



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.

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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.

THE ECONOMICS OF LAMB FATTENING


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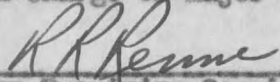
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Approved:



In Charge of Major Work



Chairman Examining Committee



Chairman Graduate Committee

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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 I.--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/ Rinohard, E. F., Hickman, C. W., and Johnson, E. 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 feeders 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 fed 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.

