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LAMB FEEDING EXPERIMENTS WITH ATLAS SORGO

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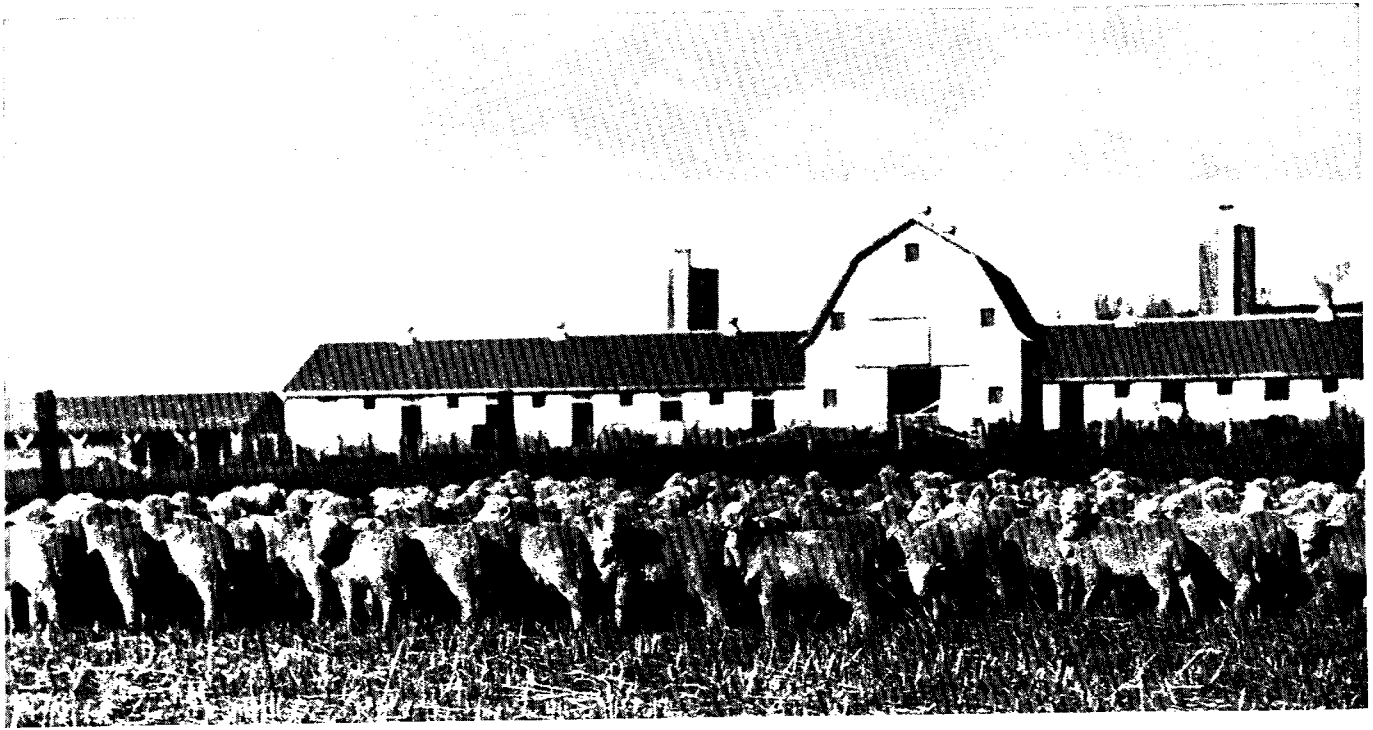

FIG. 1.—The experimental lambs at the beginning of the feeding period. Weight approximately 62 pounds each.

LAMB FEEDING EXPERIMENTS WITH ATLAS SORGO[1]

R. F. COX AND W. E. CONNELL

INTRODUCTION

The various grain sorghums are grown in western Kansas far in excess of local demands. Consequently, it is often necessary to dispose of the surplus on the cash market. Because of the limited knowledge of their high feeding value, especially outside the grain-sorghum belt, sorghum grains are often at a distinct disadvantage on the open market. This often results in lower prices being paid for sorghum grains than their feeding value justifies. This condition has stimulated farmers and feeders to seek additional outlets for such crops. The feeding of grain sorghums to western lambs is one enterprise that many Kansas farmers are adopting as a means of marketing their surplus sorghum crops. There are many reasons why this seems to be a logical move. Aside from the fact that many feeds suitable for lamb feeding are produced in this section. Kansas lies directly between the chief sources of supply for range lambs and several of the large central river markets, to which fed lambs commonly move. Furthermore, several trunk-line railroads cross the state, connecting the ranges and the market, making feeding in transit possible.

In many sections of Kansas alfalfa is ordinarily plentiful, especially in the valleys, but in much of the region where grain sorghums are grown, alfalfa or any other hay is scarce and usually high in price. It was thought that if the grain-sorghum fodders could be properly prepared and fed, taking the place of alfalfa, wholly or in part, as the roughage portion of the ration, the feeding of lambs could be much more economically carried out. Some feeders in those localities where sorghum crops are grown, already are grinding and feeding the fodder of the various sorghums. Some farmers feed the ground sorghum alone or with a small allowance of protein supplement, while others add some grain, but nowhere is there any standardization of practices. Sufficient information is not available to warrant any definite statements as to the best methods of mixing and feeding such feeds. Experiments dealing with the feeding of ground sorghum fodder were, therefore, begun at this station in an effort to determine to what extent the sorghum crops might be utilized profitably for lamb feeding.

Atlas sorgo, a cross between Blackhull kafir and Sourless sorgo, was chosen for this study because it is one of the highest yielding and most satisfactory sorghum crops for those sections of Kansas where sorghums are grown. The stalk of atlas is sweet while the

1. Contribution No. 99 from the Department of Animal Husbandry.

grain is similar to kafir grain. It is believed that the methods employed and results obtained from feeding atlas will be, in a general way, applicable to the feeding of any of the common grain-sorghum crops.

Numerous inquiries coming to the Kansas Agricultural Experiment Station indicate an increasing interest in the utilization of sorghum crops in lamb feeding. For this reason an experiment was conducted, having in the main the following objects.

OBJECTS OF EXPERIMENT

1. To determine the most efficient proportions of concentrates and roughage to use in feeding ground atlas fodder, cottonseed meal, and atlas grain to fattening lambs.
2. To determine whether ground limestone (calcium carbonate) is beneficial to fattening lambs when fed in various rations in which the roughage is ground atlas fodder, atlas silage, or atlas fodder plus alfalfa hay.
3. To test the relative feeding value of wheat and atlas grain for lamb feeding when fed with cottonseed meal and ground atlas fodder.
4. To compare ground atlas fodder with ground atlas fodder plus alfalfa hay, as the roughage portion of lamb-fattening rations.
5. To compare ground atlas fodder plus alfalfa with ground atlas fodder plus ground limestone, as roughages in lamb-fattening rations.
6. To compare ground atlas fodder with atlas silage, as roughages in lamb-fattening rations.

GENERAL PLAN OF EXPERIMENT

KIND OF LAMBS USED

A carload of 270 good-grade white-face range feeder lambs, uniform in weight, breeding, and quality, originating in the vicinity of Vaughan, N. Mex., was used in this experiment. They were divided into 10 lots as evenly balanced in respect to weight, quality, and conformation as possible. The average weight at the beginning of the feeding period was approximately 62 pounds. They are shown in figure 1.

FEEDS AND METHODS OF FEEDING

The lambs in all lots were hand fed twice daily as much of the particular ration as they would readily consume. The grain, cottonseed meal, limestone, and roughages were fed mixed together, with the exception of the alfalfa in lots 7 and 8, which was fed whole and separate from the other feeds. The grain added to the different rations was coarsely ground or cracked to approximate the grinding that the grain in the fodder underwent in grinding the fodder. The atlas fodder was ground with a hammer mill, using a three-quarter-inch screen.

The atlas grain and fodder and the alfalfa were raised on or adjacent to the animal husbandry farm. Feed prices used in all calculations were those actually paid, or prevalent at the time, and include the cost of grinding and feeding. It was necessary to grind the fodder every other day, because of the fact that it contained a high percentage of moisture and heated readily. Granulated salt was fed to all lots of lambs. The ground limestone used contained 98 per cent calcium carbonate.

RATIONS FED

Lot 1—Ground atlas fodder and cottonseed meal. (Approximately 25 per cent concentrates and 75 per cent roughage.)

Lot 2—Ground atlas fodder, cottonseed meal, ground atlas grain.

FIG. 2.—Shelter and lots used for the lamb-feeding experiments.

(Approximately 40 per cent concentrates and 60 per cent roughage.)

Lot 3—Ground atlas fodder, cottonseed meal, ground atlas grain. (Approximately 50 per cent concentrates and 50 per cent, roughage.)

Lot 4—Ground atlas fodder, cottonseed meal, ground atlas grain, ground limestone.

Lot 5—Ground atlas fodder, cottonseed meal, ground wheat.

Lot 6—Ground atlas fodder, cottonseed meal, ground wheat, ground limestone.

Lot 7—Ground atlas fodder, alfalfa, cottonseed meal, ground atlas grain.

Lot 8—Ground atlas fodder, alfalfa, cottonseed meal, ground atlas grain, ground limestone.

Lot 9—Atlas silage, cottonseed meal, ground atlas grain.

Lot 10—Atlas silage, cottonseed meal, ground atlas grain, ground limestone.

FEEDLOTS AND EQUIPMENT

A shed, opening to the south, provided shelter and protection for the lambs and feed. (Fig. 2.) The feeders, ordinary combination grain and hay feeders, providing approximately one foot of feeder space per lamb, were located under the shed. The weather of the fall and winter of 1931-'32 in the vicinity of Manhattan, Kan., was decidedly unfavorable for lamb feeding because of excessive rainfall and prevailing high temperatures. Much of the time the shelter was inadequate to provide even dry bedding space. For these reasons the lambs were at no time forced for the most rapid gains.

LENGTH OF FEEDING PERIOD

The feeding was begun December 3,1931, and continued 110 days. The lambs were identified by a number stamped on the back which made it possible to take weights on each lamb. Individual weights were taken every 15 days throughout the feeding period and the weights averaged by lots. At the beginning of the experiment the lambs were weighed on three consecutive days and the average of these three weights was taken as the initial weight. Likewise, the final weight was the average of three consecutive days' weighings made at the close of the experiment.

The lambs in each lot as they appeared at the close of the feeding period are shown in figures 3 to 12.

PART I

PROPORTION OF CONCENTRATES TO ROUGHAGE

In comparing different proportions of concentrates to roughage, three lots of lambs, lots 1, 2 and 3, were fed ground atlas fodder and equal amounts of cottonseed meal per lamb, but received different proportions of concentrates to roughage through the addition of different amounts of grain to the fodder and cottonseed meal. Since some feeders grind grain-sorghum fodder and feed it without the addition of other grain, lot 1 was fed in that manner. The atlas fodder contained approximately 20 per cent grain by weight, and when one-fourth pound of cottonseed meal per lamb daily was added to the feed, the lambs in lot 1 received approximately 25 per cent concentrates and 75 per cent roughage. The lambs in lot 2 received sufficient additional atlas grain to make their ration approximately 40 per cent concentrates to 60 per cent roughage. The lambs in lot 3 received enough more atlas grain to bring their ration up to about 50 per cent concentrates and 50 per cent roughage. The details of this experiment are given in Table I.

TABLE I.—PROPORTION OF CONCENTRATES TO ROUGHAGE.

December 3, 1931, to March 22, 1932.

Lot No.	1	2	3
RATION FED.	Ground atlas fodder, cottonseed meal.	Ground atlas fodder, cottonseed meal, ground atlas grain.	Ground atlas fodder, cottonseed meal, ground atlas grain.
Number of lambs per lot	27	24	27
Number of days on feed	110	110	110
	Pounds.	*Pounds.*	*Pounds.*
Initial weight per lamb	61.49	62.10	61.42
Final weight per lamb	83.25	86.61	87.05
Total gain per lamb	21.76	24.51	25.63
Daily gain per lamb	.20	.22	.23
Feed consumed per lamb daily:			
Ground atlas fodder	3.80	2.68	1.89
Cottonseed meal	.25	.22	.24
Ground atlas grain	.....	.54	.76
Feed consumed per 100 pounds gain:			
Ground atlas fodder	1,923.16	1,201.92	811.20
Cottonseed meal	124.22	99.59	104.84
Ground atlas grain	.....	242.19	325.91
Feed cost per 100 pounds gain	$5.57	$5.21	$4.91
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	2.98	3.01	2.98
Feed cost per lamb (*b*)	1.21	1.28	1.26
Lamb cost plus feed cost (per head)	4.19	4.29	4.24
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	5.03	4.95	4.87
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	4.80	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	—.23	.85	.93
Margin per head over lamb cost plus feed cost	—.19	.74	.81

Feed Prices.—Ground atlas fodder, $4.50 per ton; cottonseed meal, $20 per ton; atlas grain, 85 cents per bushel.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

OBSERVATIONS

1. The gains made by the lambs were greatest in the lot receiving the largest proportion of grain, and least in the lot receiving the smallest proportion of grain.

2. The cost of the gains made was lowest in the lot fed the largest amount of grain and highest in the lot receiving the smallest amount of grain.

3. The lot receiving the largest proportion of grain showed a margin of 81 cents per head above lamb and feed costs. The lot receiving the smallest proportion of grain showed a loss of 19 cents per head.

4. The lambs receiving the smallest amount of grain made the largest and cheapest gains of any of the lots during the first 35 days of the 110-day feeding period. For the remainder of the period and for the entire feeding period, however, their gains were smallest and most expensive.

5. This experiment indicates:

(a) That ground atlas fodder supplemented with cottonseed meal, fed without additional grain, is too bulky to produce satisfactory gains and finish on lambs.

(b) That sufficient grain added to make the ration at least 50 per cent concentrates, will produce larger and cheaper gains than a ration that is 40 per cent concentrates.

(c) That there is the possibility of producing very efficient gains on lambs by feeding ground sorghum fodder supplemented with cottonseed meal during the early part of the feeding period, if extra grain is added during the latter part of the period.

PART II

FEEDING GROUND LIMESTONE WITH ATLAS FODDER, COTTONSEED MEAL, AND ATLAS GRAIN

Atlas fodder, as well as most other sorghum plants, is deficient in calcium or lime. In an effort to improve ground atlas fodder as a roughage for lamb feeding, ground limestone containing a high percentage of calcium carbonate was fed with it. In order to determine the value of adding ground limestone to the fodder an experiment was arranged using two lots of lambs. The lambs in lot 2 received a ration of ground atlas fodder, cottonseed meal, and ground atlas grain, while those in lot 4 received the same feed plus one-fourth ounce of ground limestone per head daily. The grain and cottonseed meal, or grain, cottonseed meal, and ground limestone were mixed and poured over the ground fodder in the feeders. Feeding was done twice daily and the lambs had access to as much feed as they would readily consume. Practically equal amounts of grain, roughage, and cottonseed meal were fed to the lambs in both lots. The detailed results of this experiment, are reported in Table II.

OBSERVATIONS

1. The addition of one-fourth ounce of ground limestone per lamb daily to a ration of ground atlas fodder, cottonseed meal, and ground atlas grain, resulted in more than 4 pounds of gain per lamb over lambs fed the same ration without the limestone.

2. The feed consumed per 100 pounds of gain made by the lambs fed limestone was considerably less than for lambs getting no limestone, therefore the cost per hundred pounds of gain was much lower.

3. The use of ground limestone greatly improved a ration of ground atlas fodder, cottonseed meal, and ground atlas grain for lamb feeding, and its use in such a ration is recommended.

TABLE II.—FEEDING GROUND LIMESTONE WITH ATLAS FODDER, COTTONSEED MEAL, AND ATLAS GRAIN.

December 3, 1931, to March 22, 1932.

Lot No.	2	4
RATION FED.	Ground atlas fodder, cottonseed meal, ground atlas grain.	Ground atlas fodder, cottonseed meal, ground atlas grain, ground limestone.
Number of lambs per lot	24	26
Number of days on feed	110	110
	Pounds.	*Pounds.*
Initial weight per lamb	62.10	62.61
Final weight per lamb	86.61	91.56
Total gain per lamb	24.51	28.95
Daily gain per lamb	.22	.26
Feed consumed per lamb daily:		
Ground atlas fodder	2.68	2.70
Cottonseed meal	.22	.24
Ground atlas grain	.54	.54
Ground limestone	.....	(Oz.) .25
Feed consumed per 100 pounds gain:		
Ground atlas fodder	1,201.92	1,026.49
Cottonseed meal	99.59	90.64
Ground atlas grain	242.19	205.32
Ground limestone	.....	5.94
Feed cost per 100 pounds gain	$5.21	$4.56
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	3.01	3.04
Feed cost per lamb (*b*)	1.28	1.32
Lamb cost plus feed cost (per head)	4.29	4.36
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.95	4.76
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	.85	1.04
Margin per head over lamb cost plus feed cost	.74	.95

Feed Prices.—Ground atlas fodder, $4.50 per ton; cottonseed meal, $20 per ton; atlas grain, 35 cents per bushel; ground limestone, $1 per cwt.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

PART III

FEEDING GROUND LIMESTONE WITH ATLAS FODDER, COTTONSEED MEAL, AND GROUND WHEAT

Wheat being somewhat richer in lime than atlas grain, the question arises as to whether limestone is needed or would be of any benefit in the ration when some wheat is fed. To test this two lots of lambs were used. Each lot received a basal ration consisting of ground atlas fodder, cottonseed meal, and ground wheat. In addition the lambs in lot 6 received one-fourth ounce of ground limestone per head daily. The grain and cottonseed meal were mixed together for lot 5 and the grain, cottonseed meal, and ground limestone for lot 6. In each case the mixture was spread over the ground fodder. Table III shows a comparison between these two lots.

TABLE III.—FEEDING GROUND LIMESTONE WITH ATLAS FODDER, COTTONSEED MEAL, AND WHEAT.

December 3, 1931, to March 22, 1932.

Lot No.	5	6
RATIONS FED.	Ground atlas fodder, cottonseed meal, ground wheat.	Ground atlas fodder, cottonseed meal, ground wheat, ground limestone.
Number of lambs per lot	27	26
Number of days on feed	110	110
	Pounds.	*Pounds.*
Initial weight per lamb	61.98	62.00
Final weight per lamb	89.35	92.06
Total gain per lamb	27.37	30.06
Daily gain per lamb	.25	.27
Feed consumed per lamb daily:		
Ground atlas fodder	2.67	2.66
Cottonseed meal	.24	.24
Ground wheat	.54	.54
Ground limestone		(Oz.) .25
Feed consumed per 100 pounds gain:		
Ground atlas fodder	1,074.06	973.65
Cottonseed meal	97.77	88.99
Ground wheat	216.51	197.77
Ground limestone		5.72
Feed cost per 100 pounds gain	$5.02	$4.62
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	3.01	3.01
Feed cost per lamb (*b*)	1.37	1.39
Lamb cost plus feed cost (Per head)	4.38	4.40
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.90	4.78
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	.90	1.02
Margin per head over lamb cost plus feed cost	.80	.94

Feed Prices.—Atlas fodder, $4.50 per ton; cottonseed meal, $20 per ton; ground wheat, 45 cents per bushel; ground limestone, $1 per cwt.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

OBSERVATIONS

1. Ground atlas fodder, cottonseed meal, and ground wheat fed with ground limestone, produced over two and one-half pounds more gain per lamb than did the same feeds fed without the limestone.

2. While the addition of ground limestone where wheat was fed resulted in only a small increase in gains, there was no increase in feed consumed, therefore, the feed consumed and cost per 100 pounds of gain were lower when limestone was fed.

3. The two lots of lambs were appraised the same, hence the lambs receiving ground limestone made a larger profit due to the fact that their gains were made at a lower cost,.

4. By comparing these results with those reported in Part II it will be noted that less benefit was derived from adding ground limestone to the ration when the grain consumed was approximately half wheat and half atlas grain than when the grain consumed was made up entirely of atlas grain.

PART IV

FEEDING GROUND LIMESTONE WITH ATLAS FODDER, ALFALFA HAY, COTTONSEED MEAL, AND ATLAS GRAIN

Previous work indicated that the addition of ground limestone to low--calcium roughages rendered them practically as good as alfalfa for lamb feeding, provided a protein supplement was fed.

Since alfalfa is rich in lime, compared with sorghum fodders and other nonlegume roughages, it would appear that the addition of ground limestone to rations containing alfalfa is unnecessary. In order to verify this point, however, and to further substantiate the other ground-limestone experiments reported in this bulletin, the experiment was so conducted that two lots of lambs, lots 7 and 8,

TABLE IV.—FEEDING GROUND LIMESTONE WITH ATLAS FODDER, ALFALFA, COTTONSEED MEAL, AND ATLAS GRAIN.

December 3, 1931, to March 22, 1932.

Lot No.	7	8
RATION FED.	Ground atlas fodder, alfalfa hay, cottonseed meal, ground atlas grain.	Ground atlas fodder, alfalfa hay, cottonseed meal, ground atlas grain, ground limestone.
Number of lambs per lot	27	27
Number of days on feed	110	110
	Pounds.	*Pounds.*
Initial weight per lamb	61.96	61.93
Final weight per lamb	92.37	92.42
Total gain per lamb	30.41	30.49
Daily gain per lamb	.28	.28
Feed consumed per lamb daily:		
Ground atlas fodder	1.65	1.68
Alfalfa	.60	.60
Cottonseed meal	.24	.24
Ground atlas grain	.65	.65
Ground limestone		(Oz.) .25
Feed consumed per 100 pounds gain:		
Ground atlas fodder	598.26	604.59
Alfalfa	216.61	216.04
Cottonseed meal	88.00	87.77
Ground atlas grain	236.90	236.27
Ground limestone		5.64
Feed cost per 100 pounds gain	$4.68	$4.74
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	3.01	3.00
Feed cost per lamb (*b*)	1.42	1.45
Lamb cost plus feed cost (per head)	4.43	4.45
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.80	4.81
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	1.00	.99
Margin per head over lamb cost plus feed cost	.92	.91

Feed Prices.—Ground atlas fodder $4.50 per ton; alfalfa, $9 per ton; cottonseed meal, $20 per ton; ground atlas grain, 35 cents per bushel; ground limestone, $1 per cwt.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

received as roughage approximately one-fourth alfalfa hay and three-fourths ground atlas fodder. Cottonseed meal and ground atlas grain were also fed and lot 8 received in addition one-fourth ounce ground limestone per lamb daily. The grain and cottonseed meal were mixed and spread over the ground fodder. The alfalfa hay, 0.6 pound per lamb daily, was fed separately from the other feeds.

This experiment was conducted to give a direct comparison between a ration of ground atlas fodder, alfalfa hay, cottonseed meal, and atlas grain and the same ration plus ground limestone, and should indicate the value of adding ground limestone to a ration containing alfalfa hay. Table IV shows this comparison in detail.

OBSERVATIONS

1. When 0.6 pound of alfalfa hay per lamb was fed daily with ground atlas fodder, the addition of ground limestone produced no increase in gain, and only added to the cost of the ration.

2. The amount of feed consumed per hundred pounds of gain was not reduced by the feeding of ground limestone, when alfalfa was included in lamb-fattening rations.

3. The feeding of ground limestone is not recommended when alfalfa hay is included in lamb-fattening rations.

PART V

FEEDING GROUND LIMESTONE WITH ATLAS SILAGE, COTTONSEED MEAL, AND ATLAS GRAIN

Two other lots of lambs, lots 9 and 10, were fed atlas grain and cottonseed meal, but received atlas silage as roughage rather than ground atlas fodder. The value of adding ground limestone to this ration was tested by adding one-fourth ounce per lamb daily to the ration fed in lot 10.

Rations, the roughage portion of which is made up exclusively of silage, have not proved satisfactory for fattening lambs. An attempt was made in this experiment to overcome this difficulty by adding ground limestone. If this procedure proved to be satisfactory it would be of great economic importance to Kansas feeders who have an abundance of crops that can be used in the form of silage. The results of this experiment are shown in Table V.

OBSERVATIONS

1. The feeding of ground limestone to lambs receiving atlas grain, cottonseed meal, and atlas silage, increased the gains nearly 3 pounds per lamb over those receiving the same ration without the limestone.

2. In this experiment the addition of ground limestone to the ration resulted in a lower feed consumption per hundred pounds of gain, and a lower cost of gains.

3. Ground limestone apparently greatly improves atlas silage as roughage.

TABLE V.—FEEDING GROUND LIMESTONE WITH ATLAS SILAGE, COTTONSEED MEAL, AND ATLAS GRAIN.

December 8, 1931, to March 22, 1932.

Lot No.	9	10
RATION FED.	Atlas silage, cottonseed meal, ground atlas grain.	Atlas silage, cottonseed meal, ground atlas grain, ground limestone.
Number of lambs per lot	26	25
Number of days on feed	110	110
	Pounds.	*Pounds.*
Initial weight per lamb	61.28	62.24
Final weight per lamb	86.14	90.04
Total gain per lamb	24.86	27.80
Daily gain per lamb	.23	.25
Feed consumed per lamb daily:		
Atlas silage	3.18	3.25
Cottonseed meal	.24	.24
Ground atlas grain	.75	.75
Ground limestone	.....	(Oz.) .25
Feed consumed per 100 pounds gain:		
Atlas silage	1,408.37	1,285.18
Cottonseed meal	107.60	96.29
Ground atlas grain	331.17	296.87
Ground limestone	.....	6.19
Feed cost per 100 pounds gain	$5.26	$4.81
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	2.97	3.02
Feed cost per lamb (*b*)	1.31	1.34
Lamb cost plus feed cost (per head)	4.28	4.36
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.97	4.84
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	.83	.96
Margin per head over lamb cost plus feed cost	.71	.86

Feed Prices.—Atlas silage, $3 per ton; cottonseed meal, $20 per ton; ground atlas grain, 35 cents per bushel; ground limestone, $1 per cwt.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

PART VI

TEST A—GROUND ATLAS GRAIN VERSUS GROUND WHEAT (EACH FED WITH GROUND Atlas FODDER AND COTTONSEED MEAL)

As a rule ground sorghum fodder contains insufficient grain for fattening lambs, hence additional grain must be fed with it to secure satisfactory results. Wheat can often be fed more economically than other grains, therefore, wheat was compared with atlas grain in order to determine their relative values in combination with ground atlas fodder. Two lots of the experimental lambs were fed ground atlas fodder and cottonseed meal. The lambs in lot 2 received ground atlas grain while lot 5 received an equal amount of ground wheat. It should be kept in mind that the lambs in lot 5 received some atlas grain in their fodder, so their grain feed was really a mix-

TABLE VI.—GROUND ATLAS GRAIN VERSUS GROUND WHEAT (EACH FED WITH GROUND ATLAS FODDER AND COTTONSEED MEAL).

December 3, 1931, to March 22, 1932.

Lot No.	2	5
RATION FED.	Ground atlas fodder, cottonseed meal, ground atlas grain.	Ground atlas fodder, cottonseed meal, ground wheat.
Number of lambs per lot	24	27
Number of days on feed	110	110
	Pounds.	*Pounds.*
Initial weight per lamb	62.10	61.98
Final weight per lamb	86.61	89.35
Total gain per lamb	24.51	27.37
Daily gain per lamb	.22	.25
Feed consumed per lamb daily:		
Ground atlas fodder	2.68	2.67
Cottonseed meal	.22	.24
Ground atlas grain	.54	.....
Ground wheat	.....	.54
Feed consumed per 100 pounds gain:		
Ground atlas fodder	1,201.92	1,074.06
Cottonseed meal	99.59	97.77
Ground atlas grain	242.19	.....
Ground wheat	.....	216.51
Feed cost per 100 pounds gain	$5.21	$5.02
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	3.01	3.01
Feed cost per lamb (*b*)	1.28	1.37
Lamb cost plus feed cost (per head)	4.29	4.38
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.95	4.90
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	.85	.90
Margin per head over lamb cost plus feed cost	.74	.80

Feed Prices.—Ground atlas fodder, $4.50 per ton; cottonseed meal, $20 per ton; ground atlas grain, 35 cents per bushel; ground wheat, 45 cents per bushel.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

ture of approximately equal parts wheat and atlas grain. The grain was apparently palatable and the lambs ate the mixture readily.

Table VI lists the details of this comparison between wheat and atlas grain.

OBSERVATIONS

Results of this experiment indicate:

1. A mixture of wheat and atlas grain will produce somewhat larger gains than will atlas grain alone, when fed with ground atlas fodder and cottonseed meal to fattening lambs.
2. A little less feed is required lo produce 100 pounds of gain, where wheat is added to the ground fodder and cottonseed meal than where atlas grain is added.
3. A bushel of ground wheat was worth approximately 15 per cent more than a bushel of ground atlas grain in this particular experiment.

TEST B—GROUND ATLAS GRAIN VERSUS GROUND WHEAT (EACH FED WITH GROUND ATLAS FODDER, COTTONSEED MEAL, AND GROUND LIMESTONE)

This test differs from the preceding one only in that any lime deficiency in the ration was cared for by feeding ground limestone in the rations of both lots. It was included to determine whether the addition of limestone will tend to equalize the value of the two grains, since wheat contains more lime than atlas grain. The lambs in lots 4 and 6 each received ground atlas fodder, cottonseed meal, and ground limestone. In addition lot 4 received ground atlas grain while lot 6 received ground wheat. The grain ration of lot 6, therefore, was a mixture of about equal parts of wheat and atlas grain.

The results of this comparison between wheat and atlas grain are shown in Table VII.

OBSERVATIONS

1. From the standpoint of gains produced, ground atlas grain proved to be practically equal to ground wheat, when each was fed with ground atlas fodder, cottonseed meal, and ground limestone.
2. Slightly less feed was required to produce 100 pounds of gain where wheat was fed, but the saving was not sufficient to offset the higher price of the wheat and consequently the gains made on wheat were more expensive.

TABLE VII.—GROUND ATLAS GRAIN VERSUS GROUND WHEAT (EACH FED WITH GROUND ATLAS FODDER, COTTONSEED MEAL, AND GROUND LIMESTONE).

December 3, 1931, to March 22, 1932.

Lot No.	4	6
RATION FED.	Ground atlas fodder, cottonseed meal, ground atlas grain, ground limestone.	Ground atlas fodder, cottonseed meal, ground wheat, ground limestone.
Number of lambs per lot	26	26
Number of days on feed	110	110
	Pounds.	*Pounds.*
Initial weight per lamb	62.61	62.00
Final weight per lamb	91.56	92.06
Total gain per lamb	28.95	30.06
Daily gain per lamb	.26	.27
Feed consumed per lamb daily:		
Ground atlas fodder	2.70	2.66
Cottonseed meal	.24	.24
Ground atlas grain	.54	.....
Ground wheat	.....	.54
Ground limestone	(Oz.) .25	(Oz.) .25
Feed consumed per 100 pounds gain:		
Ground atlas fodder	1,026.49	973.65
Cottonseed meal	90.64	88.99
Ground atlas grain	205.32	.....
Ground wheat	.....	197.77
Ground limestone	5.94	5.72
Feed cost per 100 pounds gain	$4.56	$4.62
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	3.04	3.01
Feed cost per lamb (*b*)	1.32	1.39
Lamb cost plus feed cost (per head)	4.36	4.40
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.76	4.78
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	1.04	1.02
Margin per head over lamb cost plus feed cost	.95	.94

Feed Prices.—Ground atlas fodder, $4.50 per ton; cottonseed meal, $20 per ton; ground atlas grain, 35 cents per bushel; ground wheat, 45 cents per bushel; ground limestone, $1 per cwt.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

PART VII

THE VALUE OF FEEDING ALFALFA AS A PART OF THE ROUGHAGE IN LAMB FATTENING RATIONS

Test A—Alfalfa and Ground Atlas Fodder Versus Ground Atlas Fodder as Roughages Fed With Ground Atlas Grain and Cottonseed Meal

Many feeders who have only a limited supply of alfalfa or are forced to pay high prices for it, have raised the question of the value, from the standpoint of rate of gains made and cost of gains, of a small allowance of alfalfa as a part of the roughage portion of the ration with ground fodder. Some feeders feel that at least a small amount of alfalfa is necessary in a lamb-fattening ration,

while others are able to fatten lambs successfully without alfalfa. With this in mind, a comparison was made between ground atlas fodder fed as the only roughage in one lot, against ground atlas fodder and alfalfa hay fed as the roughage in another lot. In this test lot 2 received ground atlas grain and cottonseed meal with ground atlas fodder as roughage, while lot 7 received the same ration except that both ground atlas fodder and alfalfa hay were fed as the roughage. More grain was added to the ration fed lot 7 than to that fed lot 2, but lot 2 received more grain in their larger fodder allowance, hence, the amounts of grain consumed were nearly equal. The amounts of cottonseed meal as well as total dry matter consumed by the two lots were approximately equal.

The details of this experiment may be seen in Table VIII.

TABLE VIII.—FEEDING ALFALFA AS A PART OF THE ROUGHAGE, WITH GROUND ATLAS FODDER, COTTONSEED MEAL, AND ATLAS GRAIN.

December 3, 1931, to March 22, 1932.

Lot No.	2	7
RATION FED.	Ground atlas fodder, cottonseed meal, ground atlas grain.	Ground atlas fodder, cottonseed meal, ground atlas grain, alfalfa.
Number of lambs per lot	24	27
Number of days on feed	110	110
	Pounds.	*Pounds.*
Initial weight per lamb	62.10	61.96
Final weight per lamb	86.61	92.37
Total gain per lamb	24.51	30.41
Daily gain per lamb	.22	.28
Feed consumed per lamb daily:		
Ground atlas fodder	2.68	1.65
Alfalfa	.....	.60
Cottonseed meal	.22	.24
Atlas grain	.54	.65
Feed consumed per 100 pounds gain:		
Ground atlas fodder	1,201.92	598.26
Alfalfa	.....	216.61
Cottonseed meal	99.59	88.00
Ground atlas grain	242.19	236.90
Feed cost per 100 pounds gain	$5.21	$4.68
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	3.01	3.01
Feed cost per lamb (*b*)	1.28	1.42
Lamb cost plus feed cost (per head)	4.29	4.43
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.95	4.80
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	.85	1.00
Margin per head over lamb cost plus feed cost	.74	.92

Feed Prices.—Ground atlas fodder, $4.50 per ton; alfalfa, $9 per ton; cottonseed meal, $20 per ton; ground atlas grain, 35 cents per bushel.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

OBSERVATIONS

1. A small amount of alfalfa hay used to replace a part of the ground atlas fodder in a ration containing ground atlas grain and cottonseed meal, greatly increased the efficiency of the ration.
2. Lambs fed atlas grain and cottonseed meal with ground atlas fodder and alfalfa hay as roughage, made nearly 6 pounds more gain than lambs receiving ground atlas fodder alone as roughage.
3. Much less feed was required to produce 100 pounds of gain on lambs where alfalfa was included in the ration, and the cost of gains was greatly reduced.
4. In this test alfalfa hay used as a part of the roughage with ground atlas fodder, showed a feed replacement value of $12.28 per ton.

Test B—Alfalfa and Ground Atlas Fodder Versus Ground Atlas Fodder as Roughages Fed with Ground Atlas Grain, Cottonseed Meal, and Ground Limestone

Previous experiments have indicated that a part of the advantage that alfalfa possesses over many other roughages is due to its high calcium or lime content. To secure more definite information on this point,, the same rations as fed in the preceding comparison were fed to two lots and in addition each lamb received one-fourth ounce daily of ground limestone. Lots 4 and 8 received ground atlas grain, cottonseed meal, and ground limestone. Lot 4 was fed ground atlas fodder alone as roughage, while lot 8 received ground atlas fodder and a small amount of alfalfa hay. Table IX shows the results of this comparison.

OBSERVATIONS

1. In this test ground limestone was fed to both lots of lambs. The lambs receiving a small allowance of alfalfa as a part of their roughage, made only a little larger gains than those receiving only atlas fodder as roughage.
2. The difference in favor of the alfalfa-fed lambs was not sufficient to offset the higher cost, of their ration.
3. Apparently no benefit was derived in this test from feeding both alfalfa hay and ground limestone in lamb fattening rations.

TABLE IX—FEEDING ALFALFA AS A PART OF THE ROUGHAGE, WITH GROUND ATLAS FODDER, COTTONSEED MEAL, ATLAS GRAIN, AND GROUND LIMESTONE.

December 3, 1931, to March 22, 1932.

Lot No.	4	8
RATION FED.	Ground atlas fodder, cottonseed meal, ground atlas grain, ground limestone.	Ground atlas fodder, cottonseed meal, ground atlas grain, ground limestone, alfalfa.
Number of lambs per lot	26	27
Number of days on feed	110	110
	Pounds.	*Pounds.*
Initial weight per lamb	62.61	61.93
Final weight per lamb	91.56	92.42
Total gain per lamb	28.95	30.49
Daily gain per lamb	.26	.28
Feed consumed per lamb daily:		
Ground atlas fodder	2.70	1.68
Alfalfa		.60
Cottonseed meal	.24	.24
Atlas grain	.54	.65
Ground limestone	(Oz.) .25	(Oz.) .25
Feed consumed per 100 pounds gain:		
Ground atlas fodder	1,026.49	604.59
Alfalfa		216.04
Cottonseed meal	90.64	87.77
Atlas grain	205.32	236.27
Ground limestone	5.94	5.64
Feed cost per 100 pounds gain	$4.56	$4.74
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	3.04	3.00
Feed cost per lamb (*b*)	1.32	1.45
Lamb cost plus feed cost (per head)	4.36	4.45
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.76	4.81
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	1.04	.99
Margin per head over lamb cost plus feed cost	.95	.91

Feed Prices—Ground atlas fodder, $4.50 per ton; alfalfa, $9 per ton; cottonseed meal, $20 per ton; atlas grain, 35 cents per bushel; ground limestone, $1 per cwt.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

Test C—Ground Atlas Fodder Alone Versus Ground Atlas Fodder and Alfalfa Hay Versus Ground Atlas Fodder and Ground Limestone as Roughages in Lamb Fattening Rations

In this comparison, three lots of lambs were each fed a basal ration of ground atlas grain, cottonseed meal, and ground atlas fodder. Lot 2 received the basal ration alone; lot 4 received the basal ration plus one-fourth ounce ground limestone per lamb daily; and lot 7 received the basal ration plus a small amount of alfalfa hay, which replaced a part of the fodder. Approximately equal amounts of roughage, cottonseed meal, and grain were consumed by the lambs

in all three lots. Lot 7 received more added grain but lots 2 and 4 received more grain in the larger fodder allowance. Lot 2 is included in Table X for convenience since the value of feeding ground limestone and of adding alfalfa to the above ration has been discussed. Special attention is called, however, to the comparison between ground atlas fodder plus ground limestone, lot 4, and ground atlas fodder plus alfalfa, lot 7.

Table X gives the results of this test in detail.

TABLE X.—THE VALUE OF ADDING EITHER ALFALFA HAY OR GROUND LIMESTONE TO A RATION OF GROUND ATLAS FODDER, COTTONSEED MEAL, AND GROUND ATLAS GRAIN.

December 3, 1931, to March 22, 1932.

Lot No.	2	4	7
RATION FED.	Ground atlas fodder, cottonseed meal, ground atlas grain.	Ground atlas fodder, cottonseed meal, ground atlas grain, ground limestone.	Ground atlas fodder, cottonseed meal, ground atlas grain, alfalfa hay.
Number of lambs per lot	24	26	27
Number of days on feed	110	110	110
	Pounds.	*Pounds.*	*Pounds.*
Initial weight per lamb	62.10	62.61	61.96
Final weight per lamb	86.61	91.56	92.37
Total gain per lamb	24.51	28.95	30.41
Daily gain per lamb	.22	.26	.28
Feed consumed per lamb daily:			
Ground atlas fodder	2.68	2.70	1.65
Cottonseed meal	.22	.24	.24
Ground atlas grain	.54	.54	.65
Ground limestone	.....	(Oz.) .25	.....
Alfalfa hay	.....	.....	.60
Feed consumed per 100 pounds gain:			
Ground atlas fodder	1,201.92	1,026.49	598.26
Cottonseed meal	99.59	90.64	88.00
Ground atlas grain	242.19	205.32	236.90
Ground limestone	.....	5.94	.....
Alfalfa hay	.....	.....	216.61
Feed cost per 100 pounds gain	$5.21	$4.56	$4.68
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	3.01	3.04	3.01
Feed cost per lamb (*b*)	1.28	1.32	1.42
Lamb cost plus feed cost (per head)	4.29	4.36	4.43
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.95	4.76	4.80
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	.85	1.04	1.00
Margin per head over lamb cost plus feed cost	.74	.95	.92

Feed Prices.—Ground atlas fodder, $4.50 per ton; cottonseed meal, $20 per ton; ground atlas grain, 35 cents per bushel; ground limestone, $1 per cwt.; alfalfa hay, $9 per ton.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

OBSERVATIONS

1. Ground atlas fodder and a small allowance of alfalfa hay fed together as the roughage, produced more and cheaper gains on fattening lambs than ground atlas fodder alone as the roughage.

2. When ground limestone was added to ground atlas fodder, lambs gained almost as much as those receiving alfalfa hay and ground atlas fodder, and made cheaper gains. Therefore, atlas fodder may be used as a very satisfactory substitute for alfalfa hay in lamb-fattening rations, provided a protein supplement and ground limestone are fed with it.

PART VIII

GROUND ATLAS FODDER VERSUS ATLAS SILAGE

The experiment was so arranged that atlas silage could be compared with ground atlas fodder when fed to lambs receiving ground atlas grain and cottonseed meal. Lots 3 and 9 were each fed ground atlas grain and cottonseed meal and the two lots consumed nearly equal amounts of each. For roughage, lot 3 received ground atlas fodder, while lot 9 received an equivalent amount of dry matter in the form of atlas silage. The atlas fodder and silage were cut at the same time and were, therefore, at the same stage of maturity. Table XI gives a detailed report of this comparison and includes lot 10 for reference.

OBSERVATIONS

1. The lambs fed fodder in this test gained slightly more and consumed less feed per hundred pounds of gain than the lambs fed silage and, therefore, made somewhat cheaper gains when no limestone was added to the silage.

2. In lot 9, which did not receive ground limestone, some difficulty was experienced in getting the lambs to eat their full allowance of silage during the latter part of the feeding period.

3. Silage alone did not prove to be so satisfactory as ground atlas fodder alone as the roughage portion of the ration fed, but silage fortified with one-fourth ounce of ground limestone per head daily proved to be slightly more satisfactory in every way than ground atlas fodder alone as the roughage portion of the ration fed.

GENERAL DISCUSSION

As previously stated all grain added to the various rations was coarsely cracked. This is not usually recommended, since lambs generally eat most whole grains just as readily as they do ground grain. That portion of the grain contained in the ground fodder was cracked in passing through the hammer mill. Since the proportion of grain fed in this manner varied, it was obviously necessary that

TABLE XI.—GROUND ATLAS FODDER VERSUS ATLAS SILAGE.

December 3, 1931, to March 22, 1932.

Lot No.	3	9	10
RATION FED.	Ground atlas fodder, cottonseed meal, atlas grain.	Atlas silage, cottonseed meal, atlas grain.	Atlas silage, cottonseed meal, atlas grain, ground limestone.
Number of lambs per lot	27	26	25
Number of days on feed	110	110	110
	Pounds.	*Pounds.*	*Pounds.*
Initial weight per lamb	61.42	61.28	62.24
Final weight per lamb	87.05	86.14	90.04
Total gain per lamb	25.63	24.86	27.80
Daily gain per lamb	.23	.23	.25
Feed consumed per lamb daily:			
Ground atlas fodder	1.89	.....	.....
Atlas silage	.....	3.18	3.25
Cottonseed meal	.24	.24	.24
Ground atlas grain	.76	.75	.75
Ground limestone	.....	.....	(Oz.) .25
Feed consumed per 100 pounds gain:			
Ground atlas fodder	811.20	.....	.....
Atlas silage	.....	1,408.37	1,285.18
Cottonseed meal	104.84	107.60	96.29
Ground atlas grain	325.91	331.17	296.87
Ground limestone	.....	.....	6.19
Feed cost per 100 pounds gain	$4.91	$5.26	$4.81
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	2.98	2.97	3.02
Feed cost per lamb (*b*)	1.26	1.31	1.34
Lamb cost plus feed cost (per head)	4.24	4.28	4.36
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	4.87	4.97	4.84
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	5.80	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	.93	.83	.96
Margin per head over lamb cost plus feed cost	.81	.71	.86

Feed Prices.—Ground atlas fodder, $4.50 per ton; atlas silage, $3 per ton; cottonseed meal, $20 per ton; ground atlas grain, 35 cents per bushel; ground limestone, $1 per cwt.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.

all grain be ground in order that any possible variation that might arise from grinding the fodder be eliminated.

It will be noted that the daily gains were comparatively low in all lots. Much more rapid gains could have been secured if the lambs had been forced by feeding more grain and less roughage. However, a heavier death loss would likely have resulted. Very satisfactory total gains were secured and, as shown by the gains, the lambs made very efficient use of their feed. It is felt that this is of more importance than rapid daily gains unless there is some good cause to rush the feeding, such as the anticipation of market declines.

The death loss for the entire experiment was 2.22 per cent. The charge against the lambs for this item was distributed equally over the entire group, rather than to separate lots where the losses occurred. This was because the few losses were not traceable to the feeds fed nor methods of feeding, but to other causes. It was felt

that it would be unfair to charge death loss against any particular ration when the ration was apparently in no way connected with the cause of death. It will be noted that this item is charged in with the initial cost of the lambs.

The appraised value of the various lots of lambs was made at the feedlot, April 2, by a member of the John Clay Live Stock Commission firm of Kansas City, Mo. The appraisal represented the relative value of such lambs on the Kansas City market at that time. These lambs sold on the Kansas City market, April 5, at $6.50 per hundred-weight, with no cut-back.

For the benefit of those who are interested in the total amount of each feed required to fatten a lamb when the various rations were fed, the total feed consumed per lamb by lots is given in Table XII

TABLE XII.—TOTAL FEED CONSUMED PER LAMB (POUNDS).

Lot No.	1	2	3	4	5	6	7	8	9	10
Number of days on feed	110	110	110	110	110	110	110	110	110	110
Ground atlas fodder	418.5	294.6	207.9	294.0	297.2	292.7	181.9	184.3	.....	.....
Atlas silage	.....	.....	.....	.....	.....	.....	.....	.....	350.1	357.3
Alfalfa	.....	.....	.....	.....	.....	.....	65.9	65.9	.....	.....
Cottonseed meal	27.0	24.4	26.9	26.8	26.2	26.8	26.8	26.8	26.8	26.8
Ground atlas grain	.....	59.4	83.5	.....	59.4	.....	72.0	72.0	82.3	82.5
Ground wheat	.....	.....	.....	59.3	.....	59.5	.....	.....	.....	.....
Ground limestone	.....	.....	.....	.....	1.7	1.7	.....	1.7	.....	1.7

Shrinkage in shipment is listed in Table XIII for any who might be interested. Shrinkage was unduly high on these lambs largely because they were not sold and weighed until noon.

TABLE XIII.—SHRINKAGE INFORMATION.

Lot No.	1	2	3	4	5	6	7	8	9	10
Shrinkage in shipment:										
Pounds per head	8.7	7.1	7.1	7.7	8.0	5.6	8.1	7.2	6.0	7.7
Per cent	10.2	7.9	7.9	8.5	8.5	6.1	8.6	7.7	6.9	8.4

GENERAL SUMMARY

1. With rations of ground atlas fodder, cottonseed meal, and ground atlas grain fed to fattening lambs, a mixture of approximately 50 per cent concentrates and 50 per cent roughage was found to produce larger and cheaper gains than one of approximately 40 per cent concentrates and 60 per cent roughage.

2. Lambs receiving 40 per cent concentrates and 60 per cent roughage in a ration of ground atlas fodder, cottonseed meal, and ground atlas grain, while not making so good gains as lambs receiving more grain, made very satisfactory gains as evidenced by the fact that they were appraised the same as the lambs fed a heavier grain ration. This method of feeding will prove very satisfactory when the feeding period is to be comparatively long.

3. Lambs fed atlas fodder and cottonseed meal without any added grain, making the ration approximately 25 per cent concentrates and 75 per cent roughage, failed to fatten satisfactorily. For the first 35 days' feeding they made slightly larger and cheaper

FIG. 3.—Lambs in lot 1 at the close of the experiment. These lambs were fed ground atlas fodder and cottonseed meal (approximately 25 per cent concentrates and 75 per cent roughage). They gained 21.76 pounds per head, and weighed 83.25 pounds per head at the close of the experiment.

gains than the heavier grain-fed lambs, but after that they failed to gain as did the other lots.

4. The addition of ground limestone to a ration of ground atlas fodder, cottonseed meal, and ground atlas grain, resulted in an increase of over 4 pounds total gain per lamb more than was made by the lambs to which no limestone was fed, and resulted in a decided reduction in the cost of the gains.

5. The addition of ground limestone to a ration of ground atlas fodder, cottonseed meal, and ground wheat, resulted in a small increase in gains and reduced the cost of gains. Less benefit, however, resulted from the addition of ground limestone to the ration when wheat made up half the grain allowance, than was derived from it when atlas grain made up the entire grain allowance.

6. When fattening lambs were fed a small amount of alfalfa as a part of the roughage ration with ground atlas fodder, no benefit re-

sulted from the addition of ground limestone to the ration. The limestone only added to the cost of the ration in this case since the feed consumed per unit of gain was not reduced by its use, nor was there an appreciable increase in gains made.

7. When atlas silage, cottonwed meal, and ground atlas grain were fed, the addition of ground limestone to the ration resulted in 3 pounds more gain per lamb and materially reduced the cost of gains. The lambs receiving ground limestone also consumed the silage more readily than those receiving no limestone.

8. In comparing ground atlas grain and ground wheat, each fed with ground atlas fodder and cottonseed meal, the ration containing

FIG. 4.—Lambs in lot 2 at the close of the experiment. These lambs were fed ground atlas fodder, cottonseed meal, and ground atlas grain (approximately 40 per cent concentrates and 60 per cent roughage). They gained 24.51 pounds per head, and weighed 86.61 pounds per head at the close of the experiment.

ground wheat, produced a little larger and somewhat cheaper gains. When ground limestone was added to these rations, the wheat produced slightly more gain, but at a slightly higher cost than did the atlas grain.

9. Lambs fed a small amount of alfalfa as a part of the roughage with ground atlas fodder, cottonseed meal, and ground atlas grain, made decidedly larger and more economical gains than those receiving no alfalfa with the above ration.

10. Ground atlas fodder plus ground limestone, fed as roughage with cottonseed meal and atlas grain, produced nearly as much gain on fattening lambs as ground atlas fodder plus alfalfa, and cheaper gains were produced with the ground limestone-fodder ration.

11. Ground atlas fodder, when fed to fattening lambs with cot-

tonseed meal and atlas grain, produced a little larger gain and produced the gain at a lower cost than did atlas silage.

12. Atlas silage plus ground limestone fed to lambs, produced slightly larger and cheaper gains than ground atlas fodder without limestone, when each was fed with cottonseed meal and atlas grain.

13. Fattening lambs receiving atlas silage as the sole roughage

FIG. 5.—Lambs in lot 3 at the close of the experiment. These lambs were fed ground atlas fodder, cottonseed meal, and ground atlas grain (approximately 50 per cent concentrates and 50 per cent roughage). They gained 25.63 pounds per head, and weighed 87.05 pounds per head at the close of the experiment.

FIG. 6.—Lambs in lot 4 at the close of the experiment. These lambs were fed ground atlas fodder, cottonseed meal, ground atlas grain, and ground limestone. They gained 28.95 pounds per head, and weighed 91.56 pounds per head at the close of the experiment.

fed with cottonseed meal and atlas grain, made satisfactory gains and finished well, especially when one-fourth ounce ground limestone was fed per lamb daily.

14. Table XIV gives in composite form the data discussed in the body of this bulletin.

FIG. 7.—Lambs in lot 5 at the close of the experiment. These lambs were fed ground atlas fodder, cottonseed meal, and ground wheat. They gained 27.37 pounds per head, and weighed 89.35 pounds per head at the close of the experiment.

FIG. 8.—Lambs in lot 6 at the close of the experiment. These lambs were fed ground atlas fodder, cottonseed meal, ground wheat, and ground limestone. They gained 30.06 pounds per head, and weighed 92.06 pounds per head at the close of the experiment.

FIG. 9.—Lambs in lot 7 at the close of the experiment. These lambs were fed ground atlas fodder, alfalfa, cottonseed meal, and ground atlas grain. They gained 30.41 pounds per head, and weighed 92.37 pounds per head at the close of the experiment.

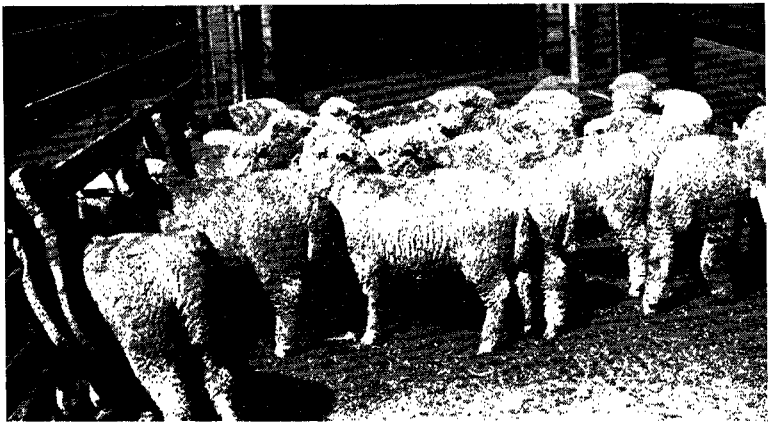

FIG. 10.—Lambs in lot 8 at the close of the experiment. These lambs were fed ground atlas fodder, alfalfa, cottonseed meal, ground atlas grain, and ground limestone. They gained 30.49 pounds per head, and weighed 92.42 pounds per head at the close of the experiment.

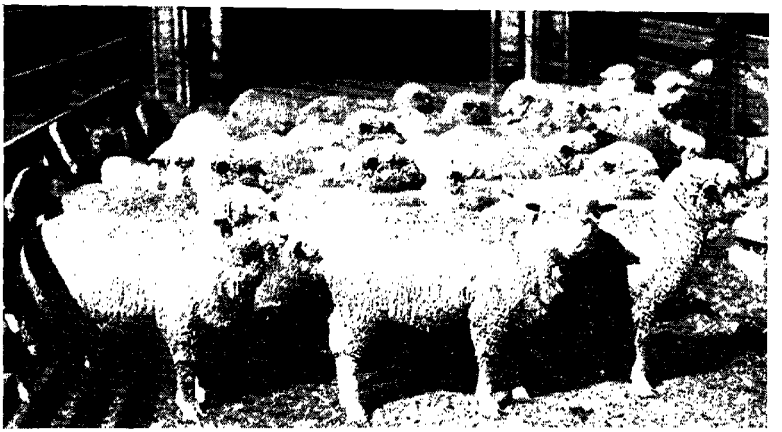

FIG. 11.—Lambs in lot 9 at the close of the experiment. These lambs were fed atlas silage, cottonseed meal, and ground atlas grain. They gained 24.86 pounds per head, and weighed 86.14 pounds per head at the close of the experiment.

FIG. 12.—Lambs in lot 10 at the close of the experiment. These lambs were fed atlas silage, cottonseed meal, ground atlas grain, and ground limestone. They gained 27.80 pounds per head, and weighed 90.04 pounds per head at the close of the experiment.

TABLE XIV.—RESULTS OF LAMB FEEDING EXPERIMENTS WITH ATLAS SORGO, INCLUDING TWELVE DISTINCT COMPARISONS.

PART I: Proportion of concentrates to roughage, **lots 1, 2, and 3.**

PART II: Comparison showing the value of GROUND LIMESTONE added to a ration of atlas fodder, cottonseed meal, and atlas grain, **lots 2 and 4.**

PART III: Comparison showing the value of GROUND LIMESTONE added **to a** ration of atlas fodder, cottonseed meal, and ground wheat, **lots 5 and 6.**

PART IV: Comparison showing the value of GROUND LIMESTONE added to a ration of atlas fodder, alfalfa hay, cottonseed meal, and ground atlas grain, **lots 7 and 8.**

PART V: Comparison showing the value of GROUND LIMESTONE added to a ration of atlas silage, cottonseed meal, and ground atlas grain, **lots 9 and 10.**

PART VI: GROUND ATLAS GRAIN *versus* GROUND WHEAT fed with ground atlas fodder and cottonseed meal **(test 1, lots 2 and, 5)** and with ground atlas fodder, cottonseed meal, and ground limestone **(test 2, lots 4 and 6).**

PART VII: Comparison showing the value of ALFALFA HAY added to a ration of ground atlas fodder, cottonseed meal, and ground atlas grain **(test 1, lots 2 and 7)** and to a ration of ground atlas fodder, cottonseed meal, ground atlas grain, and ground limestone **(test 2, lots 4 and 8);** also showing value of ALFALFA HAY in comparison with GROUND LIMESTONE added to **a** ration of ground atlas fodder, cottonseed meal, and ground atlas grain **(test 3, lots 2, 4, and 7).**

PART VIII: Ground atlas fodder *versus* atlas silage fed without ground limestone and atlas silage fed with ground limestone, **lots 3, 9 and 10.**

December 3, 1931, to March 22, 1932.

Lot No.	1	2	3	4	5	6	7	8	9	10
RATION FED.	Ground atlas fodder, cottonseed meal.	Ground atlas fodder, cottonseed meal, ground atlas grain.	Ground atlas fodder, cottonseed meal, ground atlas grain.	Ground atlas fodder, cottonseed meal, ground atlas grain, ground limestone.	Ground atlas fodder, cottonseed meal, ground wheat.	Ground atlas fodder, cottonseed meal, ground wheat, ground limestone.	Ground atlas fodder, alfalfa, cottonseed meal, ground atlas grain.	Ground atlas fodder, alfalfa, cottonseed meal, ground atlas grain, ground (i.e.	Atlas silage, cottonseed meal, ground atlas grain.	Atlas silage, cottonseed meal, ground atlas grain, ground limestone.
Number of lambs per lot	27	24	27	26	27	26	27	27	26	25
Number of days on feed	110	110	110	110	110	110	110	110	110	110
	Pounds.	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Initial weight per lamb	61.49	62.10	61.42	62.61	61.98	62.00	61.96	61.93	61.28	62.24
Final weight per lamb	83.25	86.61	87.05	91.56	89.35	92.06	92.37	92.42	86.14	90.04
Total gain per lamb	21.76	24.51	25.63	28.95	27.37	30.06	30.41	30.49	24.86	27.80
Daily gain per lamb	.20	.22	.23	.26	.25	.27	.28	.28	.23	.25

Feed consumed per lamb daily:										
Ground atlas fodder	3.80	2.68	1.89	2.70	2.67	2.66	1.65	1.68	.....	.....
Atlas silage	.....	.....	.....	.....	.....	.....	.....	.....	3.18	3.25
Alfalfa	.....	.....	.....	.....	.....	.....	.60	.60	.....	.....
Cottonseed meal	.25	.22	.24	.24	.24	.24	.24	.24	.24	.24
Ground atlas grain	.....	.54	.76	.54	.....	.....	.65	.65	.75	.75
Ground wheat	.....	.....	.....	.....	.54	.54	.....	.....	.....	.....
Ground limestone	.....	.....	.....	(Oz.) .25	.....	(Oz.) .25	.....	(Oz.) .25	.....	(Oz.) .25
Feed consumed per 100 pounds gain:										
Ground atlas fodder	1,923.16	1,201.92	811.20	1,026.49	1,074.06	973.65	598.26	604.59	.....	.....
Atlas silage	.....	.....	.....	.....	.....	.....	.....	.....	1,408.37	1,285.18
Alfalfa	.....	.....	.....	.....	.....	.....	216.61	216.04	.....	.....
Cottonseed meal	124.22	99.59	104.84	90.64	97.77	88.99	88.00	87.77	107.60	96.29
Ground atlas grain	.....	242.19	325.91	205.32	.....	.....	236.90	236.27	331.17	296.87
Ground wheat	.....	.....	.....	.....	216.51	197.77	.....	.....	.....	.....
Ground limestone	.....	.....	.....	5.94	.....	5.72	.....	5.64	.....	6.19
Feed cost per 100 pounds gain	$5.57	$5.21	$4.91	$4.56	$5.02	$4.62	$4.68	$4.74	$5.26	$4.81
Initial cost per lamb into feed lot at $4.85 per cwt. (*a*)	2.98	3.01	2.98	3.04	3.01	3.01	3.01	3.00	2.97	3.02
Feed cost per lamb (*b*)	1.21	1.28	1.26	1.32	1.37	1.39	1.42	1.45	1.31	1.34
Lamb cost plus feed cost (per head)	4.19	4.29	4.24	4.36	4.38	4.40	4.43	4.45	4.28	4.36
Necessary price per cwt. at feed lot to cover lamb cost plus feed cost	5.03	4.95	4.87	4.76	4.90	4.78	4.80	4.81	4.97	4.84
Appraised value per cwt. at feed lot (Kansas City basis less 70 cents per cwt. to cover estimated shrink and marketing costs)	4.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80	5.80
Margin per cwt. over lamb cost plus feed cost	—.23	.85	.93	1.04	.90	1.02	1.00	.99	.83	.96
Margin per head over lamb cost plus feed cost	—.19	.74	.81	.95	.80	.94	.92	.91	.71	.86

Feed Prices.—Ground atlas fodder, $4.50 per ton; atlas silage, $3 per ton; alfalfa, $9 per ton; cottonseed meal, $20 per ton; ground atlas grain, 35 cents per bushel; ground wheat, 45 cents per bushel; ground limestone, $1 per cwt.

(*a*) Death loss included in initial cost per lamb.
(*b*) Labor cost included in feed costs.