



The economics of lamb fattening
by Ovide E Grenier

A THESIS Submitted to the Graduate Committee In partial fulfillment of the requirements for the
Degree of Master of Science In Agricultural Economics
Montana State University
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Abstract:

It has been the purpose of this study to analyse records of lamb feeding operations on a selected group of farms In order to determine the effect of various factors on costs and returns.

Due to the limited amount of time available for gathering the data, the records from fourteen feeders are all that were obtained. Realising that this is a rather limited number of records, the writer has not attempted to go into an extensive statistical analysis of the results obtained. If a larger number of records had been obtained for a period of years rather than one year, more definite conclusions could be drawn.

Many factors and conditions affect the net returns from lamb feeding, but this study seems to indicate that there are four factors of particular Importance. These four factors are (1) feeding efficiency, which is really the ability of the farmer as a feeder, (2) the margin between purchase and sale price of the lambs, (3) the death loss of the lambs, and (4) the cost of producing the gain. Other factors such as length of feeding period, average daily gain, average total gain per lamb, number of lambs fed, and weight of lambs bought had some influence on costs and returns, but were of less importance.

This study has also shown the place of lamb feeding In Montana's agriculture, particularly In our irrigated valleys where sugar beets, small grains, and alfalfa are grown, Lamb feeding makes possible the utilisation of large quantities of home-grown feeds, thus furnishing a good market for these otherwise cheap feeds. Lamb feeding also helps maintain the fertility of our farms and thus makes for higher yields.

Labor is made use of during the slack season, the share of farm overhead expenses charged against each enterprise is reduced, and the volume of business is increased due to lamb feeding.

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Approved:


In Charge of Major Work


Chairman Examining Committee


Chairman Graduate Committee

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The author wishes also to thank the farmers who so cheerfully opened their private records and furnished the material for the study.

THE ECONOMICS OF FATTENING LAMBS

ABSTRACT

It has been the purpose of this study to analyze records of lamb feeding operations on a selected group of farms in order to determine the effect of various factors on costs and returns.

Due to the limited amount of time available for gathering the data, the records from fourteen feeders are all that were obtained. Realizing that this is a rather limited number of records, the writer has not attempted to go into an extensive statistical analysis of the results obtained. If a larger number of records had been obtained for a period of years rather than one year, more definite conclusions could be drawn.

Many factors and conditions affect the net returns from lamb feeding, but this study seems to indicate that there are four factors of particular importance. These four factors are (1) feeding efficiency, which is really the ability of the farmer as a feeder, (2) the margin between purchase and sale price of the lambs, (3) the death loss of the lambs, and (4) the cost of producing the gain. Other factors such as length of feeding period, average daily gain, average total gain per lamb, number of lambs fed, and weight of lambs bought had some influence on costs and returns, but were of less importance.

This study has also shown the place of lamb feeding in Montana's agriculture, particularly in our irrigated valleys where sugar beets, small grains, and alfalfa are grown. Lamb feeding makes possible the utilization of large quantities of home-grown feeds, thus furnishing a good market for these otherwise cheap feeds. Lamb feeding also helps maintain the fertility of our farms and thus makes for higher yields. Labor is made use of during the slack season, the share of farm overhead expenses charged against each enterprise is reduced, and the volume of business is increased due to lamb feeding.

THE ECONOMICS OF FATTENING LAMBS

INTRODUCTION

Historical Background

The sheep industry has long been of very great importance as part of Montana's agriculture. During the early years, sheep were kept principally for wool production, less emphasis being placed on mutton production. As years passed and the market for mutton was developed to a greater extent, sheepmen began to pay more attention to mutton characteristics in their breeding ewes. In the earlier years no attempt was made to feed any lambs here in the state. The lambs were sold to feeders in the Middle West or Corn Belt states.

During more recent years many farmers located in the irrigated valleys and other areas of surplus feed production, have begun to feed lambs. Many of them have gone into the business quite extensively, feeding several thousand lambs annually.

The areas immediately surrounding the sugar beet factories have in recent years become the most important lamb feeding areas. These areas can feed lambs very advantageously due to the fact that use can be made of sugar beet by-products, namely; beet tops, beet pulp, and molasses.

Table I shows the number of sheep and lambs, excluding sheep and lambs on feed on the farms in Montana and the United States on January 1. Montana has had approximately 7.5 per cent of the total number of lambs on farms in the United States during the past ten years. This state ranks fourth in sheep production in the United States as a whole, being

TABLE 1.--SHEEP AND LAMBS ON FARMS IN THE UNITED STATES
AND MONTANA, JANUARY 1, 1930-1939 ^{1/}

Year	United States (thousands)	Montana (thousands)	Percentage Montana is of United States total
1939	48,062	3,010	6.3
1938	46,797	2,685	5.7
1937	47,051	2,826	6.0
1936	46,380	3,553	7.7
1935	46,640	3,740	8.0
1934	48,454	4,060	8.4
1933	47,324	3,860	8.2
1932	47,754	3,660	7.8
1931	47,720	4,020	8.4
1930	45,577	3,913	8.6
Total	471,759	35,327	7.5

Source: Crops and Markets, U.S.D.A.

^{1/} These figures do not include sheep and lambs on feed.

exceeded in numbers of sheep and lambs by Texas, Wyoming, and California.

Table II shows the number of lambs on feed in Montana and the United States from 1931 to 1939. The table also contrasts the number of lambs on feed in the entire state on January 1 with the slaughter of lambs at seven markets. Montana has fed an average of 188,000 lambs during the last nine years. This average has been 3.3 per cent of the total fed in the United States. When the slaughter for the four months, January to April, inclusive, is compared with the feeders in Montana, the eight year average shows 3.4 per cent of this slaughter could come from Montana. This shows that Montana does not occupy a very strong position on the fat lamb market. This table also shows that most of the lambs raised in the state are shipped out earlier in the fall as gross fat lambs and as feeders to be fattened in other sections of the country.

Description of Lamb Feeding Areas of Montana

Most of the lambs fed in Montana are fed in the irrigated valleys where there is plenty of alfalfa hay and small grains. Most of these valleys also raise sugar beets so that beet by-products can be used as feed. The following discussion gives a description of the main feeding areas in the state. 1/

The Missoula Feeding Area.--The irrigated Missoula River Valley produces alfalfa and sugar beets, on which feeder lambs are fed during the fall and winter months. From 20,000 to 25,000 lambs were fed annually for the five years 1926 to 1930, but only about 5,000 to 10,000

1/ Mann, L. B., "Western Cattle and Sheep Areas", Farm Credit Administration, Circular C-103, September, 1936.

TABLE II.--SHEEP AND LAMBS ON FEED IN THE UNITED STATES AND MONTANA
JANUARY 1, 1931-1939 AND NUMBER OF SHEEP AND LAMBS SLAUGHTERED
UNDER FEDERAL MEAT INSPECTION AT THE SEVEN MARKETS FROM
JANUARY 1 - APRIL 31 ^{1/}

Year	Number in United States (thousands)	Number in Montana (thousands)	Per cent of total U. S. lambs fed (per cent)	Sheep & lambs slaughtered under Federal Meat Inspect. (thousands)	Number on feed in Montana as percentages
1939	5,700	200	3.5	Not available	-
1938	5,997	190	3.2	5,828	3.3
1937	5,537	150	2.7	5,661	2.6
1936	5,631	135	2.4	5,494	2.5
1935	5,611	155	2.8	5,339	2.9
1934	5,259	220	4.2	4,972	4.4
1933	5,751	240	4.2	5,404	4.4
1932	6,220	190	3.1	6,043	3.1
1931	5,513	210	3.8	5,466	3.8
Total	51,219	1,690	3.3	44,207	3.4

Source: Crops and Markets.

^{1/} Seven markets include Chicago, So. St. Paul, Omaha, Denver, Sioux City, Kansas City, and St. Joseph.

from 1931 to 1935. Lambs from this area are marketed from December to February and go mostly to west coast markets.

The Billings Feeding Area.--This is an irrigated valley of the Yellowstone River containing 13,000 acres. The altitude is 2,000 to 2,500 feet and rainfall is 10 to 15 inches annually. Alfalfa and sugar beets are grown in the irrigated district, small grain on the slopes. From 75,000 to 100,000 lambs are winter-fed. The lambs from this area are marketed from December to March and go mostly to Chicago, St. Paul, and Omaha.

The Chinook Feeding Area (Milk River Valley).--The principal crops grown under irrigation are alfalfa and sugar beets. From 30,000 to 40,000 lambs are fed annually on beet pulp, alfalfa, and some grain. The lambs from this area go to market from late December to March and are sold at Chicago and St. Paul.

The Sidney Feeding Area.--This feeding section is located in the lower Yellowstone River Valley in northeastern Montana and northwestern North Dakota. It is a small irrigated valley where alfalfa and sugar beets are produced. Local Montana lambs are fed on alfalfa beet pulp, and some grain. From 65,000 to 100,000 lambs are fed annually. Winter-fed lambs are marketed from January to March. Most of them go to Chicago with some to St. Paul and West Fargo.

The Hardin Feeding Area.--This feeding section is located in the Big Horn River Valley in Big Horn County. This is an irrigated valley where alfalfa, sugar beets, and some small grains are produced. Local Montana lambs are fed on alfalfa, beet pulp, and some grain. This is a

new feeding area as the sugar factory has been in operation only two years. Last year approximately 25,000 lambs were fed and about the same number were fed this year. Winter-fed lambs are marketed from January to March. Most of the lambs go to Chicago. It is the general belief that more lambs will be fed in this area in the future.

Purpose of this Study

The main purpose of this study was to find out what factors affect the costs and returns of lamb fattening. The different factors that will be analyzed are as follows:

1. Relation of date of purchase to costs and returns.
2. Influence of lamb weight at start on costs and returns.
3. Effects of number of lambs fed on costs and returns.
4. Relation of length of feeding period to costs and returns.
5. Influence of feeding efficiency on costs and returns.
6. Influence of death loss on costs and returns.
7. Relation of daily gain to costs and returns.
8. Relation of price margin to net returns.

An attempt was also made to determine what factors are of most importance in determining the success of any lamb feeding project.

Method of Procedure

In this study only primary data were used. These data were obtained from a number of lamb feeders in the Billings and Hardin feeding areas. The different feeders were interviewed early last fall at the start of their feeding operations and it was agreed that they would keep an accurate

record of their feeding operations. The lambs were weighed at the start and at the end. It would have been interesting to have had weights of the lambs at different stages of the operations but this would have necessitated much additional work on the part of the feeders in most cases. The feeders kept a close record of all feeds used and the cost of the feeds. They also kept a close record of all other expenses such as labor costs, equipment costs, and other miscellaneous costs. The death losses were also checked very closely. The feeders were visited at varying intervals in order to keep as close contact with them as possible. When they were through feeding, they were again interviewed and records of their operations obtained.

Records were obtained from two types of feeders, namely; (1) those who fed on contract and (2) owner feeders. The contract feeders fed on a gain basis and were paid so much for each pound of gain that was added over the average weight in the feed yards. In the case of these contract feeders, range weights were used but the lambs were fed in the Holly Sugar Corporation yards for two or three days before they were delivered. One feeder fed on a contract that called for seven cents per pound of gain and he absorbed all death losses. In the case of the other contract feeders, the following conditions were outlined in the contract in regard to method of payment:

1 lb. to and including 15 lbs. gain per lamb	- 6 cents per lb.
Over 15 lbs. to and including 20 lbs. gain per lamb	- 7 cents per lb.
Over 20 lbs. to and including 30 lbs. gain per lamb	- 8 cents per lb.
Over 30 lbs. gain per lamb	- 9 cents per lb.

This contract also stipulated that the owner had the privilege of

cutting out as many lambs as he saw fit after 60 days on feed. The death loss was also absorbed by the feeders in this case.

Limitations of the Study

The data as obtained in this study are quite accurate and the feeders are to be commended for their fine cooperation. However, the study is limited in scope to a certain extent because of the limited number of records and the fact that the study covers only one year. If the study had been carried out for several years and supplemented by accurate records of all farm operations carried on by the feeders and also records of non-feeders, more accurate conclusions could be drawn. By the use of such a long-time study, the true importance of lamb feeding in the farming program of our irrigated Montana farms could have been determined in addition to finding out something about the cost of gains, rate of gains, and different factors affecting the profits to be made by feeders.

BASIC CONSIDERATIONS IN LAMB FATTENING

Due to the limitations of this study it was thought best to bring in a review of literature based on work carried on by other institutions. Certain other people have made studies of the economics of lamb fattening based on data obtained directly from feeders in much the same manner as this study was carried on. These various studies have attempted to determine the feeder margin necessary, the importance of quality and type of lambs fed, the best weight for feeder lambs, the effects of the ration fed on costs and returns and also on shipping shrinkage, different factors affecting cost of gains and profits, factors affecting rapidity of gains, and

factors affecting prices of lambs.

Feeder Margin Necessary

The difference or "spread" between the buying price per pound of feeder lambs and the selling price of fat lambs is known as the feeding margin.

According to a bulletin published by the Agricultural Development Department of the Northern Pacific Railway, 2/ experienced feeders usually figure on a margin of three cents per pound to make a fair profit. In general, when lambs are high in price, the feeding margin can be narrower than when the price is low because the same gain in weight will sell for more money. According to the above named bulletin, the amount of actual margin necessary to insure a profit depends on the following factors:

1. The ability of the feeder to make rapid gains on the lowest feed consumption possible.
2. Cost of feeds.
3. Quality of lambs.
4. Keeping the death loss down.
5. Per cent of lambs which are "tops".
6. The selling price.

All factors except the last one are under the control of the feeder.

In a study made in Michigan by K. T. Wright, 3/ the relation of

2/ Dexter, A. J., "Sixty Farmers Fatten Range Lambs in North Dakota and Western Minnesota", Agricultural Development Department, Northern Pacific Railway, 1931.

3/ Wright, K. T., "Economic Aspects of Lamb Feeding in Michigan", Special Bulletin 234, June, 1937.

price margin to net returns was studied. The feeders with the least margin purchased their lambs early and sold them early while the feeders having the widest margin bought their lambs late in October and sold their lambs in March and April. The feeders with the most margin had the greatest net return per lamb. The low margin feeders made \$.53 per lamb, the medium margin feeders \$.76, and the feeders with the most margin made \$1.21 on an average. It was found that even though the factors affecting the cost of producing a pound of gain were important, their influence on net returns was sometimes over-shadowed by the margin a lamb feeder had between the purchase and sale price of his lambs.

Good feeders occasionally are forced to sell on a down market. This suggests the necessity of making lamb feeding a permanent farm enterprise covering a period of years in order to be in on the years when the feeding margin is wide. The in-and-out feeders seldom are in when they should be. Some years fluctuations in market price are favorable to the feeder and some years they are disastrous to him. Over a long period the bad years are more than offset by the good ones. All farmers who wish to feed lambs should do so on at least a five year program. Lamb feeding can be made a paying proposition or a highly speculative venture, depending entirely on the feeder. 4/

Importance of Type and Quality of Feeder Lambs

Some feeders have a decided preference for black-faced lambs. Others insist on white-faces. Some want prairie lambs while others will feed

4/ Dexter, A. J., Op. cit.

nothing but mountain lambs. Nearly all shun the lambs from the small irrigated farms while, as a matter of fact, some of the best results listed in the bulletin put out by the Northern Pacific Railway were from that type of lambs. In his study, Dexter 5/ found that some feeders wanted wether lambs only, whereas, others were best pleased with mixed ewe and wether lambs.

In his study of 60 North Dakota and Minnesota farmers, Dexter 6/ noted from his observations of the lambs secured and a careful study of the results, that the color of the face, the particular section of the range from which the lambs came, the sex or any of these other notions which certain feeders have, are not important things after all. He listed thriftiness, good feeding type, quality, and uniformity as being far more important. It was noted that when thrifty deep-bodied, compact lambs free from wrinkles are secured there should be little to worry about in regard to making top gains provided they receive proper care.

In the case of feeders who have a small farm flock, the distinct advantage of buying mixed lambs should not be overlooked, however, because it affords the opportunity to sort out some of the best ewe lambs for additions to the breeding flock.

How Much Should Feeder Lambs Weigh

In over 80 per cent of all inquiries from farmers made to the Agricultural Development Department of the Northern Pacific Railway 7/

5/ Dexter, A. J., Op. cit. p. 22.

6/ Dexter, A. J., Ibid.

7/ Dexter, A. J., Ibid.

in 1930 in regard to securing lambs for feeding, mention was made of "light" lambs, some even specifying they should weigh not over 50 pounds. In the first place, very few lambs of that weight are for sale on the range. Good thrifty lambs easily make a weight of 60 to 65 pounds and since the rancher rarely secures a premium on light-weight lambs, he desires to carry them just as long as possible on his available range, which he has leased for the season. Consequently, extremely light-weight lambs found on the range late in the fall should be inspected carefully as there is danger of their being stunted, unthrifty, or "starved out" lambs.

Practically all feeders steer away from heavy thin lambs as it is hard to fatten them before they get overweight. Experienced feeders usually try to buy lambs running from 63 to 65 pounds. They are guided somewhat by the price. In general, when the range price is high, they buy under 65 pounds if possible, and when the price is low, as it was in 1930, they buy above, some not hesitating in going up to 75 pounds. The reason given is that at a low price per pound they can buy the additional weight cheaper than they can put it on in their feed lots. Other factors enter into their decision, of course, such as amount of feed available, price of feeds, whether a long or short feed offers best prospects to hit the high market later on, time of fall when buying, and type and quality of the lambs. 8/

Contract feeders who are to receive a set price per pound of gain naturally want just as light lambs as possible, providing they are thrifty

8/ Dexter, A. J., Op. cit.

and of good type and quality. The first gains on light lambs are growth gains and these are cheaper to put on than fat gains. However, if lambs are to run in corn fields soon after arrival, heavier weights are the most desirable. 9/

In a study carried on at Michigan by K. T. Wright 10/ it was found that light weight lambs made more efficient gains and returned a greater net profit per lamb than did heavier lambs. This is discussed further under the heading of factors affecting cost of gains and profits.

Factors Affecting Shipping Shrinkage

Material taken from the Colorado Bulletin 379 written by Maynard, Morton, and Osland 11/ shows the effect of rations fed on shipping shrinkage. In their ration experiments an attempt was made to ascertain as nearly as possible the true relative fattening values of feed tested. A detailed study of the shrinkage of lambs enroute to market has revealed a significant difference based on the character of ration fed and has further revealed the unreliability of shrinkage figures taken from single trials.

Feedlot gains based on averages of a series of initial and final weights of lambs are obviously most reliable for comparison but characteristic shrinkages to market must be included if figures presented for final comparison are to show true relative value on a basis readily available for use by practical feeders.

A study of shrinkage figures in these tests has indicated that

9/ Dexter, A. J., Op. cit.
10/ Wright, K. T., Op. cit.
11/ Maynard, E. J., Morton, G. E., and Osland, H. B., "Colorado Drylot Fattening Rations for Lambs", Bulletin 379, August, 1931.

lambs hand-fed on grain and alfalfa rations containing in addition a succulent or dry bulky feed such as wet or dry pulp, beet molasses, corn fodder, or corn silage, and also that lambs self-fed on ground mixture of feed, show a greater average shrinkage when shipped to market than lambs in the same experiments that have been hand-fed on grain and alfalfa alone or on grain and alfalfa with a protein concentrate.

Over 700 lambs fattened on grain and alfalfa with or without a protein concentrate in these tests showed an average shrinkage of only 3.76 per cent when shipped to market while over 1,400 lambs fattened in the same tests on grain and alfalfa rations containing the bulky supplements or when self-fed shrank 5.29 per cent enroute to the same market.

General observations and the experience of feeders have indicated that the shipping shrinkage of any single group of lambs either to Colorado or river markets depends largely on opportunity for rest and "fill" and that shrinkage "to the river" may not necessarily be greater or even as great as shrinkage to local markets. 12/

The shrinkage of lambs enroute to market is dependent on a number of factors:

1. The basis of home weights. It has been found that if lambs are weighed as late in the afternoon as possible rather than in the forenoon, the lambs may show a difference of one and a half pounds in favor of the afternoon weighing. In trailing lambs to the point of shipment, they may lose from 2 to 4 pounds each.
2. Loading the lambs. If the car is heavily loaded so that

12/ Maynard, Morton, and Osland, Op. cit.

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 shrinkage 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 an experiment at the Idaho Experiment Station, 13/ 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 at the market. In Chicago the lambs

13/ Rinehard, E. F., Hickman, C. W., and Johnson, R. F., "Fattening Range Lambs in Idaho", Bulletin 194, December, 1932.

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 they are sold rather promptly and weighed they do not shrink very heavily but if the market is dull and the lambs are constantly being disturbed by buyers and sold late in the day, shrinkage will be heavy.

Importance of Feed Costs on Cost of Producing Gains

In the Colorado Bulletin 379 by Maynard, Morton, and Osland ^{14/} a discussion of the factors influencing net returns to the lamb feeders is considered and the authors believe that the feed cost of producing gain is the most important. While it is considered in Colorado a sound policy to fatten regularly enough livestock each year to use up home grown grains, roughages, and by-products, market fluctuations have often turned anticipated profits into unavoidable losses.

The authors proceed to state that experience has taught that the individual feeder has little if any control over livestock or feed costs, over interest or railroad rates, and no guarantee as to what his fat stock will bring at market. Consequently, a knowledge of the values of available feeds furnishes him his best opportunity to reduce overhead through the use of the most efficient fattening ration available. By reducing the cost of gain, the feeder can materially increase his profits in good years and reduce his losses when losses are inevitable.

The efficiency of a ration can be estimated quite closely by noting

^{14/} Maynard, Morton, and Osland, Op. cit.

the selling price and market grade of the finished lambs along with the cost of the ration. The degree of finish put on by a ration is particularly important on a weak market because packer buyers discriminate very heavily against unfinished lambs under such conditions.

Different Factors Affecting Cost of Gains and Profits

In a study made in Michigan on the economic aspects of lamb feeding by K. T. Wright, ^{15/} during the years 1931-35, an effort was made to determine the factors affecting costs and returns. The relation of date of purchase to costs and returns was studied. The records for each year of the study were sorted into three groups, based on date of purchase. The groups were divided into those purchasing lambs before October 15, those purchasing lambs October 16 to November 15, and those purchasing their lambs after November 15. The average purchase price per hundred-weight was the same on the first two groups, but 10 per cent higher on the third, or late purchase group. The length of the feeding period was somewhat shorter on the third group than the other two. Death loss averaged higher on the early purchased lambs. The farmers purchasing their lambs from October 16 to November 15 had the lowest cost per pound of gain, because they were the most efficient feeders. The net return per lamb was highest on this group, because of the low cost, good margin between purchase and sale price, and good average wool income.

A study was also made of the influence of lamb weight at start on costs and returns. The records were again divided into three groups according to weight when purchased. The first group was made up of lambs

^{15/} Wright, K. T., Op. cit.

weighing under 60 pounds, the second group from 60 to 65 pounds, and the third group 66 pounds and up. The lambs purchased by the feeders buying the lightest lambs averaged 56 pounds compared with 70 pounds for the heaviest group of lambs. A gain of 27 pounds was "put on" the light lambs (based on market weights), and 18 pounds on the heavy lambs. The purchase price of the two groups was nearly the same, but the sale price was nearly one dollar a hundredweight higher on the light lambs. The lambs were fed longer and sold at a later date, when prices averaged higher. The light lambs were fed less concentrates and more roughage per pound of gain than the heavier lambs, resulting in a lower cost of gain during the period of study. The wider margin and slightly lower cost of gain were largely responsible for the higher average net return on the light lambs.

In this study the effects of number of lambs fed on costs and returns was also considered. The records were divided into three groups as follows; those feeding 325 or less, those feeding 326 to 975, and those feeding 976 and up. The men feeding the most lambs had approximately nine times the number fed by those having the least, and those feeders reduced their labor and building charge per lamb nearly one-half. This reduction, however, of 17 cents a lamb was relatively unimportant in reducing the total cost of fattening the lambs. Feed cost per lamb was also slightly lower on farms where the largest numbers of lambs were fed, consequently fattening cost totaled \$2.34 per lamb compared to \$2.68 on farms where the fewest lambs were fed. Net return for management amounted to about \$135 per farm on farms where the least lambs were fed and \$1,750 on farms where

three carloads or more were fed.

The relation of length of feeding period to costs and returns was also studied. The records were divided into three groups as follows; those feeding their lambs under 100 days, those feeding from 100 to 125 days, and those feeding 126 days and up. As an average for the five years, the farmers with the shortest feed had their lambs 81 days, the middle group 112 days, and those feeding the longest fed the lambs 148 days. The "short-fed" lambs averaged heavier at the start, and made faster daily gains than the lambs of either of the other groups. Those lambs consumed more concentrates per pound of gain, but considerably less roughage, and had the lowest cost per pound gain. The lambs that were on feed 148 days as an average were 5 pounds lighter than the "short-fed" lambs at the start, and the daily gain during the longer feeding period was more than one-fourth slower.

The net return per lamb was the highest for the lambs on feed 100 to 125 days, because the cost per pound of gain was relatively low, and the margin between purchase and sale price was comparatively high. The net return on the "long-fed" groups was slightly less, because of higher cost per pound of gain, and despite a good margin. The net return per lamb in the "short-fed" group was considerably less due to the smaller margin.

A comparison of hand and self-feeding was also made in this study. Approximately 55 per cent of the farmers keeping records hand-fed and 45 per cent self-fed the lambs. The feeders self-feeding fed two and one half times as many lambs as those hand-feeding. Death loss averaged 4.4

per cent where self-feeding was practiced and 4.0 per cent where the lambs were hand-fed. Farmers using self-feeders fed the lambs 100 days compared to 119 for those hand-feeding. Daily gain was 20 per cent faster on lambs self-fed. From the standpoint of feeding efficiency, there was no difference in the pounds of concentrates required to produce a pound of gain but the self-fed lambs used less roughage. Total cost per pound gain was 25 per cent lower on lambs self-fed than those hand-fed due to the use of less roughage, lower valued concentrates, and economics of the larger enterprise. Net return per lamb averaged 66 cents on those hand-fed and 86 cents on those self-fed.

The influence of feeding efficiency on costs and returns was studied. The records were divided into the highest, medium, and lowest efficiency groups. The most efficient group had an average feed cost of 7.0 cents per pound of gain while the feed cost of the least efficient was 12.6 and the medium 8.4. The amount of concentrates and roughages fed by the least efficient group to produce a pound of gain was also approximately 80 per cent more than the low-feed-cost group. Factors contributing to the greater efficiency on the low-cost farmers were; ability on the part of the farmers to feed better balanced rations according to the daily gains, better quality lambs, lighter lambs, less death loss, shorter feeding periods, and faster average daily gain. Regarding method of feeding, about one-half of the low-cost farmers self-fed the lambs, and the same per cent of the high-cost men used that method of feeding. Net return per lamb averaged \$1.07 on the farms with the highest feeding efficiency, and \$.17 on those with the lowest efficiency. This difference was greater than for

any other one factor, showing that feeding efficiency was the most important factor affecting net returns.

The influence on death loss on costs and returns was also studied. The records were sorted according to the death loss percentage to study the effect on costs and net returns. The feeders having the lowest death loss averaged only 1.3 per cent death loss. Daily gain per lamb was .25 pound and the gain cost 9.4 cents a pound. Net return averaged \$1.04 a lamb. On the farms with the highest death loss, 6.8 per cent of the lambs died. Daily gain per lamb averaged only .17 pound on these farms and the gain cost 12.0 cents a pound. The net return per lamb was only 63 cents. On the farms with the medium death loss, 3.4 per cent of the lambs died. Daily gain per lamb averaged only .20 pound on these farms, and the gain cost 10.6 cents a pound. The net return per lamb was 81 cents.

The relation of daily gain to costs and returns was also studied. The one-third of the farms on which the gain was the slowest had an average daily gain of .13 pound per lamb, compared with .21 pound on the medium third, and .30 pound on the high third. In comparing the high and low groups, the following points stand out; the rapid-gain group purchased better quality lambs, the death loss on those better quality lambs was less than one-half that of the slow-gain group, the rapid-gain lambs were fed 40 per cent more concentrates daily, and finally, the rapid-gain lambs were on feed 91 days as an average, while the slow-gain lambs were on feed 123 days. The average starting weight of the lambs was practically the same in each group. The total cost per pound gain as an average for the five years was 8.7 cents on the rapid-gain lambs and 13.5 cents on the slow-

gain, and net return per lamb \$1.06 and \$.61 cents respectively.

The relation of price margin to net returns has already been discussed earlier in the thesis. It was found that those feeders having the widest feeding margin, make the most money as a general rule.

Factors Affecting the Price of Lambs

According to the Colorado Bulletin 394 by Burdick and Pingrey 16/, there are various factors that influence lamb prices. They state that to the casual observer, prices seem always to be rising or falling without cause or justification. There is usually a reason back of every such change. The problem is to find it. Probably there is no field of activity associated with farming in which so much diligent search is made, and out of which so few satisfactory conclusions are found, as in this matter of why prices vary. These authors state that it has been their experience, however, that there are many factors which can be observed, that do have an influence on prices. It is their belief that one who seriously studies these factors will be able to judge much more accurately the trend of prices than one who relies on memory and market opinion.

The following factors have been listed according to Burdick and Pingrey:

1. Size of the lamb crop. Is it larger or smaller than last year?
2. Conditions of the range country. Are pastures good or are they dry so that sheepmen must hurry their lambs to market to

16/ Burdick, R. T. and Pingrey, H. B., "Profits from Winter Feeding in Northern Colorado", Bulletin 394, pages 60-63, October, 1932.

avoid loss?

3. Prospects for heavy or lightweight feeder lambs. If lighter than normal, is this due to weather conditions and short feed that have stunted their growth, or is it due to a late spring lamb crop?

4. The breeding and quality of the feeder lambs. Is their lightweight due to the breed of lamb? Are flock-masters making radical changes in their methods of breeding, which will affect the growing abilities of the lambs?

5. Competition for feeder lambs from buyers in other areas. What are the "intentions to feed" for competing areas? Are more lambs going into the Corn Belt? This may easily prove to be an important item. A heavy movement of feeder lambs into the Corn Belt means a heavy movement of fat lambs to market in December to February. Hence, there is little chance for good market prices till these lambs are out of the way. Under these conditions, a Montana feeder will favor the purchase of lighter lambs that will be fat by March and April, after the Corn Belt lambs are sold.

6. Weight of lambs going into Montana feedlots. Are they heavier than normal? If so, the winter market will be over-crowded, or else overweight lambs will depress the March and April market. But in case the Corn Belt is not buying many lambs, these heavy lambs may strike a fat-lamb market in January and February that is short of its normal supply of lambs.

7. The storage of all meats. What is the storage supply

of all kinds of meats in the fall? Is it above normal? If so, this means more competition for the fat lambs.

8. The outlook for Pacific coast spring lambs. If a heavy supply is in sight, then Colorado fat lambs late in March and April will meet the competition of these spring lambs and take correspondingly lower prices.

9. The amount of farm feeds. With a large surplus of alfalfa and a feed bin full of oats or other grains, a farmer will usually plan to feed more lambs.

10. The prices of farm feeds. If low, that will tend to increase the feeding of lambs. But with high priced feeds, the farmer may decide to sell the feed rather than feed it himself.

11. The prices of shipped-in feeds. If corn and cottonseed cake are high in price, it may reduce the number of lambs fed.

12. Prices of feeds in other feeding areas. Low feed prices in other areas tend to increase the competition for feeder lambs and the number of lambs on feed in those areas, hence, affect the fat-lamb market.

13. Weather conditions. Cold, stormy fall and winter weather with snow on the ground may change the prospects for an otherwise successful feeding season. It may affect the fattening, slow up the gains, and cause the majority of lambs to fatten for the late market instead of being ready for uniformly distributed sales for several months.

14. Time of year that majority of lambs will be ready for

market. This includes lambs from competing areas as well as from Colorado. The best prices for fat lambs each winter are usually found during a period of one or more weeks when few lambs are coming to market. This exact time varies from year to year but is usually not the time most Colorado lambs are ready to sell.

15. Recent profits from feeding. There is a general belief that losses one year are made back the next. Taken by itself, it is a dangerous belief. Coupled with information as to the number of lambs on feed and many other factors, it is helpful. It is reasonable to anticipate less demand for feeder lambs in a year following severe losses, as banks are less willing to increase their loans and many are unable to secure money to buy feeder lambs. Incidentally, it might be well to consider the following rule when borrowing money to buy feeder lambs. Find out how much money the bank will loan for the feeding enterprise, then borrow one-half of that amount. That will reduce the risk by one-half and give a second chance next year to feed again. Over extension of feeding credit has harmed more men than it has helped.

16. Comparative fall prices of feeder and fat lambs. It is risky to buy feeder lambs at prices as high as fat lambs and trust that the fat-lamb market will improve enough to make the feeding profitable. Other factors must be checked very closely before such a plan is followed.

17. The spread between fall feeder lamb prices and fat

lamb prices the next spring. If this has been satisfactory for several years, it weakens the chance of its being repeated next year, as prices never stay "normal". They are getting better or worse and the fact that they have been in our favor is good evidence that they are soon to go against us.

18. The long-time trend of prices. Are they drifting to lower levels, holding steady, or steadily improving? The price of an individual commodity, such as lambs, may go counter to the general price level for a few years, but it usually tends to follow it over a period of years.

19. The production of sheep. Is the number of sheep on farms increasing or decreasing? If the number is increasing and the general price level is falling, it is reasonable to expect lamb prices to drop faster than general prices.

20. Prices of competing meats. Over-production of pork or beef, forcing prices below normal, may cause lamb prices to drop in sympathy as the public, within limits, will use one meat in place of another.

21. General business conditions. Hard times mean short rations and less demand for meat. Are times getting better or getting worse? This may have an important bearing on fat lamb prices next spring.

22. Unemployment. This is a direct outgrowth of general business conditions. High wages are not so important as yearly earnings and the ability to buy. Men out of work eat the cheapest

foods. Agriculture always suffers when business is having hard times.

23. The trend of consumption of meat. Are people eating less meat, or shifting from one kind of meat to another? It is generally agreed that the long-time trend of meat consumption shows a shift downward tendency, but it is a question whether this is a cause or a result of other factors.

24. Advertising of foods. Vigorous advertising campaigns seem to swing food consumption either toward or against certain foods. This is worth watching, but is not yet as important as changing habits of life which necessitate changes in eating habits.

25. Changing living conditions are not watched as closely as they deserve.

These factors give some idea of the things that must be considered if one is to be a successful lamb feeder. Experienced lamb feeders can add to this list. The factors as outlined were made for Colorado but, since conditions in Montana are much the same, I believe that they fit our conditions admirably. Should these factors be carefully studied by our Montana feeders, there can be little doubt in the mind of anyone that many mistakes of the past could be avoided.

Factors that Affect Lamb Profits

Burdick and Pingrey ^{17/} state that, while the factors which affect lamb prices are many and varied, the factors which affect profits are not

^{17/} Burdick and Pingrey, Op. cit. p. 63 and 64.

so numerous. They state further that the two outstanding ones are purchase price of feeder lambs and sale price of fat lambs both of which are largely outside the immediate control of the farmer.

Some important items which are in a measure under the control of the feeder according to Burdick and Pingrey are:

1. Feed cost per pound of gain. This is partly controlled by choice of feeds and proper balancing of rations.
2. Other costs such as labor, corral and equipment, water, interest, miscellaneous cash and overhead. The proper attention to detail of management will reduce these to some extent.
3. Gain per head and per day. These are partly under control of the farmer, but are limited largely by the type of lamb and his ability to put on weight.
4. Weather conditions. These are not under the control of anybody except insofar as the use of proper windbreaks, slope of feed yard and adequate bedding tend to improve general conditions.
5. Another factor affecting profits is death loss. Death loss may result from buying weakling lambs, sudden change of feed that occurs between range conditions and feedlots, contracting of disease enroute from range to feedlot or to the sudden change of range and feedlot feed conditions may cause the lambs to become susceptible to disease, lastly, overfeeding of lambs which generally is caused by the feeder's desire to market the lambs at a given time in order to take advantage of the price relationships.

Summary of Review of Literature

There has been some very good work done by some people on the economics of fattening lambs. The difficulty with much of the work, however, is the fact that the data were not obtained directly from lamb feeders in all cases. Studies of this kind must be based on actual farm data because data obtained under closely controlled experiments carried on at our experiment stations are not on a comparable basis with actual field conditions. The reason for this is that in most cases, all costs are not considered in experimental data.

COSTS AND RETURNS OF FATTENING LAMBS

In the final analysis, records of the lamb feeding operations of fourteen different feeders were used. Seven of these feeders fed on a contract basis and seven purchased their lambs outright. A total of 19,174 lambs were placed in the different feedlots. This represents approximately 9.6 per cent of all lambs on feed in Montana as of January 1, 1939. The number of lambs put on feed by the different feeders ranged from a low of 830 to a high of 2,456.

Because of rather wide variations among the different feeders, and because of the limited number of records obtained, it was thought best to make the analysis on a case basis. Results for each feeder have been thoroughly examined and an effort will be made to point out the reasons for the differences in results obtained.

Definition and Description of Terms Used in this Study

Purchase Cost in the Feedlot.--This includes freight charges to the feedlot, commissions paid for having the lambs purchased and other miscellaneous costs in connection with purchasing the lambs. The cost per head is the cost in the feedlot at time of purchase.

Initial Weight.--The weight paid for on the range or at the market and in the case of contract feeders, this is also range weight.

Final Weight.--In the case of contract purchasers, this is the average weight per finished lamb when turned back to the owner. These lambs were weighed locally with a good fill and four per cent subtracted from the filled weight. In the case of the feeders who fed their own lambs, the final weight is the average weight per finished lamb when sold either locally or at the central markets.

Gain Per Head.--The difference between range purchase weights and market sale weight was used in the case of the outright purchasers. In the case of the contract feeders, the difference between range weights and home weights was used. Any shrinkage from range to feedlot has been ignored. In the case of the contract feeders, feedlot gains were used. The gain per head has been figured on an average per lamb sold.

Days on Feed.--This is the average length of the feeding period found by multiplying the number of head fed by the days each head was on feed and dividing the total feeder days by the number of head sold.

Feed Cost.--This includes all purchased feeds at cost, plus all farm feeds at prevailing local prices.

Death Loss.--The number of lambs lost is divided by the initial

number of lambs placed on feed to get a percentage death loss.

Death Loss Cost.--The value of animals lost is divided by the number of animals sold to give a death loss cost.

Man Labor.--Only hired labor was put down as a cost as the returns are based on a labor income to the feeder rather than a net return for risk taking and management.

Interest.--The interest actually paid on feeder loans was charged. No charge was made for interest on feeds.

Equipment Cost.--This includes the use of corrals, trucks, trailers, feed grinders, and all other equipment used in connection with the feeding operations.

Miscellaneous.--Includes all minor expenditures which could not be included in the other cost items.

Sale Price per Hundredweight.--This is the net average sale price per hundredweight of lambs marketed after deducting all marketing costs.

Shrinkage to Market.--This is based on final market weights and home filled weights from which four per cent shrinkage was subtracted.

Average Marketing Costs per Hundredweight.--This includes freight to market, yardage, commissions, and feed cost to market.

Actual Margin to Market.--This is the difference between the purchase price per hundredweight and the sale price per hundredweight.

Necessary Margin from Feedlot to Market.--This is the margin necessary to meet feed costs per head, cost of lambs per head, other feedlot costs and marketing costs.

Feed Cost Per Hundredweight of Gain.--This is the feed cost divided

by the total market gain.

Other Feedlot Costs per Hundredweight of Gain.--Includes such items as hired labor, interest, equipment use, and miscellaneous cash expenses.

Income from Manure.--The number of lambs in each lot was divided by twelve to give the number of one thousand pound animal units. Each animal unit produced 33.15 pounds of manure per day while in the feedlot. The value placed on the manure was \$3.57 per ton. These figures were arrived at from information selected from results obtained on a government irrigation project in which the same general rotations were used and the same crops grown. 18/

Net Income Per Finished Lamb.--This is the amount that remained after feed costs and other feedlot costs had been subtracted from the returns per lamb finished and the value of the manure produced per lamb.

Return Per Dollar Feed Fed.--This was obtained by adding the return above all costs to the value of the feed used and dividing by the value of the feed.

Description of Feeds Used

Shelled Corn.--The shelled corn that was used was locally grown yellow corn of good grade and well matured.

Corn Fodder.--The fodder that was used was of high quality and well cured. The estimated yield of this corn was about 40 bushels per acre so that the resulting chopped fodder made excellent feed.

Whole Barley.--The barley used was of the Trebi variety and was

18/ Harris, Lionel, "The Value of a Ton of Farm Manure in the North Platte Valley", Nebraska Experiment Station, Bulletin 318, May, 1938.

grown locally under irrigation. It weighed about 48 pounds per bushel.

Whole Oats.--The oats was uncleaned, and was grown locally under irrigation. It weighed 40 pounds per bushel and was of very good quality, being bright and very plump with a minimum of chaff.

Whole Wheat.--The wheat used was a soft white spring wheat of the Federation variety weighing about 60 pounds per bushel.

Dried Molasses Beet Pulp.--In most beet sugar factories all or a portion of the wet pulp is dried with coal or waste steam. A ton of sugar beets will produce 95 pounds of plain dried pulp. In the production of dried molasses beet pulp, 500 pounds of beet molasses are dried with 1,500 pounds of dried pulp. This gives approximately 1,600 pounds of dried pulp and 400 pounds of dried molasses in each ton of the product.

Beet Molasses.--"Steffens discard" is the molasses recovered from the Steffens process for precipitating with lime additional sugar from the "foreign" molasses. This molasses with less than 20 per cent moisture is classed as a carbohydrate concentrate.

Siloed Beet Pulp.--The wet pulp fed by the feeders was stored at the factory and hauled daily by truck to the lambs. The pulp varied in moisture content and contained much less water towards the end of the feeding period.

In an experiment at Colorado 19/ the average percentage of dry matter in siloed beet pulp was obtained for the months of September to May, inclusive.

Their results were as follows:

19/ Maynard, E. J., Morton, G. E., and Osland, H. B., Op. cit.

At Factory*

September	8.64 per cent
October	3.94 " "
November	9.99 " "
December	9.92 " "
January	10.89 " "
February	12.65 " "
March	13.30 " "
April	13.73 " "
May	13.34 " "

* Average for 12 factories of Great Western Sugar Company in Colorado, 1930.

Dried Beet Tops.--Fairly good quality dried beet tops were fed by some feeders. In one case, however, some of the lambs scoured quite badly due to improperly cured, and slightly moldy beet tops. If tops are hauled and fed in dry lots it is usually a poor practice to feed them through panels. The lambs may pull them through, trample, and waste them.

It is better to scatter out on clean straw in an adjacent pen just what the lambs will clean up each day. According to feeding value under ideal conditions, tops would be worth from \$.50 to \$1 per ton of beets produced. The feeder purchasing tops usually must allow for a substantial loss of value due to possible bad weather conditions, consequently tops usually sell for from \$.20 to \$.50 per ton of beets produced.

Cottonseed Cake.--This feed was of the nut size and carried a guaranteed analysis of not less than 43 per cent protein, 23 per cent nitrogen-free extract and 6 per cent fat and not more than 12 per cent fiber.

Alfalfa Hay.--Hay from three cuttings was used by the feeders. In some cases rather coarse and discolored alfalfa was fed. The second and

third cutting hay was good quality, bright, and free from dust and mold.

Clean Water.--Those feeders who fed wet beet pulp did not furnish water so as to induce greater consumption of the pulp. The other feeders kept clean water available at all times.

Salt.--Most of the feeders used block salt and seemed to prefer it stating that there was less danger of over-eating of block salt. However, several feeders used coarse ground salt throughout the feeding period.

Minerals.--No minerals other than common salt were used.

Importance of Good Quality Feeds

The hay used should not be musty or bleached as the lambs will not like it very well. Hay that has been badly bleached is also lower in feeding value. One feeder stated that he started feeding coarse bleached alfalfa but changed over to second cutting hay of first class quality. He stated that there was a definite change in the rapidity of gain and the general appearance of his lambs when the better hay was fed.

If grain is musty or smutty the lambs will not consume a maximum amount and will not fatten the way they should. The feeds used must be palatable and of good quality. 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.

Cost of Grinding and Mixing

Most feeders charged from \$2 to \$2.50 per ton to chop hay and corn fodder. This cost would be relatively more important when alfalfa was cheap in price than when it was higher in price. Many farmers stated that

they thought it would not pay to chop cheap hay as the cost would more than offset the benefits derived from savings in feed and probably faster gains.

Pasturing

On the average irrigated farm where lambs are fed there is usually 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 region in which these feeders were located, sugar beets were grown so that there was a large quantity of beet tops on which the lambs could feed.

Beet tops are considered a very excellent feed for putting on cheap gains. Ten of the feeders in this study pastured their lambs on beet tops. Due to the fact that platform scales were not available in most cases, no attempt was made to weigh the lambs into the dry lot from the pasture, thus the daily gain while on pasture can not be figured. Beet tops were found very satisfactory in most cases and the death losses while on beet top pasture were very low on the average.

There are approximately 1,400 pounds of green top recovered from each ton of sugar beets produced. About 70 per cent of the weight of the beet is represented by the green tops which are composed of about 25 per cent crown and 75 per cent green leaves. They have an average moisture content of about 85 per cent when first cut. They are thrown into windrows when the beets are topped and from then on their moisture content and nutritive value depend largely on weather conditions and methods used in handling them.

Because of the possibility for wide variation in moisture content during the feeding season, tops are generally considered in terms of tops per ton of beets produced. When pastured with little or no waste, the tops from 14 tons of beets will furnish sufficient feed for 1,000 lambs for one day. If lambs have access to stubble land the tops from 7 tons of beets and 1.5 acres of alfalfa stubble and small grain stubble should carry 1,000 lambs for one day. 20/

Alfalfa stubble was also pastured in some cases. Alfalfa is quite satisfactory but requires more caution because of bloat. Some feeders stated that they have known of instances where a large number of lambs were lost in just a short time due to bloating. It is considered good practice to feed the lambs on alfalfa hay for several hours before turning them out on alfalfa pasture. In this way they are filled up so that they do not eat so much of the succulent forage and, therefore, there is less danger of bloat. When the lambs are first put out on the alfalfa pasture, they should not be moved around too much but should be made to remain pretty much in one spot until they have filled themselves after which they will lie down and should remain undisturbed.

Weather conditions on pasture are very important. In wet rainy seasons the lambs put on small gains and practically none of them fatten. One feeder told me that his lambs lost weight during a stormy period last fall while on pasture. This loss in weight while on pasture resulted in a much smaller return for this particular feeder. Lambs should not be kept on pasture when the ground is too wet. They should also be removed

20/ Maynard, E. J., Morton, G. E., and Osland, H. B., Op. cit.

from the pasture as soon as they have cleaned most of the beet tops or alfalfa because they will run around and will not gain in weight.

The feeders that I interviewed agreed very definitely that big "horsey" lambs should not be allowed to go on pasture because they will not fatten but will continue to grow. As a result, this type of lamb will be too heavy by the time he has "put on" a sufficient degree of finish to merit shipment and will, therefore, sell at a discount. Most of the feeders agreed that lambs weighing over 80 pounds should not be pastured but should be put into the dry lot and finished as quickly as possible.

Financial Summary of Lamb Feeding

As can be seen from table III, there is quite a lot of variation in net return to each feeder. Feeders 1 to 7, inclusive, are contract feeders and the other seven are outright purchasers.

The return per finished lamb ranged from a low of 84 cents for feeder number 8 to a high of \$2.20 for feeder number 2, giving a range of \$1.36 between the high and low. This is quite a large difference and will be explained later when the factors affecting costs and returns are studied.

Feeders 1 to 6, inclusive, received 9 cents per pound of gain and feeder number 7 received 7 cents per pound of gain. The other seven owned their lambs and sold them either locally or at one of the two following markets: South St. Paul or Chicago. The average sale price per hundred-weight ranged from \$7.58 to \$8.35. The latter feeder sold lambs early last fall at a very high price and late this spring at a high price so that his average selling price was increased. Feeder number 14 sold his lambs

TABLE III.--FINANCIAL SUMMARY OF LAMB FEEDING ON
FOURTEEN MONTANA FARMS, 1938-1939

	Feeder number				
	1	2	3	4	5
Number of lambs finished	1585	1226	1299	1282	1496
Average initial weight*	68.5	71.1	75.2	71.14	70.5
Average final weight	101.47	106.22	109.76	105.51	107.1
Gain per lamb	32.97	35.12	34.56	34.37	36.6
Purchase date	Oct. 17	Oct. 6	Oct. 12	Oct. 8	Oct. 7
Purchase price per cwt.	-	-	-	-	-
Sale price per cwt.	-	-	-	-	-
Margin per cwt.	-	-	-	-	-
Shrinkage to market	-	-	-	-	-
Ave. marketing costs per cwt.	-	-	-	-	-
Total costs:					
Lambs	-	-	-	-	-
Feed	1922.47	1423.05	2253.60	1720.85	2094.10
Equipment use	100.00	200.00	310.00	150.00	142.25
Labor (hired)	500.00	200.00	170.00	100.00	109.35
Interest	-	-	-	-	-
Miscellaneous	-	-	-	-	23.05
Total	2522.47	1823.05	2733.60	1970.85	2368.75
Income:					
Lambs and pelts	4585.05	3789.99	3950.91	3810.15	4779.90
Manure	553.35	689.01	549.78	556.92	614.04
Total	5138.40	4479.00	4500.69	4367.07	5393.94
Net Return	2615.93	2655.95	1767.09	2396.22	3025.19
Costs per finished lamb:					
Lamb cost	-	-	-	-	-
Feed	1.24	1.19	1.77	1.40	1.45
Other feedlot costs	.39	.33	.38	.20	.19
Total cost per finished lamb	1.63	1.52	2.15	1.60	1.64
Income per finished lamb:					
Lamb	2.97	3.16	3.11	3.09	3.29
Manure	.35	.56	.42	.43	.41
Total income	3.32	3.72	3.53	3.52	3.70
Labor income per finished lamb	1.69	2.20	1.38	1.92	2.06
Return per dollar feed fed	2.36	2.85	1.78	2.37	2.42

* This figure includes all lambs purchased.

TABLE III, sheet 2

	6	7	8	9	10
Number of lambs finished	1198	1447	1086	1089	1999
Average initial weight	76.40	78.41	78.14	69.26	79.96
Average final weight	109.35	103.11	104.01	99.12	102.48
Gain per lamb	32.85	24.71	25.87	29.86	22.52
Purchase date	Oct. 14	Oct. 25	Nov. 25	Oct. 20	Oct. 8
Purchase price per cwt.	-	-	7.03	6.85	6.78
Sale price per cwt.	-	-	7.75	7.98	8.01
Margin per cwt.	-	-	.72	1.13	1.23
Shrinkage to market	-	-	4.63	5.18	5.63
Ave. marketing costs per cwt.	-	-	.94	1.03	.86
Total costs:					
Lambs	-	-	6110.69	5416.50	11140.47
Feed	1916.70	1183.83	1793.40	1768.63	3183.33
Equipment use	144.00	50.80	85.10	92.68	132.00
Labor (hired)	149.75	-	114.25	289.25	345.00
Interest	-	-	108.14	98.79	173.00
Miscellaneous	-	-	60.82	-	-
Total	2210.45	1234.13	8272.40	7665.85	14973.80
Income:					
Lambs and pelts	3283.47	2388.12	8751.43	8612.79	16421.72
Manure	521.22	549.78	456.96	533.35	749.70
Total	3804.69	2937.90	9208.39	9166.14	17171.42
Net Return	1594.24	1703.77	935.99	1500.29	2197.62
Costs per finished lamb?					
Lamb cost	-	-	5.49	4.74	5.42
Feed	1.72	.87	1.79	1.71	1.76
Other feedlot costs	.27	.04	.37	.47	.36
Total cost per finished lamb	1.99	.91	7.65	6.92	7.54
Income per finished lamb:					
Lamb	2.89	1.73	8.07	7.91	8.21
Manure	.43	.38	.42	.51	.37
Total income	3.32	2.11	8.49	8.42	8.58
Labor income per finished lamb	1.33	1.20	.84	1.50	1.04
Return per dollar feed fed	1.77	2.38	1.47	1.88	1.59

* This figure includes all lambs purchased.

TABLE III, sheet 3

	11	12	13	14
Number of lambs finished	920	2405	818	970
Average initial weight*	68.04	72.6	72.78	81.10
Average final weight	96.32	93.55	96.45	94.05
Gain per lamb	28.28	20.95	23.67	12.95
Purchase date	Oct. 10	Oct. 15	Oct. 20	Oct. 18
Purchase price per cwt.	6.92	6.26	6.82	6.63
Sale price per cwt.	7.90	8.35	7.70	7.58
Margin per cwt.	.98	2.09	.88	.95
Shrinkage to market	5.43	4.80	-	-
Ave. marketing costs per cwt.	.93	.87	-	-
Total costs:				
Lambs	4520.50	11165.55	4116.80	5215.82
Feed	1558.12	3051.50	965.80	843.08
Equipment use	61.00	150.00	-	-
Labor (hired)	200.00	400.00	-	-
Interest	-	218.00	-	-
Miscellaneous	-	-	-	-
Total	6339.62	14985.05	5082.60	6058.90
Income:				
Lambs and pelts	6957.96	18780.27	6158.60	6914.58
Manure	410.55	924.63	378.42	235.62
Total	7368.51	19704.90	6537.02	7150.20
Net Return	1028.89	4719.85	1454.42	1091.30
Costs per finished lamb:				
Lamb cost	4.71	4.51	4.96	5.38
Feed	1.93	1.37	1.16	.87
Other feedlot costs	.32	.35	-	-
Total cost per finished lamb	6.96	6.23	6.12	6.25
Income per finished lamb:				
Lamb	7.61	7.81	7.43	7.13
Manure	.45	.38	.46	.24
Total income	8.06	8.19	7.89	7.37
Labor income per finished lamb	1.10	1.96	1.77	1.12
Return per dollar feed fed	1.57	2.43	2.53	2.29

* This figure includes all lambs purchased.

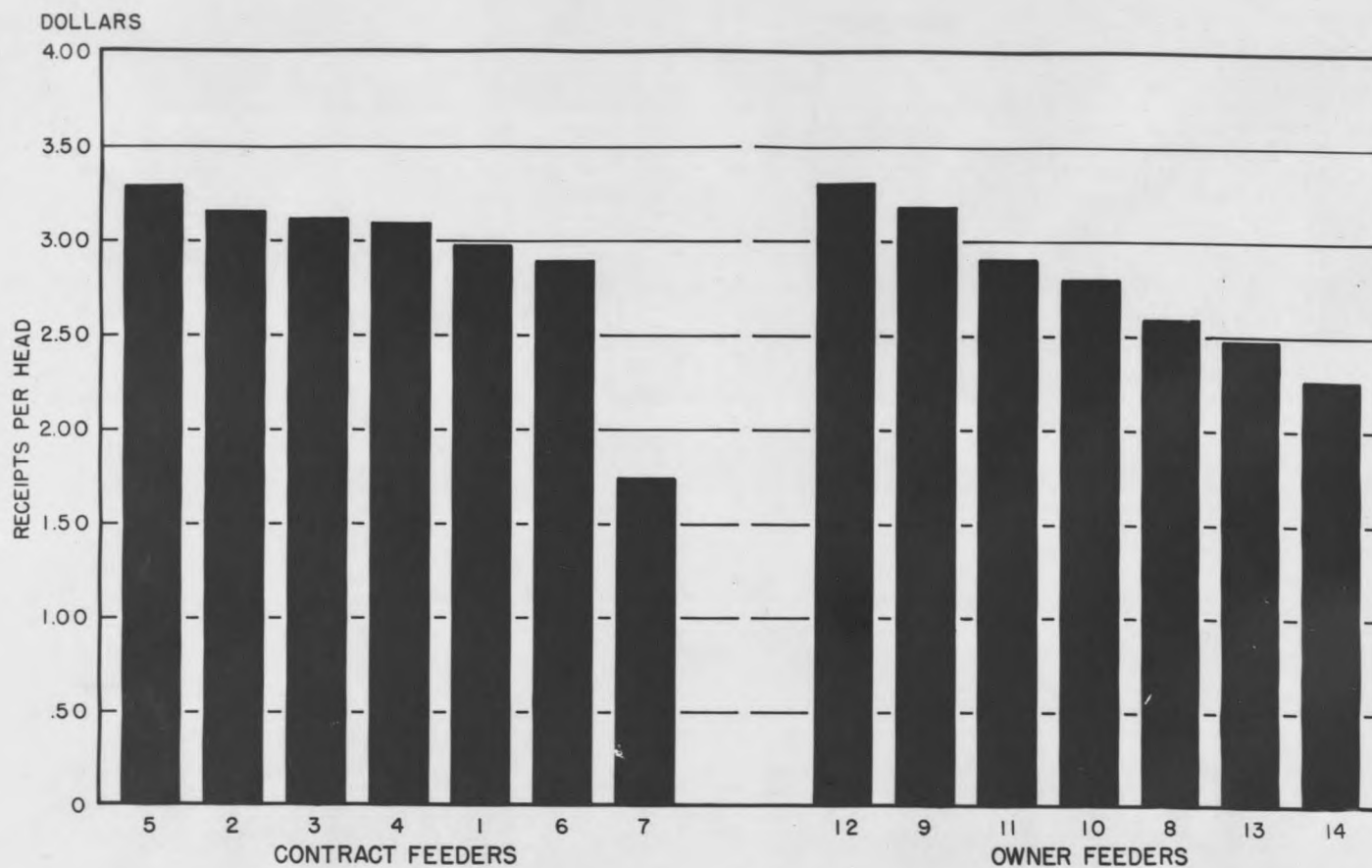


Figure 1.--Average receipts per lamb finished to cover feed, labor, interest, equipment, and miscellaneous costs for fourteen feeders in Montana, 1938-1939

locally before they were completely finished and as a consequence received a lower price.

The price paid per hundredweight for feeder lambs last fall ranged from \$6.26 to \$7.03 with an average of approximately \$6.63 for the seven feeders purchasing their own lambs. The high figure of \$7.03 can be explained by the fact that these lambs were bought at a rather late date when feeders had become quite scarce.

The shrinkage to market did not vary very much in most cases. The lowest figure was 4.63 per cent and the highest was 5.63. This difference was due in large part to more adverse weather conditions, when the lambs were shipped, on the part of the high shrink group.

Average marketing costs per hundredweight varied from 86 cents to \$1.03, depending upon the market to which the lambs were shipped. Eighty-six cents represents the average marketing cost to South St. Paul and \$1.03 represents the costs to Chicago. The difference is due to the additional freight charge.

There is a wide difference in feed costs per head finished. The feed costs varied from a low of 87 cents to a high of \$1.93. These differences will be explained later in the discussion. Factors such as the kind of ration fed, the amount of feed required per hundredweight of gain, the amount of feed purchased and the amount of cheap feeds used are all considerations which will be gone into.

The other feedlot costs also varied quite a lot due to differences in amounts spent for hired labor. As only amounts actually spent for labor were included as labor costs, this alone necessarily makes for a large

difference because some feeders did not hire any labor at all, some feeders did not have any corral costs because they were on a rented farm. Interest charges were not brought in in some cases because only actual cash expenditures for interest paid on borrowed money was included.

The income for lamb and pelts includes all income for lambs sold or pelts sold plus income from lambs butchered and consumed on the farm. The contract feeders were paid for the net pounds of gain and they were also credited for any lambs butchered and consumed on the farm.

The net return per dollar feed fed varied from a low of \$1.47 to a high of \$2.85. This difference can be explained by the type of ration used and the kinds of feed used. A ration made up largely of home grown feeds in this particular study proved to be more economical because the home grown feeds were much cheaper than the commercial feeds in most instances. The price received for the finished lambs also has much to do with the net return per dollar feed fed. In this study, the feeder with the lowest amount had a low margin. On the whole, the contract feeders made a very good return per dollar of feed fed due primarily to their low cost of feed.

Summary of Weights, Gains, and Feed Consumption
Per Head of Lamb Finished

Table IV shows that there was quite a difference in the number of lambs fed in a few cases. Feeder 13 started with 830 lambs and was the lowest. Feeder number 12 started with 2,456. With the exception of feeder number 10 who fed 2,053 and feeder number 1 who fed 1,604, there was not much difference in the numbers fed.

The weights of the lambs for the different feeders ranged from a low

TABLE IV.--SUMMARY OF WEIGHTS, GAINS, AND FEED CONSUMPTION PER HEAD OF LAMBS
 FED ON FOURTEEN MONTANA FARMS, 1938-1939

	Feeder number						
	1	2	3	4	5	6	7
Initial number of lambs	1604	1238	1311	1303	1514	1228	1469
Final number of lambs	1585	1226	1299	1282	1496	1198	1447
Death loss	19	12	12	21	18	30	22
Death per cent	1.2	1.0	.9	1.6	1.2	2.4	1.5
Average initial weight	68.5	71.1	75.2	71.14	70.5	76.4	78.41
Average final weight	101.47	106.22	109.76	105.51	107.1	109.35	103.11
Gain per lamb	32.97	35.12	34.56	34.37	36.6	32.95	24.71
Average daily gain	.32	.29	.33	.31	.36	.31	.32
Length of feeding period	103	120	106	111	102	107	77
Length in the feedlot	71	84	86	88	84	87	77
Average daily feed:							
Oats					.23	.33	.15
D.M.B.P.							.38
Barley	.29		.33	.06	.17		
Wheat				.05			.22
Shelled corn							
Cotton seed cake	.25	.16	.22	.23	.22	.30	
Molasses	.34	.29	.28	.27	.29	.19	
Wet pulp	15.70	14.00	15.16	14.4	15.38	15.27	4.15
Beet tops*	11.68	11.20	8.08	14.2	14.2	7.08	.99
Alfalfa	.71	.43	1.13	.71	.95	.77	1.18
Corn fodder		.58					
Bean straw							
Screening (crested wheat grass)							

* The figure for the average daily consumption of beet tops is figured on the basis of days on pasture only. The consumption of other feeds is figured on the basis of days in the dry feed lot.

TABLE IV, sheet 2

	Feeder number						
	8	9	10	11	12	13	14
Initial number of lambs	1113	1113	2053	960	2456	830	970
Final number of lambs	1086	1089	1999	920	2405	818	9970
Death loss	27	24	54	40	51	12	-
Death per cent	2.4	2.2	2.6	4.2	2.1	1.5	-
Average initial weight	78.14	69.26	79.96	68.04	72.6	72.78	81.10
Average final weight	104.01	99.12	102.48	96.32	93.55	96.45	94.05
Gain per lamb	25.87	29.86	22.52	28.28	20.95	23.67	12.95
Average daily gain	.30	.29	.23	.22	.20	.25	.26
Length of feeding period	85	103	100	126	107	94	49
Length in the feedlot	85	103	76	90	78	94	49
Average daily feed:							
Oats	.61	.24	.71	1.07	.32	.29	1.45
D.M.B.P.	.43	.70	1.20	1.12	.45	.70	
Barley		.47					
Wheat	.58				.38	.33	
Shelled corn			.09				
Cotton seed cake			.05				
Molasses	.04		.02				
Wet pulp	1.08		3.04		1.92		
Beet tops*		3.73	5.2	6.07	4.76		
Alfalfa	.82	1.48	.86	1.17	1.71	.80	1.50
Corn fodder	.52		.11		.74	.12	
Bean straw		.71					
Screening (crested wheat grass)							.93

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* The figure for the average daily consumption of beet tops is figured on the basis of days on pasture only. The consumption of other feeds is figured on the basis of days in the dry feed lot.

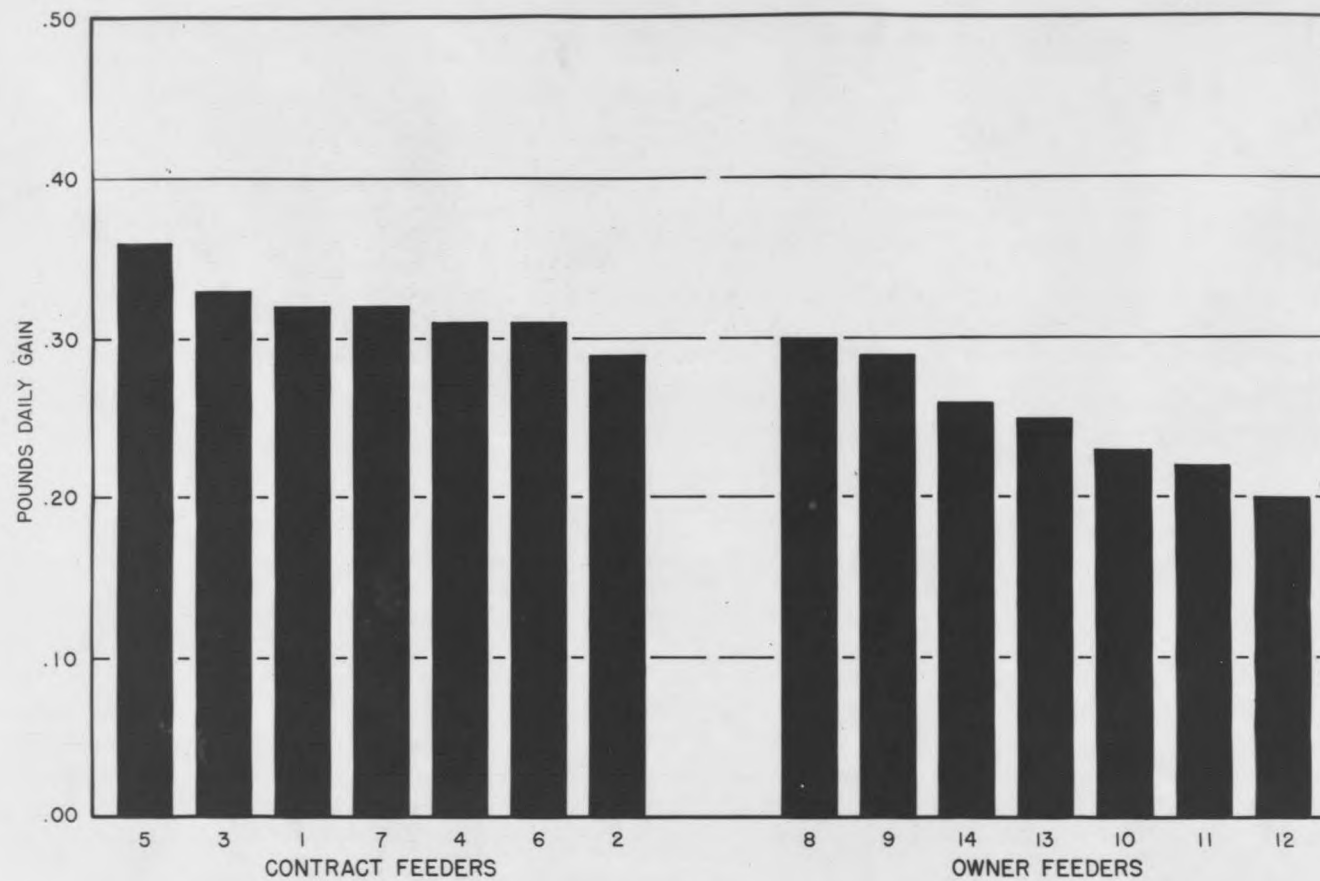


Figure 2.--Average daily gain per lamb finished for fourteen feeders in Montana, 1938-1939

of 68.04 pounds per head to a high of 81.10 pounds at the start. Most of the lambs on the different farms weighed over 70 pounds on the average. The lambs that came in the feedlots at a fairly high weight were in some cases purchased late and in other cases, the lambs had been kept on exceptionally good range during the last few weeks before the feeders bought them so that they were in better condition than the lighter lambs. The lambs came in at a heavier weight this year than they have for several years due to the better condition of the ranges. This resulted in bigger and growthier lambs, some of which were really undesirable from a feeder standpoint.

Approximately the same difference in weight existed between the different lots when the lambs were weighed out and sold as when they went into the various lots. The contract lambs weighed more on the average due to the fact that they did not suffer the shrink that the owner fed lambs did as home weights minus 4 per cent shrink were used in the case of contract fed lambs whereas market weights were taken as final for the others. The contract lambs were also bigger lambs when they came into the feedlots and they put on more gain. The average final weights ranged from a low of 93.55 for feeder 12, to a high of 109.76 for feeder 3.

The average gain per lamb was figured on the basis of the number of lambs finished in all cases. The contract feeders made the highest total gains in all cases with the exception of feeder 7 who had a lower gain than three of the owner feeders. The results obtained by the contract feeders and other lambs sold locally should be adjusted by the extent of the shrink to market in order to have absolutely comparable figures.

The results obtained by the contract feeders will be adjusted later in the discussion. Feeder 14 fed only 49 days and had the lowest gain with 12.95 pounds per lamb and feeder 5 had the highest total gain per lamb with 36.6 pounds.

The average daily gain per lamb finished ranged from a low of .20 pound per day for feeder 12 to a high of .36 pound per day for feeder 5. The contract feeders as a whole had the highest average daily gain but this figure would be lowered somewhat if shrinkage to market were subtracted. However, feeders 13 and 14 sold their lambs locally and still showed a lower daily gain than did the first seven feeders.

The shortest length of feeding period was 49 days for feeder 14 and the longest feeding period was 126 days. An average total length of feeding period has been worked out and an average length of period in the dry lot and the pasture. The difference between the total length of feeding period and the number of days gives the average length of time on pasture. Four of the fourteen feeders did not pasture their lambs at all. The average total length of feeding period for the seven contract feeders was 102.85 days as compared with 97.13 days for the owner feeders. The average length of feeding period for all feeders was 100.03 days. This has been shown graphically in figure 3.

The average daily feed consumed per head was calculated for each separate feeder. In calculating the amount of beet tops consumed per day per head, the total number of tons of beet tops to which the lambs had access to were multiplied by 50 per cent because it was estimated that only 50 per cent of the tops were utilized. The amount of beet tops

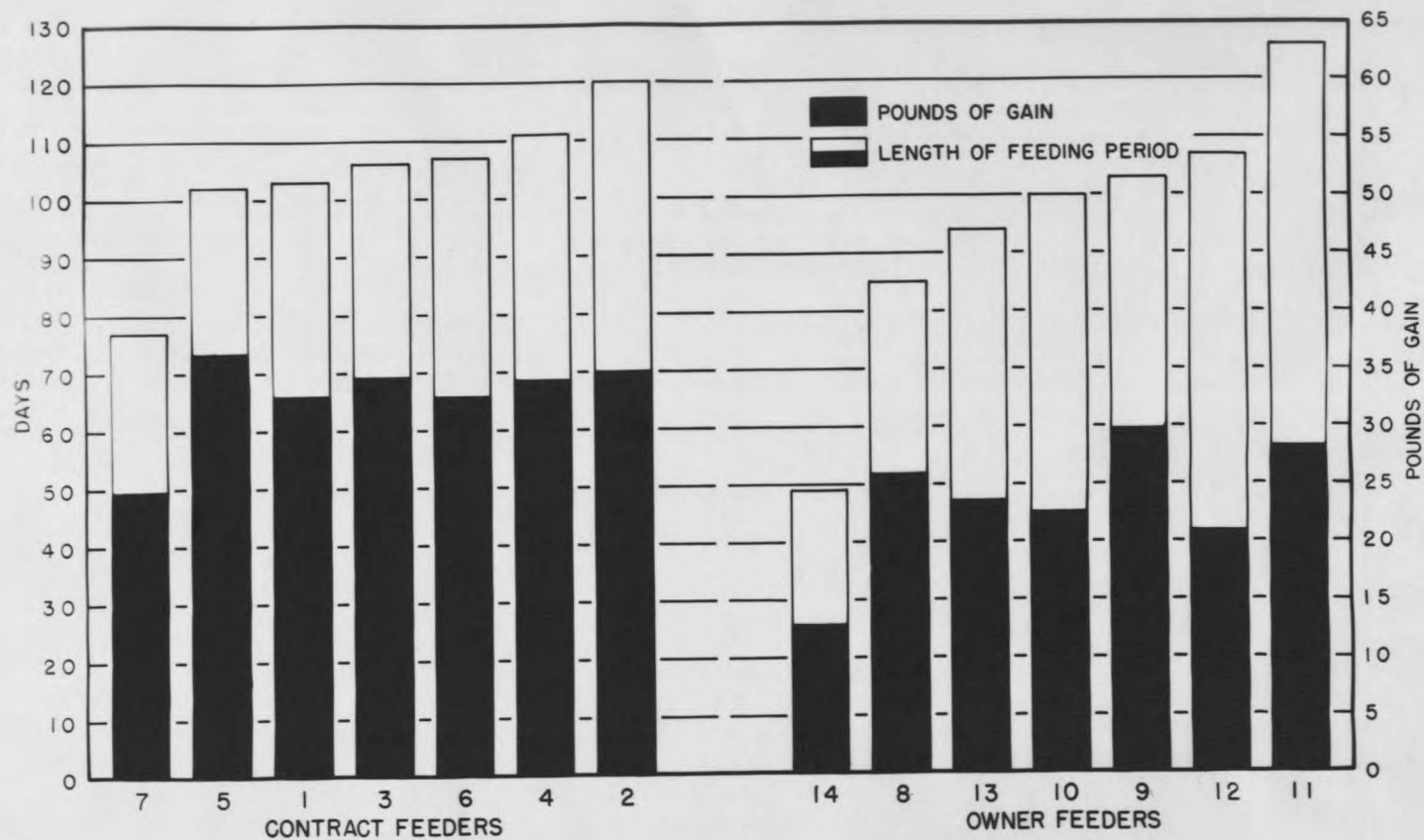


Figure 3.--Average length of feeding period and average total gain per lamb finished for fourteen feeders in Montana, 1938-1939

consumed per head is based on a per day consumption while being pastured in every case except where the tops were fed in the dry lot and the lambs were not pastured. The daily consumption of the other feeds has been based on the consumption per day while in the dry lot.

The consumption of wet beet pulp for the first six feeders is quite high but this can be explained in large part by the fact that these lambs did not have access to very much concentrates. Also, these lambs received no water as it was felt that they would get enough water from the wet pulp. The consumption of beet tops appears rather high in some cases and probably is as the estimation of the percentage of consumption may be a little high. The amount of alfalfa consumed varied to quite an extent with the type of other feeds used. When wet pulp was fed, the alfalfa consumption was fairly low as was the case when corn fodder was fed. The feeders in most cases attempted to use as much of their home grown feeds as possible because of their relatively low price compared to commercial feeds.

Total Feed Consumed and Amount Consumed
Per Hundredweight of Gain

In table V the total amount of feed consumed for each lot of lambs is given. There is quite a wide difference in the total amount of each kind of feed made use of by the various feeders. Feeders 1 to 6, inclusive, used a large amount of wet pulp so that not much other feed was consumed. These six feeders used more cottonseed cake than the others because a high protein feed was necessary to balance the ration as the wet pulp is very low in protein. Several of the other feeders fed some wet pulp--most of

TABLE V.--TOTAL FEED CONSUMED PER FARM AND AMOUNT CONSUMED PER HUNDREDWEIGHT
OF GAIN FOR LAMBS FED ON FOURTEEN MONTANA FARMS, 1938-1939

Feeder number	1	2	3	4	5	6	7
Total feeds used: (pounds)							
Oats					28,875	34,000	16,530
D.M.B.F.							42,000
Barley	32,496		36,384	6,720	22,025		
Wheat				6,000			24,600
Shelled corn							
Cotton seed cake	28,000	16,100	25,000	25,400	27,900	31,500	
Molasses	37,750	29,710	31,140	29,910	37,090	19,810	
Wet pulp	1,722,370	1,443,360	1,696,140	1,625,000	1,937,360	1,592,960	462,470
Beet tops	1,188,000	990,000	420,000	840,000	770,000	595,000	110,000
Alfalfa	80,000	44,000	126,000	80,000	120,000	80,000	131,600
Corn fodder		60,000					
Bean straw							
Screenings							
Salt	3,000	3,500	3,000	3,400	3,800	2,000	1,700
Bone meal							
Feed consumed per cwt. gain (pounds)							
Oats					52.44	86.46	46.88
D.M.B.F.							118.75
Barley	62.35		80.85	15.30	38.76		
Wheat				12.75			68.75
Shelled corn							
Cotton seed cake	53.75	38.72	53.90	58.65	50.16	78.60	
Molasses	73.10	70.18	68.60	68.85	66.12	49.78	
Wet pulp	3,375.5	3,388.0	3,714.20	3,672.0	3,506.64	4,000.74	1,296.88
Beet tops	1,132.96	1,153.60	468.64	965.6	710.0	431.88	309.38
Alfalfa	152.65	104.06	276.85	181.05	216.60	201.74	368.75
Corn fodder		140.36					
Bean straw							
Screenings							

TABLE V, sheet 2

Feeder number	8	9	10	11	12	13	14
Total feeds used: (pounds)							
Oats	56,140	26,840	107,750	88,220	60,000	22,413	68,935
D.M.B.P.	40,000	78,300	181,800	92,000	84,000	54,000	75
Barley		52,200					
Wheat	53,160				72,000	25,522	
Shelled corn			13,930				
Cotton seed cake			8,000				
Molasses	4,000		3,290				
Wet pulp	100,000		462,625		360,000		
Beet tops		418,000	500,000	400,000	519,000		
Alfalfa	75,640	166,320	130,000	96,000	320,000	61,350	71,295
Corn fodder	48,000		22,400		138,000	11,452	
Bean straw		80,000					
Screenings							44,300
Salt	2,000	1,000	2,000	400	2,000		
Bone meal	500						
Feed consumed per cwt. gain (pounds)							
Oats	203.13	82.56	235.01	345.61	116.80	116.00	558.25
D.M.B.P.	143.19	240.80	397.20	361.76	164.25	280.00	
Barley		161.68					
Wheat	193.14				138.70	132.0	
Shelled corn			29.79			48.0	
Cotton seed cake			16.55				
Molasses	13.32		6.62				
Wet pulp	359.64		1,006.24		700.80		
Beet tops		1,283.12	540.30	806.24	642.60		
Alfalfa	273.06	509.12	284.66	377.91	624.15	320.0	577.50
Corn fodder	173.16	244.24	36.41		270.10		
Bean straw							
Screenings							358.05

these fed only that amount which was allotted to them according to the number of tons of beets that they sold. Some of the owner feeders tried to use as much of their home grown feeds as possible.

Not much difference was found to exist in the amounts of the different feeds consumed per hundredweight of gain in the case of the first six feeders. The amount of wet pulp consumed per hundredweight of gain is just about the same in every case. The amounts of cottonseed cake, molasses, and grain also run much the same for this group of feeders. There is, however, somewhat more difference in the amounts of grain consumed. Some of the differences in feed consumption in this group of feeders is due to differences in length of time which the lambs were pastured.

Wider differences were found existing among the last eight feeders. In this group more variation exists as to the kinds of feeds used in the ration. Some fed large quantities of dried molasses beet pulp, and others did not feed much. Some dried molasses beet pulp was used in all the rations of feeders 7 to 13, inclusive, but none was used by feeder 14. In all cases where the dried molasses beet pulp was used, the lambs were self-fed at least part of the time. The purpose of the pulp in many of these cases was to lighten the feed in order to avoid the danger of over-eating. The pulp is also an excellent conditioner and was well liked by all feeders. It helps put out a very desirable type of lamb with a very nice looking carcass. The fat on pulp-fed lambs is white in color and is very desirable from a selling standpoint.

The amounts of grain used varied to quite an extent with the kind and with the amount of dried molasses beet pulp fed. More wheat was used

this year due to its low price. The wheat was quite satisfactory but oats was preferred in most cases due in large part to the fact that it is a safer feed to use. Ground corn fodder was used in several cases and was found to be very satisfactory, particularly where self-feeding is practiced. It is the investigator's belief that more corn fodder will be fed in the future, particularly in the Billings area where high quality corn can be produced.

The difference in alfalfa consumed per hundredweight of gain can be explained in large part by the type of lambs the feeders purchased and the way in which they handled them. In the case of feeder 12, the heavy end of the lambs was out out and self-fed quite heavily on concentrates and the light end of the lambs was hand-fed just a small amount of grain so that they consumed more roughage. This feeder grew his light lambs on as cheap a ration as possible which turned out to be alfalfa hay this year due to its low price per ton. In cases where heavier lambs were purchased, it would be impossible to get as high a consumption of roughage because big lambs would be produced that would be too heavy for the market by the time they reached a high enough degree of finish to merit shipment.

FACTORS AFFECTING COSTS AND RETURNS

Up to this point the discussion has been a general description and statement of some of the main differences in the physical and financial requirements of fattening lambs. Since individual farms varied widely in some cases in rate of gain, cost of gain, and net returns from the lamb feeding enterprise, an attempt will be made to analyze these differences

TABLE VI.--AVERAGES PER FARM: FOURTEEN MONTANA FARMS ARRAYED ACCORDING TO
DAILY GAIN PER HEAD OF LAMB FINISHED, 1938-1939

Farm No.	Daily gain pounds per day	Purchase weight	Gain per head	Sale weight	Purchase cost per cwt. in feedlot	Sale price per cwt. at market	Days on feed	Feed cost per cwt. of gain	Other feed- lot costs	Actual margin to market	Necessary margin from feed- lot to market	Profit per head	Percentage death loss
	lbs.	lbs.	lbs.	lbs.	dol.	dol.		dol.	dol.	dol.	dol.	dol.	pct.
5	.36	70.5	36.6	107.1		9.00	102	3.97	.52	-	-1.65	1.65	1.2
3	.33	75.2	34.56	109.76		9.00	106	5.13	1.09	-	-.96	.96	.9
1	.32	68.5	32.97	101.47		9.00	103	3.77	1.18	-	-1.34	1.34	1.2
7	.32	78.41	24.71	103.12		7.00	77	3.55	.15	-	-.82	.82	1.5
4	.31	71.14	34.37	105.51		9.00	111	4.06	.59	-	-1.49	1.49	1.6
6	.31	76.40	32.13	109.53		9.00	107	5.25	.81	-	-.90	.90	2.4
8	.30	78.14	25.87	104.01	7.03	7.75	85	6.90	1.42	.72	.32	.42	2.4
2	.29	71.1	35.12	106.22		9.00	120	3.38	.95	-	-1.64	1.64	1.0
9	.29	69.26	29.86	99.12	6.85	7.98	103	5.73	1.56	1.13	.13	.89	2.2
14	.26	81.10	12.95	94.05	6.63	7.58	49	6.71	-	.95	.10	1.12	-
13	.25	72.78	23.67	96.45	6.82	7.70	94	4.91	-	.88	-.46	1.31	1.5
10	.23	79.96	22.52	102.48	6.78	8.01	100	7.82	1.60	1.23	.59	.67	2.6
11	.22	68.04	28.28	96.32	6.92	7.90	126	6.83	1.14	.98	.29	.65	4.2
12	.20	72.6	20.95	93.55	6.26	8.35	107	6.55	1.65	2.09	.40	1.58	2.1

more closely in an effort to find out which of the factors are most important in connection with costs and returns. Since only fourteen feeders are involved, the analysis will be made on a case basis where the wide differences occur. The factors to be analyzed are relation of date of purchase to costs and returns, influence of lamb weight at start on costs and returns, effects of number of lambs fed, relation of length of feeding period to costs and returns, influence of feeding efficiency, influence of death loss, relation of daily gains to costs and returns, and relation of price margin to net returns. Table VI has been so arranged that direct comparisons may be made by the reader.

Relation of Date of Purchase to Costs and Returns

As shown in table III, most of the lambs were purchased at the same time so that no great difference exists there and probably it would be unwise to attempt to draw any conclusions. However, one of the feeders, feeder 8, purchased his lambs on November 25 which is approximately a month later than any other feeder. The result of this late purchase is that there were only a few feeder lambs remaining in the state so that it was rather difficult to obtain lambs. The price of lambs had also advanced in the meantime so that this particular feeder had to pay more per pound for his lambs than any other feeder. This high purchase price reduced his margin per hundredweight and as a result feeder 8 had the lowest labor income per lamb of any feeder studied.

Influence of Lamb Weight at Start on Costs and Returns

Although no great differences occur in lamb weight at the start, a

few of the owner fed lambs came in at a rather heavy weight. Feeder 8, 10, and 14 had some rather heavy lambs and as a result they had to hurry and put these lambs on a fairly heavy feed in order to try and finish them before they reached too heavy a weight. Due to the fact that these lambs had to be "pushed" along as rapidly as possible, it was impossible to make use of as high an amount of cheap home grown feeds such as beet tops and alfalfa. This resulted in a higher cost of gain. Some of the lambs shipped by feeders 8 and 10 were also discriminated against to a certain extent on the market due to heavy weight lambs. This resulted in a somewhat lower sale price per hundredweight.

Effect of Number of Lambs Fed on Costs and Returns

The number of lambs finished ranged from a low of 818 head to a high of 2,405 and the average for the fourteen feeders was 1,345 lambs. This range would appear to be large enough so that significant differences could be pointed out. However, the results obtained or the labor income per finished lamb do not run parallel with the amounts fed. It is the opinion of the investigator that in the case of the feeder who had the smallest number of lambs, all of his work was done by himself and in the case of some of the others only that amount of additional labor was hired which could be profitably made use of. In all cases enough lambs were fed so that the expenses per head were reasonably low. This factor would be more important where only several hundred lambs were fed because there would be a danger of inefficient use of labor and equipment and an increase in overhead cost per lamb fed.

Relation of Length of Feeding Period to Costs and Returns

There was a variation in the length of feeding period of from 49 days to 126 days. There is no definite evidence that the length of feeding period affects costs and returns in this study. However, if more records could be studied over a period of years under varying conditions, perhaps one would probably be able to find more concrete evidence pointing towards a more desirable length of feeding period. In this study those feeders having the longest length of feeding period were able in some cases to utilize more cheaply grown roughage so that cheaper gains were obtained. However, the results are not consistent so that it is difficult to draw definite conclusions. Such factors as cost of feed used and margin existing at different times during the feeding period would affect the relation of length of feeding period to costs and returns. If concentrates fed were high in price compared to roughage, it would pay to feed the lambs as long as possible if the lambs were light enough to start with. If, however, the price of roughage was high in relation to the price of concentrates, the reverse would be true.

Influence of Feeding Efficiency on Costs and Returns

In this study we find a wide variation in feed cost per pound of gain. Feeder 2 with a feed cost per hundredweight of gain of \$3.38 was the lowest and feeder 10 was the highest with \$7.62 per hundredweight of gain. In this study, the feeders who fed a large quantity of wet pulp had the lowest feed cost per hundredweight of gain. Feeder 10 bought some lambs that were quite heavy to start with. These particular lambs

lost weight during a stormy period last fall while on beet tops so that the total net gain was lowered, increasing the cost of gain. This feeder also used more commercial feeds and purchased more of his farm grown feeds than some of the other feeders who in most cases used only their own grain. Factors which contribute to greater efficiency on most farms are: ability of the farmers to feed a well balanced ration so as to get a reasonably high daily gain and a low cost of gain, better quality lambs, light lambs, less death loss, shorter feeding period, and faster average daily gain. Self-feeding was used by all the feeders who used a large percentage of grain and dried molasses beet pulp. This method of feeding has not been used so very much in previous years but the feeders found it very satisfactory this year, 1938-39. It is the belief of most feeders that the death loss can be held down to a minimum by the use of a proper feed mixture when self-fed.

Influence of Death Loss on Costs and Returns

The average death loss as shown in table VII was 1.78 per cent for all feeders. The lowest death loss was .9 per cent for feeder 3 and the highest was 4.2 for feeder 11. The wet pulp feeders had the lowest death loss on the average with most of their losses occurring on beet top pasture and alfalfa stubble due to bloat and choking on beet top crowns. Feeder 11 said that most of the lambs that he lost became stiff and seemed to suffer a lot of pain. These lambs died within a few days in most cases but some of them lingered on. Feeder 10 stated that most of his losses were due to over-eating and bloat and probably due in some cases to worms.

TABLE VII.--DEATH LOSS: NUMBERS, PER CENT OF TOTAL,
AND COST ON FOURTEEN MONTANA FARMS, 1938-39

Feeder number	Total death loss	Percentage death loss	Death loss costs per head (cents)
1	19	1.2	6
2	12	1.0	6
3	12	.9	6
4	21	1.6	10
5	13	1.2	8
6	30	2.4	17
7	22	1.5	11
8	27	2.4	14
9	24	2.2	11
10	54	2.6	15
11	40	4.2	20
12	51	2.1	11
13	12	1.5	7
14	-	-	0
Total	342	1.78	10

The death loss cost varied from 6 cents per lamb sold for feeders 1, 2, and 3 to a high of 20 cents for feeder 11. In most cases the death loss cost was low enough so that it did not affect costs and returns but in the case of feeder 11, the heavy death loss cost made a very definite difference in the returns for this feeder. This feeder started with 960 lambs and lost 40 leaving 920. With a cost of 20 cents per lamb sold, this amounts to \$184 for this particular feeder. The cost of gains is increased to quite an extent where the death loss is greater.

Relation of Daily Gain to Costs and Returns

The daily gain figures used in this study are based on the number of lambs finished. The lowest gain was .20 of a pound per day and the highest .36 pound per day per lamb. The contract feeders who fed wet pulp had the highest daily gain. This is due in part to the fact that home weights were used in calculating their gain. Those feeders with the lowest daily gain had a higher cost of gain in most cases. Feeder 12, however, had a low gain but a high net return--this is due to the fact that he used more roughage and grew his lambs. He also had a type of lambs that could be fed longer so that he was able to hold them longer and sell them on the higher market in March and April. The quality of lambs purchased, the death loss, the length of feeding period, and the degree of finish of lambs when sold affect the daily gain.

If lambs are fed to a high degree of finish, the gains made per day decrease with an increase in finish, that is, slower gains are made. The "law of diminishing returns" comes into operation when the lambs reach a high degree of finish. This explains in part the differences in average

daily gain for different feeders. If the premium paid for extremely well finished lambs is large enough, then it might pay to continue feeding even though the returns per day are beginning to diminish. This suggests the necessity for studying the market and noting the spread in prices between highly finished lambs and lambs carrying less condition.

Relation of Price Margin to Net Returns

This study does not present enough evidence to determine the real importance of price margin to net returns. However, the feeder who made the lowest profit per head in the owner-fed group, had the lowest price margin whereas feeder 12 who had the greatest amount of margin of any of the owner-fed lambs also had the greatest profit per head sold.

In this particular study, the price margin of lambs purchased early and sold late had the widest margin while those lambs that were purchased late and sold fairly early had the least margin. Most feeders agreed that the price was very important but that it could vary a lot. If the feed costs were low and selling prices of lambs were high when they sold, a wide margin would not be necessary. However, if feed costs were high, a wider price margin would be necessary if a profit were to be made.

Comparison of Feed Cost per Hundredweight of Gain and Other Feedlot Costs

The cost per hundredweight of gain was divided into feed costs and other feedlot costs. The other feedlot costs made up 15.93 per cent of the total feedlot costs and the feed costs made up 84.07 per cent of the cost per hundredweight of gain. Two owner feeders did not have any other feedlot costs because they did not hire any work done and did not charge

TABLE VIII.--COMPARISON OF FEED COSTS PER HUNDREDWEIGHT OF GAIN
AND OTHER FEEDLOT COSTS ON FOURTEEN MONTANA FARMS, 1938-1939

Farm number	Feed cost per cwt. gain dollars	Other feedlot costs per cwt. gain dollars	Total feedlot costs per cwt. gain dollars	Other costs as a percentage of feedlot costs per cent
1	3.77	1.18	4.95	23.84
2	3.38	.95	4.33	21.94
3	5.13	1.09	6.22	17.52
4	4.06	.59	4.65	12.69
5	3.97	.52	4.49	11.58
6	5.25	.81	6.06	13.37
7	3.55	.15	3.70	4.05
Ave. for all con- tract feeders	4.14	.78	4.92	15.85
8	6.90	1.42	8.32	17.07
9	5.73	1.56	7.29	21.40
10	7.82	1.60	9.42	16.99
11	6.83	1.14	7.97	14.30
12	6.55	1.65	8.20	20.12
13	4.91		4.91	
14	6.71		6.71	
Ave. for all owner feeders	6.61	1.27	7.88	16.11
Ave. for all feeders	5.12	.97	6.09	15.93

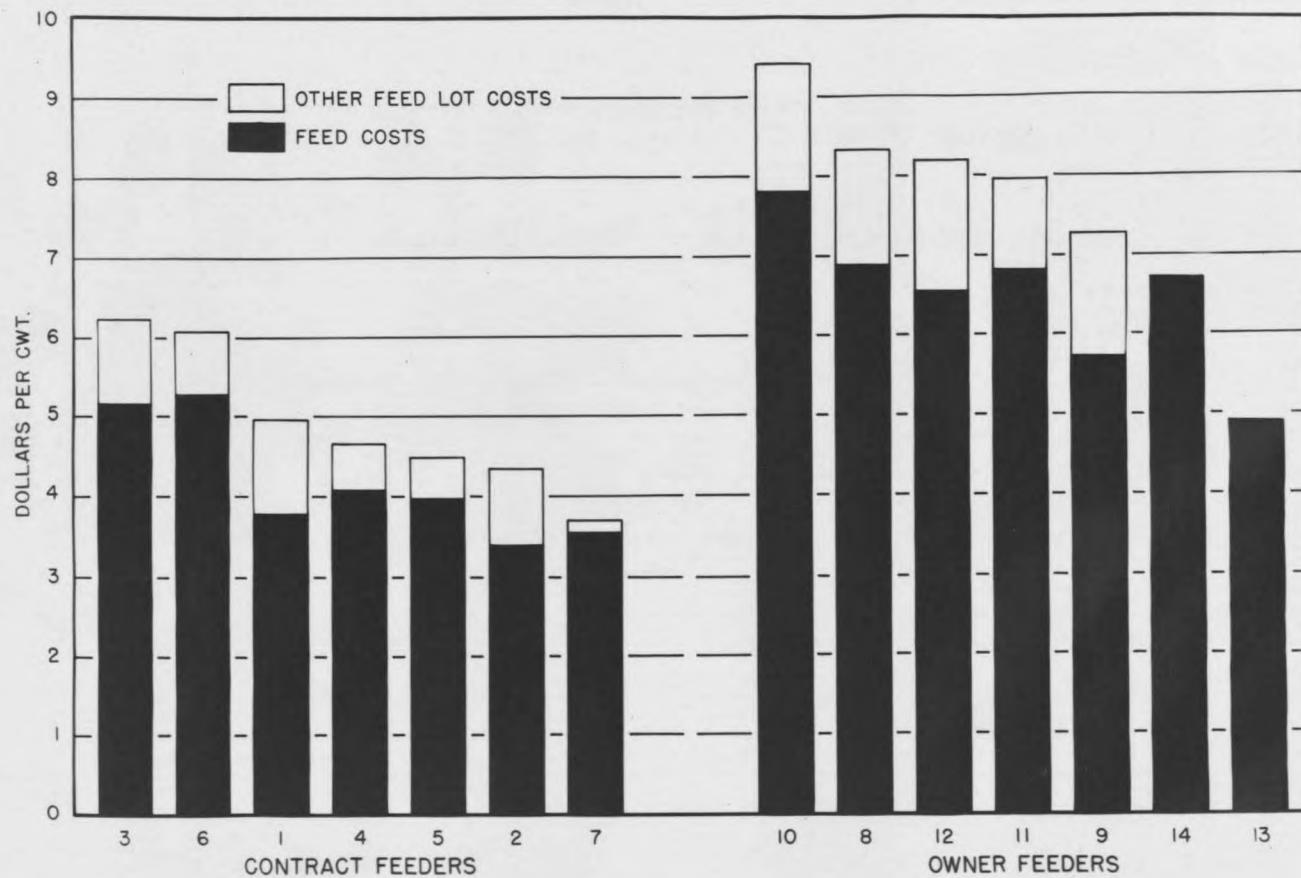


Figure 4.--Comparative costs of producing 100 pounds of gain for lambs on fourteen selected Montana farms, 1938-1939

anything for equipment use.

In the case of the contract feeders, other feedlot costs varied from 4.05 per cent to 23.84 per cent of all costs and the average was 15.85 per cent. The owner feeders who had other feedlot costs listed, had a range of 14.30 to 21.40 per cent and an average for all owner feeders of 16.11 per cent. In a year when feed costs are low, one can naturally expect the other feedlot costs to comprise a high percentage of the total costs. However, in a year of high feed prices, the other feedlot costs would not amount to as high a percentage of the total costs per hundred-weight of gain.

Importance of Manure Produced as a Factor
Affecting Net Returns

An attempt was made to find out something about the value of the manure produced by the lambs on the different farms. The figures as given in most cases varied so much that it was thought best to reduce them all down to a standard basis.

The number of lambs finished were divided by 12 to give the number of one thousand pound animal units on each farm. A figure of 33.15 pounds was used as the production of manure per day per animal unit. The average length of time the lambs were in the dry lot was used as the length of the recovery period. The manure produced was valued at \$3.57 per ton. These figures were obtained from a study made under much the same conditions in Nebraska. 21/

The value of manure produced per head ranged from a low of 24 cents

21/ Harris, Lionel, Op. cit.

TABLE IX.--MANURE; AMOUNT PRODUCED PER ANIMAL UNIT OF 1000 POUNDS
AND VALUE PER HEAD ON FOURTEEN MONTANA FARMS IN 1938-1939

Feeder number	Length of recovery period	Number of animal units of 1000 lbs. live weight	Amount of manure produced (tons)	Value of manure produced (dollars)	Value per head (cents)
1	71	132	155	553.35	35
2	84	102	193	689.01	56
3	86	108	154	549.78	42
4	88	107	156	556.92	43
5	84	125	172	614.04	41
6	87	101	146	521.22	43
7	77	121	154	549.78	38
8	85	91	128	456.96	42
9	103	91	155	553.35	51
10	76	167	210	749.70	37
11	90	77	115	410.55	45
12	78	200	259	924.63	38
13	94	68	106	378.42	46
14	49	81	66	235.62	24
Total			2,169	7,743.33	42
					Ave. for all feeders

for feeder 14, who had his lambs in the dry lot only 49 days, to a high of 56 cents per head for feeder 2 who had his lambs in the dry lot for 84 days. The average for all lambs was 42 cents per head.

These figures no doubt look rather high but they are based on actual farm data under conditions that are much the same as found in the areas in which this study was made.

Important Considerations Necessary to the Success
of any Lamb Feeding Enterprise

The feeders were questioned in regard to the important considerations necessary to the success of any lamb feeding enterprise. Most of them agreed that lambs should not be too heavy when purchased, that is, lambs weighing over 75 pounds should not be bought. Many of them stated that lambs weighing between 60 and 70 pounds would be best to buy but stated that care should be taken when buying light lambs because they may be light due to unthriftiness and sickness. Runty lambs are not good feeders.

Other considerations deemed of importance were, hired good labor, feed a well balanced ration, keep the lambs well bedded at all times, do not make sudden changes in feed, furnish plenty of clean water, separate the lambs according to size, and feed at regular intervals. Several feeders stated that it might be a good thing to treat the lambs for worms as soon as they are put in the feedlot. Another important thing is to feed enough lambs to efficiently use the equipment at hand. Finally, only fat lambs should be shipped in order to get the highest possible price. Some feeders have developed a reputation on the large central

markets so that their lambs sell at a premium.

RESULTS OBTAINED BY CONTRACT FEEDERS WHEN FIGURED
ON AN OWNER FEEDER BASIS

Table X shows what the results obtained by the contract feeders would have been like had they owned their lambs. The same purchase price of \$6.63 as used for the owner feeders was used in calculating the lamb cost in the feedlot. An interest charge of 9 cents was also added.

To figure the income, 4.8 per cent of the final weight was subtracted to take care of shrinkage. This is the average amount that the owner-fed lambs shrank enroute to market. The average sale price of \$7.98 per hundredweight obtained by the owner feeders was used in figuring the income from lambs sold.

In the final analysis, we find that the computed labor income was larger in all cases than the actual labor income. The first six feeders who received 9 cents per pound of gain, would have made from 1 cent to 12 cents more per head had they owned the lambs. Feeder 7 who received 7 cents per pound of gain, would have made 70 cents more per head.

The results as obtained in table X, however, must be studied very carefully. It is the belief of the investigator that the average shrink for the contract fed lambs would have been higher than 4.8 per cent because of the ration on which they were fed. Also, these lambs did not show as much quality as the owner-fed lambs because they were extremely heavy and there is no doubt that they would not have received an average of \$7.98 per hundredweight on the open market. Therefore, it can be said that in the case of the first six feeders they were better off to feed on a

TABLE X.--RESULTS OBTAINED BY CONTRACT FEEDERS WHEN FIGURED ON AN OWNER FEEDER BASIS

	Feeder number						
	1	2	3	4	5	6	7
	dollars	dollars	dollars	dollars	dollars	dollars	dollars
Cost per finished lamb:							
Lamb cost	4.60	4.77	5.04	4.81	4.75	5.24	5.31
Feed	1.24	1.19	1.77	1.40	1.45	1.72	.87
Other feedlot costs	.39	.33	.38	.20	.19	.27	.04
Interest	.09	.09	.09	.09	.09	.09	.09
Total cost per finished lamb	6.32	6.38	7.28	6.50	6.48	7.34	6.31
Income per finished lamb:							
Lamb	7.71	8.07	8.34	8.01	8.14	8.32	7.83
Manure	.35	.56	.42	.43	.41	.43	.38
Total income	8.06	8.63	8.76	8.54	8.55	8.75	8.21
Labor income figured on owner basis	1.74	2.25	1.48	2.04	2.07	1.41	1.90
Actual labor income obtained	1.69	2.20	1.38	1.92	2.06	1.33	1.20
Difference	+.05	+.05	+.10	+.12	+.01	+.08	+.70

contract basis because they received as much labor income and did not have to bear the risks involved in owning lambs outright.

RECOMMENDED PLAN TO USE

A feeder buying 1,250 lambs will be used as an hypothetical case. When the lambs are first bought, at least 250 of the biggest and fattest lambs should be cut out and placed in the dry lot and finished as quickly as possible. When these 250 are finished, the next fattest lot should be cut out and placed in the feedlot on self feeders. The thinnest lambs and smallest lambs should be pastured as long as possible and then put into the feedlot. However, only the fattest ones should be self-fed so that the others could be hand-fed on a limited amount of grain and given all the roughage that they will consume. By holding back the smallest and thinnest lambs, more use can be made of cheap roughages and crop residues thus decreasing the cost of gains.

The average daily gains would be low but this would be compensated by the low cost.

Another point in favor of such a plan is that only finished lambs of uniform size would be shipped making for a higher quality product that would command a higher price on the market.

THE PLACE OF LAMB FEEDING ON MONTANA FARMS

Utilizes Home Grown Feeds.--Most of the feeders in this study utilized large quantities of home grown feeds such as alfalfa, corn fodder, oats, barley, and wheat. Some feeders used more commercial feeds than home-grown feeds but most of them used more home grown feeds. In

this way, the fattening of lambs furnished a good market for a major portion of the feeds raised by the farmers. Large quantities of crop residues such as beet tops and alfalfa stubble were made use of that would otherwise be wasted in most cases.

Helps Maintain Soil Fertility of Farms.---The feeding of the home-grown feeds on the farm, rather than selling them makes possible the returning of a large share of the fertilizing constituents in the crops to the soil. Some of the commercial feeds used also had a high manurial value. An average of 155 tons of manure was produced per farm at an average value of \$3.57 per ton. The application of this amount of manure to 10 to 15 acres on each farm will do much to maintain or improve the soil fertility. One feeder stated that the manure he applied on his particular farm had increased the income in rent paid to his landlord by one-half in just a few years.

Makes Use of Labor at Slack Season.---The work of growing and harvesting of farm crops on an irrigated farm keeps the farmer busy from spring to fall. Unless the production of crops is supplemented with some kind of livestock, not much productive work can be done during the winter. With an average length of feeding period of 100 days, the feeders were able to utilize their time very profitably by feeding lambs whereas their time might have been wasted.

Reduces the Share of Farm Overhead to each Enterprise.---In the operation of a farm there are many expenses which cannot be charged directly against any particular enterprise. Such items as telephone and light bills, auto expense, labor or miscellaneous jobs, depreciation

on certain equipment, taxes, and license fees for trucks and cars are listed as overhead charges. If lambs are fed they may be charged with their proportionate share of this overhead charge thus reducing the amount charged against other enterprises.

Summary

Besides making use of labor during slack periods, utilizing home-grown feeds, reducing the overhead expenses to each enterprise and helping to maintain the soil fertility, lamb feeding also helps to enlarge the volume of business and increase the receipts to the farm above that which is received from crops. In this way, the farm income can be increased and possibilities of providing a satisfactory standard of living are greater.

It has been the purpose of this study to find out the effect of various factors on the costs and returns of lamb fattening. The results obtained in this study indicate that the following factors are of primary importance, namely:

(1) The feeding efficiency, which as used in this study, is the ability of the farmer to so utilize his time as to obtain the greatest possible gain from the feed used and to use his time and equipment in such a way that he will obtain the most profitable results under the existing conditions.

(2) The margin between the purchase price and the sale price. In this study those feeders having the widest margin obtained the largest income per lamb finished.

(3) Death Loss. As found in this study, the percentage of death loss can have a very definite effect on the results obtained. Only one of the feeders had a relatively high death loss and his returns were lowered to quite an extent.

(4) Cost of producing the gain. This was also found to be a very important factor.

(5) Miscellaneous factors. Other factors such as length of feeding period, average daily gain, average total gain per lamb, number of lambs fed, and weight of lambs bought had some influence on costs and returns, but were of less importance.

In closing, the writer wishes to state that it is his belief that it is possible to fatten lambs profitably in our irrigated valleys here in Montana where large quantities of cheap home-grown feeds are produced. Particularly is it important where sugar beets are produced because the by-products of the industry make excellent sheep feed and also the yield of beets is greatly increased where farm manure is used as fertilizer. After all, why should we ship our lambs to the Corn Belt to be fattened when we can do the job just as well here in our own state?

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