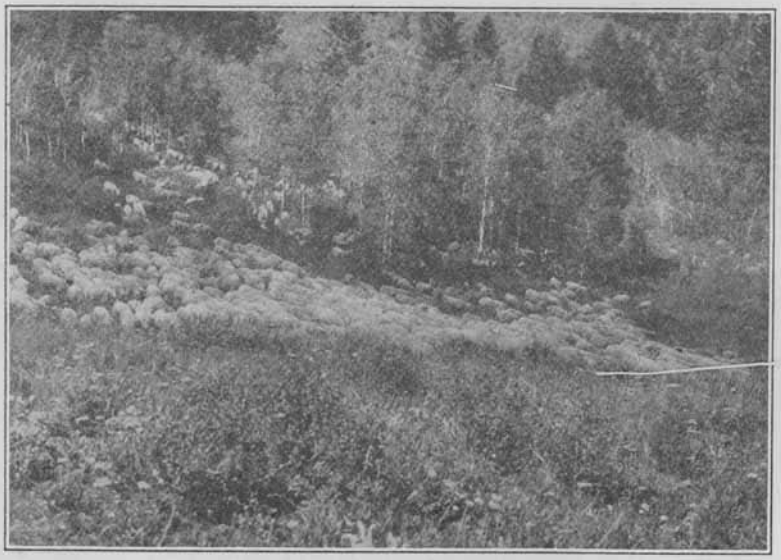
UNIVERSITY OF IDAHO
AGRICULTURAL EXPERIMENT STATION
Department of Animal Husbandry

Fattening Range Lambs In Idaho

By
E. F. RINEHART, C. W. HICKMAN, and R. F. JOHNSON



Lambs produced on western ranges are strong, healthy and vigorous

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Table of Contents

Summary

FALL pasturing and winter dry lot fattening of range lambs is a practical method of marketing the home-grown grain, roughage and various by-products produced on the Idaho ranch. The combination of feeds that will produce maximum gain at minimum cost is an important factor within the control of the feeder. Quality of feeds, regularity of feeding, adequate watering facilities, and dry, comfortable lots, all add to rapidity and economy of gains.

The buying of feeder lambs is one of the important phases of the lamb feeding operation. The value of feeder lambs depends upon breed, type, weight, condition, and quality. The size and weight of the lambs purchased will depend upon length of the pasturing and feeding periods.

When properly handled, lambs pastured on the aftermath of hay fields, grain stubble, and beet tops make economical gains. The cost of the lambs may be materially lowered by the proper use of the aftermath and waste feeds in the fields. From 10 to 15 pounds additional weight may be secured by the utilization of waste by-products in harvested fields for which there is no other method of profitable utilization.

The relative value of barley, corn, and wheat is not materially different. Shelled corn is slightly superior to barley. The value of wheat is slightly lower than barley or corn. Wheat is improved by the addition of barley to the ration. Oats are excellent to start lambs on grain but tend to produce growth. Whole barley is superior to ground barley in increased gains and lower grain and hay requirements.

Cottonseed meal and linseed oil meal fed with barley and alfalfa increase the rate of gain, lower the barley and alfalfa requirements, and increase the market value of the lambs. Their value in a ration depends on the value of the barley and alfalfa they replace and the influence of a better finish upon selling price of the lambs.

Cull beans can replace approximately 20 per cent of the barley satisfactorily. Larger amounts cause digestive disturbance and scouring. Each ton of beans replaced 1591 pounds of barley, but required 409 pounds more of alfalfa. Grinding the barley and beans did not increase their efficiency.

Cull peas, when replacing 20 per cent of the barley, were a valuable supplement to a ration of barley and alfalfa. Each ton of peas replaced 2057 pounds of alfalfa and 1371 pounds of barley. Cull peas, when replacing only 10 per cent of the barley, did not make a favorable showing.

Recleaned, heavy alfalfa seed screenings, when replacing one-third of the barley, were a valuable supplement. Each ton of screenings replaced 1762 pounds of alfalfa and 1762 pounds of barley.

A ton of stored wet beet pulp, fed at the rate of one pound per head per day, replaced 285 pounds of alfalfa and 115 pounds of barley. When fed at the rate of 1.75 pounds per head per day, each ton replaced 426 pounds of alfalfa and 90 pounds of barley. Each ton of

pressed beet pulp, fed at the rate of 1.75 pounds per day, replaced 405 pounds of alfalfa and 227 pounds of barley. Wet beet pulp fed at the rate of 3 to 4 pounds per day is a valuable supplementary feed to alfalfa and barley. Pulp helps to keep the lambs on feed and lowers the cost of gains.

Each ton of cull potatoes, fed at the rate of one pound per day with barley and alfalfa, replaced 240 pounds barley and 562 pounds alfalfa. When fed at the rate of 1.63 pounds per day, they replaced 156 pounds of barley and 410 pounds alfalfa. Cooking the potatoes did not prove profitable. Each ton of cooked potatoes replaced 68 pounds barley and 422 pounds alfalfa.

Corn silage, fed at the rate of one pound per head daily, with barley and alfalfa, did not influence gains or feed requirements materially. When fed at the rate of two pounds per head daily, the corn silage made a significant saving in alfalfa and slightly increased the gains. Corn silage is valuable in maintaining the thrift and keeping the lambs on feed.

The chopping and grinding of alfalfa hay does not change the rapidity and economy of gains, but does effect a saving of hay. Chopping or grinding does not change the composition of hay, but does change the relative proportion of leaves and stems consumed. The results of two trials show that lambs wasted 30.39 per cent long hay, 7.79 per cent chopped hay and 3.72 per cent ground hay. The average daily consumption of hay was shown to be: long hay, 2.17 pounds; chopped hay, 2.10 pounds, and ground hay, 1.91 pounds. Determining factors in chopping or grinding alfalfa hay are: the supply and price of hay, the cost of chopping, and the use that may be made of the waste hay.

Alfalfa chaff and clover chaff are fibrous roughages, not adapted for lamb fattening rations. When fed as one-third of the hay allowance, they have approximately one-half the feeding value of alfalfa hay.

Pewee lambs are as economical to feed as average sized feeder lambs, provided they are fed separately. Pewee lambs require a long feeding period. In the average of two trials the pewees ate 94.7 per cent as much hay and 90.1 per cent as much barley, and gained 96.4 per cent as much as the average sized lambs.

Shearing lambs 35 days before they are marketed did not prove profitable in one year's trial. The rate of daily gains was increased after shearing, but the additional gains were offset by the greater shipping shrinkage of the sheared lambs.

Shrinkage to market varies greatly, no two shipments shrinking the same. The amount of shrink is dependent upon home weighing conditions, finish of the lambs, proportion of grain and roughage, nature of the run, comfort of the lambs in the cars, condition of the feed yards enroute, and the fill on the market.

Discussion of shipping and marketing is given on pages 44-47.

Fattening Range Lambs in Idaho

By

E. F. RINEHART, C. W. HICKMAN and R. F. JOHNSON*

SETTLEMENT of all available homestead lands, and the development of the irrigated tracts, have established the Idaho agricultural and range livestock industry on a rather stable basis during the last decade. This has caused but little fluctuation in numbers of range cattle and sheep. The fully stocked Idaho ranges carry approximately 500,000 cattle and 2,000,000 sheep. The improved and unimproved farms of the State, constituting 17.5 per cent of the total area, produce alfalfa hay and small grains far in excess of the winter needs of the farm and range livestock. This surplus of feed affords a basis for the fattening of sheep and cattle in Idaho. Since 1920, Idaho has produced approximately 1,700,000 lambs annually. As most of the lambs are produced on the range, where their size, weight, and finish depend largely upon moisture and weather conditions, the percentage of fat and feeder lambs varies greatly, but over this period has averaged 1,100,000 fat lambs and 600,000 feeder lambs per year. Many of the feeders are sent to the River markets with the fat lambs where they are sorted out and sent to corn belt farms for finishing.

During the last ten years there has been more of a tendency to hold the feeder lambs back for finishing in the West. The development of the irrigated farms has resulted in the production of a surplus of bulky feed crops. The population of the West coast has increased to such an extent that meat and other food products from the Intermountain country are much in demand. The demand is naturally for a fairly uniform distribution of fat livestock throughout the year. While the Pacific Coast states send large numbers of fat and feeder lambs East during the summer and fall, the winter demand for fat lambs and cattle is so great as to draw heavily from the Intermountain country. Idaho lambs generally are sent East from May to November. From November to April many of the fat Idaho lambs find their best outlet on the Pacific Coast.

The finishing of feeder lambs on the irrigated farms of the State is a means of providing a market for the bulky feed crops. During the fall season, aftermath in harvested fields, as well as waste growth on ditch banks and along fence rows, offers feed which can be

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D. A. Stubblefield has been Superintendent of the Caldwell Substation since 1920. The lambs in 1920-21 were fed under the direction of A. W. Johnson. The lambs in 1921-22 and 1923-24 were fed under the supervision of Mr. Stubblefield. Since 1927 the feeding experiments at the Caldwell Substation have been under the direction of R. F. Johnson.

Lamb feeeding at the Aberdeen Substation was under the direction of A. E. McClymonds, Superintendent, who resigned in 1931, and the 1931-32 lambs were fed under the direction of John L. Toevs, Superintendent.

turned into profit by pasturing with lambs. Feed lot lambs offer a means of profitable disposal of hay, grain, and the by-products of other crops. The feeding industry also helps to maintain the fertility of the soil.

A decision to feed lambs is based upon the farming system and the nature of the feed produced. The type and size of the lambs chosen depend largely upon the proportion of fall pasture to winter feed and the season of the year the lambs are to be marketed.

Supply of Feeder Lambs

Among the range sheep outfits, both shed and range lambing are practiced. The shed lambing system is practiced in the lower altitudes where the winters are open, alfalfa hay is abundant, and the lower ranges are good early in the season. By the time the spring range is ready the lambs are old enough to use it fully. They become fat and are ready for market before the summer sun has dried the numerous streams and water holes, and before the rapidly growing, nutritious, but short-lived plants of the plains and foothills become dry and of little value for fattening lambs.

Most of the shed lambs are black faces. The breeding eyes are of white face cross breeding, either three-quarters Rambouillet and one-quarter long wool blood, known as quarterbloods, or halfbloods between the Rambouillet and the Lincolns, Cotswolds, or Romneys. The rams are principally purebred Hampshires, although some Suffolks are used. The entire lamb crop, both ewes and wethers, is sent to market, selling mostly as fat lambs. Replacement ewes are generally purchased as ewe lambs.

In the higher altitudes of Idaho and in the surrounding states of

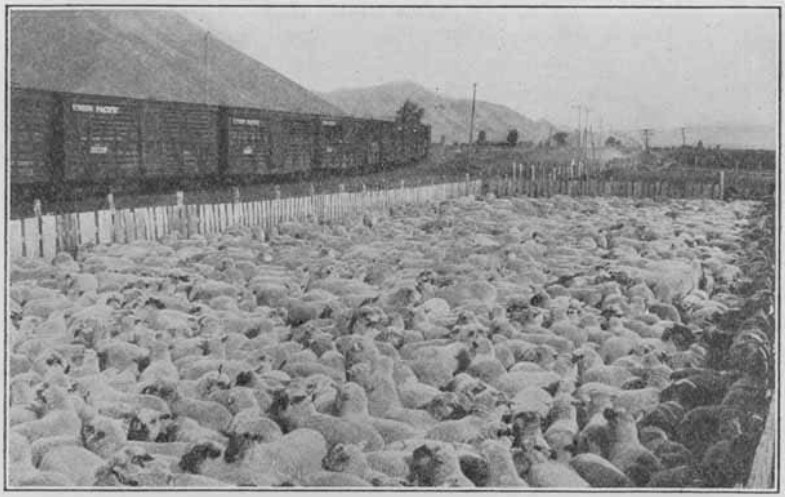


Fig. 1.—Idaho summer lambs show result of proper breeding and skillful management that produce the type and finish favored on the market.

Oregon, Nevada, Utah, Wyoming, and Montana, are ranges where much of the sheep operation consists of the growing of white faced lambs. The ewes are lambed in April and May. Ewe lambs are mostly for replacement of range ewe bands. A large percentage of the wether lambs are feeders.

Types and Grades of Feeder Lambs

The feeder lambs available to the State are:

1. Black faced lambs from the Idaho range outfits. These vary in weight from 65 to 80 pounds. A good pasture will fatten a high percentage of these, which are sent on to market, with the lighter, thinner lambs finished in the feed lots.
2. The white faced crossbred lambs, which will range in weight from 55 to 80 pounds. Like the blackfaces, the heavier, larger lambs need to be crowded so that they are not too large, rough, and coarse when finished for market.
3. The quarter bloods, ranging in weight from 50 to 75 pounds. Light weight lambs of this breeding are the general preference of those who wish to make a long feed.
4. Rambouillets, ranging in weight from 50 to 80 pounds. The type varies greatly from heavy wrinkles on the neck and body to a comparatively smooth, meaty type, popularly known as the "Mutton Merino."

Buying Feeder Lambs

Western lambs vary greatly in breeding, type, and weight. Each has a place and should be bought in accordance with the plan of feeding to be followed.

1. *Blackfaces.* The black faced lambs are strong feeders, finishing rapidly either on pasture or in the feed lot. If the purpose is to dispose of a large amount of pasture with a short feeding period, they are unexcelled as feeders.
2. *Crossbreds.* The crossbreds are usually raised in a country where the range feed is fairly abundant and are apt to carry considerable size and weight. They are popular as a class of lambs that pasture and feed well, though they do not finish as rapidly as the blackfaces.
3. *Quarter Bloods.* The quarter bloods are good, strong, vigorous, hardy lambs that are good feeders, yet as a rule require a longer feeding period than either the blackfaces or the crossbreds. As they are comparatively smooth and open faced, their hardiness and wool protection make them very popular for the open lot feeding of the West.
4. *Rambouillets.* Rambouillets vary greatly, more than any other class.

a. They may be quite narrow, on the heavy shearing, greasy order. Wrinkles may predominate, and where this occurs the sheep are apt to be so wool-blind that the wool must be frequently sheared away from the eyes, both on the range and in the feed lot. They

fatten slowly and are discriminated against on the market because of the heavy pelt and the low dressing percentage.

b. A more mutton type of wrinkled, heavy shearing lamb, that is satisfactory for a long feeding period. These, too, are inclined to have too much face covering to be practical without frequent shearing away from the eyes.

c. The smooth, open faced Rambouillet, the type mostly preferred on the range. Although of straight Rambouillet breeding, the most carefully selected and well bred of these tend greatly to the quarter blood type in mutton conformation.

As a general rule Rambouillets are the lighter weight feeder lambs, not because of the straight breeding, but because of the fact that they are from scanty, difficult ranges where the blackfaces, crossbreds, and quarterbloods do not thrive. Many of these are dropped somewhat late in the season and are received off the ewes in the fall. They are hardy, thrifty lambs but feed somewhat slowly, though the gains are as economical as the gains of the blackfaces and the crossbreds which consume more feed per day and consequently gain faster.

Condition of the Feeder Lambs

Owing to the seasonal conditions feeder lambs vary greatly as to their condition and thrift. If the spring range was late and cold, the growth of the lambs may have been retarded when they were young. The summer may have been hot and dry, the water scarce and the feed scanty. Under such conditions lambs are known as "dried out." The wool has a dead appearance and the lambs are somewhat inactive and dull. While fattening eventually, such lambs are hard to start. A feeding period of from 20 to 35 days is usually required to start the lambs on the up-grade. Lambs that are thriving, immediately start gaining. A lamb that is gaining is a much better buy than one that is going down in condition and flesh.

Lambs that are big and growthy, but thin in flesh, are popularly called "horsey" lambs. Because of their size they will usually make rapid gains and will become quite fat, but the size will cause a discrimination on the market; hence they should be bought at a lower price per pound.

Wrinkled and heavy pelted lambs are also discriminted against on the market, having a lower selling value.

In the range area lambs are often bought through commission dealers, who charge a commission of 10 cents per head. The service rendered varies greatly. In some cases the lambs are properly bought on a contract which specifies the breeding, type, and approximate weight. The bucks, cripples and those under a certain weight, are to be accepted only upon a lower agreed price. Weighing conditions are specified. Where this service is rendered, the commission is worth while, but often they are purchased over the telephone or without making the hard trip to see the lambs on the range, in which case they may be unthrifty, or may vary greatly from the specified weight—a variation of from 10 to 15 pounds on the weight ordered not being unusual. When bought in this way the money paid for

commission is wasted and each feeder can do as well on telephone orders, or in buying sight unseen, as a man who buys on commission.

Feeder lambs from one outfit will vary in size and weight. Some of the earliest singles will weigh from 75 to 80 pounds, while some of the later twins may weigh only 40 to 45 pounds. When handled in large numbers this is no handicap. The larger lambs will finish on pastures and will be shipped to market at the close of the pasturing season. The others will be sorted through the dodge gate into lots of 500 to 600, on the basis of their size. Small lambs will feed out to advantage if sufficient time is allowed, and if fed by themselves. When large lambs and little lambs are fed together, the small ones are crowded back and do not get a full ration or fatten until the large lambs are taken out.

Each type of lamb feeds differently. Blackfaces eat their feed voraciously, consuming the grain in less time than is required by Rambouillets. Each class of lamb eats at a different rate; hence those of different breeding should be fed separately. If blackfaces and whitefaces are fed together, the blackfaces will eat rapidly and secure more than their share of the grain. The Rambouillets eat deliberately, consuming as large a quantity but requiring more time; hence the experienced feeder divides his lambs according to the breeding as well as to the size and condition.

For the feeders who desire only one or two carloads, cooperation with other feeders is necessary. The lambs purchased from any range outfit will vary so much in size that it is necessary to have a fairly large number to sort. One of the most popular ways of securing feeder lambs is for a community to buy the entire supply together. The lambs are sorted through the dodge gate into uniform carload lots and weighed to the individual feeder at the actual delivered cost of the lambs. In this way each feeder secures one or more carloads of lambs that can be fed together and be ready for market at the same time.

During the early years of the experiments, when only 500 lambs were fed, the experimental lambs were purchased in cooperation with other feeders, taking an even sort. Since 1928, 1000 lambs have been fed each year and the Station has purchased its own lambs, buying four cars, or approximately 1,300 light weight feeder lambs. An even sort of 500 was sent to the Aberdeen Substation. The remaining 800 were left on pasture at the Caldwell Substation. At the close of the pasturing season the larger and more uneven lambs were shipped to market. This included those that had fattened on pasture as well as those that were too large and in too high a condition for a 100-day feeding period. The small lambs were left on hand, and were fed out separately. The Aberdeen Substation has fed a larger type of lamb than the Caldwell Substation, for the reason that, being an Agronomy station, it was desirable to have the lambs finished and on the market before it was necessary to use the men and teams for the spring work.

Contract Feeding

A number of the lambs fed in Idaho each year are on contract. Forms of contract vary, the following being the most common:

1. *Guaranteed Spread.* The lambs are weighed up to the feeder at a specified price and immediately contracted back to the owner. The contract usually calls for taking delivery of the lambs at a specified weight, 90 to 95 pounds. When the lambs are high priced the spread may be lacking, the same price per pound being paid for fat as for feeder lambs; but when the feeder price is low the margin varies from $1.00 to $2.00. Most lambs during the winter of 1931-32 were fed on a $1.25 and $1.50 margin, going in at $3.75 and out at $5.00 and $5.25.

2. *Feed Cost Method.* The pasture, hay, and grain are purchased on the farm at the prevailing market prices, with the stipulation that the owner is to furnish water, bedding and the corrals, and supervise the feeding. The feeder receives compensation either in the form of wages based on the number of lambs on hand, or on a higher allowance for feed prices. In the past the prevailing equipment and labor allowance for man and team was 10 cents per lamb per month. Often the labor expense is added to the feed cost, an allowance of $1.00 per ton on hay. silage, and pulp, and $3.00 per ton on the grain being common.

3. *Pounds Gain Basis.* The lambs are weighed to the feeder and taken out when fat. Basis of compensation is the difference between the initial weight and the final weight. For this difference in weight a compensation based on the prevailing price of pasture and feed is agreed upon. For pasture gains the price has varied from 5 to 9 cents per pound, while the feed lot gains have been paid for at the rate of from 6 to 12 cents per pound.

4. *Cooperative Share Agreement.* The lambs are weighed up to the feeder at the prevailing price for feeder lambs of this grade. Hay is measured and the value of the feed computed at prevailing market prices, plus an allowance for the man and horse labor of the feeder. At the close of the contract the lambs are sold and the net proceeds divided in proportion to the value contributed by each party.

Of the forms of contract prevailing, the last two give most general satisfaction. Most contracts carry a provision that in case of dispute, settlement is to be made by arbitration by a committee of three, each party choosing a representative who then choose a third party to go into the merits of the case and make a final settlement. The contract usually is deposited at the local bank.

Pasturing

On the average irrigated farm where the lambs are fed there is much waste feed, consisting of the aftermath in the harvested hay and grain fields and the waste growth along the fences and ditch banks. In the beet growing districts the beet tops furnish valuable pasture, where the larger, thriftier lambs fatten for market.

Lambs are purchased according to the movement of lambs from the ranges and the time that aftermath in harvested fields will be ready. They are then pastured until the weather becomes bad. Lambs properly handled make cheap and satisfactory gains. In many instances the early gains are lost by keeping the lambs out too late after the feed is frozen and the weather becomes adverse.

Feeder lambs cannot be held on pasture as long as ewe lambs that are being grown out for breeding purposes. When the feed supply becomes somewhat depleted, so that the lambs must run and feed all day long, they are losing the early gains and should be removed to new pasture or put into the feed lots. Lambs that are gaining and putting on weight fill up and rest much of the day. When there is not sufficient feed for this, so that they must move about continuously, they are not gaining and may be actually losing weight.

Pastures vary, but generally come under the following classifications:

1. Alfalfa stubble
2. Alfalfa and grain stubble
3. Beet tops

Alfalfa pasture involves some risk. Extension work with a large number of contract lambs shows an average gain of .19 pound and an average death loss of 4.4 per cent. Care needs to be taken in turning the lambs onto pasture. The most popular method is to have the lambs full, either on blue grass and weeds, or alfalfa hay, before turning onto alfalfa pasture.

Fig. 2.—Lambs properly handled on pasture make economical and satisfactory gains. Lambs received after long, hard trails, or off cars, should be started on pasture carefully. A safe way is to allow the lambs to fill on bluegrass pasture or weeds before turning onto alfalfa pasture, grain stubble or beet tops.

After filling on a safe feed they are turned onto alfalfa and herded closely until they fill and lie down, when they are left undisturbed. If the pastures are not fenced the lambs must be open-herded. Running and driving about, especially by the use of dogs, is dangerous and should not be practiced. The average carrying capacity of the alfalfa stubble is 217 lambs per day per acre.

The combination of alfalfa with any other pasture, such as grain stubble or beet tops, is much safer. Ten years' data secured by Extension work with contract lambs show that on combination grain and alfalfa stubble the death loss was 2.5 per cent, compared with 4.4 per cent on straight alfalfa. The gain of all the lambs on alfalfa and grain stubble was .20 pound per day.

Access to a field of beet tops in combination with alfalfa and grain stubble is the ideal combination. The contract lambs handled in this manner gained .28 pound per day, with a death loss of only .6 per cent. Many of the lambs were fattened.

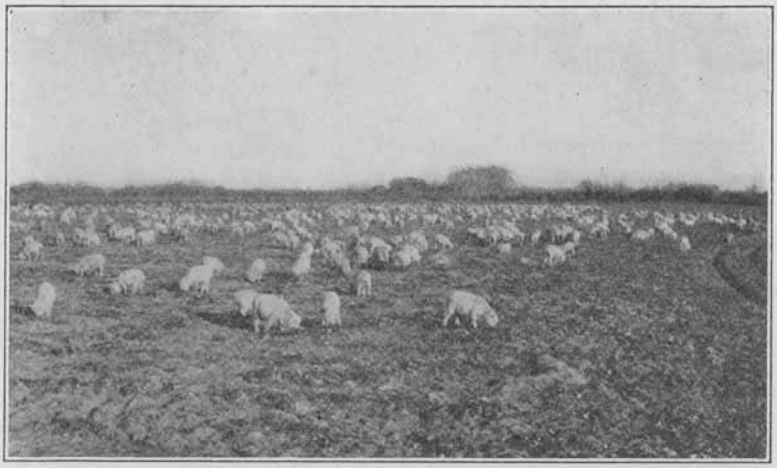


Fig. 3.—Lambs pasturing on beet tops in combination with alfalfa or grain stubble have ideal pasture. The larger, fleshier lambs are usually ready for market off pasture. Scene shows open herding of lambs.

Weather conditions on pasture are very important. In wet, rainy seasons the lambs put on small gains and practically none of them fatten. When the weather is cold and pastures are severely frozen, sore mouths* will be common and gains so small as to hardly pay the expense of pasture. When the pastures are frozen, the experimental lambs are fed hay in the morning and not turned out until 10 o'clock, when the frozen feed has thawed. In stormy periods, when the fields are muddy, the lambs are practically at a standstill, gains being small. The pasturing season varies, but over a 10-year period has

*Sore mouths are cured by removing the scabs from the sores and applying a solution of one part nitric acid and seven parts of water. Severe cases may require more than one treatement.

averaged 46 days. During this time, results on pasturing 134,624 contract lambs showed an average daily gain of .23 pound. The best gains were made in corn fields, with beet tops second. During the average 46-day pasturing season, death loss from all causes was 2.35 per cent.

Harvesting corn in the field with lambs offers possibilities, yet the fact should not be overlooked that death losses may be heavy. The losses have been reduced by supplying roughage, in the form of supplementary pasture or hay, after the forage in the corn field has been consumed. This tends to prevent the lambs from over-eating on corn. The system is not extensively followed in Idaho.

The value of fall pasture depends upon the availability of water. Water may be difficult to provide after the irrigation season. Lambs that must be trailed far to water every day make but small gains on pasture, and it is profitable to haul water to them.

Lambs on pasture should have access to salt at all times.

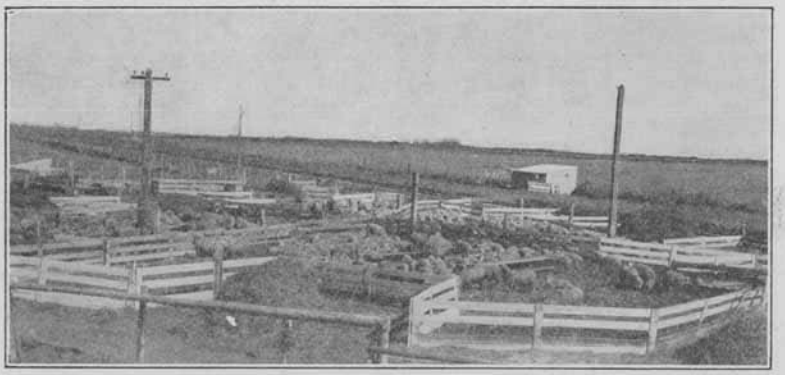


Fig. 4.—Panel equipment used at Aberdeen Substation accommodating four lots of 125 lambs each.

Equipment Generally Used in Fattening Lambs in Idaho

The open lot system of feeding lambs prevails in Idaho. A fence made of boards or brush, or a windbreak of trees, affords considerable protection from wind and drifting snow. The corrals are preferably located on a well drained slope, a sheltered, southern slope being favored.

Lamb feeding equipment is simple and inexpensive. Lambs are usually fed in lots made of panels set "zig-zag" or at right angles to give maximum hay feeding space and minimum lot space (*Fig. 4*). Long alfalfa hay is usually fed through panels. The hay is fed on the outside of the panels, the lambs reaching through the lower opening to obtain the hay. A large feed lot is undesirable, as more bedding is required to keep the lambs dry, clean, and comfortable. Too much space permits a lamb to exercise too much so that the rate of gain is lowered. Ordinarily 6 to 8 square feet per lamb is sufficient.

The panels or hurdles used are 16 feet long and 3 feet 2 inches in height (*Fig. 5*). Ready cut material for making each panel is as follows:

Top boards	2—1″x 6″—16′
Bottom board	1—1″x12″—16′
Vertical slats	2—1″x 6″—12′
Cut to	6—1″x 6″—43″ slats
and	3—1″x 6″— 5″ spacing blocks

This provides for three horizontal boards with a vertical binding slat at each end and one in the middle of the panel. The vertical slats should be extended five inches below the bottom of the panel. In erecting the panels into a fence, these five inch lengths are sunk in the ground to make the enclosure more firm. The 1″x12″x16′ is used for the bottom horizontal board.

A grain feeding trough that has proved satisfactory is 12 feet long, 1 foot wide, and 4 inches deep (*Fig 5*). This 12-foot grain trough accommodates 24 lambs, 12 on each side. The grain trough shown in *Fig. 5* is made of one inch material in the bottom. A more substantial and permanent trough can be made by using 2″x12″ instead of 1″x12″ board in bottom of trough. The trough is so constructed that it can be turned over when not in use to keep out snow, rain, or dirt. Lambs do much better if given hay, grain, and water in the cleanest possible manner. A bill of material for building a grain trough is as follows:

Top rail	1—2″x 4″—12′
End supports	2—2″x 4″— 8′
Trough sides	2—1″x 4″—12′
Trough bottom	1—1″x12″—12′
Trough ends	1—1″x 8″—10′

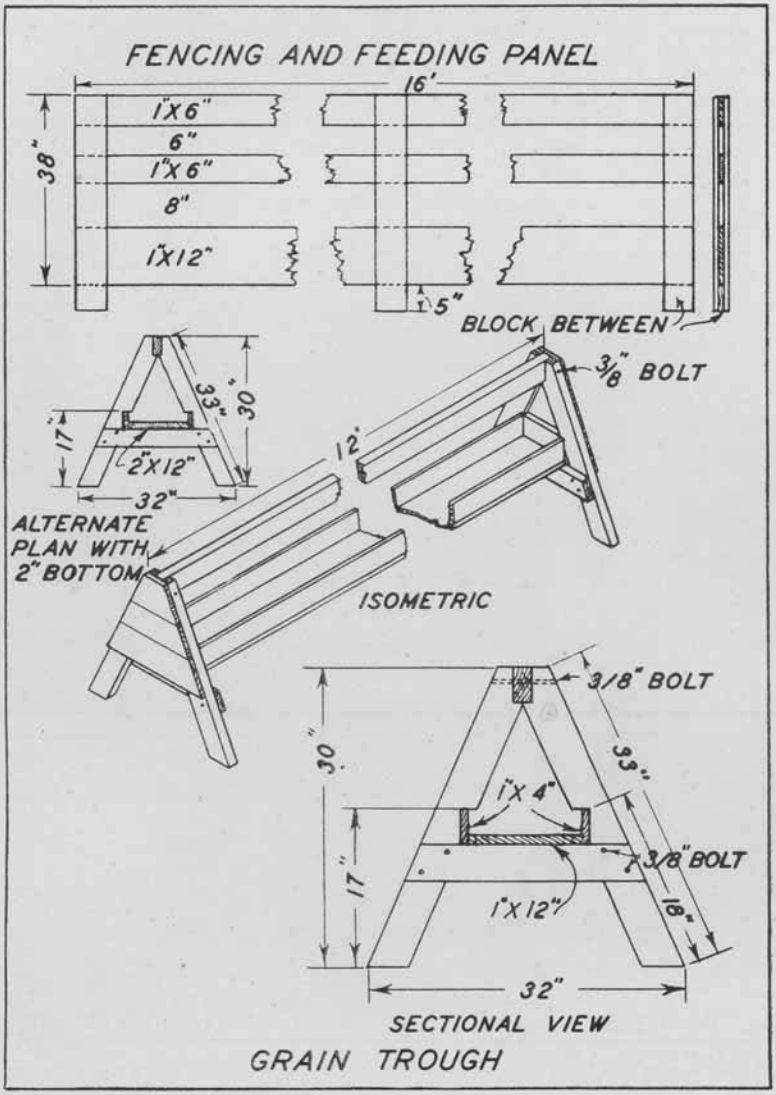
2—⅜″x8″ bolts with nuts and washers
8—⅜″x4″ bolts with nuts and washers
1—pound 8d common nails

Grain may be fed in a small separate enclosure, conveniently arranged, into which from two to four lots of lambs may be fed in turn. This system of feeding grain in a separate lot requires the minimum number of grain troughs and is the common method in use.

The amount of equipment necessary is determined by allowing one running foot of grain and hay feeding space per lamb.

The troughs and panels should be removed and stacked after each year's feeding to prevent warping. This makes it more convenient to remove the manure and permits feeding grounds to be used for other purposes during the remainder of the year.

The feed lots should be bedded with straw when the lambs are put in, and fresh straw added when needed to keep the lambs clean and dry.



(These plans courtesy Department of Agricultural Engineering, Idaho Experiment Station.)

Fig. 5.—(Upper) Hay feeding panel, used generally in feeding long hay. It is simple, practical and economically constructed equipment.

(Lower) Grain feeding trough. Should be turned over on side when not in use to keep clean.

Available Feeds

The choice of a ration depends upon the comparative amounts of hay and grain, as well as supplementary feeds, such as cull beans, peas, alfalfa seed screenings, potatoes, and the by-products of the sugar beet industry. Generally a lamb feeder will desire to feed the crop on the farm with the purchase of as little supplementary feed as possible, though the question may arise as to the advisability of buying a protein supplement to lower the feed requirements and improve the finish of the lambs.

The combination of feeds that will give maximum gain at minimum cost is one of the first factors considered. Regularity of feeding, comfort of the lambs, with adequate bedding to insure a dry bed, adequate watering facilities, with clean, fresh water, and access to salt, all add to the rapidity and economy of the gains. In years when the margin between the prices of feeders and fat stock is narrow, these factors within the control of the feeder will often decide the question of profit or loss.

The most common Idaho ration consists of alfalfa hay and barley. Each year at each Substation a check lot of lambs is fed on this combination, which is recognized as a standard Idaho lamb feeding ration.

The questions confronting the feeder are:

1. Shall the ration consist only of alfalfa hay and barley? Shall wheat, oats, or corn be substituted wholly or in part for the barley?
2. The use of supplementary waste feeds that are by-products from the cash crops produced on the farm. These may consist of

Fig. 6.—Showing lot arrangement at Caldwell Substation, type and finish of lambs, a dry, clean bed of straw keeping the lambs clean and comfortable.

cull beans, cull peas, or alfalfa seed screenings. With a limited demand and a low market value, it may be more advisable to feed these as part of the lamb fattening ration than to sell them.

3. The use of a succulent feed such as beet pulp, cull potatoes, or corn silage.

4. The addition of a protein supplement, such as cottonseed cake or linseed oil meal.

5. Shall the alfalfa hay be fed long, chopped, or ground?

Quality of Feed. In fattening lambs it is important that the feed be palatable and of good quality. If the hay is musty or bleached, or coarse and stemmy with but a small percentage of leaves, a maximum amount will not be consumed. If the grain is musty or smutty, the lambs will not eat a full ration. When inferior feeds are used, lambs will probably eat enough to grow, but not enough above the maintenance ration to put on the desired degree of finish.

Water. Fresh, clean water is necessary for best results and should be available at all times. Filthy, discolored water is consumed in so limited an amount as to reduce the gains. Inadequate space at the water trough, which permits only a few lambs to drink at a time, making it necessary for some to wait from one to two hours for a chance to drink, results in slow, expensive gains. All water troughs should be cleaned frequently.

Salt. Coarse, granulated salt, commonly known as stock salt, is satisfactory and should be available to feed lot lambs at all times.

Lamb Feeding Experiments

Object: To determine the relative value of home-grown feeds and by-products available for fattening lambs in different sections of the State, and to find a market for the surplus feeds. The rations used in the experiments have been planned after careful consideration of feeds available and relative feed prices. An effort has been made to determine the value of the various by-products when fed with alfalfa hay and barley.

Location of Experimental Lamb Feeding Lots

The Aberdeen Substation is located in Bingham county. The elevation of the station if 4,400 feet. In addition to alfalfa hay and the small grains, sugar beets and potatoes are grown extensively. Production of alfalfa and clover seed are leading industries. The Aberdeen Substation is an Agronomy station, conducted by the Agronomy Department of the University of Idaho and the United States Bureau of Plant Industry cooperating. Lamb feeding has been conducted at the Substation since 1924 as a means of helping to maintain the soil fertility.

The Caldwell Substation is located in the Boise valley. The elevation is 2,372 feet and the winters are comparatively open. The principal crops grown at the Substation are alfalfa hay, barley, and corn. Alfalfa grows rapidly and the plants are larger and somewhat coarser than those grown on the Aberdeen Substation. Experimental steer feeding has been conducted continuously since 1919.

Lambs were fed in 1920-21, 1921-22, 1923-24, and continuously since 1927.

Each Substation has equipment for feeding two double deck carloads of 250 lambs each. At the Aberdeen Substation the 500 lambs are fed in four lots of one deck each. At the Caldwell Substation the lamb feeding has been in either seven or eight lots, consisting of from 60 to 72 lambs each. Each lot carries a separate brand, and though shipped together they are sorted into the original lots and sold separately on the market.

During the early years of the experiments, hay was abundant and cheap, while grain was scarce and comparatively high in price. As lamb feeding was one of the industries started primarily to dispose of the surplus of alfalfa hay, the practice of early lamb feeding was to give a maximum amount of alfafa hay and a minimum amount of grain. This method requires a long feeding period and produces a lamb that is somewhat paunchy. During the later years of the feeding experiments, there was a greater diversity of crops grown in the State, with the result that grain was more abundant. However, the present day lamb feeding is on the basis of a comparatively heavy alfalfa ration.

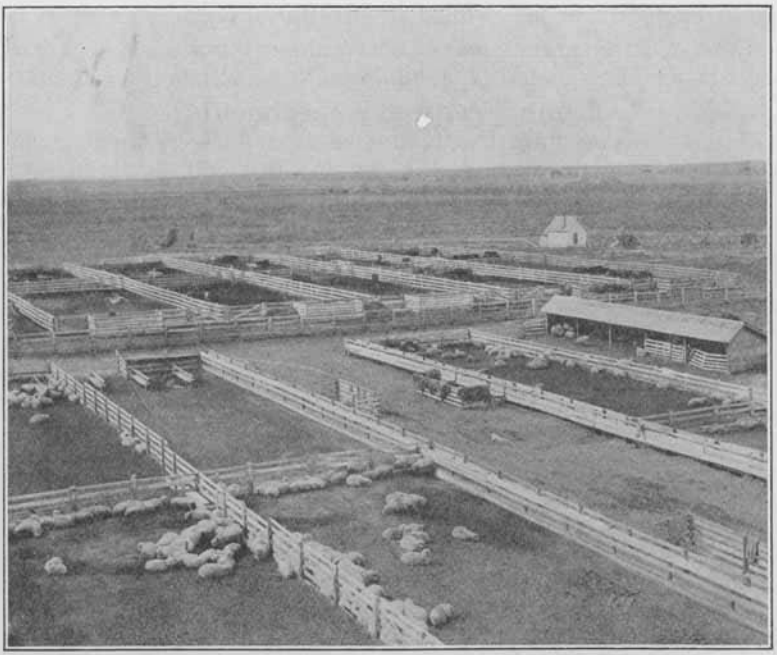


Fig. 7.—General feeding plant. Permanent lots for experimental lamb and steer feeding at Caldwell 'Substation. Accommodations for 500 lambs and 150 steers.

Arrangement of Lots

At the Caldwell Substation the lambs are fed in permanent lots. There are eight rectangular lots, in two sets of four, each having hay manger capacity for 75 lambs, with movable grain troughs in the center of the lot. Seven of the lots are open, the eighth having an open shed facing the south. On the outside of each pen, a shed 8 by 16 by 9 feet, having a capacity of one ton of loose hay, is provided for the storage of hay, from which it is fed as needed.

At the Aberdeen Substation the equipment is temporary, consisting of hay feeding panels set at right angles to give a minimum space, with the enclosure divided into four sections by two cross partitions (*Fig. 4*). The grain feeding lot arrangement, or cafeteria system, is used. A lot having sufficient grain troughs to feed 125 lambs is located near the regular lots and is used only for grain feeding.

The four temporary lots are constructed of panels 16 feet in length and situated so that every other panel is set in or out at right angles, the indentations on the outside being used to pile hay, the hay being fed on the outside of the panels, and the lambs reaching between the first and second boards from the ground for the hay. This set-up conserves space, requires a relatively small amount of straw, and is one of the most economically constructed plans of equipment.

CHEMICAL ANALYSES OF FEED USED IN EXPERIMENTS*

Feed	No. of Analyses	Water	Ash	Crude Protein	Crude Fat	Crude Fiber	Nitrogen-free Extract
Corn Silage	8	72.32	2.62	3.06	0.59	6.95	14.83
Cull Potatoes (raw)	3	78.87	1.04	1.99	0.056	0.58	17.47
Cull Potatoes (cooked)	1	80.7	0.93	1.78	0.03	0.51	16.05
Cull Peas	2	9.60	3.45	26.40	2.53	8.02	50.00
Cull Beans	6	11.25	4.98	23.45	1.53	3.05	55.76
Cottonseed Meal	5	7.17	7.03	46.94	6.07	9.48	23.33
Linseed Meal	1	7.23	5.97	37.90	4.87	9.25	34.78
Barley	19	9.73	2.93	10.44	1.58	5.67	69.53
Corn	3	10.16	1.78	9.97	2.96	2.40	72.98
Wheat	3	11.43	1.83	11.15	1.83	2.65	70.62
Oats	3	8.27	4.06	11.91	4.60	11.31	59.86
Molasses	1	18.1	12.1	3.7	0.20	0.0	65.9
Beet Pulp (wet)	2	86.25	1.30	1.89	0.26	4.89	5.43
Long Alfalfa (fed)	14	15.54	7.76	13.33	1.39	28.78	33.19
Long Alfalfa (refused)	7	21.38	5.35	6.90	0.82	36.81	28.75
Chopped Alfalfa (fed)	5	11.99	7.43	12.36	1.58	30.36	36.28
Chopped Alfalfa (refused)	2	16.27	4.89	8.79	1.17	35.25	33.63
Ground Alfalfa (fed)	3	8.79	7.45	12.89	1.48	31.02	38.38
Alfalfa Seed Screenings	3	10.48	4.89	32.59	9.86	11.18	31.00

*Determinations made by the Department of Agricultural Chemistry, Idaho Experiment Station.

Description of Feeds Used in Experiments

Alfalfa Hay. The hay in the experiments was grown locally, either on the Substation or in the immediate vicinity. Usually three crops of hay are harvested at each Substation. The growth following the third cutting is utilized as pasture. A late or light third cutting is sometimes pastured either standing or cut and shocked.

Barley. Substation-grown or other locally-grown Trebi barley, of uniform high quality and weight per bushel, was used. It was plump and well filled, averaging 48 to 52 pounds per bushel. Whole barley was fed in all trials except where noted in *Table VIII.*

Corn. Locally-grown shelled corn was fed at the Caldwell Substation. It graded No. 2 to 4 because of its high moisture content.

Silage. The silage fed was made from corn grown on the Caldwell Substation farm and cut during the denting stage.

Wheat. The wheat fed was soft wheat grown locally under irrigation, and was fed whole. The average weight per bushel ranged from 57.5 to 60 pounds.

Oats. The oats were produced locally and represented average quality. They averaged from 38 to 42.8 pounds per bushel. The oats were fed whole.

Cull Beans. The beans (Great Northern variety) were grown in Twin Falls county and consisted of the immature, discolored, small and split beans. They were cleaned after removal from the first grade stock, and were free of foreign material.

Cull Peas. The peas were grown in the upper Snake river valley, and consisted of small, split and discolored peas, free of foreign material. They were cleaned after removal from the first grade stock.

Alfalfa Seed Screenings. As the name implies, alfalfa seed screenings are composed of immature and small alfalfa seed, with a certain percentage of weed seeds. The screenings were re-cleaned, so that the weed seed content was low.

Beet Pulp. The beet pulp was shipped to Aberdeen from the sugar refinery at Blackfoot and stored at the Substation in a temporary pit.

Pressed Pulp. Pressed pulp, so called from having the excess water removed to decrease the cost of transportation, was fed in one year's trials.

Cull Potatoes. Small, immature, sun burned, ill shaped, and cut potatoes make up this class of potatoes and are generally disposed of as a feed for livestock. No spoiled potatoes were used in the experiment.

Clover and Alfalfa Chaff. These feeds represent the straw from the clover and alfalfa seed crops. Like other straws they are relatively low in feed value and are more commonly used for wintering livestock.

Cottonseed Cake and Linseed Oil Meal. Cottonseed cake and linseed oil meal are high protein feeds, relatively high in price because of the distance they are shipped, and used in limited proportions to supplement the grain feeds. The guaranteed protein content of cottonseed cake was 43 per cent, and of linseed oil meal, 34 per cent.

Preparation of Chopped and Ground Alfalfa Hay

Ground and chopped hay are ordinarily designated as such after being prepared by a grinding or chopping machine. The usual grinding machine for preparing hay is equipped with revolving hammers traveling at a high rate of speed, which pulverize the material until it is fine enough to go through the openings in a screen surrounding the revolving hammers. Screens with variable sized perforations are made for each machine so that the degree of fineness may be regulated. The capacity of a machine is in direct ratio to the screen size, while the cost of preparation increases with the smaller screen sizes.

Chopped hay, as the name implies, is prepared with a machine wherein sharp knives shear the hay into lengths as it is fed into the machine. Chopped hay may vary in fineness, depending largely on the number and sharpness of the knives, their revolving speed, and the rate at which the hay is fed into the machine. Hay should be thoroughly dry before chopping and grinding.

From the standpoint of fineness, not a great deal of difference can be found between chopped hay prepared under the best of conditions and ground hay prepared with a large sized screen. In the ground hay practically all the stems are split lengthwise, giving it a lighter color and a fluffier appearance. All hay used in the chopped hay experiments reported herein was prepared with some type of ensilage or hay chopping machine. The ground hay used in

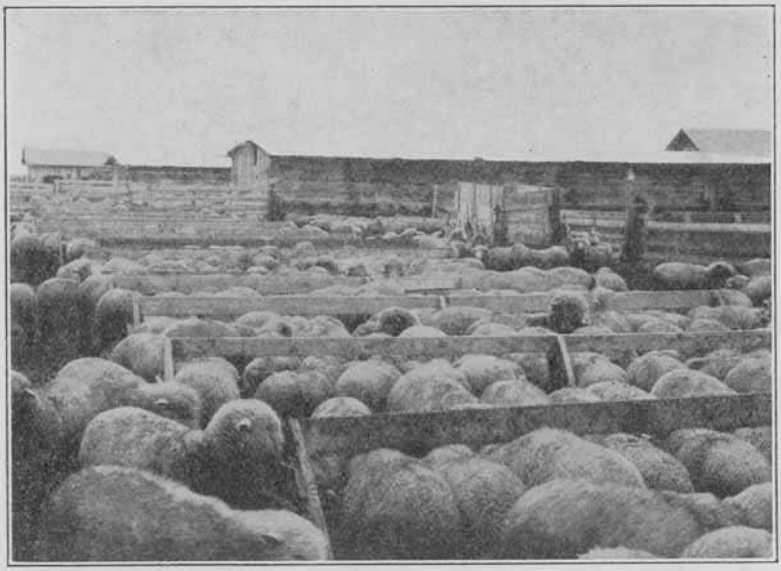


Fig. 8.—An Idaho feed lot, showing the separate grain feeding lot, or cafeteria system. This system makes most efficient use of grain troughs and is a most satisfactory way of feeding grain so that all lambs can get their grain allowance.

the experiments was prepared with a small hammer-type grinder using a screen with one-fourth inch perforations.

Details of feed grinding and forage processing appear in Idaho Experiment Station Bulletin No. 180, *"Rural Electrification Development in Idaho."*

Order of Feeding

During the first years of the experiments the abundance of Idaho grown alfalfa made it advantageous to feed as much as possible to all classes of livestock. In later years a greater diversity of crops resulted in more abundant and cheaper grains which changed the prevailing feeding system.

At Caldwell, in all tests except 1931-32, hay was fed previous to the grain and the lambs were permitted to eat hay before and after the grain feeding. Grain was fed twice daily and hay three times per day.

With the separate grain lot, or cafeteria system of feeding at Aberdeen, the grain was placed in the troughs for the lambs before they were turned in.

While the lambs were consuming the grain, the feeder placed fresh hay around the feeding panels. For the morning feed the hay fed the night before was turned over and new hay added. Before the evening feed of hay was given, all stems from the previous daily feed were carefully cleaned up and placed in convenient piles, so that they could be gathered up and weighed at three- or four-day intervals.

The additional concentrates, including alfalfa seed screenings, cull beans, cull peas, cottonseed, and linseed oil meal, were all fed mixed with the barley.

Corn Silage. Corn silage was fed in the bunks, mixed with the grain.

Beet Pulp. Beet pulp and potatoes were fed in bunks inside the lots during the warmer part of the day.

Clover Chaff and Alfalfa Chaff. Clover chaff and alfalfa chaff were fed in self-feeding racks within the lots.

Salt. Coarse, granulated salt was kept in troughs, easily accessible to the lambs at all times. During damp weather the hard crusts that formed over the salt had to be broken, so that it could be eaten rather than licked.

Water. Well water was supplied in shallow troughs situated in the center of four adjacent pens so that four lots could be watered from one tank. During cold weather ice had to be removed daily from the troughs. The tank was cleaned once or twice weekly, depending upon the amount of straw and filth that had accumulated. Since 1926 an electric water heater has been operated at the Aberdeen Substation to keep the water free from ice and to remove the chill from the water.

Methods

Number of Lambs per Lot. Equipment at each Substation is provided for the feeding of two carloads or 500 lambs. At Caldwell seven or eight lots of lambs have been fed averaging from 60 to 72 lambs per lot. At Aberdeen four temporary panel enclosures holding 125 lambs, or one deck each, are fed each year. The lambs are divided evenly with respect to weight, type, and grade.

Weights. For initial and final weights of the feeding period the lambs were weighed by lots for three consecutive days, the second day of each weighing falling on the first and final day of the experiment, and the average of the weights was used without shrink as initial and final weights, respectively. One-day weighings of each lot were made at 14-day intervals.

Basal Ration. A ration of alfalfa hay and barley has been taken as the basal ration in all experiments. Alfalfa hay was fed liberally in all lots.

Total Hay. In the feed for 100 pounds gain, the total amount of hay fed is given. To obtain the amount actually consumed the percentage of waste hay must be deducted.

Feed Costs of any combination of feeds may be determined from the tables by using the market values of the feeds required for 100 pounds gain.

Shrink. Shrink to market is based on the difference between the full home weight at the Substations and the selling weight at the market.

Market Value. The market value per head is the selling weight multiplied by the price received per hundredweight. The percentage of lambs sorted as "feeders" and "seconds" varies with the year and the market, a slow or falling market resulting in a heavy sort, with light sorting on a rising, active market.

Table Calculations. All tables in this Bulletin are based on one average lamb.

Carcass Grading. Carcass grading was secured on most shipments, but was not obtainable on some split shipments and at certain markets, consequently cannot be used for uniform comparison with all lots.

Pasturing Lambs Prior to Dry-Lot Feeding Period. Pasturing range lambs in the fall on the aftermath of alfalfa, grain stubble, and beet fields is a common practice in Idaho.

Since 1920 the Idaho Experiment Station has pastured 8,885 lambs, 4,844 at the Caldwell Substation, and 4,041 at the Aberdeen Substation. The buying weight ranged from 52.14 to 64.55 pounds, averaging 57.80 pounds. The pasturing season varied from 18 to 56 days, averaging 38.5 days. The average daily gain on pasture was .21 pound. The death loss was 171 lambs, an average of 1.92 per cent.

The amount of gain secured while on pasture was calculated from differences in buying weights, which were taken on the range, and the initial weight at which the lambs started on experiment,

less 4 per cent shrinkage. The lambs were divided into experimental lots when taken from pasture; the uneven sorts were shipped to market.

At the close of the pasturing season 8,714 lambs remained from the 8,885 lambs turned onto pasture. Of this number 7,685 were put onto experimental feed. The remaining 1,029 head were sorted out in making up uniform lots for the experimental feeding and were shipped to market.

The 7,685 lambs weighed into the experimental feed lots had an initial weight of from 59.39 to 75.02 pounds, averaging 66.28 pounds. The feeding period ranged from 71 to 122 days, averaging 95 days. The feed lot loss was 81 head, an average of 1.05 per cent. The average final weight of the 7,604 lambs was 93.80 pounds, giving an average gain per lamb of 27.52 pounds, and an average daily gain of .290 pound.

During the twelve-year period, Extension work with 190,578 lambs fattened on contract showed an average initial weight of 65.56 pounds, and an average final weight of 92.67 pounds. The average feeding period was 92 days and the average gain 27.11 pounds, or an average daily gain of .294 pound. The percentage of lambs lost in the feed lot was 1.43 per cent.

Starting the Lambs on Grain

The lambs were started on a small grain allowance, which was increased slowly. Range lambs have never had grain, and all do not start eating grain at once. When the grain ration is raised too fast the lambs go off feed or "stall." The rate of grain feeding was influenced by the character of the feed and the size and thrift of the lambs. To 60-pound feeder lambs one twenty-fifth of a pound of

TABLE I
Barley and Alfalfa vs. Corn and Alfalfa
3 Trials—1921-22, 1923-24, 1929-30

	Alfalfa Barley	Alfalfa Corn
Number of lambs	202	204
Number of days	94	94
Average initial weight, lbs.	65.38	66.03
Average final weight, "	92.74	94.59
Average daily gain, "	.291	.303
Average daily ration:		
Alfalfa, lbs.	3.38	3.49
Barley, "	.86	.....
Corn, "	.....	.84
Feed for 100 lbs. gain:		
Alfalfa, lbs.	1,161	1,148
Barley, "	296	.....
Corn, "	.....	276
Per cent waste hay	28.70	29.11
Shrink to market, per cent	7.15	7.84
Market weight, lbs.	88.14	89.29
Market value, per head	$12.18	$12.41

barley was fed per day per lamb, and increased one twenty-fifth of a pound per day per lamb on alternate days until they received slightly more than 1.5 pounds per day. For 500 lambs this amounts to 20 pounds per day, with increases of 20 pounds every other day, and requiring 60 to 75 days to reach a feed of 1.5 pounds per head per day. The lamb feeder in Idaho is interested primarily in marketing the maximum amount of alfalfa, which explains in part the length of time used in getting the lambs on feed.

Feed Lot Losses

Some losses in the feed lot seem to be unavoidable. In general, however, the losses can be kept down by using care in getting the lambs on grain. If losses persist, it is necessary to reduce the grain allowance.

Discussion of Results

Comparing Barley and Alfalfa with Corn and Alfalfa

In three trials barley and shelled corn were compared when fed with alfalfa hay (*Table I*). The average daily feed consumption was essentially the same in both lots. The average daily gain was slightly in favor of the lot receiving corn. The alfalfa hay requirements for 100 pounds gain were quite similar, while grain requirements were 276 pounds of corn as compared with 296 pounds of barley. The relative values of barley and shelled corn, based upon grain required for 100 pounds gain, were: barley 100 per cent and shelled corn 107 per cent.

A Comparative Study of Barley, Corn, and Wheat when fed with Alfalfa

In one trial, barley, shelled corn, and wheat were compared when fed with alfalfa hay (*Table II*). The average daily consumption of grain and hay was approximately the same in the lots receiving barley and shelled corn. The lambs fed wheat went off feed when receiving 1.4 pounds of grain daily. This condition naturally resulted in a smaller grain consumption when compared with the other lots.

The lambs fed barley and shelled corn made essentially the same daily gains. The lambs fed wheat gained .23 pound daily, compared with .26 pound daily for the other lots.

As indicated in *Table II*, the feed requirements for 100 pounds gain for the various lots were not materially different. The relative value of barley, shelled corn, and wheat, based upon grain required for 100 pounds gain were: barley, 100 per cent; shelled corn, 104 per cent; and wheat, 98.5 per cent. The hay requirements were essentially the same in all lots.

Comparison of Barley, Corn, and Wheat-Oats when fed with Alfalfa

In trials conducted in 1921-22 and 1923-24, comparing the use of barley, corn, and a mixture of three parts wheat and one part oats, all grains were fed at the rate of approximately three-fourths of a pound per day per lamb (*Table III*). The value of corn for the

TABLE II

Comparison of Barley, Corn and Wheat
1 Trial—1929-30

	Alfalfa Barley	Alfalfa Corn	Alfalfa Wheat
Number of lambs	64	64	64
Number of days	110	110	110
Average initial weight, lbs.	63.92	63.28	64.34
Average final weight, "	92.70	91.90	89.66
Average daily gain, "	.261	.260	.230
Average daily ration:			
Alfalfa, lbs.	2.27	2.25	2.01
Barley, "	1.06	.....	.....
Corn, "	.....	1.02	.....
Wheat, "	.....	.....	.95
Feed for 100 lbs. gain:			
Alfalfa, lbs.	870	864	875
Barley, "	408	.....	.....
Corn, "	.....	393	.....
Wheat, "	.....	.....	414
Per cent waste hay	21.3	18.7	21.9
Shrink to market, per cent	7.21	5.11	4.98
Market weight, lbs.	87.46	89.68	85.56
Market value, per head	$8.59	$8.97	$8.23

TABLE III

Comparison of Barley, Corn and Wheat-Oats
2 Trials—1921-22, 1923-24

	Alfalfa Barley	Alfalfa Corn	Alfalfa Wheat-75 parts Oats-25 parts
Number of lambs	138	140	137
Number of days	86.5	86.5	86.5
Average initial weight, lbs.	66.05	67.28	66.85
Average final weight, "	92.75	95.82	93.09
Average daily gain, "	.308	.330	.303
Average daily ration:			
Alfalfa, lbs.	4.03	4.22	4.67
Barley, "	.736	.....	.....
Corn, "	.....	.735	.....
Wheat, "	.....	.....	.55
Oats, "	.....	.....	.18
Feed for 100 lbs. gain:			
Alfalfa, lbs.	1306	1277	1546
Barley, "	238	.....	.....
Corn, "	.....	222	.....
Wheat, "	.....	.....	182
Oats, "	.....	.....	61
Per cent waste hay	31.19	32.34	27.16
Shrink to market, per cent	6.26	8.07	8.11
Market weight, lbs.	89.09	90.39	87.66
Market value, per head	$13.91	$14.11	$13.69

production of 100 pounds gain was 107.2, compared with barley at 100 per cent. The corn fed lambs gained .330 pound daily, while the barley fed lambs gained .308 pound, and required slightly less hay for 100 pounds gain.

The ration composed of wheat and oats had a value of 97.9 per cent, in comparison with barley at 100 per cent, and required 15.5 per cent more hay for the production of 100 pounds gain.

The hay requirements in these trials were relatively higher than those shown in later experiments, and the grain requirements lower. This was a natural result of the plan of feeding followed in which an attempt was made to utilize as much hay as possible.

Table IV shows an average of three trials comparing barley with a mixture of three parts wheat and one part oats. Daily gains were .305 pound on the barley and .290 pound on wheat and oats. Taking barley as 100 per cent, the wheat and oats ration was worth only 95.0 per cent as much in producing 100 pounds gain, and required 11.9 per cent more hay.

Comparing Barley and Wheat-Barley when fed with Alfalfa

A mixture of barley 40 per cent and wheat 60 per cent was fed in comparison with barley and alfalfa hay (*Table V*). The gains produced were essentially the same for both rations, but the efficiency of the barley was increased, as measured by feed required for 100 pounds gain, by adding wheat. The wheat-barley mixture had a value of 104 per cent compared with 100 per cent for the barley. In addition the wheat-barley ration saved 6.3 per cent alfalfa in the production of 100 pounds gain.

TABLE IV
Comparison of Barley and Wheat-Oats
3 Trials—1921-22, 1923-24, 1930-31

	Alfalfa Barley	Alfalfa Wheat-75 parts Oats-25 parts
Number of lambs	198	198
Number of days	98	98
Average initial weight, lbs.	65.55	65.89
Average final weight, "	95.48	94.36
Average daily gain, "	.305	.290
Average daily ration:		
Alfalfa, lbs.	3.46	3.64
Barley, "	.89	.....
Wheat, "	.....	.65
Oats, "	.....	.21
Feed for 100 lbs. gain:		
Alfalfa, lbs.	1122	1256
Barley, "	290	.....
Wheat, "	.....	231
Oats, "	.....	74
Per cent waste hay	23.07	23.83
Shrink to market, per cent	9.13	10.30
Market weight, lbs.	88.69	86.46
Market value, per head	$11.73	$11.43

TABLE V

Comparison of Barley and Wheat-Barley
2 Trials—1930-31, 1931-32

	Alfalfa Barley	Alfalfa Barley-40 parts Wheat-60 parts
Number of lambs	121	123
Number of days	117	117
Average initial weight, lbs.	63.78	63.81
Average final weight, "	97.80	97.56
Average daily gain, "	.290	.288
Average daily ration:		
Alfalfa, lbs.	2.35	2.20
Barley, "	1.12	.40
Wheat, "	.....	.67
Feed for 100 lbs. gain:		
Alfalfa, lbs.	810	759
Barley, "	386	138
Wheat, "	.....	234
Per cent waste hay	6.81	10.48
Shrink to market, per cent	7.49	8.01
Market weight, lbs.	92.07	91.21
Market value, per head	$7.01	$6.92

TABLE VI

Utilization of Wheat Alone and in Combination with Oats and Barley
1 Trial—1930-31

	Alfalfa Barley	Alfalfa Wheat	Alfalfa Wheat-75 parts Oats-25 parts	Alfalfa Wheat-75 parts Barley-25 parts
Number of lambs	62	62	62	62
Number of days	122	122	122	122
Average initial weight, lbs.	64.43	64.40	63.76	64.06
Average final weight, "	101.65	101.53	97.22	102.06
Average daily gain, "	.305	.304	.274	.311
Average daily ration:				
Alfalfa, lbs.	2.60	2.47	2.18	2.34
Barley, "	1.13	.....	.....	.28
Wheat, "	.....	1.08	.82	.85
Oats, "	.....	.....	.27	.....
Feed for 100 lbs. gain:				
Alfalfa, lbs.	840	811	797	752
Barley, "	366	.....	.....	91
Wheat, "	.....	356	300	273
Oats, "	.....	.....	100	.....
Per cent waste hay	8.98	12.50	12.06	9.93
Shrink to market, per cent	7.22	7.61	7.12	7.24
Market weight, lbs. { Lamb	87.79	87.10	83.77	88.40
Market weight, lbs. } Wool	7.03	7.26	7.03	6.76
Market value per head { Lamb	$6.80	$6.84	$6.37	$6.80
Market value per head } Wool	$ .95	$ .98	$ .95	$ .91

Comparing Wheat alone and in combination with Oats and Barley when fed with Alfalfa

In one year's trial wheat alone was compared with a mixture of wheat and other grains (*Table VI*).

Barley and wheat, fed with alfalfa, were compared. The gains were the same, but wheat had a value of 102.8 per cent compared with barley at 100 per cent, and the wheat ration saved 3.4 per cent alfalfa hay.

The ration of wheat 75 per cent and oats 25 per cent was compared with barley. The mixture of wheat and oats had a value of only 90 per cent that of barley. The wheat-oats mixture saved 5.1 per cent alfalfa hay. The average daily gains were .274 pound for the mixture of wheat and oats as compared with .305 pound for barley.

Wheat 75 per cent and barley 25 per cent was compared with barley. The mixture of wheat and barley had a value of 100.5 per cent compared with barley at 100 per cent. The wheat-barley mixture saved 10.5 per cent alfalfa hay. The gains were essentially the same for both lots.

Value of Various Grains. As a general summary of the various grains fed with alfalfa hay for fattening lambs, the actual difference has been small. When wheat is fed, the addition of a small amount of barley will be advisable. From the standpoint of the gains and the degree of finish, there is but slight, if any, difference between corn and barley, the dressing percentage and carcass grading being practically the same. The finish of the lambs fed wheat alone was below the corn and barley fed lots. Oats in the ration with alfalfa hay tend to produce more growth than finish, producing a lamb lacking in thick fleshing, and with lower carcass grading than where they are not included in the ration. However, oats are excellent to start lambs on feed.

Lambs fed wheat or wheat and barley should be watched very carefully. When they are receiving 1.4 to 1.5 pounds of grain per head daily the lambs sometimes go "off feed." The lambs receiving a grain ration of oats and wheat did not go "off feed," but the efficiency of this ration was materially lower.

The Value of Protein Supplements with Alfalfa and Barley

Five tests were made with cottonseed cake or meal compared with the alfalfa-barley ration (*Table VII*). In all cases the hay and barley requirements for 100 pounds gain were lowered by the addition of cottonseed meal. One year's trial was made with one lot on linseed oil meal compared with one lot on alfalfa and barley and one lot on alfalfa, barley, and cottonseed meal. *Table VII* gives the comparative results.

In the five years' trials, each ton of cottonseed meal replaced 3167 pounds of alfalfa hay and 3111 pounds of barley. The lambs fed cottonseed meal had a higher market value, a higher dressing percentage, and graded higher in the coolers.

In the 1931-32 trial, each ton of cottonseed meal replaced 4970 pounds of hay and 3091 pounds of barley. Each ton of linseed oil meal replaced 4200 pounds of hay and 5067 pounds of barley.

A study of the comparisons in *Table VII* indicates the influence of relative feed prices on the advisability of using these protein supplements. Cottonseed meal and linseed oil meal fed with barley and alfalfa hay increased the rate of gain, lowered the barley and alfalfa requirements, and increased the market value of the lambs. Their value in a ration of barley and alfalfa hay will depend on the value of the barley and alfalfa that they replace, plus the influence of a better finish upon selling price of lambs. The feeding period is shortened by the use of protein supplements.

Use of Supplementary Waste Feed

Throughout the feeding sections of southern Idaho the production of beans, peas and alfalfa seed are important industries. The small, immature, discolored, and second grade products have no market value other than as feed for livestock. Alfalfa seed screenings, cull beans, and cull peas are all protein-rich supplements, and a number of experiments have been conducted to determine their value in a ration. Four trials with alfalfa seed screenings, and two trials with cull peas have been conducted at the Aberdeen Substation. Six trials were made with cull beans, three at the Aberdeen and three at the Caldwell Substation.

TABLE VII

Comparison of Cottonseed Meal and Linseed Oil Meal Added to a Ration of Barley and Alfalfa

	5 Trials—1926-27, 1929-30, 1930-31, 1931-32		1 Trial—1931-32		
	Alfalfa Barley	Alfalfa Barley Cottonseed Meal	Alfalfa Barley	Alfalfa Barley Cottonseed Meal	Alfalfa Barley Linseed Oil Meal
Number of lambs	447	447	62	60	62
Number of days	103.5	103.5	112	112	112
Average initial weight, lbs.	62.05	61.89	62.98	63.25	63.44
Average final weight, "	91.01	93.26	93.03	96.27	97.98
Average daily gain, "	.280	.302	.268	.295	.310
Average daily ration:					
Alfalfa, lbs.	2.26	2.26	2.11	2.06	2.33
Barley, "	1.04	.96	1.02	.96	.94
Cottonseed meal, "	.....	.108	.....	.09	.....
Linseed oil meal, "	.....	.....	.....	.....	.09
Feed for 100 lbs. gain:					
Alfalfa, lbs.	808	751	787	705	724
Barley, "	374	318	380	329	304
Cottonseed meal, "	.....	36	.....	33	.....
Linseed oil meal, "	.....	.....	.....	.....	30
Per cent waste hay	22.75	20.18	9.84	10.62	7.56
Market weight, lbs.	85.37	87.89	89.84	91.14	92.95
Shrink to market, per cent.	7.33	6.96	3.42	5.33	5.15
Market value, per head	$8.62	$8.93	$6.29	$6.38	$6.51

Alfalfa and Barley vs. Alfalfa, Barley and Cull Beans

On the Twin Falls and tributary tracts the growing of beans is an important industry. The leading variety of beans grown is the Great Northern, and all trials were made with this variety. Large quantities of cull beans are available for livestock feeding. Six trials were made to determine their value in a ration, three at the Aberdeen and three at the Caldwell Substation. During the early trials difficulty was experienced in keeping the bean-fed lambs on full feed. A part of the lambs did not find the beans palatable, with the result that the others ate large quantities which caused indigestion and scouring. In order to overcome this tendency and have all eat an equal proportion of beans and barley, one trial was made at the Caldwell Substation in which the beans and barley were ground separately and mixed together in the proportion of 80 per cent barley and 20 per cent beans. This comparison was made the same year that one lot was fed on whole barley and whole beans. In order to check the difference in the ground grain against the whole grain, one lot was fed ground barley. The results appear in *Table VIII*.

Grinding the barley, and the barley and beans did not prove profitable, the rate of daily gains being lowered and feed requirements increased (*Table VIII*). The lambs in both lots on ground grain ate the grain allowance rapidly, consuming the grain ration in approximately one-half the time required by the lambs on the whole grain.

TABLE VIII

Whole Barley vs. Ground Barley and Whole Barley and Beans vs. Ground Barley and Beans
1 Trial—1928-29

	Alfalfa Whole-Barley	Alfalfa Whole-Barley 80 parts Whole-Beans-20 parts	Alfalfa Ground-Barley	Alfalfa Ground-Barley 80 parts Ground-Beans-20 parts
Number of lambs	71	70	72	70
Number of days	90	90	90	90
Average initial weight, lbs.	75.32	74.46	75.13	74.95
Average final weight, "	102.58	99.26	100.14	98.57
Average daily gain, "	.303	.276	.270	.262
Average daily ration:				
Alfalfa, lbs.	3.39	3.40	3.44	3.10
Barley, "	1.04	.80	1.03	.83
Beans, "	.....	.21	.....	.20
Feed for 100 lbs. gain:				
Alfalfa, lbs.	1134	1257	1238	1208
Barley, "	348	311	371	325
Beans, "	.....	78	.....	81
Per cent waste hay	31.9	32.1	33.9	33.0
Market weight, lbs.	96.30	95.71	95.14	93.48
Shrink to market, per cent	7.29	6.60	6.01	6.19
Market value, per head	$15.65	$15.55	$15.46	$15.19

Value of Cull Beans

A summary of all the lambs fed on barley supplemented with beans shows a higher hay consumption with the bean-fed lambs, an average of 2 per cent more hay being required for 100 pounds gain, though each 100 pounds of beans replaced 79.5 pounds of barley (*Table IX*). Each ton of beans fed was equal to 1590.9 pounds of barley but required 409.0 pounds more alfalfa. With barley at $1.00 per cwt., and alfalfa hay at $8.00 per ton, the beans had a replacement value of 71 cents per cwt. The proportion of beans that may be used to advantage in a ration is approximately 20 per cent. During the early trials as high as 50 per cent beans was included in the grain ration, which resulted in throwing a part of the lambs off feed. Similar results were secured by feeding 40 per cent, and 30 per cent beans in the grain ration, but good results were secured by feeding 20 per cent beans. Although high in protein, the beans do not improve the finish over the barley-alfalfa fed lambs; hence the addition of beans slightly lowers the value of the barley-alfalfa ration.

TABLE IX

Barley and Alfalfa vs. Barley, Alfalfa and Cull Beans
6 Trials—1926-27, 1927-28, 1928-29, 1929-30, 1931-32

	Alfalfa Barley	Alfalfa Barley-80 parts Beans-20 parts
Number of lambs	583	577
Number of days	98	98
Average initial weight, lbs.	66.26	66.32
Average final weight, "	93.62	92.99
Average daily gain, "	.279	.272
Average daily ration:		
Alfalfa, lbs.	2.50	2.50
Barley, "	1.09	.92
Beans, "	-----	.23
Feed for 100 lbs. gain:		
Alfalfa, lbs.	905	923
Barley, "	395	325
Beans, "	-----	88
Per cent waste hay	29.08	28.62
Market weight, lbs.	87.85	87.82
Shrink to market, per cent	7.60	6.87
Market value, per head	$11.46	$11.41

The Value of Cull Peas with Alfalfa and Barley

In two trials with peas constituting 20 per cent of the grain ration, the finish of the lambs was improved and feed requirements lowered (*Table X*). When fed in the proportion of 20 per cent peas and 80 per cent barley, each ton of peas replaces 2057 pounds of alfalfa hay and 1371 pounds of barley. The result of one trial with 10 per cent peas gave each ton of peas a replacement value of 3871 pounds of alfalfa, but required 452 pounds more barley. In

TABLE X

Barley and Alfalfa vs. Barley, Cull Peas and Alfalfa

	2 Trials—1930-31, 1931-32		1 Trial—1930-31		
	Alfalfa Barley	Alfalfa Barley-80 parts Peas-20 parts	Alfalfa Barley	Alfalfa Barley-90 parts Peas-10 parts	Alfalfa Barley-80 parts Peas-20 parts
Number of lambs	250	250	125	125	125
Number of days	93	93	85	85	85
Average initial weight, lbs.	67.22	67.27	68.70	67.88	67.90
Average final weight, "	94.06	95.41	96.04	95.06	97.82
Average daily gain, "	.288	.302	.330	.320	.352
Average daily ration:					
Alfalfa, lbs.	2.43	2.33	2.70	2.43	2.48
Barley, "	1.04	.95	1.00	.99	1.01
Peas "	.....	.21	.....	.09	.20
Feed for 100 lbs. gain:					
Alfalfa, lbs.	884	772	832	772	716
Barley, "	363	315	307	314	291
Peas "	.....	70	.....	31	58
Per cent waste hay	19.7	18.3	16.7	15.6	17.5
Market weight, lbs.	88.56	91.14	90.73	90.41	92.48
Shrink to market, per cent.	6.95	5.74	6.81	6.15	6.79
Market value, per head	$5.99	$6.25	$7.26	$7.23	$7.40

the same trial the feeding of 20 per cent of peas gave each ton of cull peas a replacement value of 4000 pounds of alfalfa hay and 552 pounds of barley.

The Value of Alfalfa Seed Screenings Fed with Alfalfa and Barley

In these trials each ton of the screenings replaced 1726 pounds of alfalfa hay and 1762 pounds of barley (*Table XI*). The addition of alfalfa seed screenings increased the rate of gain 13.8 per cent and improved the finish, all lots proving superior on the market to the alfalfa-barley fed lambs.

Alfalfa seed screenings, consisting of the small, shriveled, and broken alfalfa seeds, are a valuable protein supplement in a lamb feeding ration. The alfalfa seed screenings are far from a standard product, the value decreasing as the proportion of weed seeds increases. An objectionable feature of the screenings is that many undesirable and noxious weeds may be introduced onto the farm, this objection being so pronounced that some feeders will not use screenings on this account. In all cases the experimental trials were made with recleaned, unground screenings.

Beet Pulp, Barley and Alfalfa

Beet pulp has long been used in rations for the fattening of sheep and cattle, and the trials made were for the purpose of determining the most desirable methods and the comparative market value. In all, five trials with varying amounts of pulp were conducted. The amounts used are to be regarded as minimum. The feeding of from

TABLE XI

Barley and Alfalfa vs. Barley, Alfalfa and Alfalfa Seed Screenings
4 Trials—1924-25, 1925-26, 1926-27, 1927-28

	Alfalfa Barley	Alfalfa Barley-2 parts Screenings-1 part
Number of lambs	480	478
Number of days	93	93
Average initial weight, lbs.	62.35	62.35
Average final weight, "	87.29	90.77
Average daily gain, "	.268	.305
Average daily ration:		
Alfalfa, lbs.	2.44	2.45
Barley, "	1.02	.83
Screenings,"	.....	.39
Feed for 100 lbs. gain:		
Alfalfa, lbs.	911	800
Barley, "	381	270
Screenings,"	.....	126
Per cent waste hay	29.42	28.32
Market weight, lbs.	81.28	85.14
Shrink to market, per cent	6.89	6.20
Market value, per head	$13.30	$13.52

TABLE XII

Barley and Alfalfa vs. Barley, Alfalfa and Beet Pulp

2 Trials—1924-25, 1925-26				1 Trial—1927-28	
	Alfalfa Barley	Alfalfa Barley Wet Pulp	Alfalfa Barley Wet Pulp	Alfalfa Barley	Alfalfa Barley Pressed Pulp
Number of lambs	229	229	229	124	124
Number of days	85	85	85	90	90
Average initial weight, lbs.	63.25	63.36	63.90	62.72	62.04
Average final weight, "	84.07	85.36	86.21	91.18	90.66
Average daily gain, "	.244	.258	.262	.316	.318
Average daily ration:					
Alfalfa, lbs.	2.66	2.68	2.52	2.39	2.05
Barley, "	.87	.87	.87	1.15	1.00
Beet Pulp,"	.....	.81	1.76	.....	1.75
Feed for 100 lbs. gain:					
Alfalfa, lbs.	1085	1040	944	772	658
Barley, "	356	338	326	371	307
Beet Pulp,"	.....	315	661	.....	563
Per cent waste hay	24.46	29.32	26.21	32.6	34.8
Market weight, lbs.	80.80	81.62	82.12	84.43	85.16
Shrink to market, per cent	7.01	7.61	8.67	7.40	6.06
Market value, per head	$12.57	$12.68	$12.75	$13.47	$13.58

five to ten pounds of wet pulp to a lamb is sometimes done but is not the best practice.

In all cases the pulp proved beneficial in keeping the lambs thrifty, maintaining keen appetites, and giving the lots on pulp a uniform finish (*Table XII*).

When fed at the rate of one pound per head per day, each ton of pulp replaced 285 pounds of alfalfa hay and 115 pounds of barley. When fed at the rate of 1.75 pounds per day, the wet pulp replaced 426 pounds of hay and 90 pounds of barley. The wet pulp in these trials had been shipped forty miles and stored in a pit, shrinking approximately 40 per cent of the weight at the factory.

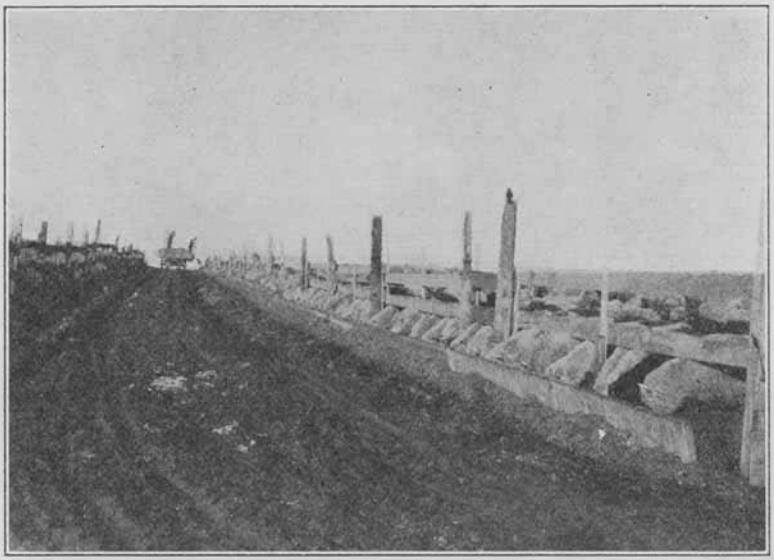


Fig. 9.—Showing common method of feeding beet pulp. Beet pulp is valuable in a ration of grain and alfalfa for keeping the lambs thrifty, maintaining keen appetites, increasing the gains and finish, and lowering the grain and hay requirements. Chopped or ground alfalfa may be fed in this manner. Arrangement of lots can mean much in saving time and labor in feeding.

One ton of pressed pulp, when fed at the rate of 1.75 pounds per head per day, replaced 405 pounds of hay and 227 pounds of barley. While excessive amounts of pulp are sometimes fed, this is inadvisable because it furnishes considerable bulk with a relatively low dry matter content. When fed at from 3 to 6 pounds per day per head, wet pulp constitutes a valuable supplementary feed to the hay and barley ration, lowering the feed cost.

Value of Cull Potatoes When Fed with Alfalfa and Barley

Fed in light amounts, one ton of potatoes replaced 562 pounds of alfalfa and 240 pounds of barley (*Table XIII*). The lambs in this lot were all thrifty and well finished.

The lambs on the heavy ration of potatoes were allowed all the potatoes they would eat, which was less than had been anticipated. On a full ration of hay and grain, with unlimited potatoes allowed, the amount consumed was only 1.63 pounds of potatoes per day. Fed in this way each ton of potatoes replaced 410 pounds of alfalfa and 156 pounds of barley. This lot of lambs was the most uniform of the four used in that year's trials.

Cooking the potatoes did not prove profitable. In addition to the expense involved in cooking, the feeding value of the cooked potatoes was less than when the potatoes were fed raw. Each ton of cooked potatoes replaced 422 pounds of hay and 68 pounds of barley.

In the winter of 1931-32 potatoes were checked on their grain replacement value. In this trial more hay was consumed by the lambs receiving potatoes than by those on any other ration. Each ton of potatoes saved 463 pounds of barley, but 109 pounds more of alfalfa was required with each ton of potatoes.

The raw potatoes were sliced with a spade in a cutting box. The potatoes were fed in the grain trough during the middle of the day in place of the mid-day feed of hay.

During severely cold weather all refused potatoes should be removed from troughs in a short time after feeding to prevent the lambs from eating frozen potatoes. It may be advisable to discontinue feeding potatoes until the weather moderates.

TABLE XIII

The Value of Cull Potatoes Added to a Ration of Barley and Alfalfa

	1 Trial—1928-29				1 Trial—1931-32	
	Alfalfa Barley	Alfalfa Barley Light Potatoes	Alfalfa Barley Heavy Potatoes	Alfalfa Barley Cooked Potatoes	Alfalfa Barley	Alfalfa Barley Potatoes
Number of lambs	123	124	122	122	125	124
Number of days	80	80	80	80	100	100
Average initial weight, lbs.	73.92	73.84	74.09	73.62	66.75	66.69
Average final weight, "	99.58	101.31	103.30	100.64	92.08	92.56
Average daily gain, "	.321	.343	.365	.337	.253	.259
Average daily ration:						
Alfalfa, lbs.	2.71	2.65	2.59	2.52	2.17	2.26
Barley, "	1.12	1.10	1.09	1.09	1.06	.89
Potatoes, "	.....	.92	1.63	.94	.....	.90
Feed for 100 lbs. gain:						
Alfalfa, lbs.	847	772	750	785	858	877
Barley, "	352	320	315	342	426	345
Potatoes, "	.....	267	473	294	.....	350
Per cent waste hay	25.05	24.78	25.90	29.82	22.70	19.60
Shrink to market, per cent	3.51	6.58	7.46	7.40	5.07	4.62
Market weight, lbs.	96.46	96.13	97.46	94.55	90.04	90.00
Market value, per head	$16.40	$16.34	$16.57	$16.07	$ 5.06	$ 4.83

Value of Corn Silage When Fed with Alfalfa and Barley

To study the value of corn silage for fattening lambs under Idaho conditions, a ration of corn silage, barley, and alfalfa was fed in five trials, comparing it with a ration of barley and alfalfa. The gains were practically the same in both lots.

Corn silage mixed with grain and fed at the rate of one pound per head per day kept the lambs thrifty (*Table XIV*). When fed at the rate of approximately one pound per head per day with grain, one ton of silage replaced 451 pounds of hay and 7 pounds of barley. At the close of the experiment the silage lambs were neater and trimmer lambs than the hay and barley lambs, the latter being more paunchy. The silage fed lambs dressed higher and graded better than when the silage was not fed.

To make an appreciable difference in the amount of hay saved, it was necessary to feed approximately two pounds of silage per day, in which case one ton of silage replaced 1058 pounds of hay and 7 pounds of barley. The feeding of a small amount of silage had very little monetary value, unless the superior thrift and finish of the lambs are considered.

In *Table XIV*, section C, one trial shows the comparison of feeding hay and barley; hay, barley, and silage; barley, silage, and cot-

TABLE XIV

The Value of Corn Silage Added to a Ration of Barley and Alfalfa

	5 Trials—1920-21, 1921-22, 1923-24, 1927-28, 1929-30 Section A		2 Trials—1921-22, '23-24 Section B		1 Trial—1929-30 Section C		
	Alfalfa Barley	Alfalfa Barley Silage	Alfalfa Barley	Alfalfa Barley Silage	Alfalfa Barley	Alfalfa Barley Silage	Alfalfa Barley Silage Cotton-seed Meal
Number of lambs	333	335	138	141	64	64	64
Number of days	94	94	86.5	86.5	110	110	110
Average initial weight, lbs.	67.89	68.07	68.32	67.06	63.29	64.05	63.95
Average final weight, "	94.66	94.95	94.79	95.35	92.70	92.93	94.37
Average daily gain, "	.285	.286	.306	.327	.267	.262	.276
Average daily ration:							
Alfalfa, lbs.	3.47	3.32	4.03	3.62	2.27	2.21	2.15
Barley, "	.77	.77	.74	.73	1.06	1.06	.96
Silage, "	.....	.80	.....	1.71	.....	.96	.96
Cottonseed meal, "	.....	.....	.....	.....	.....	.....	.10
Feed for 100 lbs. gain:							
Alfalfa, lbs.	1221	1158	1380	1106	871	856	778
Barley, "	269	268	222	220	408	412	348
Silage, "	.....	279	.....	518	.....	372	348
Cottonseed meal, "	.....	.....	.....	.....	.....	.....	39
Per cent waste hay	23.75	25.30	29.04	33.73	21.36	28.27	25.73
Market weight, lbs.	87.69	88.90	88.48	89.96	86.10	86.72	87.50
Shrink to market, per cent	8.11	7.95	7.20	7.10	7.12	6.68	7.28
Market value, per head	$11.61	$11.74	$13.83	$14.26	$8.46	$8.72	$8.75

tonseed cake. The addition of silage proved to be of little value in increasing the rate and economy of gains, but increased the market value of each lamb by 26 cents. Supplementing the grain ration with 10 per cent cottonseed cake increased the gains by 5.1 per cent, resulting in a slight increase of market value per head. Each ton of cottonseed meal replaced 4000 pounds of hay, 3282 pounds of barley, and 1231 pounds of silage.

Comparing the Value of Long, Chopped and Ground Alfalfa When Fed with Barley

In three trials chopped alfalfa and barley were compared with long alfalfa hay and barley (*Table XV*). In two trials the value of ground alfalfa and barley was compared with long alfalfa hay and barley (*Table XV*). Chopping or grinding alfalfa hay does not materially change the composition. Such preparation of alfalfa, however, may change the composition of the alfalfa that is actually consumed. In the process of grinding or chopping there is some loss of leaves that have been reduced to meal. When long alfalfa hay is fed in abundance, the leafy, finer stems are consumed and the large, coarse stems are refused. In feeding chopped alfalfa, however, a higher percentage of the coarse stems are consumed, as indicated by the percentage of waste hay, which averaged 9.78 per cent as compared with 26.64 per cent long hay wasted. In ground hay a still higher percentage of the coarse stems are consumed, when only 3.72 per cent hay is wasted. Any difference in the feeding results of long, chopped or ground alfalfa would be due primarily to the feeding of a higher percentage of coarse stems against the more

TABLE XV

The Value of Chopping and Grinding Alfalfa for Fattening Lambs

	3 Trials—1921-22, 1927-28, 1928-29		2 Trials 1927-28, 1928-29		
	Long Alfalfa Barley	Chopped Alfalfa Barley	Long Alfalfa Barley	Chopped Alfalfa Barley	Ground Alfalfa Barley
Number of lambs	204	204	135	135	135
Number of days	83	83	87.5	87.5	87.5
Average initial weight, lbs	73.10	74.04	73.04	73.22	73.50
Average final weight, "	97.67	96.73	97.93	97.11	97.46
Average daily gain, "	.297	.274	.284	.273	.273
Average daily ration:					
Alfalfa, lbs.	3.46	2.58	3.12	2.28	1.98
Barley, "	.92	.89	1.01	1.01	1.02
Feed for 100 lbs. gain:					
Alfalfa, lbs.	1163	939	1100	838	723
Barley, "	310	324	356	369	374
Per cent waste hay	26.64	9.78	30.39	7.79	3.72
Market weight, lbs.	92.60	92.06	91.63	91.04	90.56
Shrink to market, per cent	.....	.....	7.50	7.28	8.01
Market value, per head	$14.38	$14.30	$14.36	$14.50	$14.33

leafy, tender portion consumed by lambs offered liberal amounts of long alfalfa hay.

In the three trials of feeding chopped alfalfa compared with long alfalfa hay, the lambs fed chopped alfalfa hay required 19.3 per cent less hay, but required 4.5 per cent more barley to produce 100 pounds gain. Average daily gains were .297 pound on long hay and .274 pound on chopped hay.

In the two trials of feeding chopped alfalfa hay compared with long alfalfa hay, the lambs fed chopped alfalfa hay required 23.8 per cent less alfalfa, but required 3.7 per cent more barley. Chopped alfalfa produced average daily gains of .273 pound as compared with gains of .284 pound on long alfalfa.

The actual average daily consumption of alfalfa hay, obtained by deducting the waste hay from the total amount offered, was 2.17 pounds for long hay and 2.10 pounds for chopped hay. Since the lambs consume the leaves and more nutritious stems and refuse the fibrous stems, the total nutrients derived from the hay consumed are greater for the long hay than the chopped hay.

The waste hay, which amounted to 26.64 per cent of the long hay, and 9.78 per cent of the chopped hay in the three trials, was used for wintering horses, stock cattle, and sheep.

Factors which may influence the decision to chop alfalfa are the available supply of hay for feeding, the price of hay, and the cost of chopping. When the supply of hay is short, chopping is advantageous from the standpoint of more complete utilization of the hay. With a surplus of hay, and prices low, the cost of chopping is not offset by the value of the hay saved.

Chopping costs vary, but are lowest when the chopping is done as a part of the harvesting operation. Hay chopped directly from the field should be well cured before chopping to prevent stack burning or spontaneous combustion.

Other advantages of chopped alfalfa are the convenience with which it may be handled and fed in comparison with long alfalfa, and the reduction of storage space necessary for chopped hay when stored under cover.

Grinding alfalfa hay for small feeding units is expensive. In two trials comparing the value of ground alfalfa with long alfalfa hay, 34.3 per cent less alfalfa hay and 4.8 per cent more grain were required to produce 100 pounds gain. Ground hay produced 3.8 per cent less average daily gains. The lot receiving ground alfalfa consumed 1.91 pounds daily, compared with 2.17 pounds by the lot on long hay.

The chopping or grinding of alfalfa hay does not increase the rate of gain and does not lower the barley requirements for the production of 100 pounds gain. However, chopping or grinding alfalfa does reduce the alfalfa requirements.

The value of chopping or grinding alfalfa will depend on the amount of alfalfa saved. Whether or not this saving will pay the cost of preparation will depend upon the supply and price, the cost

of chopping, and the value of the waste alfalfa for wintering horses, stock cattle, and sheep.

The quality of the hay is not improved. Coarse, stemmy, discolored hay that is chopped or ground gives poor feeding results since a large amount of unpalatable, coarse, indigestible portions are consumed, which, were the hay fed long, would be refused.

With the system of liberal hay feeding practiced in Idaho, the better the quality of hay, the less will be the difference in the comparative value of feeding it long, chopped, or ground. When poor quality hay is chopped or ground, the feeding results will be less satisfactory than when long hay is fed in liberal quantities.

The record of variable amounts of waste hay appearing in this Bulletin, ranging from 15.6 per cent to 40.2 per cent for the long hay, and from 5.11 per cent to 22.6 per cent for chopped hay, were due primarialy to the variation in quality of the hay, although rainy and snowy weather increase the percentage of waste hay.

The following Table shows the composition of long, chopped and ground alfalfa hay as fed in the trials, and of the refused portions. Figures calculated on a moisture-free basis have been included to facilitate comparison.

Chemical Analyses of Alfalfa Hay in Various Forms*

Feed	No. of analyses	Water	Ash	Crude protein	Crude fat	Crude fiber	Nitrogen-free extract
Long Alfalfa (fed)	14	15.54	7.76	13.33	1.39	28.78	33.19
		0	9.18	15.76	1.65	34.63	40.02
Long Alfalfa (refused)	7	21.38	5.35	6.90	0.82	36.81	28.75
		0	6.79	8.70	1.02	47.12	36.37
Chopped Alfalfa (fed)	5	11.99	7.43	12.36	1.58	30.36	36.28
		0	8.45	14.06	1.79	34.79	40.92
Chopped Alfalfa (refused)	2	16.27	4.89	8.79	1.17	35.25	33.63
		0	5.85	10.49	1.39	42.08	40.18
Ground Alfalfa (fed)	3	8.79	7.45	12.89	1.48	31.02	38.38
		0	8.14	14.08	1.61	34.09	42.08

*Determinations made by the Department of Agricultural Chemistry, Idaho Experiment Station.

Feeding Beet Syrup with Alfalfa Meal, Clover Chaff and Alfalfa Chaff

Two trials were made with beet syrup, one mixed with alfalfa meal, and the meal-syrup mixture fed with barley, against alfalfa

meal and barley. The second use made of syrup was when mixed with clover chaff and alfalfa chaff in a trial made in 1929-30, where chaff was used to replace part of the alfalfa hay. Without the syrup, approximately half of the chaff was refused. Results of the two trials apear in *Table XVI.*

Two trials were made with beet syrup. In the first trial a limited amount of syrup was mixed with alfalfa meal and fed with a small allowance of barley. This ration was compared with a similar ration of alfalfa meal and barley. The meal in this ration came from a different source than the meal in the syrup-meal mixture, and was inferior in quality. In the second trial the syrup was mixed with clover chaff and alfalfa chaff, which was used to replace part of the alfalfa hay.

In the 1920-21 trial, with minimum amounts of grain and syrup fed, the mixture of good quality alfalfa meal and syrup proved superior to meal made from an inferior grade of hay. The results of this trial are not comparable to the results of the later trial because in addition to the variation in the quality of the hay, there is also a possibility of variation in the composition of the syrup. Improved sugar refining processes have changed the composition of the syrup by-product.

In 1929-30, where use was made of clover chaff, the addition

TABLE XVI

The Value of Clover Chaff, Alfalfa Chaff and Syrup in a Ration of Barley and Alfalfa

	1 Trial—1920-21		1 Trial—1929-30			
	Alfalfa Meal Barley	Alfalfa Meal Barley Syrup	Alfalfa Barley	Alfalfa Barley Clover Chaff	Alfalfa Barley Clover Chaff Syrup	Alfalfa Barley Alfalfa Chaff Syrup
Number of lambs	66	65	122	122	120	120
Number of days	100	100	98	98	98	98
Average initial weight, lbs.	69.45	70.43	65.62	65.92	66.06	66.19
Average final weight, "	94.63	100.95	93.59	95.14	95.69	95.96
Average daily gain, "	.251	.305	.285	.298	.302	.304
Average daily ration:						
Alfalfa, lbs.	3.17	3.33	2.30	1.83	1.68	1.83
Alfalfa chaff,"	.....	.....	.....	.....	.....	.89
Clover chaff, "	.....	.....	.....	.88	.88	.....
Barley, "	.36	.294	.98	1.07	1.02	1.01
Syrup, "	.....	.073	.....	.....	.158	.161
Feed for 100 lbs. gain:						
Alfalfa, lbs.	830	709	805	614	593	604
Alfalfa chaff,"	.....	.....	.....	.....	.....	295
Clover chaff, "	.....	.....	.....	295	295	.....
Barley, "	95	63	342	358	343	333
Syrup, "	.....	15.7	.....	.....	53	53
Per cent waste hay	2.13	3.18	30.8	30.9	30.4	28.9
Shrink to market, per cent	10.1	9.8	5.76	8.55	8.89	8.77
Market weight, lbs.	85.03	91.06	88.20	87.00	87.18	87.54
Market value, per head	$7.01	$7.51	$9.70	$9.57	$9.59	$9.63

of syrup proved an advantage. The three decks being fed chaff were growing, a part of the gain being growth rather than finish. At this time the ration consisted of half chaff and half hay, supplemented with barley. During the latter part of the feeding period the chaff was reduced to one-fourth of the roughage. Fed with alfalfa hay and barley, each ton of clover chaff replaced 1067 pounds of alfalfa hay. When 15 per cent syrup was mixed with the chaff each ton of the mixture replaced 1078 pounds of hay. The grain requirements were practically the same in all cases. Both alfalfa chaff and clover chaff, when used in these rations to replace approximately one-third of the hay, had a value of one-half that of hay.

One ton of syrup added to the chaff replaced 79 pounds of alfalfa and 57 pounds of barley. Possibly a part of the value of the syrup was lost by the consumption of the woody, indigestible portions of the chaff which were consumed by the lambs receiving the chaff-syrup mixture but rejected by the lot receiving the clover chaff without the syrup.

Comparing the Feeding Qualities of Light (Pewee) and Medium Weight Lambs

Among the feeder lambs from the range are a number of small, undersized lambs that may be orphans, or late lambs lacking maturity. Such lambs are commonly called "pewees." When fed with the larger lambs, results are unsatisfactory for the reason that the pewees are crowded from the feed bunks and grain troughs and do not fatten until the larger lambs are finished and shipped to market.

TABLE XVII

Comparison of Light Weight vs. Medium Weight Lambs

	2 Trials 1928-29, 1931-32		1 Trial 1931-32		1 Trial 1930-31
	Medium Lambs	Pewees	Medium Lambs	Pewees	Pewees*
Number of lambs	134	144	60	71	73
Number of days	101	101	112	112	122
Average initial weight, lbs.	69.15	54.28	63.25	52.14	52.72
Average final weight, "	97.80	81.29	96.27	82.51	88.82
Average daily gain, "	.284	.270	.295	.271	.296
Average daily ration:					
Alfalfa, lbs.	2.72	2.42	2.06	1.82	1.62
Barley, "	1.03	.87	.96	.82	.....
Corn, "	.....	.....	.....	.....	.85
Cottonseed meal,"	.....	.....	.09	.08	.09
Feed for 100 lbs. gain:					
Alfalfa, lbs.	960	910	705	670	548
Barley, "	364	328	329	302	.....
Corn, "	.....	.....	.....	.....	389
Cottonseed meal,"	.....	.....	33	30	32
Shrink to market, per cent	5.0	7.15	5.3	5.1	4.6
Market weight, lbs.	94.71	76.87	92.66	78.31	78.83
Market value, per head	$11.15	$ 9.02	$ 6.49	$ 5.48	$ 5.91

*A demonstration lot with no feed comparison.

The pewees lacked the finish of the larger lambs, yet met with favor on the market because of their weight. As the pewees were part of two even carload lots, it was necessary to send them to market when the larger lambs were finished. Had they constituted full carload lots, they could have been held for a thirty-day longer feeding period to advantage. The results (*Table XVII*) indicate that the small lambs are satisfactory for a long feeding period when fed with lambs of the same size.

In the average of two trials the pewees received 94.7 per cent as much hay and 90.1 per cent as much barley for 100 pounds gain as the larger lambs. The pewees gained 96.4 per cent as much as the larger lambs. In one trial the pewees required 95 per cent as much hay and 91.8 per cent as much concentrates for 100 pounds gain and gained 93.1 per cent as much as the larger lambs.

In one trial in 1930-31 the 73 pewees were fed a ration of chopped alfalfa and corn with 10 per cent cottonseed meal. No attempt was made to compare these lambs with the others in the trial, the aim being rather to have them ready for market at the same time the larger lambs were finished. The gains were very satisfactory. On the market they weighed 78.8 pounds and sold at the same price per cwt. as the larger lambs, without sort.

The Influence of Shearing, Warm Water, and Open Shed on Fattening and Marketing Lambs

The lambs at the Caldwell Substation in 1930-31 did not finish as rapidly as had been anticipated. During February the weather became warm. The Aberdeen Substation lambs had been on the market early in February, selling with very little additional value on account of their wool. A decision was made, therefore, to shear 440 lambs at the Caldwell Substation, leaving one lot of 61 lambs in full fleece for comparison.

Four lots used as a part of the five-year investigation under way on the value of warm water and shelter, had all been on the same ration of alfalfa hay and barley. Previous to shearing these four lots were weighed for the completion of this investigation. Since the winter was rather open, the results of this trial were not influenced by warm water or open shed.

After shearing, the appetites of the lambs were keen, all feed being consumed quickly, with more hay consumed. The percentage of waste hay was immediately reduced. Final home weights showed that the gains on the sheared lambs had materially increased.

The lambs in this trial were held for one week on this ration before shipping. Allowing the same rate of daily gain for the extra week, the shrinkages on the sheared lambs ranged from 9.26 to 10.6 per cent, against a shrinkage of 4.8 per cent on the wooled lambs. As noted by the market returns with the net home value of the wool after deducting the shearing expense, shearing did not prove profitable this year.

TABLE XVIII

Value of Shearing, Warm Water, and Open Shed on Fattening Lambs
One Trial—1930-31

	Alfalfa Barley Cold Water Sheared	Alfalfa Barley Warm Water Sheared	Alfalfa Barley Cold Water Wooled	Alfalfa Barley Cold Water Sheared Shed
Number of lambs	62	60	61	61
Number of days	122	122	122	122
Average initial weight, lbs.	64.43	63.57	64.51	63.62
Average weight of fleece, "	7.03	7.08	.....	7.54
Average final weight, "	94.62	94.28	99.78	95.00
Total average final weight,"	101.65	101.36	.....	102.54
Average daily gain, "	.305	.310	.289	.320
Average daily gain before shearing	.30	.30	.30	.31
Average daily gain after shearing	.305	.327	.268	.339
Average daily ration:				
Chopped alfalfa, lbs.	2.60	2.39	2.35	2.29
Barley, "	1.13	1.15	1.14	1.15
Feed for 100 lbs. gain:				
Chopped alfalfa, lbs.	840	771	813	717
Barley, "	366	372	296	360
Per cent waste hay	8.98	13.27	15.57	12.60
Shrink to market, per cent	7.22	7.46	2.15	8.37
*Market weight, lbs.	87.79	87.25	96.64	87.05
Market value, per head	$6.80	$6.77	$8.21	$6.83
Net wool value, per head	.80	.81	.....	.86
Total value, per head	$7.60	$7.58	$8.21	$7.69

*An additional seven days' feed was made after the home weights of the lambs were taken.

Shipping and Marketing

At the close of the experiments the lambs were loaded and shipped to an open market. Since Idaho is far from central markets, long and rather expensive trips are necessary. With the exception of the spring of 1932, when the minimum was reduced to 20,000 pounds, the minimum loading weight was 23,000 pounds; hence the experiments were planned to have full double deck carloads for shipment.

Selection of the market was made just prior to shipping. Factors determining the choice of a market were the weight, size, and finish of the lambs, and the apparent market demand of this classification. During the early years the experimental lambs were shipped East, but with the strong western demand of the last five years, the west coast markets offered the best outlet. Of the 32 carloads of lambs fattened, 12 went to Chicago, two to Sioux City, two to St. Joseph, two to Denver, one to Omaha, one to Ogden, four to San Francisco, two to Los Angeles, five to Portland, and one to Seattle.

The expense of shipping and marketing was an average of $294.56 per car, or an average of $1.20 per lamb. Based on the home weight

this was an average of $1.28 per cwt. Calculated on the market weight the cost was $1.38 per cwt. In addition the value of the shrinkage must be calculated on the 32 cars. This amounted to 6.7 pounds per lamb. The loading weight of the lambs averaged 94.02, and the market weight 87.32 pounds.

On shipping day the feed of grain is omitted, but the lambs are fed a light feed of hay. The Caldwell lambs are trailed 4.2 miles and the Aberdeen lambs three-fourths of a mile to the loading point. An effort is made to have the lambs in the yards an hour before loading in order that they may cool and rest.

The lambs should be loaded dry, because wet fleeces are dangerous. Losses of full fleeced lambs loaded wet are apt to be heavy. In 1922, in two cars of full fleeced crossbred lambs that were loaded when wet with snow, 14 lambs were lost. In 1932 the lambs were loaded after a heavy rain, and loss was prevented only by the fact that they were loaded on a slow stock train that stopped frequently to load stock enroute, affording an opportunity to work the cars.

As the feed lot lambs are loaded at an average of 90 to 95 pounds, the most popular loading is 250 lambs per car. The carload weight of feed lot lambs will more nearly meet the minimum requirements than summer range lambs, which have less weight. In receiving the feeder lambs in the fall, the average weight of the loadings was less than 18,000 pounds.

The average number of experimental lambs loaded was 246 head, with an average full loading weight of 23,020 pounds. The average market weight per car was 21,380 pounds, a shrinkage of 1640 pounds, or an average shrink of 7.12 per cent. In 32 cars the number of lambs lost enroute to market was 24 head, of which 14 were lost due to loading with wet fleece. Eight were lost in one other shipment of two cars, and two head in another two-car shipment. The other 25 cars went through without loss.

The results of shipping 313 cars of contract-fed lambs over this period gave an average home weight of 22,590 pounds and an average market weight of 20,930 pounds. This was a shrinkage of 1660 pounds, or 7.33 per cent. As these are the full home weights, the customary 4 per cent shrinkage should be deducted. As an additional 3⅓ per cent was lost in shipping, the cost of shipping was determined by the actual shipping expense plus 3.3 per cent of the home weight of the lambs.

All shipments were accompanied to market. The lambs were looked over during all long stops, and at every division point. When all the lambs were evenly spaced over the car, with none in distress, the shipment was not disturbed. When loaded lambs lie down in a natural position there is less danger of crowding to one end of the car. When evenly spaced over the car, with some lying down in a natural, restful position, they are not disturbed. Should one lamb be lying on his back, or in a position from which he cannot get up, with others standing on him, he should be helped to his feet. The practice of some shippers of getting all lambs to their feet at

every stop involves some danger of crowding and piling up before they again become spaced out evenly and some lie down.

A Federal regulation requires that the cars be unloaded for feed, water, and rest every 28 hours, unless permission is received from the shipper by a signed release which extends the time to 36 hours. At the feed yards both alfalfa and wild hay are available. As the experimental lambs had all been fed on alfalfa hay, the feed at each stop consisted of 500 pounds of alfalfa hay to the car. Grain was not fed except at the last feed station outside of the Chicago and River markets. A daylight feed is more desirable than a night feed, because at night much of the hay is wasted and many of the lambs do not find the water.

Adjoining the Chicago and River markets a rest is made before going in to the market. This time varies from three to six days. Usually a three-day feed and rest period is sufficient. The first day the lambs rest. The second day they eat considerable hay and grain. By the third day they have mostly recovered and may be given the usual ration of hay and grain which they received at home. The night of the third day they are loaded for market going in with a brighter, fresher appearance than if unloading on the market after an 1800-mile run.

Shrinkage of the lambs enroute to market is dependent on a number of factors:

1. The basis of home weights. All experimental shrinkages are determined by the full afternoon weights in the home yards. Trials with the same lambs weighed at 1:30 in the afternoon and 9:00 o'clock in the morning, show a difference of one and a half pounds in favor of the afternoon weighing. In trailing 4.2 miles from the Caldwell Substation to the Caldwell stockyards, the shrinkage has amounted to from 2 to 4 pounds per lamb.

2. Loading the lambs. If the car is heavily loaded so that the lambs are crowded and uncomfortable, the shrinkage will be greater than if there is ample space to rest and sleep in the car.

3. Finish and condition of the lambs. Well finished lambs ship with a lighter shrink than those that are only partially fattened. To overcome the handicap of a long, hard trip, it is necessary to feed the lambs longer than if they were adjacent to a market. The rule of experienced feeders is to have the lambs in the condition in which they wish them to appear on the market, and then feed for an additional three weeks' period to overcome the disadvantage of shrinkage to market. In one trial in which half-fat and well finished lambs were taken to market together in the same shipment, the shrinkage of the half-fat lambs was double that of the finished lambs.

4. Weather conditions enroute. Most of the feed yards are open. If the weather is stormy and the yards muddy and uncomfortable, the lambs will waste a high percentage of the feed and get but little rest at the feeding-in-transit yards. In this case the shrinkage is heavy.

5. Time of feeding-in-transit. Unloading and feeding in the dark results in the consumption of less feed and water than daylight feeding.

6. Feeding conditions on the market. In Chicago, Omaha, and St. Joseph the lambs are fed at adjacent feed yards the evening before, arriving on the market during the night, where they are allowed to remain in pens with water but no hay. If the market is active so that the lambs sell and go over the scales early in the day, the shrinkage is not excessive, but if constantly disturbed by buyers and not sold until late in the afternoon, the shrinkage will be heavy. On the Sioux City, Denver, Ogden, and West coast markets, the lambs have both hay and water in the pens, hence selling later in the day is not a disadvantage.

Financial Statement

Table XIX is a financial statement of all the lambs bought and sold since 1920. The cost of pasture is on all lambs. The cost of feed and the marketing data are on the 32 loads finished in the feed lot. The expense of marketing the three cars sold off pasture is credited in the financial statement, but the detailed shipping and marketing expense is not included.

Number of lambs bought	8885
Number of lambs sold	8608
Number of lambs lost	277
Percentage of lambs lost	3.12
Average cost per lamb	$5.37
Average cost feed and pasture	$2.53
Average cost on market, per lamb	$9.33
Average market value, per lamb	$10.26
Percentage division cost of finished lambs:	
Cost of lambs, per cent	68.72
Feed and pasture, per cent	31.28

In the financial statement no allowance is made for labor. The amount of interest charged is that actually paid. The feed prices were those allowed each Substation at actual market price which were somewhat higher at Caldwell than at Aberdeen. The feed and pasture costs are the actual prices rather than a calculation based on average prices.

TABLE XIX

Financial Summary of Experimental Lamb-Feeding By Years

Year	No. Lambs Bought	No. Lambs Sold	Delivered Cost	Cost of Pasture	Cost of Feed	Interest†	Marketing Expense	Total Cost on Market	Value Lambs Sold Off Pasture	Market Value	Profit	Loss
1920-21	488	465	$ 2855.00	$ 161.16	$ 1413.90	$ 95.11	$ 347.50	$ 4872.67	.....	$ 3325.99	.....	$1546.68
1921-22	503	474	1552.30	69.72	648.65	51.87	800.85	3132.39	.....	6616.27	$3492.88	.....
1923-24	500	492	2873.85	89.64	1244.91	95.80	995.03	5299.23	.....	6802.28	1503.05	.....
1924-25*	433	425	2716.38	65.00	961.78	72.44	759.96	4575.56	.....	6538.10	1962.54	.....
1925-26*	500	491	4235.69	120.00	1072.99	163.20	741.32	6333.20	.....	5522.85	.....	810.35
1926-27*	524	511	3320.80	50.00	1505.32	111.17	709.76	5697.05	.....	6744.57	1047.52	.....
1927-28*	503	498	3589.27	110.66	1207.35	67.74	699.70	5674.72	.....	6847.55	1172.83	.....
1927-28	528	513	3697.31	278.38	1092.11	123.25	398.46	5589.51	.....	5907.88	318.37	.....
1928-29*	509	492	3605.80	260.46	1283.40	123.85	528.41	5810.93	.....	7660.82	1849.89	.....
1928-29	532	500	3703.82	257.50	1803.35	148.12	563.41	6476.20	.....	7454.66	978.46	.....
1929-30*	485	484	3683.91	106.16	1184.48	121.36	551.28	5647.19	.....	4559.50	.....	1087.69
1929-30	703	650	4321.22	362.55	1901.33	149.82	523.12	7258.04	$1019.27	5560.90	.....	677.87
1930-31*	517	497	1693.06	206.25	803.81	44.64	556.07	3303.83	.....	3620.00	316.17	.....
1930-31	805	784	2038.63	300.71	1192.20	**	550.77	4082.31	1094.23	4580.15	1592.07	.....
1931-32*	570	565	1925.90	53.00	706.09	**	316.91	3001.90	181.20	2598.94	.....	221.76
1931-32	785	767	1940.88	277.03	937.65	**	383.73	3539.29	768.79	3172.70	402.20	.....
Totals	8885	8608	$47753.82	$2777.22	$18959.32	$1368.38	$9426.28	$80285.02	$3063.49	$87513.16	$14635.98	$4344.35

*At Aberdeen Substation.

**Money loaned by the University of Idaho without interest charge.

†The amount of interest charged is that actually paid.