FATTENING LAMBS

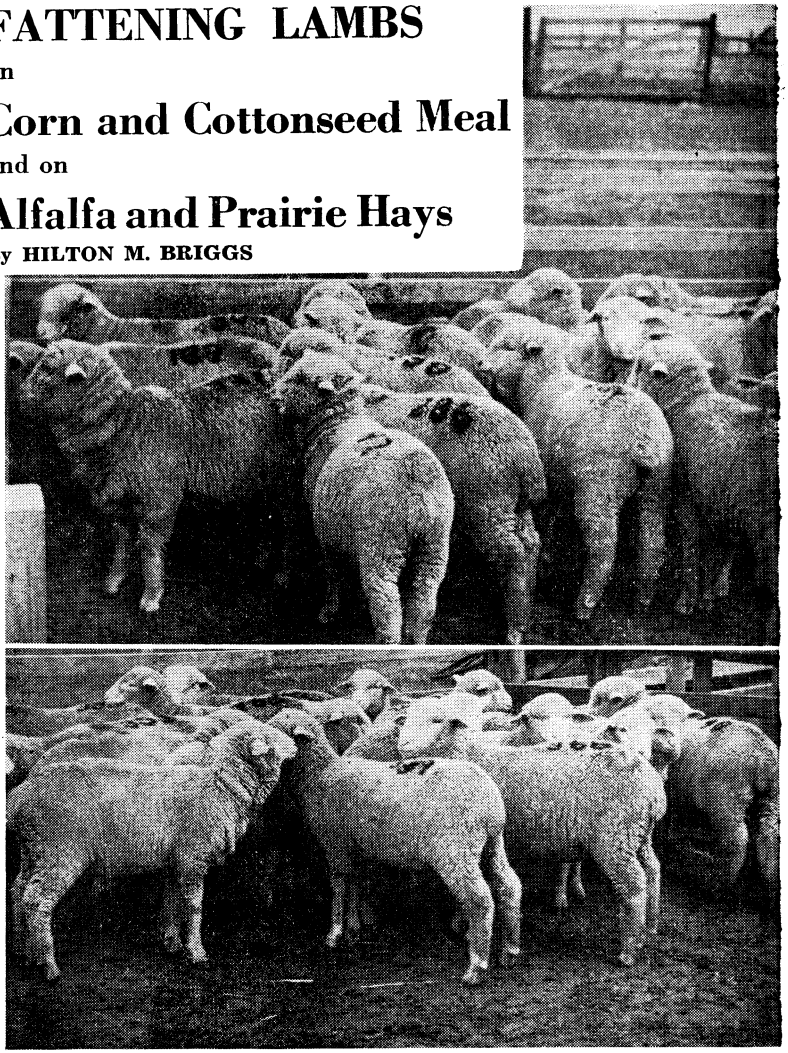
on

Corn and Cottonseed Meal

and on

Alfalfa and Prairie Hays

By HILTON M. BRIGGS



Two lots of western lambs being used in feeding tests at the Oklahoma Agricultural Experiment Station. Oklahoma is strategically located as a lamb-feeding area, between the centers of lamb production and lamb consumption.

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SUMMARY

An experiment was conducted with 120 white-faced Texas feeder lambs in each of three separate years to determine the relative values of cottonseed meal and corn grain and of prairie hay and alfalfa hay. Each year six lots, each consisting of 20 lambs, were fattened.

Cottonseed Meal vs. Corn

The addition of .1 pound of cottonseed meal improved a ration of corn and alfalfa hay only one year out of three.

Cottonseed meal in excess of .1 pound per head daily had an average value 81.3 percent that of yellow shelled corn in the lamb fattening ration.

Lambs receiving large amounts of cottonseed meal became as fat and produced as desirable carcasses as corn fed lambs.

Large amounts of cottonseed meal apparently did not interfere with the appetites or health of fattening lambs receiving yellow corn and alfalfa hay.

Prairie Hay vs. Alfalfa Hay

Prairie hay had a feeding value 87.5 percent that of alfalfa when used for fattening lambs on a limited hay ration with corn and cottonseed meal supplemented with finely ground limestone.

Alfalfa hay proved to be more palatable than the prairie hay used in the study.

The value of prairie hay was not improved by adding small amounts of alfalfa hay.

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FATTENING LAMBS ON CORN AND COTTONSEED MEAL AND ON PRAIRIE AND ALFALFA HAYS

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To the south and west of Oklahoma lies Texas, a great producer of feeder lambs. To the north and east are the lamb-consuming centers. Oklahoma, lying between the two, has opportunity to profit by fattening western lambs, which is an important farm industry in the Corn Belt.

Wheat pasture provides the most economical method of fattening lambs in Oklahoma. But wheat pasture is not available every year, and in some areas it is limited even in the best years. The alternative is dry lot feeding; and the Oklahoma Agricultural Experiment Station, therefore, conducted feeding trials for three years to determine whether Oklahoma's cottonseed meal could profitably replace the Corn Belt's corn and if Oklahoma's prairie hay crop could be used to replace more expensive alfalfa in obtaining a desirable market finish.

The results of these tests indicated that cottonseed meal had a value about four-fifths that of shelled yellow corn, and that it could be fed to lambs in large quantities without impairing the health and appetites of the lambs or the quality of the carcasses, as long as the remainder of the ration provided adequate vitamins and minerals. The comparison of prairie hay and alfalfa was not quite so clear cut. Apparently, however, a high grade of prairie hay will come close to equaling alfalfa, while a low grade of hay has a much lower feeding value.

HOW TESTS WERE MADE

In each of the three seasons during which the tests were conducted, 20 head of white-faced western feeder lambs were placed in each of six lots. To have the lots as even as possible, 150 or more lambs were purchased each season and weighed on three successive days. The heaviest and lightest lambs were used for other purposes, and the 120 nearest the average weight were divided into uniform lots. During the tests, each lamb was weighed every seven days. All rations were designed so there would be no deficiency of any known nutritive factor, including vitamins and minerals.

Comparing Corn and Cottonseed Meal

Lots I, II and III were used to compare shelled yellow corn and 43 percent cottonseed meal. The rations used were:

Lot I	Cottonseed meal	.1 pound.
	Shelled yellow corn	Nearly full-fed.
	Alfalfa hay	Nearly full-fed.
Lot II	Shelled yellow corn	Enough to produce the same gain as Lot I.
	Alfalfa hay	Same as Lot I.
Lot III	Shelled yellow corn	One-half of the amount fed to Lot I.
	Cottonseed meal	Enough to produce the same gain as Lot I.
	Alfalfa hay	Same as Lot I.

Lambs in all three lots were fed to gain as nearly as possible at the same rate, and all three lots were fed identical amounts of hay. Therefore any differences in the amount of concentrate required should show the comparative value of the feeds.

Lot I was the check lot, used as a basis for making comparisons. The lambs were maintained at a level of feeding just slightly under full-fed to give a slight margin of safety to take care of any effect that changes in temperature might have upon the appetites.

Lot II was fed no protein supplement, so that it could be compared with Lot I to determine the value of adding small amounts of cottonseed meal to a ration of corn and alfalfa.*

Lot III was used to get a direct comparison of the value of cottonseed meal and yellow corn as a concentrate for fattening lambs.

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* Morrison concludes after summarizing 49 lamb-feeding experiments that small additions of linseed meal or cottonseed meal to a lamb-fattening ration of corn and alfalfa hay will usually give a slight increase in the rate of gain. He points out, however, that at the usual prices of these supplements their addition to the ration is not economical. See F. B. Morrison, *Feeds and Feeding, A Handbook for the Student and Stockman.* 20th edition, unabridged, p. 728. Morrison Publishing Co., Ithaca, N. Y.

Comparing Alfalfa Hay and Prairie Hay

Lots IV, V, and VI were used to compare alfalfa hay and prairie hay. The rations used were:

Lot IV	Shelled yellow corn	Three-fourths of the concentrate allowance.
	Cottonseed meal	One-fourth of the concentrate allowance.
	Prairie hay	Full-fed.
	Ground limestone	¼ ounce daily.
Lot V	Shelled yellow corn	Same as Lot IV.
	Cottonseed meal	Same as Lot IV.
	Alfalfa hay	Enough to produce same gain as Lot IV.
Lot VI	Shelled yellow corn	Same as Lot IV.
	Cottonseed meal	Same as Lot IV.
	Alfalfa hay	.3 pound.
	Prairie hay	Enough to produce same gain as Lot IV.
	Ground limestone	¼ ounce daily.

As in the comparison of corn and cottonseed meal, all the three lots were fed to gain as nearly as possible at the same rate. But here the rate of gain was controlled by varying the kind and amount of roughage while the same amount of concentrates was fed to all three lots. Therefore any difference in the amount of roughage required should show the comparative value of the roughages.

Lot IV was the check lot, and the lambs were fed all the prairie hay they would clean up. Lots V and VI were fed just enough hay to keep them gaining at the same rate as Lot IV. The finely ground limestone was added at each feeding to the concentrate mixture for Lots IV and VI to overcome the shortage of calcium in the prairie hay.

Lot V was used to compare prairie hay and alfalfa hay when each was fed alone.

Lot VI was given a small amount of alfalfa hay along with the prairie hay to study the advantage of including a small amount of legume hay in a non-legume ration in order to supply vitamins and essential minerals that might be lacking in the prairie hay ration.

General Care Given the Lambs

The lambs were fed in dry lot and had adequate shelter to protect them from inclement weather. Fresh water, salt, and

a simple mineral mixture were before them at all times. The mineral mixture consisted to two parts of steamed bone meal, two parts of finely ground limestone, and one part of salt.

The proportion of hay and concentrate was varied during the feeding period. At the beginning of the feeding period, hay furnished over one-half of each ration, but during the later part furnished less than half of the total.

Some trouble was experienced each year with the virus disease known as "lip and leg ulcer." The sores on the lambs' lips yielded to treatment with silver nitrate.

One week after arrival at the station, the lambs were treated for internal parasites with copper sulphate and nicotine sulphate.

Starting the Lambs on Feed

The lambs were allowed prairie hay on arrival, and were started on feed by allowing a small amount of oats at each feeding until all lambs were eating readily. The oats were then increased, and in a few days small amounts of corn and cottonseed meal were added. The proportion of oats in the ration was decreased and the other concentrates increased until the lambs were receiving a concentrate mixture of one-third cottonseed meal and two-thirds shelled corn. Prairie hay was fed in the morning and alfalfa hay at night. The lambs took their feed readily and were on what might be called "almost full feed" in three weeks. At that time the lambs were weighed and allotted to the six lots.

Determining Market Quality

To determine the market quality of the lambs, the lots were ranked at the Oklahoma City market each year by commission men and packer buyers. After slaughter, each carcass was graded by the packing company's regular grader, and the shrinkage and dressing percentage determined for each lot.

RESULTS OF THE TESTS

Cottonseed Meal Has Four-Fifths the Value of Shelled Yellow Corn

The percentage value of cottonseed meal as compared to shelled yellow corn was upward of 80 percent, as is shown in Table I. Feed consumed and gains produced for these three years are shown in Table II while this information for each respective year is given in Tables IV, V, and VI.

TABLE I.—Percentage Value of Cottonseed Meal as Compared to Corn in Fattening Lambs.

	1936-37	1937-38	1938-39	Three Years Combined
Comparing Lots I & III	71.6	93.6	75.3	81.3
Comparing Lots II & III	83.3	95.3	75.4	84.3

Comparing Lot I which received .1 pound of cottonseed meal daily and the rest of its concentrate in the form of corn, with Lot II which received corn only, the 30.4 pounds of cottonseed meal consumed by Lot I replaced 31.6 pounds of corn plus .5 pound of alfalfa hay. (Table II.) This difference is not enough to be significant.

By comparing Lot I with Lot III, where one-half of the corn was replaced with enough cottonseed meal to produce the same daily gains, the advantage of adding the first .1 pound of cottonseed meal is removed. In this comparison, the additional .65 pounds of cottonseed meal per head daily had a value of 81.3 percent that of the yellow shelled corn. This value is based upon the fact that the additional 206.9 pounds of cottonseed meal fed per hundred pounds gain replaced 171.5 pounds of corn minus 6.1 pounds of alfalfa hay.*

Comparing Lot II, which received no cottonseed meal, with Lot III, which received an average of .73 pounds of cottonseed meal per head daily, 237.3 pounds of cottonseed meal replaced 203.1 pounds of corn minus 5.6 pounds of hay in putting on a hundred pounds gain. This would give cottonseed meal a value of 84.3 percent of corn. The somewhat higher value on this basis is probably because Lot II received slightly less than the optimum amount of protein in two out of the three years.

As indicated in Table I, the values secured in these experiments varied considerably. This is probably due to variation in the feedstuffs used. All three years No. 2 corn was specified in ordering; but, unfortunately, federal grades and chemical analysis showed the corn to differ decidedly. Likewise, the grade and character of the alfalfa were not consistent.

The carcass finish on all the lots of lambs was similar, any variation falling within the range of variation to be expected in routine packinghouse grading. Shrinkage and dressing per-

* This percentage cannot be calculated directly from the figures given in Table I, but must take into account the estimated net energy value of the various feeds. See F. B. Morrison, *Feeds and Feeding, A Handbook for the Student and Stockman.* 20th edition, p. 994. Morrison Publishing Co., Ithaca, N. Y.

centage figures for the first year's test were variable; but for the last two years they were very uniform and very similar among the various lots.

The lambs in Lot III which received the high allowance of cottonseed meal did not show any tendency to go off fed or to develop digestive or nutritive disturbances. They never seemed to become tired of the heavy feeding of cottonseed meal, and would apparently have consumed larger amounts.

Value of Prairie Hay Depends on Quality of Hay

There is little doubt that the feeding value of prairie hay is more variable than that of most other roughages. As shown

TABLE II.—A Three-year Summary Comparison of the Values of Corn, Cottonseed Meal, Alfalfa Hay, and Prairie Hay in Fattening Lambs.

Lot number	I	II	III	IV	V	VI
Ration:	Corn C. S. Meal Alf. Hay	Corn Alf. Hay	Corn C. S. Meal Alf. Hay	Corn C. S. Meal Pr. Hay Ground Limestone	Corn C. S. Meal Alf. Hay	Corn C. S. Meal Pr. Hay Alf. Hay Ground Limestone
No. lambs in lot	57 (1)	60	60	59 (2)	60	58 (3)
Av. No. days fed	96.3	96.3	96.3	96.3	96.3	96.3
Av. initial wt.	62.6	62.2	62.3	62.3	62.3	62.6
Av. final wt.	94.1	93.2	92.8	89.1	90.0	89.6
Av. daily gain	.327	.322	.317	.278	.287	.280
Av. daily feed						
Corn	1.16	1.25	.58	.97	.97	.97
Cottonseed meal	.10	---	.75	.33	.33	.33
Alfalfa hay	1.17	1.17	1.17	---	.92	.29
Prairie hay	---	---	---	1.00	---	.77
Gr. limestone	---	---	---	.03	---	.03
Salt	.02	.02	.02	.02	.02	.02
Mineral	.01	.01	.01	.01	.01	.01
Feed per cwt. gain						
Corn	355.6	387.2	184.1	348.5	337.5	346.1
Cottonseed meal	30.4	---	237.3	118.2	114.5	117.5
Alfalfa hay	361.8	362.8	367.9	---	321.7	104.0
Prairie hay	---	---	---	361.0	---	273.2
Gr. limestone	---	---	---	10.8	---	10.7
Salt	6.0	5.9	6.3	7.3	8.4	7.7
Mineral	3.2	2.9	2.9	4.3	3.9	2.9

(1) Two lambs died and one lamb was removed in 1936-37.
(2) One lamb died in 1938-39.
(3) One lamb was removed in 1936-37 and one in 1938-39.

in Table III, its value for fattening lambs as found in these tests ranged from 100 percent that of alfalfa hay down to 37.1 percent.

TABLE III.—Percentage Value of Prairie Hay as Compared to Alfalfa Hay in Fattening Lambs.

	1936-37	1937-38	1938-39	Three Years Combined
Comparing Lot IV and V	60.5	99.8	87.5	87.5
Comparing Lots V and VI	37.1	100.0	88.2	71.8

The hay used in 1936-37 was somewhat coarse, had few leaves, was rather dark in color, and appeared to have been weathered. It was graded No. 3 by the Bureau of Agricultural Economics of the United States Department of Agriculture. The hay was, however, surprisingly palatable to the lambs. The hay used in 1937-38 was of high quality, and this is reflected in its very favorable comparison with alfalfa that year. This same hay was used in 1938-39 because it was impossible to secure satisfactory new-crop prairie hay.

In the last two years of the test, the carcass grades on the prairie hay lots were similar to those on the alfalfa-fed lots; but in 1936-37 the carcasses from Lots IV and VI were graded somewhat lower than those in Lot V because they did not carry as much finish. The lambs in Lots IV and VI also sold for slightly less money that year than did those from the alfalfa-fed lot. Average data for the three years is shown in Table I, and for each year in tables IV, V, and VI.

Economy of Feeds Under Varying Market Conditions

Tables IV, V, and VI present the financial costs and returns for the different lots of lambs for the three years. These figures have no bearing on the comparative values of the feeds, but they do provide a basis upon which lamb feeders can quickly determine, for various lamb prices and feed prices, which feeds will give the greatest amount of gain at the lowest feed cost.

TABLE IV.—A Comparison of the Values of Corn, Cottonseed Meal, Alfalfa Hay, and Prairie Hay in Fattening Lambs; Nov. 10, 1936 to Feb. 14, 1937—96 days.

Lot number	I	II	III	IV	V	VI
Ration:	Corn C. S. Meal Alf. Hay	Corn Alf. Hay	Corn C. S. Meal Alf. Hay	Corn C. S. Meal Pr. Hay Ground Limestone	Corn C. S. Meal Alf. Hay	Corn C. S. Meal Pr. Hay Alf. Hay Ground Limestone
No. lambs in lot	17	20	20	20	20	19
Initial weight	63.9	63.6	63.5	63.3	63.3	63.9
Final weight	93.5	92.4	91.8	86.4	88.0	86.6
Av. daily gain	.308	.300	.295	.240	.266	.236
Av. daily ration:						
Corn	1.05	1.16	.54	.85	.85	.85
Cottonseed meal	.10		.71	.30	.30	.30
Alfalfa hay	1.13	1.13	1.13		.95	.27
Prairie hay				1.09		.90
Gr. limestone				.03		.03
Salt	.03	.02	.02	.03	.04	.03
Mineral	.01	.01	.01	.01	.01	.01
Nutritive Ratio	1:5.9	1:6.9	1:2.9	1:6.6	1:4.5	1:6.1
Feed required per cwt. gain:						
Corn	340.4	386.2	183.7	352.3	318.5	358.9
Cottonseed meal	32.2		239.4	125.0	113.0	127.5
Alfalfa hay	366.7	376.7	382.6		360.5	116.0
Prairie hay				453.9		380.1
Gr. limestone				12.5		12.7
Salt	10.3	7.2	7.7	10.2	14.2	13.0
Mineral	2.8	2.0	2.0	4.4	3.1	2.0
Feed cost per cwt. gain (1):	$11.20	$11.58	$12.17	$12.79	$12.32	$13.58
Financial result per lamb:						
Selling price per cwt.	$9.75	$9.75	$9.75	$9.60	$9.75	$9.65
Sale value	9.11	9.01	8.95	8.29	8.67	8.36
Initial cost	4.54	4.52	4.51	4.50	4.50	4.54
Feed cost (1)	3.33	3.33	3.44	2.96	3.14	3.08
Death loss	.06	.06	.06	.06	.06	.06
Mkt. & shrink. chg.	.49	.76	.92	.44	.66	.78
Total cost	$8.41	$8.67	$8.93	$7.96	$8.36	$8.46
Profit per lamb	.70	.34	.02	.33	.31	—.10

(1) Feed prices: Corn $1.15 per bu., Alfalfa hay $18.50 per ton, Prairie hay $11.50 per ton, Cottonseed meal $40.00 per ton, Ground limestone $1.00 per cwt., Salt $.50 per cwt., Mineral $2.00 per cwt.

TABLE V.—A Comparison of the Values of Corn, Cottonseed Meal, Alfalfa Hay, and Prairie Hay in Fattening Lambs; Oct. 30, 1937 to Feb. 1, 1938—94 days.

Lot number	I	II	III	IV	V	VI
Ration:	Corn C. S. Meal Alf. Hay	Corn Alf. Hay	Corn C. S. Meal Alf. Hay	Corn C. S. Meal Pr. Hay Ground Limestone	Corn Alf. Hay C. S. Meal	Corn C. S. Meal Pr. Hay Alf. Hay Ground Limestone
No. lambs in lot	20	20	20	20	20	20
Initial weight	61.2	60.7	61.0	60.8	61.2	61.1
Final weight	92.6	92.1	92.5	89.9	90.3	90.3
Av. daily gain	.334	.334	.335	.310	.310	.310
Av. daily ration:						
Corn	1.22	1.32	.61	1.05	1.05	1.05
Cottonseed meal	.10	---	.75	.35	.35	.35
Alfalfa hay	1.13	1.13	1.13		1.00	.30
Prarie hay	---	---	---	1.00	---	.70
Gr. limestone	---	---	---	.03	---	.03
Salt	.01	.01	.01	.01	.01	.01
Mineral	.01	.01	.01	.01	.01	.01
Nutritive Ratio	1:5.7	1:6.5	1:2.7	1:6.0	1:4.2	1:5.4
Feed required per cwt. gain:						
Corn	364.3	396.3	182.1	340.1	340.2	339.8
Cottonseed meal	29.9	---	224.8	113.2	113.2	113.1
Alfalfa hay	336.9	336.9	336.7		321.4	96.7
Prairie hay	---	---	---	322.3	---	225.4
Gr. limestone	---	---	---	9.7	---	9.7
Salt	4.8	4.3	4.2	4.2	4.5	4.5
Mineral	2.1	2.4	2.1	2.6	2.3	2.3
Feed cost per cwt. gain (1)	$6.79	$6.79	$7.12	$6.56	$7.42	$6.85
Financial result per lamb:						
Selling price per cwt.	$6.50	$6.50	$6.50	$6.50	$6.50	$6.50
Sale value	6.02	5.99	6.01	5.85	5.87	5.87
Initial cost	5.57	5.52	5.55	5.53	5.57	5.56
Feed cost (1)	2.13	2.13	2.24	1.91	2.16	1.99
Death loss	.00	.00	.00	.00	.00	.00
Mkt. and shrink. chg.	.44	.45	.45	.45	.45	.44
Total cost	$8.14	$8.10	$8.24	$7.89	$8.18	$7.99
Profit per lamb	$—2.11	$—2.11	$—2.23	$—2.04	$—2.31	$—2.12

(1) Feed prices: Corn $.62 per bu., Alfalfa hay $14.00 per ton, Prairie hay $8.50 per ton, Cottonseed meal $24.00 per ton, Ground Limestone $1.00 per cwt., Salt $.50 per cwt., Mineral $2.00 per cwt.

TABLE VI.—A Comparison of the Values of Corn, Cottonseed Meal, Alfalfa Hay, and Prairie Hay in Fattening Lambs; Nov. 12, 1938 to Feb. 19, 1939—99 days.

Lot number	I	II	III	IV	V	VI
Ration:	Corn C. S. Meal Alf. Hay	Corn Alf. Hay	Corn C. S. Meal Alf. Hay	Corn C. S. Meal Pr. Hay Ground Limestone	Corn C. S. Meal Alf. Hay	Corn C. S. Meal Pr. Hay Alf. Hay Ground Limestone
No. lambs in lot	20	20	20	*19	20	*19
Initial weight	63.0	62.4	62.3	62.9	62.4	62.8
Final weight	96.1	95.2	94.2	91.0	90.7	91.9
Av. daily gain	.334	.332	.322	.284	.286	.294
Av. daily ration:						
Corn	1.20	1.26	.60	1.01	1.01	1.01
Cottonseed meal	.10	---	.80	.34	.34	.34
Alfalfa hay	1.24	1.24	1.24	---	.83	.30
Prairie hay	---	---	---	.92	---	.70
Gr. limestone	---	---	---	.03	---	.03
Salt	.02	.02	.02	.02	.02	.02
Mineral	.01	.01	.01	.02	.02	.01
Nutritive ration	1:5.4	1:5.8	1:2.6	1:6.5	1:4.1	1:5.5
Feed required per cwt. gain						
Corn	358.3	379.3	186.5	354.3	351.7	342.0
Cottonseed meal	29.5	---	247.7	118.1	117.1	114.0
Alfalfa hay	370.9	374.0	385.5	---	289.6	102.2
Prairie hay	---	---	---	323.0	---	239.6
Gr. limestone	---	---	---	10.5	---	10.1
Salt	6.2	6.2	7.1	7.5	7.2	7.0
Mineral	4.4	4.4	4.6	6.1	6.2	4.6
Feed cost per cwt. gain (1)	$5.58	$5.40	$6.96	$5.76	$6.30	$5.85
Financial result per lamb:						
Selling price per cwt.	8.00	8.00	8.00	8.00	8.00	8.00
Sale value	7.69	7.62	7.53	7.28	7.26	7.35
Initial cost	4.10	4.05	4.05	4.09	4.05	4.68
Feed cost (1)	1.85	1.77	2.21	1.62	1.78	1.70
Death loss	.03	.03	.03	.03	.03	.03
Mkt. and shrink. chg.	.54	.54	.54	.53	.53	.54
Total cost	6.52	6.39	6.83	6.27	6.39	6.35
Profit per lamb	$1.17	$1.23	$ .70	$1.01	$ .87	$1.00

(1) Feed prices: Corn $.50 per bu., Alfalfa hay $10.00 per ton, Prairie hay $5.00 per ton, Cottonseed meal $26.00 per ton, Ground limestone $13.00 per ton, Salt $.50 per cwt., Mineral $2.00 per cwt.

* One lamb died in Lot IV and one was removed from Lot VI.