## Care of lambs

The ewe and her newborn lamb or lambs are placed in a small pen often called a "jail" or a "jug." Pens may be of a permanent nature or may be made by placing hinged panels along the walls of a barn (See illustration on page 22 in Section 3). The ewe should have water available and should be fed hay.

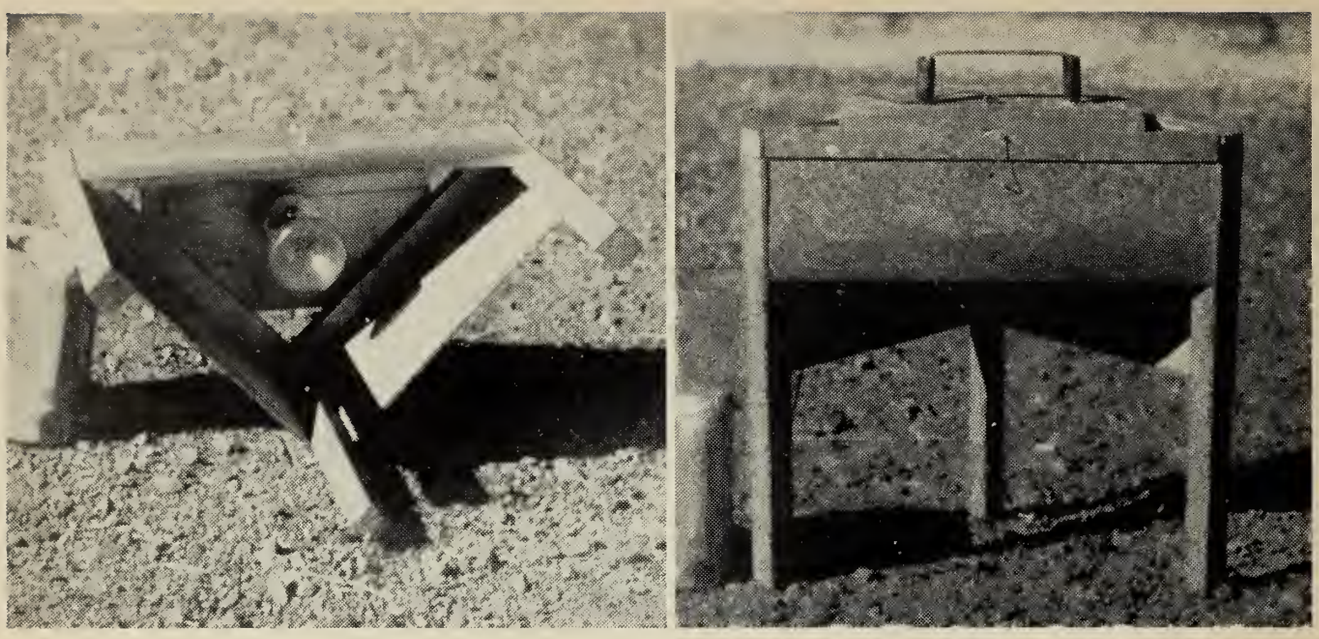
Ewes with strong single lambs do not need to stay in these small pens more than a few hours to insure that the ewe has claimed the lamb. In the case of twins, it is well to keep the ewe penned for a day or two until the shepherd is sure that both lambs are strong enough to keep up with the ewe.

When lambing through a barn, there is always some danger of navel ill—that is, an infection getting in through the navel cord of the newborn lamb. Disinfect the navel soon after birth by dipping the cord into a bottle of tincture of iodine and then tipping the bottle against the abdomen.

**Weak and chilled lambs.** Newborn lambs are easily chilled, and weak lambs will often die unless artificially warmed. They may be warmed near a stove, put in hot water for a short time and then dried, or placed on a covered hot-water bottle. The most effective warmer, however, is a lamb brooder in the corner of the jail. The light bulb provides a constant source of heat, and the lamb will be able to return and nurse the ewe at will.

**Pair branding.** A very helpful device for the shepherd is to brand both the ewe and the lamb with the same number. The ewes with single lambs may be branded with black paint or on the left side, and the ewes with twins with red paint or on the right side. This makes it easy to identify the ewe with her lamb or lambs after they are turned out of the small pens.

**Colostrum milk.** The colostrum, the first milk of the ewe, contains antibodies, large quantities of vitamin A, and other substances that help the newborn lamb to get a good start. Consequently, every lamb should be given at least one feeding of colostrum milk. This may be accomplished by milking a few ewes with large quantities of milk and freezing the excess. The milk can be obtained by milking one teat of ewes that have large udders and only single lambs. Excess milk may be frozen, then thawed and used as needed for lambs born to ewes that do not have milk at lambing or for orphan lambs. If the colostrum is in short supply, as little as a tablespoon per lamb mixed with cows' milk or canned milk



A portable lamb brooder (shown above) may be placed in the pen with the lamb and ewe to provide a protected corner for the lamb. Heat is provided by an electric light bulb.

will furnish the lamb with the necessary antibodies.

**Inverted eyelids—Entropion.** The eyes of young lambs should be checked for inverted eyelids (where the eyelid turns in so that the eyelash irritates the eyeball). If this condition is neglected, the cornea will turn white, and permanent blindness may result. It may be treated by removing an elliptical piece of skin from the eyelid with clean scissors or sheep shears. In healing, the lid contracts and the eyelid becomes normal.

**Orphans.** Ewes will occasionally refuse to claim their lambs. In some cases simply drawing a little of the ewe's milk and sprinkling it over the lamb, particularly over the rump, will be sufficient. If the ewe still refuses, tie her up reasonably short in the small pen for a few


Ewe and lamb with the same number. Such branding aids in checking progress of lambs.

days, and hold her while the lamb nurses; then she will usually accept it. Ewes that continue to fight their lambs should be marked for culling.

**Transferring lambs.** Most shepherds try to have every ewe leave the barns with at least one lamb. When a ewe loses her lamb, she is given an orphan lamb or a twin from another ewe (this is called grafting the lamb). If she refuses to adopt it, her own dead lamb should be skinned and the skin fastened on the lamb to be adopted. The ewe will usually accept the new lamb from the scent of the skin. In a day or two the skin may be taken off. If the ewe does not claim the lamb, she may be treated as described above for the disowned lamb.

***Raising orphan lambs.*** Lambs for which no ewe is available may be fed on cows' milk or a milk substitute. They are easily taught to drink from a nursing bottle with a lamb nipple, or they may be taught to drink from a pan. Warm the milk to body temperature while the lamb is small. Milk should be clean and all utensils carefully cleaned and sterilized to prevent digestive upsets.

Ewes' milk is more concentrated than cow's milk. It contains about 19.2 per cent dry matter, as compared to about 12.8 per cent dry matter in cows' milk. While lambs will grow on cows' milk, they grow faster if the milk is fortified with 5 per cent sugar to give the lamb a more concentrated feed. If cows' milk is not available, dilute ordinary canned milk and use it to feed orphan lambs. Powdered milk may be reconstituted for this purpose.

Keep orphan lambs in a dry, clean place. A lamb brooder (described above for chilled lambs) will help get such lambs started during cold weather. They should be given an opportunity to get exercise and sunshine as they grow older.

One of the commonest difficulties in rearing orphan lambs is death due to overfeeding. Young lambs should be kept hungry for the first few days. Although it is difficult to suggest definite amounts of milk because of variation in size and vigor, the following schedule is generally satisfactory.

***The first two days,*** feed 2 to 3 ounces at least four times a day.

***The second two days,*** increase the feeding by 1 or 2 ounces, fed four times a day.

***The next week,*** feed 4 to 6 ounces four times a day.

***The week after that,*** feed 6 to 8 ounces four times a day.

***Then gradually*** change the lamb over to three feedings a day, of one pint per feeding. As it grows older, it may safely take two quarts a day given in two or three feedings. Lambs will vary in their milk consumption, and the attendant must be the judge.

***After six weeks,*** skim milk may, if necessary, be substituted for the whole milk, but the lambs will gain better on the whole milk. They should be fed milk until they are at least three months old.

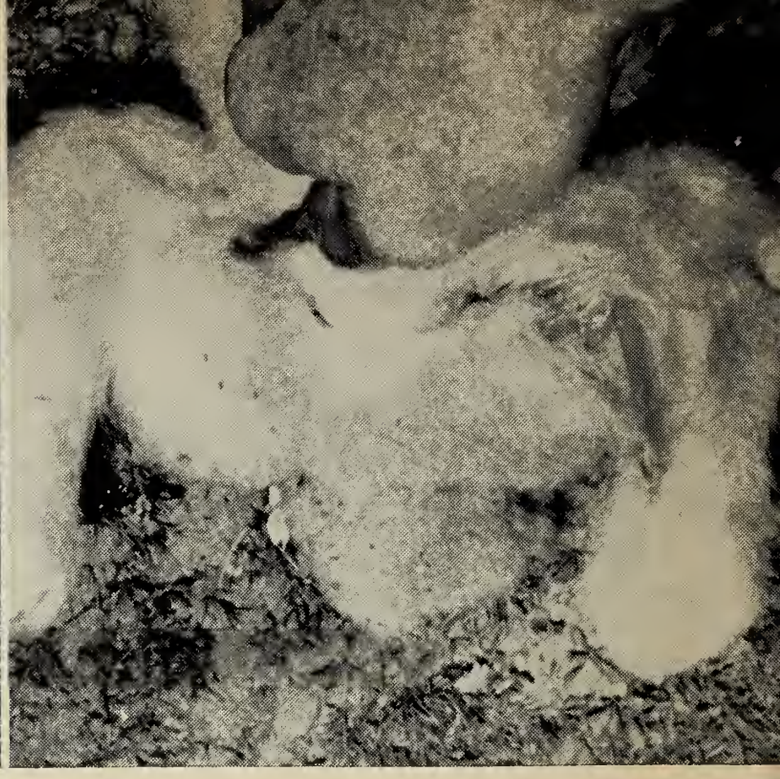
Lambs will soon begin to eat hay and grain (at two to three weeks of age). A small amount of bright alfalfa hay should be kept before them at all times. The grain mixture may consist of any of the common farm grains. Calf meals are often used with very good results.

Give the lambs free access to pasture at an early age.

**Docking and castrating lambs.** Tails and testicles may be removed from the ram lambs by any one of several methods. Dock and castrate lambs on a bright, sunny day, after the lambs are old enough and strong enough to withstand the shock. In general, the older a lamb is at marking time, the more seriously the operation will affect him. If it is available, place the lambs on clean pasture after marking.

As in all surgery, sanitation is essential. Clean all instruments at the beginning and dip them in disinfectant (1 tablespoon lysol to 1 pint of water) after each use.

1. Prepare dead lamb for skinning by cutting off legs at knees and hocks. Cut off head near the ears.



2. Open the skin across the inside of front legs; across brisket, and down the inside of the other leg.

## TRANSFERRING THE PELT FROM A DEAD

4. Hold neck with foot; pull skin off the carcass. Sometimes skin at the brisket must be loosened with a knife.

5. Slip pelt over hind legs of orphan. Cut opening for tail and for fecal outlet. For a ram, cut hole for urine elimination.

3. Starting at knife cut, loosen skin on forward portion of brisket; peel neck out of collar. Collar must remain intact.

## LAMB TO AN ORPHAN

6. When pelt is adjusted to rear quarters, turn head sharply and slip collar of pelt over head of the orphan.

***Docking.*** Cut off the tail about one inch from the body or between the second and third joints from the root of the tail. A convenient index is where the two folds of skin on either side of the anus leave the tail. Four methods of docking are in use.

The tail may be removed by simply cutting it off with a sharp knife. This method is quick and simple, and no special equipment is needed. The wound will heal rather quickly. The main disadvantage is that the lamb will lose a considerable amount of blood from the main artery of the tail. Occasionally a lamb will bleed to death. The older and heavier the lamb the greater is this danger.

Another method of removing the tail is to cut it with a dull, hot iron. The lamb's tail should be slipped under a board covered with tin so that the lamb will not be burned by the hot iron. Heat the iron to a dark red color. If too hot, it will cut through too quickly to sear the artery. The reason for the hot iron is that searing the tail will stop most of the blood loss. The disadvantages of this method are the facts that (1) it is necessary to provide a means of heating the iron at docking time, and (2) a burn heals slowly.

A third method of docking is to crush the tail with a burdizzo. The tail is then cut off by passing a knife inside the closed blades. The crushing effect of the burdizzo will stop some of the blood loss sustained when the tail is cut off with a knife.

A comparatively new method is to place on the tail a special rubber band, which shuts off the circulation. As a result, the tail will drop off within a couple of weeks. The advantages of this method are that there is no blood loss to the lamb, and it can be handled as a one-man operation. On the other hand. tetanus infection has been encountered on several farms where sheep are kept around corrals after the rings are applied.

DOCKING. Upper left: Docking with a knife—note method of holding lamb. Upper right: Docking with a hot iron. Lower left to right: Docking with a burdizzo; rubber band being placed on tail.

CASTRATING. Left: Using a burdizzo. Special care is needed to make sure cords are severed, clamping off one cord at a time. Right: Placing rubber band on scrotum of lamb.

***Castrating.*** The ram lambs may be emasculated by several methods, including surgery, whereby the lower half of the scrotum is cut off and the testicles pulled out without cutting the cords. The testicles may be pulled out by the shepherd's gripping them with his teeth, by grasping them with his thumb and forefinger, or by the use of special castrating shears, which have a serrated edge for grasping the testicles. When a tool or the fingers are used, they should be disinfected frequently. The main disadvantage of the surgical method is that lambs will occasionally die from hemorrhage or infection.

Two types of bloodless castration may be used. In the first type, rubber bands are applied with a special instrument. Be careful that both testicles are below the band. In this case the scrotum and testicles both atrophy and drop off.

The second bloodless method is the use of the burdizzo to crush the cord above the testicle without cutting into the scrotum. If properly crushed, the testicle will resorb but the scrotum is intact. The main objection to this method is that occasionally the shepherd will miss one of the cords and the testicle will continue to develop. There is also danger of crushing too low, leaving testicular tissue that will continue to develop. When the burdizzo is used too high, the urethra may be crushed and the lamb will die.

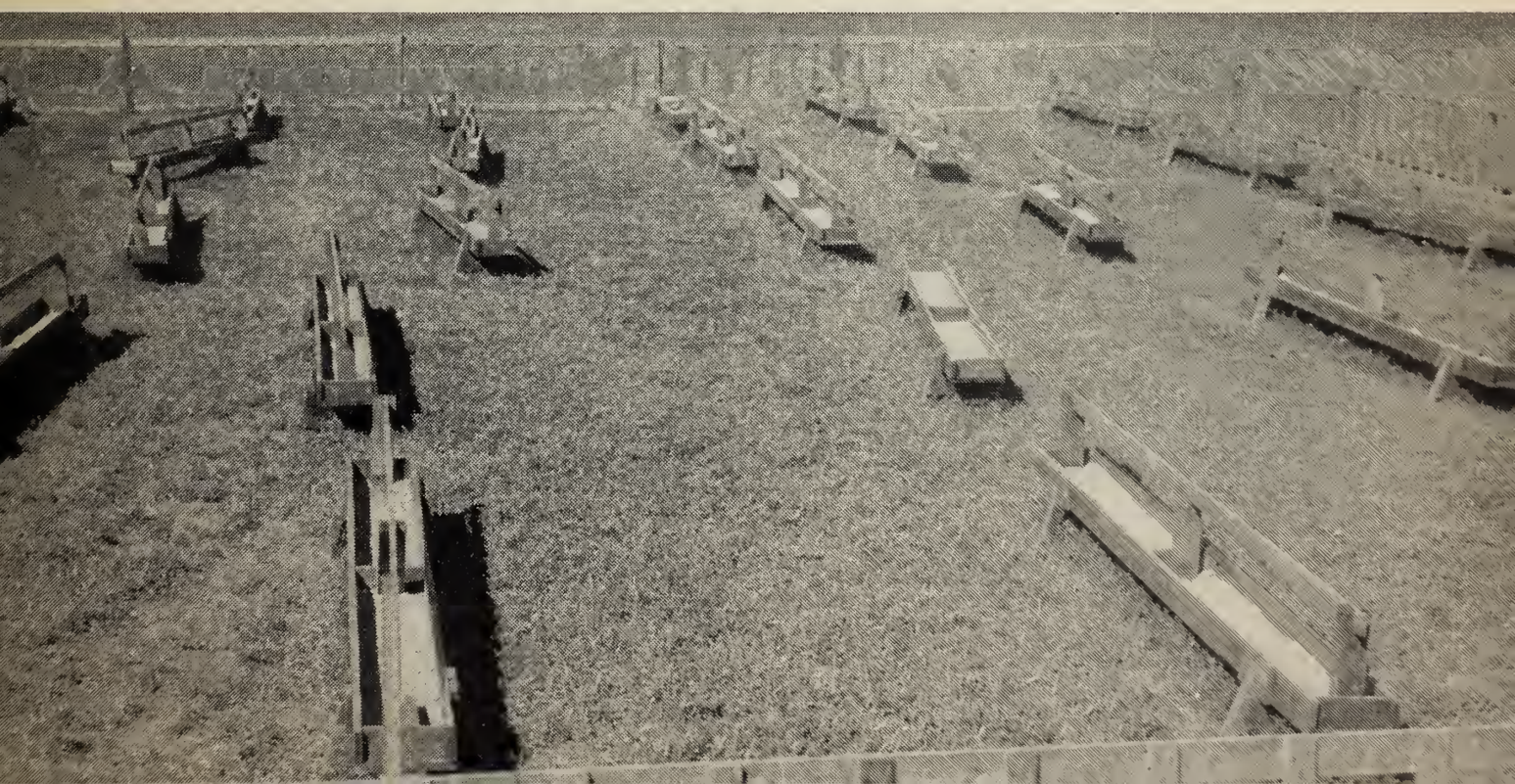
If flies are a problem when lambs are docked or castrated, a fly repellent should be placed on and around the wound and the lambs closely watched for fly strike.

**Creep-feeding the lambs.** Lambs will start eating hay and grain at two to three weeks of age. Their gain will be increased if they have an opportunity to obtain grain in addition to the ewe's milk. A "creep" is an area fenced so that the lambs can enter but the ewes cannot. The openings in a creep panel are usually about 8 inches wide and about 15 to 18 inches high. It is well to place hay as well as grain in the creep as the lambs will be attracted to the hay at an early age. Once the lambs have learned to eat from the creep they will make regular visits to get the grain. Older lambs are harder to start on a creep than lambs less than one month of age.

Creep-feeding is desirable for maximum gains. Under range conditions it is especially good when pasture feed is short. Where twins are operated as a separate band, creep-feeding will aid in producing a uniform group of lambs.

A portable creep that will load on a truck or trailer may be used on the range—being moved as the sheep are moved to fresh range.

An ideal arrangement for creep feeders.



A foxtail in the eye of a lamb.

Any of the common grains is satisfactory for feeding in the creep. Whole milo grain is popular as a creep feed because the lambs relish it and start eating it sooner than other feeds.

**Eye trouble from foxtails.** As the native feed begins to dry, lambs are likely to pick up the awns of grasses (particularly foxtails) in their eyes. Lambs having wool around their eyes are especially bad in this respect. The awn must be removed by rolling back the eyelid and plucking out the beard; otherwise the lamb will become blind. Any lamb with a draining eye should be caught and the eye examined for foreign material. Injured eyes may be treated with medicine obtained from a veterinarian.

**Weaning.** Many lambs are sold at the time they are taken from the ewes. Others such as ewe lambs kept for replacements, purebred lambs, and feeder lambs should be weaned at 4½ to 5 months. Ram lambs, particularly of the whiteface breeds, may have to be weaned earlier to avoid some of the ewes' being bred out of season. Ewe lambs and ram lambs should be separated at 4 to 5 months.

After weaning, give the lambs the best feed available to keep them growing. If the ewes are placed on scant feed for a short period, the milk flow will cease in a few days without any other treatment.

### Culling the breeding ewes

Soon after weaning time, the sheepman should carefully go through the ewes and cull out those that have previously been marked as having a spoiled udder or as being unable for any other reason to raise a lamb. It is also desirable to cull the ewes that did not lamb; those that have not raised a lamb for two seasons should certainly be sold.

Check the mouth and teeth of each ewe. Ewes with undershot or overshot jaws or with broken mouths should be sold. Where possible, it is desirable to notch the ear of each crop of ewe lambs with a different notch. In this way the age of each ewe is known. An ideal program is to sell all ewes by the time they have produced five crops of lambs and are approximately 6½ years of age. Although some ewes will show little effect of age up to 10 years, most ewes will begin to decline in wool production and vigor after 6 to 7 years. Sheep of the mutton breeds will show the effect of age earlier than will sheep of the fine-wool breeds.

### Water

Under most California conditions sheep should have access to fresh, clean water daily. During cool, moist weather, when there is dew on the feed in the mornings, the sheep need to be watered less often—depending on the amount of dew. Daily water consumption per sheep varies from one quart to over a gallon.

### Shade

Sheep will use shade during warm weather wherever it is available. Most sheepmen attempt to provide adequate shade for breeding stock during the warm season. Shade is usually not provided, however, for lambs being fattened on irrigated pasture. Most pasture feeders

believe that the lambs eat more and there is less trouble with bloat and fly strike when shade is not available.

## Marketing

Most sheep producers in California sell or wean their lambs when the majority weigh 90 pounds or more and are ready for slaughter, or when the feed available becomes too dry for them to continue putting on good gains. Which of these two situations arises first will depend on the locality and the weather during the particular season. Lambs that are not fat "off the ewe" may be sold as feeders, or the owner may place them on irrigated pasture if he has it.

The bulk of the California spring lambs are marketed in April and May. Fat lambs may be disposed of in several ways: 1) sold direct to local butchers, 2) sold to country buyers representing packers and livestock-marketing organizations, 3) shipped to stockyards such as South San Francisco, Los Angeles, and Stockton, to be sold by a marketing organization or a commission firm, or 4) sold through livestock auctions located throughout the state. For a more detailed discussion, see "Trade in Western Livestock at Auctions," 1954, by Edwin C. Voorhies, listed in the Source Books on page 59.

Many lambs are contracted for in advance of delivery by the buyers. Such contracts specify the conditions of purchase: that is, a "fat contract" means that the buyer takes only lambs he considers ready for immediate slaughter. Other contracts agree to take all lambs over a certain weight (for example, 60 pounds) on a certain date, or to take so many head of lambs on a certain date.

When only part of the lambs are fat, the seller may sell only the "fats" and keep the feeders to sell separately, but

Water, salt, and shade should be provided for breeding ewes on dry, summer pasture. This windmill has a storage tank to take care of windless days.

more eommonly he will sell all the lambs to a buyer or dealer. Then the buyer sorts the lambs, sending the "fats" to market, and places the feeders on irrigated pasture or in a feedlot until they are fat enough to kill.

When the sheepman has quite a number of feeder lambs, he may either sell them to a sheep feeder or place them on irrigated pasture on a "gain basis." By this is meant that the sheepman retains ownership of the sheep, and the pasture owner gets a variable percentage of the gain.

### Fattening feeder lambs

**Feed-lot fattening.** Feeder lambs are fattened either in a feed lot or on irrigated pasture. Those to be fattened in a feed lot should be started on feed with a ration consisting mainly of good hay. The grain mixture is gradually increased until the lambs are on full feed. Lamb-fattening rations are usually about half grain and half hay (See page 35 in section on Feeding Sheep). A series of tests at Kansas State College showed that the gains were largest and the feed was utilized most efficiently when the ration was 45 per eent eoncentrates and 55 per cent roughage. When rapid gains are desired, the coneentrates may be fed up to as mueh as 60 per eent of the ration. You must use care in giving such highly eoncentrated feeds.

Lambs fed large amounts of grain in the feed lot are subject to overeating disease, also known an enterotoxemia. Although this may be prevented by limiting the amount of concentrated feed, the gains are thereby also lessened. A vaccine against this disorder is available. The bacterin should be used as a preventive, and the antisera employed to stop an outbreak in a group of lambs on feed. These should be used only under the supervision of a veterinarian. Enterotoxemia may also be eneountered in lambs and even in ewes on exeellent pastures.

Both hand-feeding and self-feeding methods are used in feeding lambs. Hand feeding—where the hay and grain are fed separately at each feeding—has the advantage because the feeder can vary the amount and proportion of hay and grain aecording to the appetite and appearanee of the lambs. However, the feeder must exercise considerable skill in feeding the lambs; also with handfeeding, labor costs are higher. It is wise, therefore, to adopt a program of self-feeding—where the grain and hay are mixed and the lambs eat all of the mixture they will consume—and a standard mix can be fed once the lambs are on full feed. Sample feed-lot rations for lambs are shown on pages 35 and 36.

Depending on the feeds used and the relative proportion of grain and hay fed, lambs will require from 8 to 12 pounds of feed to produce a pound of gain. The average daily gain is usually about one third of a pound per day but may vary from .2 to .4 pound per lamb per day.

The feeds most commonly used for fattening lambs in the feed lot in California are barley, molasses, dried beet pulp, oats, corn, cottonseed meal, and alfalfa hay. Barley as the only coneentrate is not entirely satisfactory for lambs in that they have a tendency to "go off feed." A mixture eontaining about one third beet pulp or oats is easier to feed.

Wooled lambs are generally shorn when placed in the feed lot, especially in warm weather, and when the lambs will be on feed for any length of time.

**Fattening on pasture.** Although some feeder lambs are fattened on beet tops and other types of pasture, most feeder lambs in California are fattened on irrigated pastures. The prineipal pasture plants are ladino clover and birdsfoot trefoil. Alfalfa, Sudan grass, strawberry clover, and various grass mixtures are also used for irrigated pastures. Sheep prefer legumes to grass as feed; and since bloat is not so serious a problem with sheep as with eattle, it is not

Feeder lambs ready to go on pasture for fattening.

Feeder lambs being fattened on sugar beet tops. Even though fields look bare after beets are dug, leaves and some beet crowns furnish excellent fattening feed.

recommended that any grass be included in pasture mixes planted for fattening lambs.

Feeder lambs shipped in, either by truck or train, should be watered, given a feed of dry hay, and allowed to rest before being turned in to irrigated pasture. If there is any possibility that the lambs may be carrying many internal parasites, they should be drenched before being turned into the fresh pasture (See page 39). A salt and phenothiazine mixture—9 parts salt to one part phenothiazine—should be available to the lambs while on irrigated pasture. This mixture will aid in reducing the parasite problem.

The irrigated pastures should be subdivided into small fields so that the lambs may be moved to fresh feed every few days. Lambs will make faster gains and pastures will produce more feed if each pasture is given a minimum of three weeks' growing period between grazings. For more details on the use of irrigated pastures, see "Irrigated Pastures in California," by Jones and Brown, revised by Miller and Booher (listed among Source Books on page 59).

The average daily gain of lambs on irrigated pasture will vary from 0.2 to .45 pound per lamb per day. Good feeder lambs on desirable irrigated pasture will usually gain at least 0.3 pound per day. The carrying capacity of the pastures will vary widely with the season. During the growing season a good pasture should carry at least ten lambs to the acre.

**Supplementing on pasture.** Lambs will reach choice slaughter grade when grazing on good irrigated pasture without receiving any supplemental feed. Hay as a supplement to pasture will reduce the incidence of scouring, particularly early in the season, when the pasture forage is watery and low in dry matter. Trials conducted on the use of grain to supplement good irrigated pasture have shown that, while the gains may be increased slightly, it is generally not economical to supplement lambs on pasture. Later in the season it may be profitable to supplement them in order to get them to the desired slaughter weight before the pasture is exhausted.

### Feeding lambs on pasture as a soiling crop

Some interest is developing in cutting the pasture crop with a forage harvester and hauling it green to lambs in a dry lot. This practice is still in the experimental stage and has not been sufficiently tested to be recommended at this time.

### Stilbestrol implants for lambs on irrigated pasture

Two recently conducted trials have shown that the gains of lambs can be increased by implanting a pellet of stilbestrol—a female sex hormone—in the ear of each lamb. In both trials, however, the treated lambs did not produce such desirable carcasses as the untreated lambs. Until this practice is approved by the Pure Food and Drug Administration it cannot be recommended for general use.

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