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DIVISION OF RANGE ANIMAL HUSBANDRY

(In cooperation with Division of Agriculture,  
Texas Technological College)

Effect of Calcium Supplements on Gains of Lambs  
Fed Sorghum Fodder or Sorghum Silage as the  
Roughage Portion of the Fattening Ration



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AGRICULTURAL AND MECHANICAL COLLEGE OF TEXAS  
T. O. WALTON, President

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Alfalfa hay is generally regarded as one of the most desirable and efficient roughages for use in lamb fattening rations, but it is not produced extensively in Texas and is not generally available for lamb feeding purposes in many areas. The grain sorghums are extensively produced, ranking third among the important crops of Texas, but feeding investigations of the Texas Station for many years have indicated that lambs fed sorghum roughage in place of alfalfa hay made considerably lower gains and did not finish as well as those fed the alfalfa hay. Alfalfa contains much more calcium than the sorghum. In order to ascertain whether the low calcium content of the sorghum roughages is responsible for the lower gains of fattening lambs fed these roughages, feeding experiments were conducted for six years beginning in 1928-29, testing the effect of calcium in the form of pulverized limestone or pulverized oyster shell when used as an addition to chopped or ground sorghum fodder or sorghum silage used as roughage in the fattening ration. The first test was conducted at Substation No. 7, Spur, and the remaining five tests at Lubbock in cooperation with the Division of Agriculture, Texas Technological College.

The calcium supplement ranged from 0.2 ounce to 0.47 ounce per head daily; however during the last three years, a standard amount of 0.4 ounce of the supplement was used inasmuch as this addition brought the calcium level of the sorghum roughage to approximately that of the alfalfa hay fed to the check lot. The check lot receiving alfalfa hay in all six of the experiments made decidedly more gains than those fed the sorghum roughage to which no calcium supplement had been added, but when the calcium supplement was added to the sorghum roughage the gains in practically all cases were significantly similar to the gains produced by the alfalfa roughage.

Results of these experiments indicated that lamb feeding rations in which sorghum roughage is used without a calcium supplement are unbalanced and therefore inefficient. Approximately 0.4 ounce pulverized limestone or pulverized oyster shell per head should be added to these sorghum roughages for lambs.

## CONTENTS

General plan of work.....	6
Lambs used .....	7
Feeds used .....	8
Feed prices .....	11
Weather conditions during test.....	12
Experimental results .....	12
Results 1928-29 (first test).....	12
Results 1929-30 (second test).....	18
Results 1930-31 (third test).....	20
Results 1931-32 (fourth test).....	24
Results 1932-33 (fifth test).....	27
Results 1933-34 (sixth test).....	30
Productive energy of feeds used.....	36
Discussion .....	45
Acknowledgment .....	45
Summary .....	46
Literature cited .....	47

## EFFECT OF CALCIUM SUPPLEMENTS ON GAINS OF LAMBS FED SORGHUM FODDER OR SORGHUM SILAGE AS THE ROUGHAGE PORTION OF THE FATTENING RATION

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The problem of the efficient utilization of the sorghum roughages in lamb fattening rations is important to feeders in Texas because of the tremendous acreage devoted to these crops. Possibilities for expansion are practically unlimited. One of the major obstacles that has in the past tended to retard the feeding and finishing of lambs in Texas has been the lack of a suitable roughage to be used in place of alfalfa hay. Though alfalfa hay is generally regarded as one of the most desirable and efficient roughages for use in lamb fattening rations, it is not produced extensively in Texas, and is not generally available for lamb feeding purposes in many areas. On the other hand the grain sorghums are extensively produced, ranking third among the important crops of Texas (1). In 1935, the Texas alfalfa acreage harvested was 72,000, as compared with 6,155,000 that had been planted to sorghum crops (2).

Earlier feeding investigations at this Station had indicated that fattening lambs fed sorghum roughage in place of alfalfa hay made considerably lower gains and did not finish as satisfactorily as those fed the leguminous hay (3). It was with full realization of the importance of gaining some further definite information covering the more efficient utilization of sorghum roughages in the lamb fattening ration that the series of six tests herein reported were initiated.

Analyses of the sorghum roughages for a determination of the mineral content showed that the calcium content of the fodder is only about one-fourth of that of good alfalfa hay. Naturally in consideration of this problem, the question arose as to whether the low calcium content in these roughages could in any way be associated with the lower gains of fattening lambs on such rations.

In 1927 the Kansas Station reported a feeding test in which fattening lambs fed sorghum fodder and sorghum silage supplemented with 0.016 pound pulverized limestone per head daily during a 60-day period made increased gains over groups similarly fed without limestone (4).

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### GENERAL PLAN OF WORK

This experiment was planned to determine the influence of 0.2 to 0.4 ounce per head daily of pulverized limestone or pulverized oyster shell, each of high calcium content, on the gains made by lambs fed chopped or ground sorghum fodder or silage as the roughage portion of the fattening ration. Tests were conducted during six consecutive feeding seasons beginning in 1928-29 and ending in 1933-34. The first test was conducted at Substation No. 7 located at Spur and the latter five at Lubbock in cooperation with the Division of Agriculture, Texas Technological College. Nine lots of 30 lambs each were used in the first test, which study included a comparison of several of the leading grain sorghum fodders. Six lots of 20 lambs each were used in the five subsequent tests.

In each test duplicate ear tags were placed in the ears of each lamb as a means of identification. The lambs were weighed individually on three consecutive days at the beginning and end of each trial and the average of the three weighings, respectively, constituted the initial and final weights. Individual weights were also taken at regular 30-day intervals during each trial except in the 1932-33 and 1933-34 tests. In 1932-33, the first, second, and third periods were of 28 days' duration while the fourth lasted only 14 days. In 1933-34, the first two periods were of 30 days' duration while the final period extended over 33 days. All weighings started at 2 P. M. on the respective weighing dates and proceeded without interruption until all lambs had been weighed.

The actual periods of feeding for each of the respective tests were as follows:

- 1st test, 1928-29, from Dec. 2, 1928 to March 2, 1929, 90 days
- 2nd test, 1929-30, from Nov. 26, 1929 to Feb. 24, 1930, 90 days
- 3rd test, 1930-31, from Dec. 1, 1930 to March 1, 1931, 90 days
- 4th test, 1931-32, from Jan. 1, 1932 to March 31, 1932, 90 days
- 5th test, 1932-33, from Jan. 25, 1933 to May 3, 1933, 98 days
- 6th test, 1933-34, from Dec. 30, 1933 to April 2, 1934, 93 days.

In the first test at Spur, all of the lots were of similar dimensions, and an open shed 18 feet in depth served to provide shelter for the lambs during inclement weather. Slatted combination grain and hay racks of identical size and the same general structure were used in all of the lots. Water was supplied from a shallow well which provided "gyppy" water. A supply of granulated stock salt was kept before the lambs at all times.

At Lubbock, the same pens were used in each of the five tests conducted there. Each lot had access to an open shelter 10 feet by 16 feet in addition to an outside pen 10 feet by 50 feet. Feed troughs similar in design to those used at Spur and of the same dimensions were used. Salt and water were kept before the lambs continuously.

The lambs were fed twice each day, the morning feed being supplied about 7 A. M. and the evening feed at 5 P. M. The feed racks were cleansed with a broom before each feeding, any waste or refused feed being weighed in order to obtain as accurate a record as possible for the actual feed

consumed. All unconsumed feed was weighed and deducted from the original amount supplied. The grain and cottonseed meal, except in the check lots, were mixed together in definite proportions for each test. The proportions varied slightly from year to year, but insofar as possible they were kept constant for all lots fed sorghum roughages. The check lots, fed alfalfa hay, were fed less cottonseed meal in proportion to the grain, since alfalfa is much higher in protein content than are the sorghum roughages. The amount of concentrates fed was increased in accordance with the ability of the respective groups to consume more.

### Lambs Used

In the 1928-29 test, high grade smooth-bodied Rambouillet wether lambs were used. They were divided into nine lots of 30 lambs each. Lots 1 to 7 inclusive were fed during a 90-day period. They were uniform in type, size, and condition when the experiment started, the average weight being about 63 pounds. Lots 8 and 9 were fed during an 88-day period. They were heavier lambs, the average weight at the beginning of the test being 71 pounds. They were uniform in type and condition. A lamb in Lot 2 receiving ground sorgo (Red Top) fodder died on January 7, 1929. Two lambs in Lot 3 receiving ground feterita fodder died before being slaughtered in Fort Worth. One lamb was removed from Lot 4, fed ground kafir fodder on January 26, 1929, and one died in the Fort Worth yards after selling. Three lambs were removed from Lot 5, fed ground hegari fodder, due to uremic poisoning—one on February 12, 1929; one on February 26, 1929; and one in Fort Worth before the lambs were sold. On February 21, 1929, one sick lamb was taken out of Lot 6, fed ground milo fodder. One sick lamb was taken out of Lot 7, fed ground milo fodder with pulverized limestone, just before shipment to market, and one died en route.

The lambs used in the 1929-30 test were high grade Rambouillets. The average weight when the test started was approximately 60 pounds. They were divided as equally as possible as to type, size, and condition into six lots of 20 lambs each. Pneumonia caused the death of one lamb in Lot 4, fed ground hegari fodder with pulverized oyster shell, on February 4, 1930. On February 13, 1930, a lamb died in Lot 6, fed ground hegari fodder, caused by occlusion of urethra due to a deposit of urinary salts in bladder. One lamb in Lot 3, fed a mixture of ground alfalfa hay and ground hegari fodder, did not respond to the ration and was therefore not included in the analyses of the data.

High grade Rambouillet lambs were used in the 1930-31 test. They had been grazed on wheat pasture for a three weeks' period immediately preceding purchase. After delivery, they were placed on a preliminary feed of bundle hegari fodder during a five-day period until the feeding period began. Only one weight was taken at the conclusion of the test as a severe snow storm prevented the taking of the other two weights. Their average initial weight was 53.6 pounds and they were divided as equally as possible as to size, type, age, and sex into six lots of 20 lambs each. One

lamb in Lot 1, fed ground alfalfa hay, died on February 7, 1931, and another in Lot 3, fed ground hegari fodder with pulverized oyster shell, died February 9, 1931.

High grade smooth-bodied Rambouillet lambs averaging 54.3 pounds at the time of going on feed, were used in the 1931-32 test. At time of purchase the lambs were being fed Red Top sorgo fodder and were continued on this feed during a five-day period until the feeding test began on January 1, 1932. They were divided into six lots of 20 lambs each. One lamb in Lot 2, fed sorgo silage, was off feed for several days and died on March 11, 1932.

Smooth-bodied Rambouillet lambs averaging 62.6 pounds at the time of going on feed were used in the 1932-33 test. They were delivered at Lubbock, January 17, 1933 and after an eight-day preliminary feeding period, were divided as equally as possible into six lots of 20 lambs each. Three lambs either died or were removed from each of Lots 2 and 4, fed sorgo silage and sorgo fodder, respectively. A lamb died in Lot 2 on April 10, one on April 28 from urinary calculi, and one on May 1. The causes of the deaths of two of the lambs are unknown. One lamb was taken out of Lot 4 on February 15, due to a broken leg; one died on March 6 because of urinary calculi, and one died May 3, the cause of which was unknown.

The lambs used in the 1933-34 test were good to choice feeder lambs of Rambouillet breeding, and averaged 59.5 pounds at the time of being placed on feed. They were divided equally with respect to type, conformation, and weight into six lots of 20 head each at the beginning of the test. One lamb in Lot 2, fed sorgo silage, died on February 28, 1934, and two were not marketed due to having been off feed for several days. In Lot 4, one lamb was removed and one died on March 20, 1934. On March 20, 1934, two lambs were taken out of Lot 5, fed cottonseed meal and hulls with milo head chop during the last 63 days, because they had gone off feed. Another one was not marketed for the same reason.

A lamb in Lot 6, fed cottonseed meal and hulls (without grain) died on April 3, 1934 because of an extreme case of "water belly" or uremic poisoning.

#### Feeds Used

The feeds used in each of the six tests were of good quality. The cottonseed meal was purchased under a guarantee of 43 per cent crude protein content; however, three analyses by the Division of Chemistry, as given in Table 1-A, showed a protein content of only slightly over 41 per cent in cottonseed meal used in the first test. Analyses of feeds used in the second and third tests, 1929-30 and 1930-31, were not made. However, analyses of feeds used in the last three tests are shown in Table 1-B. Good leafy fine-stemmed alfalfa hay from second and third cuttings was used in the first test. Alfalfa hay of similar quality was used in the five tests at Lubbock. With the exception of the final test in 1933-34, the alfalfa hay fed in connection with the tests at Lubbock was ground.



Table 1-A. Chemical composition and mineral content of feeds used in 1928-29 Spur lamb feeding test

Feed	Year	Chemical Composition							Mineral content		
		No. analyses	Protein %	Fat %	Crude fiber %	N.F.E. %	Water %	Ash %	No. analyses	Calcium (Ca.) %	Phosphorus (P.) %
Cottonseed meal . . . . .	1928-29	3	41.24	7.26	12.10	27.76	6.39	5.25	2	.157	.747
Ground milo heads . . . . .	1928-29	3	10.40	2.16	8.77	64.56	10.38	3.73	2	.16	.266
Alfalfa hay . . . . .	1928-29	3	15.96	2.01	23.83	39.83	9.55	8.82	1	1.015	.223
Ground milo fodder . . . . .	1928-29	3	7.30	1.45	18.89	51.47	13.90	6.99	2	.343	.179
Ground feterita fodder . . . . .	1928-29	3	7.32	1.87	17.07	47.15	19.58	7.01	2	.272	.192
Ground kafir fodder . . . . .	1928-29	3	7.56	1.93	17.71	51.36	15.35	6.09	2	.207	*.197
Ground hegari fodder . . . . .	1928-29	3	6.10	1.61	16.62	49.21	20.18	6.28	2	.222	.175
Ground cane (Red Top) fodder	1928-29	3	5.64	1.60	20.66	50.18	16.04	5.88	2	.229	*.188
Pulverized limestone . . . . .	1928-29	.....	.....	.....	.....	.....	.....	.....	1	35.542	.....

\*Only one analysis for phosphorus.

Table 1-B. Chemical composition and mineral content of feeds used in Lubbock lamb feeding tests, 1931-32, 1932-33, and 1933-34

Feed	Year	Chemical composition							Mineral content		
		No. analyses	Protein %	Fat %	Crude fiber %	N.F.E. %	Water %	Ash %	No. analyses	Calcium %	Phosphorus %
Cottonseed meal.....	1931-32	2	43.48	8.29	11.86	26.00	5.45	4.92	1	.186	.708
Cottonseed meal.....	1932-33	1	43.33	9.13	9.13	28.21	4.30	5.90	1	.236	.917
Cottonseed meal.....	1933-34	2	43.91	7.96	9.58	27.61	5.51	5.43	2	.200	.917
Average.....			43.57	8.46	10.19	27.27	5.09	5.42		.207	.847
Ground milo heads.....	1931-32	2	9.90	2.59	6.55	65.98	9.52	5.46	2	.086	.201
Ground milo heads.....	1932-33	1	10.78	2.05	6.70	68.11	9.20	3.16	1	.064	.249
Ground milo heads.....	1933-34	2	10.65	2.44	7.16	66.44	8.84	4.47	2	.093	.280
Average.....			10.44	2.36	6.80	66.84	9.20	4.36		.081	.243
Ground alfalfa hay.....	1931-32	2	16.17	1.88	27.25	37.23	9.47	8.00	2	1.051	.218
Ground alfalfa hay.....	1932-33	1	14.05	1.71	30.93	34.97	9.95	8.39	1	1.036	.205
Ground alfalfa hay.....	1933-34	2	16.80	1.90	26.83	36.83	7.54	10.10	2	1.179	.210
Average.....			15.67	1.83	28.34	36.34	8.99	8.83		1.089	.211
Ground sorgo (Red Top) fodder	1931-32	2	5.50	2.18	15.00	54.88	16.64	5.80	1	.229	.092
Ground sorgo (Red Top) fodder	1932-33	1	5.41	1.30	19.14	48.76	18.29	7.10	1	.236	.096
Average.....			5.46	1.74	17.07	51.82	17.46	6.45		.232	.094
Sorgo (Red Top) silage.....	1931-32	2	2.51	0.96	6.34	21.26	66.86	2.07	1	.093	.048
Sorgo (Red Top) silage.....	1932-33	1	1.76	0.70	5.92	12.19	77.67	1.76	1	.079	.035
Sorgo (Red Top) silage.....	1933-34	2	2.48	0.94	6.62	19.83	67.96	2.17	2	.107	.052
Average.....			2.25	0.87	6.29	17.76	70.83	2.00		.093	.045
Cottonseed hulls.....	1933-34	2	5.36	1.38	42.82	38.36	8.50	3.58	2	.136	.083
Pulverized oyster shell.....	1931-32								1	38.865	
Pulverized oyster shell.....	1933-34								1	38.229	
Average.....										38.547	
Ground hegari fodder, Spur...	1928-33	6	6.51	1.91	16.40	46.21	22.22	6.75	6	.207	.170



### Weather Conditions During Test

The maximum and minimum temperatures as well as the distribution of rainfall during the period of the experiments are shown in Table 3.

### EXPERIMENTAL RESULTS

Alfalfa hay was supplied to a check group of fattening lambs in each of the six tests as a standard for the comparison of gains made by the lambs fed sorghum roughage in the form of fodder or silage with and without the calcium supplement. The conclusions from the several tests were based on (1) gains, and (2) finish as determined by carcass grades.

#### Results 1928-29

##### (First Test)

The average daily rations and gains by 30-day periods are presented in Table 4. A summary of the first year's test including initial and final weights per lamb, both at feedlot and at market, average daily gain basis feedlot and market weights, average daily rations, total feed consumed per lamb, feed per 100 pounds of gain, cost of feed per 100 pounds of gain, dressing percentage, and profit per lamb is shown in Table 5. Slaughter data are shown in Table 5A. The lambs in the check lot, fed alfalfa hay as roughage in addition to a concentrate mixture consisting of approximately 9 parts ground milo heads to 1 part of cottonseed meal, made an average daily gain of 0.36 pound per head, feedlot basis, or an average total gain of 32.7 pounds. The lambs fed the different sorghum roughages were supplied with ground milo heads and cottonseed meal in a proportion of about 4 to 1 in order to bring the protein to approximately the same level as in the check lot. The gains made by the lambs fed (1) ground sorgo fodder, (2) ground feterita fodder, (3) ground kafir fodder, (4) ground hegari fodder, and (5) ground milo fodder respectively without the calcium supplement during the 90-day period ranged from 5 to 7 pounds below the gains of the check group, fed alfalfa hay.

Table 3. Weather data during the six experiments

	1928-29 Spur			1929-30 Lubbock			1930-31 Lubbock			1931-32 Lubbock			1932-33 Lubbock			1933-34 Lubbock		
	Maximum Temperature	Minimum Temperature	Precipitation, Inches	Maximum Temperature	Minimum Temperature	Precipitation, Inches	Maximum Temperature	Minimum Temperature	Precipitation, Inches	Maximum Temperature	Minimum Temperature	Precipitation, Inches	Maximum Temperature	Minimum Temperature	Precipitation, Inches	Maximum Temperature	Minimum Temperature	Precipitation, Inches
November.....																		
After 26th, inclusive.....				71	25													
December.....				76	8	.07	62	12	1.44									
After 2nd, inclusive.....	81	16	.33															
After 28th, inclusive.....																69	20	.05
January.....	73	6	.27	68	-10	.61	68	18	.32	69	13	.93				76	12	.06
After 25th, inclusive.....													65	19				
February.....	76	7	.21				71	26	1.98	82	16	1.09	77	-17	.95	80	9	.06
Until 24th, inclusive.....				80	20													
March.....													86	22	.02	87	19	1.98
Until 2nd, inclusive.....	73	23																
Until 1st, inclusive.....							52	25	1.10									
April.....													86	24	.06			
Until 2nd, inclusive.....																85	45	
May.....																		
Until 3rd, inclusive.....													83	41				
Total precipitation.....			.81			.68			4.84			2.06			1.03			2.15

Table 4. Average daily rations and gains by periods, basis feed consumed—Spur lamb feeding test, 1928-29, 90 days (Lots 8 and 9—88 days)

Lot No.	Ration	1st 30-day period, pounds **	2d 30-day period, pounds	3d 30-day period, pounds	Average for 90-day period, pounds
1 (30 hd.)	Ground milo heads.....	1.089	1.552	2.232	1.624
	Cottonseed meal.....	.136	.172	.248	.185
	Alfalfa hay.....	1.541	1.507	.932	1.326
	Salt, oz.....	.27	.27	.22	.26
	Total gain per lamb.....	9.19	10.78	12.75	32.72*
	Average daily gain.....	.306	.359	.425	.364
2 (29 hd.)	Ground milo heads.....	.861	1.183	1.801	1.282
	Cottonseed meal.....	.287	.352	.289	.309
	Ground sorgo (Red Top) fodder.....	1.580	1.510	.957	1.349
	Salt, oz.....	.27	.50	.32	.37
	Total gain per lamb.....	10.38	6.19	10.36	26.93*
	Average daily gain.....	.346	.206	.345	.299
3 (30 hd.)	Ground milo heads.....	.861	1.183	1.801	1.282
	Cottonseed meal.....	.287	.352	.289	.309
	Ground feterita fodder.....	1.703	1.643	.830	1.392
	Salt, oz.....	.18	.35	.30	.29
	Total gain per lamb.....	9.24	7.57	8.64	25.45*
	Average daily gain.....	.308	.252	.288	.283
4 (29 hd.)	Ground milo heads.....	.861	1.183	1.801	1.282
	Cottonseed meal.....	.287	.352	.289	.309
	Ground kafir fodder.....	1.631	1.425	.672	1.243
	Salt, oz.....	.27	.45	.32	.34
	Total gain per lamb.....	9.54	7.31	8.42	25.27*
	Average daily gain.....	.318	.244	.281	.281
5 (27 hd.)	Ground milo heads.....	.861	1.183	1.801	1.282
	Cottonseed meal.....	.287	.352	.289	.309
	Ground hegari fodder.....	1.660	1.500	.741	1.301
	Salt, oz.....	.18	.27	.21	.22
	Total gain per lamb.....	8.63	9.76	8.85	27.24*
	Average daily gain.....	.288	.325	.295	.303
6 (29 hd.)	Ground milo heads.....	.861	1.183	1.801	1.282
	Cottonseed meal.....	.287	.352	.289	.309
	Ground milo fodder.....	1.635	1.532	.706	1.291
	Salt, oz.....	.18	.45	.34	.32
	Total gain per lamb.....	9.84	9.84	7.62	27.30*
	Average daily gain.....	.328	.328	.254	.303
7 (28 hd.)	Ground milo heads.....	.861	1.183	1.801	1.282
	Cottonseed meal.....	.287	.352	.289	.309
	Ground milo fodder.....	1.641	1.567	.971	1.393
	Salt, oz.....	.27	.45	.45	.38
	Pulverized limestone, oz.....	.242	.250	.250	.247
Total gain per lamb.....	10.31	10.58	10.30	31.19*	
	Average daily gain.....	.344	.353	.343	.347
8 (30 hd.)	Ground milo heads.....	.925	1.331	2.122	1.471
	Cottonseed meal.....	.308	.396	.340	.349
	Ground sorgo (Red Top) fodder.....	2.039	1.804	1.103	1.640
	Salt, oz.....	.19	.35	.32	.29
	Total gain per lamb.....	10.02	10.30	9.45	29.77*
	Average daily gain.....	.358	.343	.315	.338
9 (30 hd.)	Ground milo heads.....	.925	1.331	2.122	1.471
	Cottonseed meal.....	.308	.396	.340	.349
	Ground sorgo (Red Top) fodder.....	2.032	1.808	1.291	1.703
	Salt, oz.....	.19	.35	.34	.30
	Pulverized limestone, oz.....	.267	.267	.267	.267
Total gain per lamb.....	10.91	10.55	10.19	31.65*	
	Average daily gain.....	.390	.352	.340	.360

\*Total gain for entire period.

\*\*1st period—28 days for Lots 8 and 9.

Table 5. Summary of Spur lamb feeding trial, 1928-29, 90 days (Lots 8 and 9—88 days)

Item	Lot 1 Alfalfa hay	Lot 2 Ground sorgo fodder	Lot 3 Ground feterita fodder	Lot 4 Ground kafir fodder	Lot 5 Ground hegari fodder	Lot 6 Ground milo fodder	Lot 7 Ground milo fodder†	Lot 8 Ground sorgo fodder	Lot 9 Ground sorgo fodder†
Number lambs per lot.....	30	29	30	29	27	29	28	30	30
Average initial weight at feedlot, lbs.....	63.02	62.46	63.48	62.74	63.19	62.91	63.48	70.87	71.38
Average final weight at feedlot, lbs.....	95.74	89.39	88.93	88.01	90.43	90.21	94.67	100.64	103.03
Average final weight at market, lbs.....	87.67	82.76	83.04	79.83	82.31	81.72	84.83	91.50	94.83
Average gain per head, feedlot weights, lbs.....	32.72	26.93	25.45	25.27	27.24	27.30	31.19	29.77	31.65
Average gain per head, market weights, lbs.....	24.65	20.30	19.56	17.09	19.12	18.81	21.35	20.63	23.45
Average daily gain, feedlot weights, lbs.....	.364	.299	.283	.281	.303	.303	.347	.338	.360
Average daily gain, market weights, lbs.....	.274	.226	.217	.190	.212	.209	.237	.234	.266
Shrinkage per head during shipment, lbs.....	8.07	6.63	5.89	8.18	8.12	8.49	9.84	9.14	8.20
Shrinkage per head during shipment, %.....	8.43	7.42	6.62	9.29	8.98	9.41	10.39	9.08	7.96
Average daily ration (consumed) pounds:									
Ground milo heads.....	1.62	1.28	1.28	1.28	1.28	1.28	1.28	1.47	1.47
Cottonseed meal.....	.185	.309	.309	.309	.309	.309	.309	.349	.349
Roughage.....	1.33	1.35	1.39	1.24	1.30	1.29	1.39	1.64	1.70
Salt, oz.....	.26	.37	.29	.34	.22	.32	.38	.29	.30
Pulverized limestone, oz.....							.247		.267
Total feed consumed per head, pounds:									
Ground milo heads.....	146.16	115.36	115.36	115.36	115.36	115.36	115.36	129.49	129.49
Cottonseed meal.....	16.68	27.84	27.84	27.84	27.84	27.84	27.84	30.71	30.71
Roughage.....	119.38	121.42	125.32	111.85	117.06	116.20	125.39	144.32	149.86
Salt.....	1.43	2.04	1.58	1.93	1.22	1.80	2.17	1.61	1.64
Pulverized limestone.....							1.39		1.47
Feed required per cwt. gain (feedlot wts.):									
Ground milo heads.....	446.71	428.37	453.28	456.51	423.49	422.56	369.86	434.96	409.12
Cottonseed meal.....	50.99	103.38	109.39	110.17	102.20	101.98	89.26	103.16	97.04
Roughage.....	364.86	450.86	492.40	442.62	429.74	425.64	402.02	484.80	473.48
Cost of feed per cwt. gain:									
Basis feed consumed, feedlot weights.....	\$ 8.58	\$ 8.05	\$ 8.58	\$ 8.40	\$ 7.87	\$ 7.85	\$ 7.06	\$ 8.26	\$ 7.91
Basis feed consumed, market weights.....	\$ 11.38	\$ 10.69	\$ 11.17	\$ 12.43	\$ 11.21	\$ 11.39	\$ 10.32	\$ 11.91	\$ 10.66
Average cold carcass weight (2½% shrinkage)	41.54	38.06	38.93	38.48	39.47	39.38	41.86	43.74	46.02
Dressing percentage:									
Basis feedlot weights.....	43.39	42.58	43.78	43.72	43.84	43.65	44.60	43.46	44.67
Basis market weights.....	47.38	45.99	46.88	48.20	47.95	48.19	49.35	47.80	48.53
Financial Statement:									
Initial cost per lamb at 11 cents per lb.....	\$ 6.93	\$ 6.87	\$ 6.98	\$ 6.90	\$ 6.95	\$ 6.92	\$ 6.98	\$ 7.80	\$ 7.85
Cost of feed per lamb.....	2.98	2.25	2.29	2.25	2.25	2.33	2.32	2.59	2.60
Interest, labor, shipping, etc.....	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40	1.40
Total cost.....	11.31	10.52	10.67	10.55	10.60	10.65	10.70	11.79	11.85
Selling price per pound, cts.....	15.75	15.25	15.25	15.25	15.25	15.00	15.75	15.75	15.75
Price received per lamb.....	13.81	12.62	12.66	12.17	12.55	12.26	13.36	14.41	14.94
Profit per lamb*.....	2.50	2.10	1.99	1.62	1.95	1.61	2.66	2.62	3.09

\*Profit shown does not take into account the losses in the various lots.

†Fed pulverized limestone.

EFFECT OF CALCIUM SUPPLEMENT ON LAMBS

Table 5-A. Showing shrinkage in transit and slaughter data of lambs fed at Spur, 1928-29, first test

Item	Lot 1 Alfalfa	Lot 2 Ground sorgo fodder	Lot 3 Ground feterita fodder	Lot 4 Ground kafir fodder	Lot 5 Ground hegari fodder	Lot 6 Ground milo fodder	Lot 7 Ground milo fodder	Lot 8 Ground sorgo fodder	Lot 9 Ground sorgo fodder
Mineral supplement, pulverized limestone, oz.	none	none	none	none	none	none	0.25	none	0.27
Weight at market	87.7	82.8	83.0	79.8	82.3	81.7	84.8	91.5	94.8
Shrinkage per head in shipping, lbs.	8.1	6.6	5.9	8.2	8.1	8.5	9.8	9.1	8.2
Average weight dressed carcass, chilled	41.5	38.1	38.9	38.5	39.5	39.4	41.9	43.7	46.0
Dressing %, basis market weights	47.4	46.0	46.9	48.2	48.0	48.2	49.4	47.8	48.5
Average weight internal fat, lbs.	1.4	1.1	1.0	1.1	1.0	1.1	1.3	1.4	1.2
Average weight pelt, per head, lbs.	14.7	14.0	13.7	13.7	13.4	13.6	14.7	14.8	15.1
Carcass grades:									
Choice	3	3	1						
Good	15	15	13	16	17	11	19	12	7
Medium	5	9	10	11	6	11	3	3	1
Fair					1	3			
Heavy, 50 lbs. and up		1							
Strong, 45-49 lbs.	7		2	1	2	4	6	5	9
Condemned (uremic poisoning)		1	2		1			10	13



It will be noted, however, that the inclusion of 0.25 ounce pulverized limestone per head daily in the ration of Lot 7, fed ground milo fodder as roughage, and with the concentrates in the same amount and proportion as fed to Lots 2-6 inclusive, produced basis selling weight an average gain of 21.35 pounds, or only 13.4 per cent less gain than that made by the check group, Lot 1, fed alfalfa hay. The average gain made by Lots 2 to 6 inclusive was approximately 23 per cent less than the check group, Lot 1. In a comparison of the dressed carcass weights between the various lots, it is observed that those produced by Lot 7, fed the calcium supplement, were slightly heavier than those produced in the alfalfa group, also 2.5 pounds heavier than those in Lot 6, which with the exception of the mineral, were similarly fed. The carcasses, chilled basis, groups 2 to 6 inclusive, of lambs which did not receive the mineral supplement, averaged 38.9 pounds each, or 7.2 per cent lighter than those in Lot 7, which received milo fodder and the calcium supplement. In the comparison between the two heavier groups (Lots 8 and 9), fed during an 88-day period, the lambs in Lot 9, fed 0.27 ounce of the calcium supplement per head daily, gained approximately 2 pounds more per head during the 88 days than did Lot 8, which did not receive the calcium supplement. (See Table 5.)

Table 5 illustrates the manner in which the respective lots responded to the different kinds of sorghum roughages. Lots 7 and 9, fed pulverized limestone, also check lot, fed alfalfa hay, each required less concentrates to produce 100 pounds of gain than did any of the lots fed the various sorghum roughages without the calcium supplement. With feeds charged at the prices for the 1928-29 period as shown in Table 3, the cost of feed per 100 pounds of gain in Lot 7, fed ground milo fodder with pulverized limestone, was \$7.06, which was the most economical gain made by any of the groups and was \$0.79 less than in Lot 6, fed ground milo fodder without the calcium supplement. The inclusion of 0.27 ounce pulverized limestone per head daily also reduced the cost of gain in Lot 9 as compared with Lot 8 which did not receive the calcium supplement. The cost of feed per 100 pounds gain, feedlot basis, for the check lot, fed alfalfa hay, was as high as similar costs for the groups fed sorghum roughage or higher, due to the fact that the alfalfa hay was charged at \$20.00 per ton as compared with \$9.50 per ton for the sorghum roughage.

The advantage in finish as indicated by dressing percentages, and cold carcass weights, Table 5A, was in favor of the lambs fed the calcium supplement. The carcasses of the Lot 8 lambs, which received the sorgho fodder without the calcium supplement, averaged approximately 5 per cent lighter than Lot 9, which received this supplement.

Lot 7, receiving the calcium supplement, showed practically the same amount of internal fat as did Lot 1, fed alfalfa hay. As between the two heavier groups, Lots 8 and 9, the former lot, which did not receive the calcium supplement, showed a slight advantage in internal fat. In a comparison of pelt weights between the various lots, as shown in Table 5A, it is observed that the two groups fed the mineral supplement

yielded heavier pelts than did those fed sorghum roughages without the mineral. The check group, Lot 1, produced pelts of the same weight as those of Lot 7, which indicates that the weight of pelt is highest when sufficient calcium is provided in the ration.

### Results 1929-30

#### (Second Test)

The following comparisons were made in this test: (1) ground alfalfa hay in Lot 1; ground alfalfa hay and ground hegari fodder, approximately equal parts, in Lot 2; and ground alfalfa hay and ground hegari fodder fed in approximately 2.6 parts of alfalfa to 1 part of hegari fodder in Lot 3. (2) Varying amounts of pulverized oyster shell, Lots 4 and 5, as a calcium supplement to ground hegari fodder.

The average daily rations and gains by 30-day periods are shown in Table 6, while other important summary data are presented in Table 7. Slaughter data were not available in the 1929-30 test since fifty head of top lambs were selected from the 120 head fed, and exhibited at the Southwestern Exposition and Fat Stock Show.

The Lot 1 (check) lambs fed alfalfa hay as the roughage portion of the ration received ground milo heads and cottonseed meal in a proportion of 9 to 1 throughout the 90-day feeding period. Lot 2, which received a roughage mixture of approximately equal parts of alfalfa and hegari fodder, were fed ground milo heads and cottonseed meal in a proportion of 7 to 1 during the first 30 days and 5.7 to 1 during the second and third 30-day periods. Lot 3, which received a roughage mixture of approximately 2.6 parts of ground hegari fodder to 1 part alfalfa hay, was fed a mixture of 4 parts ground milo heads to 1 part of cottonseed meal during the first 30 days, after which time the proportion was changed to 5.7 to 1. Lots 4, 5, and 6, fed ground hegari fodder as the roughage portion of the ration, each received ground milo heads and cottonseed meal in a proportion of 3 to 1 during the first 30 days, and 4 to 1 during the second and third periods.

Gains for the respective groups basis final feedlot weights, as shown in Table 7, ranked in the following order: First, Lot 5, fed hegari fodder as roughage supplemented with 0.4 ounce pulverized oyster shell per head daily; second, Lot 1 (check), fed alfalfa hay as the sole roughage; third, Lot 4, fed hegari fodder as roughage supplemented with 0.2 ounce pulverized oyster shell per head daily; fourth, Lot 2, fed approximately equal parts alfalfa hay and hegari fodder; fifth, Lot 3, fed approximately 2.6 parts hegari fodder to 1 part alfalfa hay; and sixth, Lot 6, fed hegari fodder as roughage without the calcium supplement.

In this test, Lot 5, receiving 0.4 ounce pulverized oyster shell per head daily, made a slightly larger and cheaper gain than Lot 4, which received 0.2 ounce of this mineral per head daily. These differences were not significant, however, when compared with the gain by Lot 6, which did not receive the calcium supplement. The differences were highly significant

in favor of the addition of 0.2 to 0.4 ounce of pulverized oyster shell per head daily.

In a comparison between Lots 2 and 3 as indicated in Table 7, gains favored the feeding of equal parts of alfalfa hay and hegari fodder by 2.1 pounds per head.

An appraisal of the selling values of the respective lots, based on the Kansas City market (February 26, 1930) was made by one of the reliable Fort Worth commission firms. As shown in Table 7, Lots 1, 2, 4, and 5 were appraised at \$10.25 per 100 pounds liveweight as compared with \$10.15 and \$10.00 for Lots 3 and 6 respectively, which lacked the uniformity and finish of the other groups.

Table 6. Average daily rations and gains by periods (basis feed consumed) Lubbock, 1929-30, 90 days

Lot No.	Rations	1st 30-day period, pounds	2d 30-day period, pounds	3d 30-day period, pounds	Average for 90-day period, (entire test) pounds
1 (20 hd.)	Ground milo heads.....	1.08	1.35	1.80	1.41
	Cottonseed meal.....	.12	.15	.20	.16
	Ground alfalfa hay.....	1.49	1.39	.90	1.26
	Salt, oz.....	.67	.53	.11	.43
	Total gain per head.....	10.75	9.88	9.72	30.35
	Average daily gain.....	.36	.33	.32	.34
2 (20 hd.)	Ground milo heads.....	1.02	1.31	1.75	1.36
	Cottonseed meal.....	.18	.19	.25	.21
	Ground alfalfa hay.....	.75	.75	.52	.67
	Ground hegari fodder.....	.75	.66	.42	.61
	Salt, oz.....	.67	.53	.43	.54
	Total gain per head.....	10.33	7.87	11.68	29.88
	Average daily gain.....	.34	.26	.39	.33
3 (19 hd.)	Ground milo heads.....	.96	1.28	1.70	1.31
	Cottonseed meal.....	.24	.22	.30	.26
	Ground alfalfa hay.....	.38	.38	.26	.34
	Ground hegari fodder.....	1.12	1.00	.54	.89
	Salt, oz.....	.67	.53	.53	.58
	Total gain per head.....	10.65	8.92	8.23	27.80
	Average daily gain.....	.36	.30	.27	.31
4 (19 hd.)	Ground milo heads.....	.90	1.20	1.66	1.25
	Cottonseed meal.....	.30	.30	.41	.34
	Ground hegari fodder.....	1.50	1.43	.95	1.29
	Pulverized oyster shell, oz.....	.20	.20	.20	.20
	Salt, oz.....	.67	.53	.54	.58
	Total gain per head.....	10.46	9.66	10.15	30.27
	Average daily gain.....	.35	.32	.34	.34
5 (20 hd.)	Ground milo heads.....	.90	1.20	1.60	1.23
	Cottonseed meal.....	.30	.30	.40	.33
	Ground hegari fodder.....	1.50	1.43	.95	1.29
	Pulverized oyster shell, oz.....	.40	.40	.40	.40
	Salt, oz.....	.67	.53	.51	.58
	Total gain per head.....	10.45	9.47	11.22	31.14
	Average daily gain.....	.35	.32	.37	.35
6 (19 hd.)	Ground milo heads.....	.90	1.20	1.41	1.17
	Cottonseed meal.....	.30	.30	.35	.32
	Ground hegari fodder.....	1.50	1.41	.74	1.21
	Salt, oz.....	.67	.53	.40	.53
	Total gain per head.....	9.95	7.89	4.47	22.31
	Average daily gain.....	.33	.26	.15	.25

Table 7. Summary of Lubbock lamb feeding test—1929-30, 90 days

Item	Lot 1 Ground alfalfa hay	Lot 2 Ground alfalfa hay and hegari fodder	Lot 3 Ground alfalfa hay and hegari fodder	Lot 4 Ground hegari fodder*	Lot 5 Ground hegari fodder*	Lot 6 Ground hegari fodder
Number lambs per lot.....	20	20	19	19	20	19
Av. initial weight at feedlot, lbs....	59.35	59.20	59.46	60.38	59.35	59.58
Av. final weight at feedlot, lbs....	89.70	89.08	87.26	90.65	90.49	81.89
Av. gain per head, feedlot weights..	30.35	29.88	27.80	30.27	31.14	22.31
Av. daily gain, feedlot weight.....	.34	.33	.31	.34	.35	.25
Av. daily ration, consumed, pounds:						
Ground milo heads.....	1.41	1.36	1.31	1.25	1.23	1.17
Cottonseed meal.....	.16	.21	.26	.34	.33	.32
Ground alfalfa hay.....	1.26	.67	.34			
Ground hegari fodder.....		.61	.89	1.29	1.29	1.21
Salt, oz.....	.43	.54	.58	.58	.58	.53
Pulverized oyster shell, oz.....				.20	.40	
Feed consumed per head, pounds:						
Ground milo heads.....	126.90	122.48	118.05	112.68	111.00	105.38
Cottonseed meal.....	14.10	18.52	22.95	30.42	30.00	28.60
Ground alfalfa hay.....	113.26	60.45	30.23			
Ground hegari fodder.....		55.04	79.72	116.33	116.34	109.30
Salt.....	2.45	3.06	3.25	3.28	3.21	3.01
Pulverized oyster shell.....				1.12	2.25	
Feed required per cwt. gain:						
Ground milo heads.....	418.12	409.91	424.64	372.25	356.45	472.34
Cottonseed meal.....	46.46	61.98	82.55	100.50	96.34	128.19
Ground alfalfa hay.....	373.18	202.31	108.74			
Ground hegari fodder.....		184.20	286.76	384.31	373.60	489.91
Cost of feed per cwt. gain, feedlot weights.....	\$ 9.86	\$ 9.30	\$ 9.46	\$ 8.68	\$ 8.38	\$ 10.99
Cost of feed per lamb.....	3.08	2.81	2.69	2.65	2.63	2.52
Appraised selling value per 100 lbs., (basis Kansas City).....	10.25	10.25	10.15	10.25	10.25	10.00

\*Fed pulverized oyster shell.

## Results 1930-31

## (Third Test)

Comparisons in this test were alfalfa hay as the roughage portion of the ration, Lot 1, and ground hegari fodder supplemented by varying amounts of pulverized oyster shell in Lots 2, 3, 4, and 5. The pulverized oyster shell supplied to Lot 2 was mixed with equal parts salt and supplied free-choice. Lot 6 received ground hegari fodder without the calcium supplement. Average daily rations and gains by periods are shown in Table 8, while summary data are presented in Tables 9 and 9A.

Table 8. Average daily rations and gains by periods (basis feed consumed), Lubbock, 1930-31, 90 days

Lot No.	Rations	1st 30-day period, pounds	2d 30-day period, pounds	3d 30-day period, pounds	Average for 90-day period, pounds
1 (19 hd.)	Ground milo heads.....	1.29	1.50	1.72	1.50
	Cottonseed meal.....	.14	.17	.19	.17
	Ground alfalfa hay.....	1.20	1.05	.98	1.08
	Salt, oz.....	.79	.67	.56	.67
	Total gain per head.....	14.61	8.89	10.53	34.03
	Average daily gain.....	.49	.30	.35	.38
2 (20 hd.)	Ground milo heads.....	1.08	1.41	1.55	1.35
	Cottonseed meal.....	.36	.35	.39	.37
	Ground hegari fodder.....	1.21	1.20	1.15	1.19
	Salt, oz.....	.70	.40	.32	.48
	Pulverized oyster shell, oz.....	.70	.40	.32	.476
	Total gain per lamb.....	12.10	11.40	10.57	34.07
	Average daily gain.....	.40	.38	.35	.38
3 (19 hd.)	Ground milo heads.....	1.08	1.41	1.61	1.37
	Cottonseed meal.....	.36	.35	.40	.37
	Ground hegari fodder.....	1.22	1.19	1.20	1.20
	Salt, oz.....	1.17	.67	.56	.80
	Pulverized oyster shell, oz.....	.20	.20	.20	.20
	Total gain per head.....	12.80	10.52	11.04	34.36
	Average daily gain.....	.43	.35	.37	.38
4 (20 hd.)	Ground milo heads.....	1.08	1.41	1.55	1.35
	Cottonseed meal.....	.36	.35	.39	.37
	Ground hegari fodder.....	1.22	1.17	1.14	1.18
	Salt, oz.....	1.17	.67	.53	.78
	Pulverized oyster shell, oz.....	.30	.30	.30	.30
	Total gain per head.....	12.64	10.55	10.07	33.26
	Average daily gain.....	.42	.35	.34	.37
5 (20 hd.)	Ground milo heads.....	1.08	1.41	1.55	1.35
	Cottonseed meal.....	.36	.35	.39	.37
	Ground hegari fodder.....	1.22	1.16	1.15	1.18
	Salt, oz.....	1.17	.67	.53	.78
	Pulverized oyster shell, oz.....	.40	.40	.40	.40
	Total gain per head.....	12.17	11.42	10.14	33.73
	Average daily gain.....	.41	.38	.34	.37
6 (20 hd.)	Ground milo heads.....	1.08	1.35	1.48	1.30
	Cottonseed meal.....	.36	.34	.37	.36
	Ground hegari fodder.....	1.21	1.04	1.01	1.09
	Salt, oz.....	.79	.53	.40	.58
	Total gain per head.....	11.32	8.97	6.26	26.55
	Average daily gain.....	.38	.30	.21	.30

Table 9. Summary of Lubbock test, 1930-31, 90 days

Item	Lot 1 Ground alfalfa hay	Lot 2 Ground hegari fodder†	Lot 3 Ground hegari fodder†	Lot 4 Ground hegari fodder†	Lot 5 Ground hegari fodder†	Lot 6 Ground hegari fodder
Number lambs per lot.....	19	20	19	20	20	20
Av. initial weight at feedlot, lbs....	53.21	53.30	53.65	53.71	54.61	53.21
Av. final weight at feedlot, lbs.....	87.24	87.37	88.01	86.97	88.34	79.76
Av. final weight at market, lbs.....	81.58	79.75	81.05	79.50	83.50	76.00
Av. gain per head, feedlot weights..	34.03	34.07	34.36	33.26	33.73	26.55
Av. gain per head, market weights..	28.37	26.45	27.40	25.79	28.89	22.79
Av. daily gain, feedlot weights, lbs..	.38	.38	.38	.37	.37	.30
Av. daily gain, market weights, lbs..	.32	.29	.30	.29	.32	.25
Shrink, per hd. during shipment, lbs.	5.66	7.62	6.96	7.47	4.84	3.76
Shrink, per hd. during shipment, %..	6.49	8.72	7.91	8.59	5.48	4.71
Av. daily ration, consumed, pounds:						
Ground milo heads.....	1.50	1.35	1.37	1.35	1.35	1.30
Cottonseed meal.....	.17	.37	.37	.37	.37	.36
Ground alfalfa hay.....	1.08					
Ground hegari fodder.....		1.19	1.20	1.18	1.18	1.09
Salt, oz.....	.67	.476	.80	.78	.78	.58
Pulverized oyster shell, oz.....		.476	.20	.30	.40	
Total feed per lamb, lbs.: (consumed)						
Ground milo heads.....	135.36	121.29	122.94	121.29	121.29	117.05
Cottonseed meal.....	15.04	33.01	33.42	33.01	33.01	31.95
Ground alfalfa hay.....	96.93					
Ground hegari fodder.....		107.00	108.35	106.01	105.88	97.86
Salt.....	3.74	2.675	4.49	4.45	4.45	3.20
Pulverized oyster shell.....		2.675	1.12	1.69	2.25	
Feed req. per cwt. gain feedlot wts.:						
Ground milo heads.....	397.77	356.00	357.80	364.67	359.59	440.87
Cottonseed meal.....	44.20	96.89	97.26	99.25	97.87	120.34
Ground alfalfa hay.....	284.84					
Ground hegari fodder.....		314.06	315.34	318.73	313.90	386.59
Cost of feed per cwt. gain:						
Basis feedlot weights.....	\$ 6.30	\$ 5.80	\$ 5.79	\$ 5.91	\$ 5.86	\$ 6.96
Basis market weights.....	7.55	7.46	7.26	7.62	6.83	8.10
Av. cold carcass wt. (2½% shrink.)	39.21	37.83	38.59	37.64	39.83	36.03
Dressing percentage:						
Basis feedlot weights.....	44.93	43.31	43.85	43.28	45.08	45.17
Basis market weights.....	48.06	47.44	47.61	47.34	47.70	47.40
Financial Statement:						
Initial cost per head.....	\$ 2.93	\$ 2.93	\$ 2.95	\$ 2.95	\$ 3.00	\$ 2.93
Cost of feed per head (feed fed)..	2.18	1.99	2.00	1.98	1.99	1.88
Interest.....	.06	.06	.06	.06	.06	.06
Shipping and marketing costs....	.70	.70	.70	.70	.70	.70
Total cost per head.....	5.87	5.68	5.71	5.69	5.75	5.57
Selling price per lb., etc.....	7.25	7.25	7.50	7.50	7.50	7.50
Price received per head.....	5.91	5.78	6.08	5.96	6.26	5.70
Profit* per head.....	.04	.10	.37	.27	.51	.13

\*Profit does not take into account loss of one lamb in each of Lots 1 and 3.

†Fed pulverized oyster shell.

Table 9-A. Showing shrinkage in transit and slaughter data on lambs fed at Lubbock, 1930-31

Item	Lot 1 Ground alfalfa hay	Lot 2 Ground hegari fodder	Lot 3 Ground hegari fodder	Lot 4 Ground hegari fodder	Lot 5 Ground hegari fodder	Lot 6 Ground hegari fodder
Pulverized oyster shell, oz.....	none	0.48	0.20	0.30	0.40	none
Weight at market.....	81.6	79.8	81.1	79.5	83.5	76.0
Shrinkage per head in shipping, lbs.	5.7	7.6	7.0	7.5	4.8	3.8
Av. weight dressed carcass, chilled..	39.2	37.8	38.6	37.6	39.8	36.0
Dressing %, basis market weights..	48.1	47.4	47.6	47.3	47.7	47.4
Av. weight internal fat, lbs.....	1.4	1.6	1.4	1.4	1.6	1.4
Av. weight pelts, per head, lbs.....	13.6	14.1	14.4	14.2	14.2	12.7
Carcass grades:						
Choice.....						
Good.....	11	13	9	11	14	10
Medium.....	8	6	10	8	6	7
Fair.....		1		1		3

The check group, Lot 1, fed alfalfa hay as the roughage portion of the ration, received ground milo heads and cottonseed meal in a proportion of 9 to 1, while Lots 2 to 6 inclusive, fed ground hegari fodder as the roughage portion of the ration, received ground milo heads and cottonseed meal in a proportion of approximately 4 to 1.

Gains made by the respective groups, basis market weights, ranked in the order listed: First, Lot 5, fed hegari fodder as roughage supplemented with 0.4 ounce pulverized oyster shell per head daily; second, Lot 1 (check), fed alfalfa hay as roughage; third, Lot 3, fed hegari fodder as roughage supplemented with 0.2 ounce pulverized oyster shell per head daily; fourth, Lot 2, fed hegari fodder with mineral supplement mixed with equal parts of salt and fed free-choice; fifth, Lot 4, fed hegari fodder as roughage supplemented with 0.3 ounce per head daily; and sixth, Lot 6, fed hegari fodder as roughage without the pulverized oyster shell.

Lot 5, which received 0.4 ounce pulverized oyster shell per head in the daily ration, made during the 90-day period an average gain of 28.9 pounds basis selling weight as compared with 28.4 pounds, or approximately 1.8 per cent more than that made by Lot 1, the check group fed alfalfa hay as the roughage portion of the ration; and 27 per cent greater than Lot 6, the group receiving hegari fodder without the calcium supplement. Lots 2 to 5 inclusive, fed ground hegari fodder as the roughage portion of the ration, with different amounts of pulverized oyster shell, each required considerably less feed per 100 pounds gain in liveweight than did Lot 6, which was fed like these four except that pulverized oyster shell was not included. Lot 6 required 81 pounds more milo heads, 22 pounds more cottonseed meal, and 73 pounds more hegari fodder per 100 pounds gain in liveweight, feedlot basis, and at a cost of \$1.10 more than did Lot 5, which received 0.4 ounce pulverized oyster shell per head daily.

As shown in Table 9A, the advantage in finish as indicated by weight of internal fat and carcass grades, was slightly in favor of Lot 5, fed 0.4 ounce pulverized oyster shell per head daily. The Lot 5 carcasses weighed 0.6 pound heavier than those produced in Lot 1, check group, and 3.8 pounds or 10.5 per cent heavier than those produced in Lot 6, fed hegari fodder without the calcium supplement.

As indicated by carcass grades and internal fat, all groups should have sold at the same price per 100 pounds liveweight on the market. As in the 1928-29 test, the pelts yielded by the hegari fodder groups receiving pulverized oyster shell, averaged approximately 1.5 pounds or 12 per cent heavier than those produced by the Lot 6 lambs, which did not receive the calcium supplement.

## Results 1931-32

### (Fourth Test)

Important in the 1931-32 test was the comparison between alfalfa hay, Lot 1 (check), as the roughage portion of the ration, and sorgo silage and ground sorgo fodder respectively as roughages, when the latter were fed with and without pulverized oyster shell.

Lot 2 received sorgo silage without the mineral supplement; Lot 3 received sorgo silage with 0.4 ounce pulverized oyster shell per head daily. The roughage portion of the ration of Lot 4 was ground sorgo fodder, the mineral supplement being available as a lick free-choice mixed in equal parts with salt. The average daily consumption of pulverized oyster shell for this group was 0.44 ounce per head daily. Lot 5 received ground sorgo fodder as the roughage portion of the ration supplemented with 0.4 ounce pulverized oyster shell per head daily. Lot 6 received ground sorgo fodder as the roughage portion of the ration without the pulverized oyster shell. The average daily rations and gains by 30-day periods are shown in Table 10. Summary data are shown in Table 11, while some of the more detailed marketing and slaughter data are available in Table 11A.

During the first 30-day period, Lots 2 to 6 inclusive, fed ground sorgo fodder or sorgo silage, were fed ground milo heads and cottonseed meal in a proportion of 3 to 1. The proportion was changed to 4 parts milo heads to each pound of cottonseed meal during the final 60 days. Lot 1 (check), fed ground alfalfa hay, received ground milo heads and cottonseed meal in a proportion of 9 to 1 throughout the 90-day period.

Gains made by the respective groups, basis market weights, ranked in the order listed: First, 33.9 pounds, Lot 1 (check), fed alfalfa hay as the roughage portion of the ration; second, 32.3 pounds, Lot 3, fed silage as the roughage portion of the ration supplemented with 0.4 ounce pulverized oyster shell per head daily; third, 31.3 pounds, Lot 4, fed sorgo fodder, the calcium supplement being supplied free-choice with an equal part of salt; fourth, 31.1 pounds, Lot 5, fed ground sorgo fodder supplemented with 0.4 ounce pulverized oyster shell per head daily; fifth, 27.8 pounds, Lot 6, fed ground sorgo fodder; and sixth, 22.6 pounds, Lot 2, fed sorgo silage. Neither of the latter two lots received the mineral supplement.

Lot 3, fed sorgo silage and 0.4 ounce pulverized oyster shell per head daily, gained about 43 per cent more, basis market weights, than Lot 2, which was similarly fed, except for the mineral. The Lot 1 lambs (check group), as compared with Lot 3, showed a weight advantage of 1.6 pounds, or about 4.9 per cent, basis market weights. In a comparison between Lots 5 and 6, the former fed the mineral supplement, showed, basis market weights, an advantage of 3.26 pounds or approximately 11.7 per cent per head.

As indicated by carcass grade and weight of internal fat, Table 11A, Lots 1, 3, and 5 carried the highest finish and should have commanded



Table 10. Average daily rations and gains in pounds by periods (basis feed consumed), Lubbock, 1931-32, 90 days

Lot No.	Rations	1st 30-day period, pounds	2nd 30-day period, pounds	3d 30-day period, pounds	Average for 90-day period, pounds
1 (20 hd.)	Ground milo heads . . . . .	1.05	1.35	1.64	1.34
	Cottonseed meal . . . . .	.12	.15	.18	.15
	Ground alfalfa hay . . . . .	1.22	1.40	1.10	1.24
	Salt, oz . . . . .	.80	.48	.80	.64
	Total gain per head . . . . .	14.50	11.77	9.60	35.87
	Average daily gain . . . . .	.48	.39	.32	.40
2 (19 hd.)	Ground milo heads . . . . .	1.02	1.28	1.48	1.26
	Cottonseed meal . . . . .	.34	.32	.37	.34
	Sorgo silage . . . . .	2.59	2.67	1.77	2.34
	Salt, oz . . . . .	.80	.80	.80	.80
	Total gain per head . . . . .	12.94	8.45	4.40	25.79
	Average daily gain . . . . .	.43	.28	.15	.29
3 (20 hd.)	Ground milo heads . . . . .	1.02	1.28	1.52	1.28
	Cottonseed meal . . . . .	.34	.32	.38	.35
	Sorgo silage . . . . .	2.64	2.96	2.92	2.84
	Pulverized oyster shell, oz . . . . .	.40	.40	.40	.40
	Salt, oz . . . . .	.80	.48	.96	.80
Total gain per head . . . . .	14.10	11.92	10.09	36.11	
	Average daily gain . . . . .	.47	.40	.34	.40
4 (20 hd.)	Ground milo heads . . . . .	.88	1.20	1.45	1.18
	Cottonseed meal . . . . .	.29	.30	.36	.32
	Ground sorgo fodder . . . . .	1.20	1.39	1.09	1.23
	Pulverized oyster shell,* oz . . . . .	.53	.40	.39	.44
	Salt, oz . . . . .	.53	.40	.39	.44
Total gain per head . . . . .	12.74	10.52	10.16	33.42	
	Average daily gain . . . . .	.42	.35	.34	.37
5 (20 hd.)	Ground milo heads . . . . .	.88	1.20	1.45	1.18
	Cottonseed meal . . . . .	.29	.30	.36	.32
	Ground sorgo fodder . . . . .	1.21	1.40	1.10	1.23
	Pulverized oyster shell, oz . . . . .	.40	.40	.40	.40
	Salt, oz . . . . .	.80	1.12	1.28	1.07
Total gain per head . . . . .	13.35	9.80	11.02	34.17	
	Average daily gain . . . . .	.44	.33	.37	.38
6 (20 hd.)	Ground milo heads . . . . .	.88	1.20	1.45	1.18
	Cottonseed meal . . . . .	.29	.30	.36	.32
	Ground sorgo fodder . . . . .	1.20	1.39	1.08	1.23
	Salt, oz . . . . .	.80	.80	.80	.80
	Total gain per head . . . . .	14.34	8.85	8.86	32.05
	Average daily gain . . . . .	.48	.30	.30	.36

\*Lot 4 had free access to a mixture of equal parts oyster shell and salt.

Table 11. Summary of Lubbock test, 1931-32, 90 days

Item	Lot 1 Ground alfalfa hay	Lot 2** Sorgo silage	Lot 3 Sorgo silage†	Lot 4* Ground sorgo fodder†	Lot 5 Ground sorgo fodder†	Lot 6 Ground sorgo fodder
Number of lambs per lot. . . . .	20	19	20	20	20	20
Av. initial weight at feedlot, lbs. . . . .	53.88	55.14	53.70	54.21	54.93	53.94
Av. final weight at feedlot, lbs. . . . .	89.75	80.93	89.81	87.63	89.10	85.99
Av. final weight at Ft. Worth, lbs. . . . .	87.75	77.75	86.00	85.50	86.00	81.75
Av. gain per head, feedlot weights. . . . .	35.87	25.79	36.11	33.42	34.17	32.05
Av. gain per head, market wts., lbs. . . . .	33.87	22.61	32.30	31.29	31.07	27.81
Av. daily gain, feedlot weights, lbs. . . . .	.40	.29	.40	.37	.38	.36
Av. daily gain, market weights, lbs. . . . .	.38	.25	.36	.35	.35	.31
Shrink. per hd. during shipment, lbs. . . . .	2.00	3.18	3.81	2.13	3.10	4.24
Shrink. per hd. during shipment, % . . . . .	2.23	3.93	4.24	2.43	3.48	4.93
Av. daily ration, consumed, lbs.: . . . . .						
Ground milo heads. . . . .	1.34	1.26	1.28	1.18	1.18	1.18
Cottonseed meal. . . . .	.15	.34	.35	.32	.32	.32
Roughage. . . . .	1.24	2.34	2.88	1.23	1.23	1.23
Pulverized oyster shell, oz. . . . .			.40	.44	.40	
Salt, oz. . . . .	.64	.80	.80	.44	1.12	.80
Total feed consumed per head, lbs.: . . . . .						
Ground milo heads. . . . .	121.05	113.55	114.75	105.85	105.85	105.85
Cottonseed meal. . . . .	13.45	30.95	31.25	28.65	28.65	28.65
Roughage. . . . .	111.50	210.98	258.85	110.62	111.04	110.36
Pulverized oyster shell. . . . .			2.25	2.48	2.25	
Salt. . . . .	3.99	4.42	4.45	2.48	5.98	4.45
Feed required per cwt. gain, feedlot weights: . . . . .						
Ground milo heads. . . . .	337.47	440.29	317.78	316.73	309.77	330.27
Cottonseed meal. . . . .	37.50	120.01	86.54	85.73	83.85	89.39
Roughage. . . . .	310.84	818.07	708.53	331.00	324.96	344.34
Cost of feed per cwt. gain: . . . . .						
Basis feedlot weights. . . . .	\$ 3.83	\$ 3.98	\$ 3.12	\$ 3.01	\$ 3.02	\$ 3.09
Basis market weights. . . . .	4.06	4.53	3.50	3.23	3.32	3.56
Av. cold carcass wts. (hot less 2½%) . . . . .	40.27	36.90	40.12	39.15	40.12	37.54
Dressing per cent, feedlot weights. . . . .	44.87	45.59	44.67	44.68	45.03	43.66
Dressing per cent, market weights. . . . .	45.89	47.46	46.65	45.79	46.65	45.92
Financial Statement: . . . . .						
Initial cost at \$4.94 per cwt. . . . .	\$ 2.66	\$ 2.72	\$ 2.65	\$ 2.68	\$ 2.71	\$ 2.66
Cost of feed per head. . . . .	1.38	1.04	1.14	1.01	1.03	.99
Interest, 3 mos. at 8% . . . . .	.05	.05	.05	.05	.05	.05
Shipping and marketing costs. . . . .	.64	.64	.64	.64	.64	.64
Total cost per head. . . . .	4.73	4.45	4.48	4.38	4.43	4.34
Selling price per pound, cts. . . . .	5.50	5.25	5.75	5.50	5.75	5.50
Price received per head. . . . .	4.83	4.08	4.94	4.70	4.94	4.50
Profit per head** . . . . .	.10	— .37	.46	.32	.51	.16

\*Lot 4 had free access to mixture of salt and oyster shell.

\*\*Does not take into account loss of one lamb.

†Fed pulverized oyster shell.

Table 11-A. Showing shrinkage in transit and slaughter data on lambs fed at Lubbock, 1931-32

Item	Lot 1 Ground alfalfa hay	Lot 2 Sorgo silage	Lot 3 Sorgo silage	Lot 4 Ground sorgo fodder	Lot 5 Ground sorgo fodder	Lot 6 Ground sorgo fodder
Pulverized oyster shell, oz. . . . .	none	none	0.40	0.44	0.40	none
Weight at market. . . . .	87.8	77.8	86.0	85.5	86.0	81.8
Shrinkage per head in shipping, lbs. . . . .	2.0	3.2	3.8	2.1	3.1	4.2
Av. weight dressed carcass, chilled. . . . .	40.3	36.9	40.1	39.2	40.1	37.5
Dressing %, basis market weights. . . . .	45.9	47.5	46.7	45.8	46.7	45.9
Av. weight internal fat, lbs. . . . .	1.6	0.8	1.2	2.0	1.5	1.0
Av. weight pelt, per head, lbs. . . . .	15.6	14.4	15.5	15.5	14.7	15.0
Carcass grades: . . . . .						
Choice. . . . .	1				1	
Good. . . . .	18	8	16	14	15	13
Medium. . . . .	1	10	4	6	3	7
Fair. . . . .		1			1	

the same price on the market. In this test, pelt weights were heaviest in Lot 1, fed alfalfa hay, and with the exception of those produced by Lot 5, in the groups fed the mineral supplement. The pelts produced by the Lot 5 lambs averaged 0.3 pound lighter than those produced by the Lot 6 lambs, which received sorgo fodder as roughage without the mineral supplement.

### Results 1932-33

#### (Fifth Test)

In the 1932-33 test, alfalfa hay as the roughage portion of the ration, Lot 1, was compared with (1) sorgo silage with and without pulverized oyster shell in Lots 3 and 2 respectively; (2) a combination of sorgo silage and sorgo fodder with and without pulverized oyster shell in Lots 4 and 3 respectively; and (3) sorgo fodder with pulverized oyster shell.

The average daily rations and gains by 28-day periods are shown in Table 12. Summary data are shown in Table 13, while some of the more detailed market data, including carcass grades, are available in Table 13A.

Lot 1, fed ground alfalfa hay, received ground milo heads and cottonseed meal in a proportion of 9 to 1 throughout the 98-day fattening period. During the first 28-day period, Lots 2 to 6 inclusive were fed milo heads and cottonseed meal in a proportion of approximately 3 to 1, the proportion being changed to 4 to 1 at the beginning of the second 28-day period and continuing on that basis. The amount of concentrates fed was gradually increased as the feeding period progressed.

As shown in Table 13, Lots 2 and 3, fed sorgo silage, consumed slightly more concentrate feed than Lot 6, fed sorgo fodder. Concentrates and roughages were fed according to appetite in the respective lots. The lots fed pulverized oyster shell consumed slightly more feed than groups which, with the exception of this mineral, were similarly fed. Lot 1, fed alfalfa hay, and Lot 3, fed sorgo silage with pulverized oyster shell, each made 0.37 pound per head average daily gain, which was higher than gains made by the other lots, basis feedlot weights. Comparing gains, basis market weights, Lot 1, fed alfalfa hay as the roughage portion of the ration, showed an advantage of 2.3 pounds, or 8.4 per cent, over Lot 3, fed silage with the pulverized oyster shell, and an advantage of 7.5 pounds or 33.6 per cent over Lot 2, fed sorgo silage without the mineral supplement.

Comparing gains between Lots 2 and 3, basis market weights, the latter group which received 0.4 ounce pulverized oyster shell per head daily showed an advantage of 5.2 pounds, or 23.3 per cent. On a similar basis, Lot 5, fed sorgo silage and sorgo fodder with 0.4 ounce pulverized oyster shell per head daily, showed an increased gain of 5.6 pounds or approximately 28 per cent more than that made by Lot 4, which was similarly fed, with the exception of the mineral supplement. The check group, (Lot 1) basis market weights, when compared with Lot 6, fed sorgo fodder with 0.4 ounce pulverized oyster shell per head daily, showed an advantage in gain of 4.7 pounds, or approximately 19 per cent.

**Table 12. Average daily rations and gains in pounds by periods (basis feed consumed), Lubbock, 1932-33, 98 days**

Lot No.	Rations	1st 28-day period, pounds	2nd 28-day period, pounds	3rd 28-day period, pounds	4th 14-day period, pounds	Average for 98-day period, pounds
1 (20 hd.)	Milo head chop.....	1.17	1.64	1.94	2.07	1.65
	Cottonseed meal.....	.13	.18	.22	.23	.18
	Ground alfalfa hay.....	1.22	1.35	1.12	1.10	1.21
	Salt, oz.....	.58	.58	.58	.32	.53
	Total gain per head.....	12.52	11.62	10.30	1.83	36.27
	Average daily gain per head...	.45	.42	.37	.13	.37
2 (17 hd.)	Milo head chop.....	1.12	1.58	1.79	1.88	1.55
	Cottonseed meal.....	.38	.40	.45	.47	.42
	Sorgo silage.....	2.71	2.96	1.99	1.41	2.39
	Salt, oz.....	.99	.58	.58	.61	.70
	Total gain per head.....	10.93	9.80	6.79	1.07	28.59
	Average daily gain.....	.39	.35	.24	.08	.29
3 (20 hd.)	Milo head chop.....	1.12	1.58	1.80	1.92	1.56
	Cottonseed meal.....	.38	.40	.45	.48	.42
	Sorgo silage.....	2.75	3.00	2.98	2.62	2.87
	Salt, oz.....	.86	.86	.72	.26	.74
	Pulverized oyster shell, oz.....	.40	.40	.40	.40	.40
Total gain per head.....	11.63	10.43	10.90	3.32	36.28	
	Average daily gain.....	.42	.37	.39	.24	.37
4 (17 hd.)	Milo head chop.....	1.05	1.54	1.80	1.90	1.53
	Cottonseed meal.....	.35	.39	.45	.47	.41
	Sorgo silage.....	2.09	2.14	1.50	1.06	1.79
	Sorgo fodder.....	.50	.45	.32	.30	.41
	Salt, oz.....	.72	.29	.16	.14	.35
Total gain per head.....	11.22	8.73	5.30	2.21	27.46	
	Average daily gain.....	.40	.32	.19	.16	.28
5 (20 hd.)	Milo head chop.....	1.05	1.54	1.80	1.90	1.53
	Cottonseed meal.....	.35	.38	.45	.47	.41
	Sorgo silage.....	2.12	2.35	1.81	1.26	1.98
	Sorgo fodder.....	.50	.45	.32	.30	.41
	Salt, oz.....	.58	.29	.56	.00	.40
Pulverized oyster shell, oz.....	.40	.40	.40	.40	.40	
Total gain per head.....	12.68	9.00	8.88	2.62	33.18	
	Average daily gain.....	.45	.32	.32	.19	.34
6 (20 hd.)	Milo head chop.....	.98	1.46	1.80	1.92	1.48
	Cottonseed meal.....	.32	.36	.45	.48	.39
	Ground sorgo fodder.....	1.21	1.25	.96	.83	1.10
	Salt, oz.....	.58	.58	.43	.22	.48
	Pulverized oyster shell, oz.....	.40	.40	.40	.40	.40
Total gain per head.....	11.10	8.38	9.60	3.38	32.46	
	Average daily gain per head...	.40	.30	.34	.24	.33

Table 13. Summary of Lubbock test, 1932-33, 98 days

Item	Lot 1 Ground alfalfa hay	Lot 2 Sorgo silage	Lot 3 Sorgo silage*	Lot 4 Sorgo silage and ground sorgo fodder	Lot 5 Sorgo silage and ground sorgo fodder*	Lot 6 Ground sorgo fodder*
Number of lambs per lot . . . . .	20	17	20	17	20	20
Av. initial weight at feedlot, lbs. . . . .	62.76	62.36	62.87	62.93	62.47	62.22
Av. final weight at feedlot, lbs. <sup>1</sup> . . . . .	91.40	83.30	91.47	82.63	87.98	86.08
Av. fleece weight per head . . . . .	7.63	7.65	7.68	7.76	7.67	8.60
Av. final weight at Ft. Worth, lbs. <sup>1</sup> . . . . .	85.00	77.06	82.75	75.28	80.50	78.75
Av. gain per head, feedlot wts., lbs. <sup>2</sup> . . . . .	36.27	28.59	36.28	27.46	33.18	32.46
Av. gain per head, market wts., lbs. <sup>2</sup> . . . . .	29.87	22.35	27.56	20.11	25.70	25.13
Av. daily gain, feedlot weights, lbs. . . . .	.37	.292	.37	.28	.339	.331
Av. daily gain, market weights, lbs. . . . .	.305	.228	.281	.205	.262	.256
Shrinkage during shipment, lbs. . . . .	6.40	6.24	8.72	7.35	7.48	7.33
Shrinkage during shipment, per cent . . . . .	7.00	7.49	9.53	8.90	8.50	8.52
Av. daily ration consumed, lbs.:						
Milo head chop . . . . .	1.65	1.55	1.56	1.53	1.53	1.48
Cottonseed meal . . . . .	.184	.415	.417	.407	.406	.394
Ground alfalfa hay . . . . .	1.21					
Sumac sorghum silage . . . . .		2.39	2.87	1.79	1.98	
Sumac sorghum fodder . . . . .				.407	.407	1.10
Salt, oz. . . . .	.53	.70	.74	.35	.40	.48
Pulverized oyster shell, oz. . . . .			.40		.40	.40
Total feed consumed per head, lbs.:						
Milo head chop . . . . .	161.91	152.17	153.02	149.58	149.51	145.46
Cottonseed meal . . . . .	17.99	40.67	40.88	39.84	39.83	38.64
Ground alfalfa hay . . . . .	119.00					
Sumac sorghum silage . . . . .		234.51	281.22	175.43	193.91	
Sumac sorghum fodder . . . . .				39.88	39.88	107.45
Salt . . . . .	3.28	4.28	4.48	2.17	2.48	2.95
Pulverized oyster shell . . . . .			2.45		2.45	2.45
Feed required per cwt gain, feedlot weights:						
Milo head chop . . . . .	446.40	532.25	421.78	544.72	450.60	448.12
Cottonseed meal . . . . .	49.60	142.25	112.68	145.08	120.04	119.04
Ground alfalfa hay . . . . .	328.09					
Sumac sorghum silage . . . . .		820.25	775.14	638.86	584.42	
Sumac sorghum fodder . . . . .				145.23	120.19	331.02
Cost of feed per cwt gain:						
Basis feedlot weights . . . . .	\$ 3.42	\$ 3.25	\$ 2.76	\$ 3.44	\$ 2.95	\$ 2.89
Basis market weights . . . . .	4.15	4.15	3.62	4.70	3.81	3.75
Av. cold carcass weights (2½% shrinkage), lbs. . . . .	43.73	39.28	42.88	39.25	41.97	40.90
Dressing percentage (out of wool):						
Basis feedlot weights . . . . .	47.84	47.15	46.88	47.50	47.70	47.51
Basis market weights . . . . .	51.45	50.97	51.82	52.14	52.14	51.94
Financial Statement:						
Initial cost per head . . . . .	\$ 2.89	\$ 2.89	\$ 2.89	\$ 2.89	\$ 2.89	\$ 2.89
Cost of feed per head . . . . .	1.23	.93	1.00	.95	.99	.94
Interest on investment, 3 mos. at 8% . . . . .	.06	.06	.06	.06	.06	.06
Shipping and marketing cost . . . . .	.57	.57	.57	.57	.57	.57
Total cost per head, incl. 14 cents per head shearing costs . . . . .	4.89	4.59	4.66	4.61	4.65	4.60
Selling price per cwt . . . . .	4.85	4.85	4.85	4.85	4.85	4.85
Amount received per head . . . . .	4.12	3.74	4.01	3.65	3.90	3.82
Amount rec'd for wool, per head <sup>3</sup> . . . . .	1.73	1.79	1.80	1.88	1.74	2.04
Total amount received per head . . . . .	5.85	5.53	5.81	5.53	5.64	5.86
Profit per head <sup>4</sup> . . . . .	.96	.94	1.15	.92	.99	1.26

<sup>1</sup>Out of wool.<sup>2</sup>Basis final feedlot weights, including fleece weight.<sup>3</sup>73 cents per clean pound, less freight to and from College Station.<sup>4</sup>Profit shown does not take into account the losses in the various lots.

\*Fed pulverized oyster shell.

Table 13-A. Showing shrinkage in transit and slaughter data on lambs fed at Lubbock, 1932-33

Item	Lot 1 Ground alfalfa hay	Lot 2 Sorgo silage	Lot 3 Sorgo silage	Lot 4 Sorgo silage and ground sorgo fodder	Lot 5 Sorgo silage and ground sorgo fodder	Lot 6 Sorgo fodder
Pulverized oyster shell, oz. ....	none	none	0.40	none	0.40	0.40
Weight at market. ....	85.0	77.1	82.8	75.3	80.5	78.8
Shrinkage per head in shipping, lbs.	6.4	6.2	8.7	7.4	7.5	7.3
Av. weight dressed carcass, chilled..	43.7	39.3	42.9	39.3	42.0	40.9
Av. dressing %, basis market wts. ...	51.5	51.0	51.8	52.1	52.1	51.9
Carcass grades:						
Choice. ....	14	7	14	4	11	11
Good. ....	6	10	5	13	7	4
Medium. ....						
Fair. ....			1		2	5

All six lots, which were sheared before shipping, were sold at \$4.85 per 100 lbs. liveweight on the Fort Worth market, May 4, 1933. However, as indicated by carcass grades, Table 13A, Lots 2 and 4, fed sorgo silage, and sorgo fodder and silage respectively without the calcium supplement, graded considerably below the other four lots. Shorn fleece weights in this test showed no indication of any advantage in fleece growth for the groups fed the mineral supplement.

### Results 1933-34

#### (Sixth Test)

In the sixth and final test of the series, comparisons in the original problem were limited to (1) alfalfa hay (Lot 1) as the roughage portion of the ration vs. sorgo silage with and without pulverized oyster shell in Lots 3 and 2 respectively; (2) sorgo silage with pulverized oyster shell vs. sorgo silage without pulverized oyster shell.

A preliminary study of the utilization of cottonseed meal and cottonseed hulls in the lamb fattening ration was undertaken (1933-34) at the urgent request of interested feeders. Comparisons were made between a straight feed mixture of cottonseed meal and cottonseed hulls and a similar mixture to which ground milo heads were added (1) after the first 30 days, and (2) after sixty days on a cottonseed meal and cottonseed hull ration. These gains were all checked against that made by Lot 1, fed ground milo heads and cottonseed meal in a proportion of 9 to 1, and alfalfa hay as the roughage portion of the ration.

The average daily rations and gains by periods are shown in Table 14. Summary data are given in Table 15, while additional market data, including carcass grades, are shown in Table 15A.

Table 14. Average daily rations and gains by periods (basis feed consumed), Lubbock, 1933-34, 93 days

Lot No.	Rations	1st 30-day period, pounds	2d 30-day period, pounds	3d 33-day period, pounds	Average for 93-day period, pounds
1 (20 hd.)	Milo head chop.....	1.125	1.53	1.85	1.51
	Cottonseed meal.....	.125	.17	.21	.17
	Alfalfa hay.....	1.32	1.50	1.27	1.36
	Salt, oz.....	.53	.53	.61	.56
	Total gain per head.....	15.40	14.25	13.11	42.76
	Average daily gain.....	.513	.475	.397	.46
2 (17 hd.)	Milo head chop.....	1.05	1.52	1.60	1.40
	Cottonseed meal.....	.35	.38	.40	.38
	Sorgo silage.....	2.40	2.49	1.67	2.17
	Salt, oz.....	.30	.45	.35	.37
	Total gain per head.....	12.29	10.47	7.22	29.98
	Average daily gain.....	.410	.349	.219	.322
3 (20 hd.)	Milo head chop.....	1.05	1.52	1.74	1.44
	Cottonseed meal.....	.35	.38	.43	.39
	Sorgo silage.....	2.40	2.72	2.53	2.55
	Salt, oz.....	.56	.48	.56	.53
	Pulverized oyster shell, oz.....	.40	.40	.40	.40
Total gain per head.....	13.43	13.13	12.50	39.06	
	Average daily gain.....	.448	.438	.379	.420
4 (18 hd.)	Milo head chop.....	.....	1.12	1.58	1.36*
	Cottonseed meal.....	.451	.38	.39	.41
	Cottonseed hulls.....	2.37	2.40	2.19	2.32
	Salt, oz.....	.51	.51	.53	.51
	Total gain per head.....	16.13	6.25	9.03	31.41
	Average daily gain.....	.538	.208	.274	.338
5 (17 hd.)	Milo head chop.....	.....	.....	1.54	1.54†
	Cottonseed meal.....	.451	.576	.39	.47
	Cottonseed hulls.....	2.37	3.02	1.88	2.40
	Salt, oz.....	.43	.53	.46	.48
	Total gain per head.....	14.65	9.73	5.44	29.82
	Average daily gain.....	.488	.324	.165	.321
6 (19 hd.)	Cottonseed meal.....	.451	.555	.605	.54
	Cottonseed hulls.....	2.37	2.91	2.92	2.74
	Salt, oz.....	.58	.53	.46	.53
	Total gain per head.....	14.42	8.16	2.75	25.33
	Average daily gain.....	.481	.272	.083	.272

\*Average for 63 days.

†Average for 33 days.

Table 15. Summary of Lubbock test, 1933-34, 93 days

Item	Lot 1 Alfalfa hay	Lot 2 Sorgo silage	Lot 3 Sorgo silage <sup>1</sup>	Lot 4 Cotton- seed hulls	Lot 5 Cotton- seed hulls	Lot 6 Cotton- seed hulls
Number of lambs per lot.....	20	17	20	18	17	19
Av. initial weight at feedlot, lbs....	59.15	60.00	59.39	59.45	59.44	59.42
Av. final weight at feedlot, lbs....	101.91	89.98	98.45	90.86	89.26	84.75
Av. weight at Ft. Worth, lbs.....	94.00	84.12	89.75	80.56	79.71	77.11
Av. gain per head, feedlot wts., lbs.	42.76	29.98	39.06	31.41	29.82	25.33
Av. gain per head, market wts., lbs.	34.85	24.12	30.36	21.11	20.27	17.69
Av. daily gain, feedlot weights, lbs.	.46	.322	.42	.338	.321	.272
Av. daily gain, market weights, lbs.	.375	.259	.326	.227	.218	.19
Shrink, per hd. during shipment, lbs.	7.91	5.86	8.70	10.30	9.55	7.64
Shrink, per hd. during shipment, %	7.76	6.51	8.84	11.34	10.70	9.01
Av. daily ration consumed, lbs.:						
Milo head chop.....	1.51	1.40	1.44	1.36*	1.54†	.....
Cottonseed meal.....	.17	.38	.39	.41	.47	.54
Alfalfa hay.....	1.36	.....	.....	.....	.....	.....
Sorgo (Red Top) silage.....	.....	2.17	2.55	.....	.....	.....
Cottonseed hulls.....	.....	.....	.....	2.32	2.40	2.74
Salt, oz.....	.56	.37	.53	.51	.48	.53
Pulverized oyster shell, oz.....	.....	.....	.40	.....	.....	.....
Total feed consumed per lamb, lbs:						
Milo head chop.....	140.85	129.94	134.38	85.75*	50.96†	.....
Cottonseed meal.....	15.65	35.11	36.24	37.79	43.56	50.14
Alfalfa hay.....	126.50	.....	.....	.....	.....	.....
Sorgo (Red Top) silage.....	.....	201.81	237.15	.....	.....	.....
Cottonseed hulls.....	.....	.....	.....	215.31	223.61	254.71
Salt.....	3.23	2.14	3.11	3.00	2.76	3.03
Pulverized oyster shell.....	.....	.....	2.32	.....	.....	.....
Feed consumed per cwt. gain, feed- lot weights:						
Milo head chop.....	329.40	433.42	344.03	273.00	170.89	.....
Cottonseed meal.....	36.60	117.11	92.78	120.31	146.08	197.95
Alfalfa hay.....	295.84	.....	.....	.....	.....	.....
Sorgo (Red Top) silage.....	.....	673.15	607.14	.....	.....	.....
Cottonseed hulls.....	.....	.....	.....	685.48	749.87	1005.57
Cost of feed per cwt. gain:						
Basis feed fed, feedlot weights....	\$ 5.50	\$ 5.63	\$ 4.64	\$ 5.98	\$ 5.82	\$ 6.23
Basis feed fed, market weights....	6.74	7.00	5.95	8.90	8.57	8.93
Carcass wts., cold (hot less 2½% shrinkage).....	45.24	40.09	43.24	36.40	36.08	35.04
Dressed yield, feedlot weights.....	44.39	44.55	43.92	40.06	41.25	41.72
Dressed yield, market weights.....	48.13	47.66	48.18	45.18	46.19	45.86
Financial Statement:						
Initial cost per head at 5 cents per pound.....	\$ 2.96	\$ 3.00	\$ 2.97	\$ 2.97	\$ 2.97	\$ 2.97
Cost of feed per head, feed fed....	2.35	1.69	1.81	1.88	1.74	1.58
Interest on investment, 3 mos. at 8%.....	.06	.06	.06	.06	.06	.06
Shipping and marketing cost per head.....	.63	.63	.63	.63	.63	.63
Total cost per head.....	6.00	5.38	5.47	5.54	5.40	5.24
Selling price per cwt., mkt. wts..	8.25	8.25	8.25	8.25	8.25	8.25
Amount received per head.....	7.76	6.94	7.40	6.65	6.58	6.36
Profit per head.....	1.76	1.56	1.93	1.11	1.18	1.12

\*Average for 63 days.

†Average for 33 days.

‡Does not take into account death losses in the various lots.

¹Fed pulverized oyster shell.



Table 15-A. Showing shrinkage in transit and slaughter data on lambs fed at Lubbock, 1933-34

Item	Lot 1 Alfalfa hay	Lot 2 Sorgo silage	Lot 3 Sorgo silage	Lot 4 Cotton- seed hulls	Lot 5 Cotton- seed hulls	Lot 6 Cotton- seed hulls
Pulverized oyster shell, oz. ....	none	none	0.40	none	none	none
Weight at market. ....	94.0	84.1	89.8	80.6	79.7	77.1
Shrinkage per head in shipping, lbs. ....	7.9	5.9	8.7	10.3	9.6	7.4
Av. wt. dressed carcass, chilled. ....	45.2	40.1	43.2	36.4	36.8	35.4
Dressing %, basis market weights. ....	48.1	47.7	48.2	45.2	46.2	45.9
Av. weight pelt, per head, lbs. ....	17.0	14.7	15.5	13.8	13.8	13.5
Carcass grades:						
Choice. ....						
Strictly good. ....	20	17	20	5	9	9
Medium to good. ....				13	8	10

During the first 30-day period, Lots 2 and 3, fed sorgo silage, received ground milo heads and cottonseed meal in a proportion of 3 to 1, this being changed to a 4 to 1 basis at the beginning of the second 30-day period, and continued on that basis. As in previous tests, the concentrate feed was increased in accordance with appetites as the feeding period advanced. Lot 3, fed sorgo silage with 0.4 ounce pulverized oyster shell per head daily, as in previous tests, made a larger gain than Lot 2, which, with the exception of calcium supplement was similarly fed. Basis market weights, Lot 3 showed an increased gain of 6.24 pounds or 26 per cent more than Lot 2, fed silage without the calcium supplement. Comparing Lots 1 and 3, basis market weights, the former showed an advantage in gain of 4.5 pounds per head or 14.8 per cent.

In a comparison of the several methods of feeding cottonseed meal and hulls, as shown in Table 15, gains per head, basis market weights, for the respective lots were as follows: Lot 4, 21 pounds; Lot 5, 20.3 pounds; and Lot 6, 17.7 pounds. In Lot 4, ground milo heads was added to the ration after the lambs had been on feed 30 days, while in Lot 5, the inclusion of milo was deferred until 30 days later. The lambs in each of the three cottonseed hull lots failed to make the expected gains. Lot 1, check group, fed alfalfa hay as roughage, gained 100 per cent more (market basis) than Lot 6, fed cottonseed meal and cottonseed hulls, and 13.7 pounds or 65 per cent more than Lot 4, which received 1.4 pounds milo heads daily after the first 30 days on feed.

As indicated by carcass weights and grades, in Table 15A, Lots 1, 2, and 3 finished much better than any of the three lots fed rations in which cottonseed hulls without the calcium supplement was used as roughage.

Table 16. General summary showing average amount of feed consumed per lamb in making from 22.31 lbs. to 42.76 lbs. gain during feeding periods of 90-98 days (1928-29 to 1933-34, inclusive)

Lot No.	Year	No. days on feed	Roughage		Cotton-seed meal, Pounds	Ground milo heads, Pounds	Ground hegari fodder, Pounds	Sorgo (Red Top) fodder, Pounds	Pulv. oyster shell, Pounds	Av. gain per lamb,* Pounds
			Kind	Pounds						
1	1928-29	90	Alfalfa hay.....	119.38	16.68	146.16	.....	.....	.....	32.72
1	1929-30	90	Ground alfalfa hay.....	113.26	14.10	126.90	.....	.....	.....	30.35
1	1930-31	90	Ground alfalfa hay.....	96.93	15.04	135.36	.....	.....	.....	34.03
1	1931-32	90	Ground alfalfa hay.....	111.50	13.45	121.05	.....	.....	.....	35.87
1	1932-33	98	Ground alfalfa hay.....	119.00	17.99	161.91	.....	.....	.....	36.27
1	1933-34	93	Ground alfalfa hay.....	126.50	15.65	140.85	.....	.....	.....	42.76
			Average.....	113.44	15.25	137.21	.....	.....	.....	35.86
2	1928-29	90	Ground sorgo fodder.....	121.42	27.84	115.36	.....	.....	.....	26.93
8	1928-29	88	Ground sorgo fodder.....	144.32	30.71	129.49	.....	.....	.....	29.77
6	1931-32	90	Ground sorgo fodder.....	110.36	28.65	105.85	.....	.....	.....	32.05
			Average.....	125.37	29.07	116.90	.....	.....	.....	29.58
9	1928-29	88	Ground sorgo fodder.....	149.86	30.71	129.49	.....	.....	1.47**	31.65
4	1931-32	90	Ground sorgo fodder.....	110.62	28.65	105.85	.....	.....	2.48	33.42
5	1931-32	90	Ground sorgo fodder.....	111.04	28.65	105.85	.....	.....	2.25	34.17
6	1932-33	98	Ground sorgo fodder.....	107.45	38.64	145.46	.....	.....	2.45	32.46
			Average.....	119.74	31.66	121.66	.....	.....	2.16	32.92
3	1928-29	90	Ground feterita fodder.....	125.32	27.84	115.36	.....	.....	.....	25.45
6	1928-29	90	Ground milo fodder.....	116.20	27.84	115.36	.....	.....	.....	27.30
7	1928-29	90	Ground milo fodder.....	125.39	27.84	115.36	.....	.....	1.41**	30.37
4	1928-29	90	Ground kafir fodder.....	111.85	27.84	115.36	.....	.....	.....	25.27
5	1928-29	90	Ground hegari fodder.....	117.06	27.84	115.36	.....	.....	.....	26.96
6	1929-30	90	Ground hegari fodder.....	109.30	28.60	105.38	.....	.....	.....	22.31
6	1930-31	90	Ground hegari fodder.....	97.86	31.95	117.05	.....	.....	.....	26.55
			Average.....	108.07	29.46	112.60	.....	.....	.....	25.27

Table 16. General summary showing average amount of feed consumed per lamb in making from 22.31 lbs. to 42.76 lbs. gain during feeding periods of 90-98 days (1928-29 to 1933-34, inclusive)—Continued

Lot No.	Year	No. days on feed	Roughage		Cottonseed meal, Pounds	Ground milo heads, Pounds	Ground hegari fodder, Pounds	Sorgo (Red Top) fodder, Pounds	Pulv. oyster shell, Pounds	Av. gain per lamb,* Pounds
			Kind	Pounds						
4	1929-30	90	Ground hegari fodder.....	116.33	30.42	112.68	.....	.....	1.12	30.27
5	1929-30	90	Ground hegari fodder.....	116.34	30.00	111.00	.....	.....	2.25	31.14
3	1930-31	90	Ground hegari fodder.....	108.35	33.42	122.94	.....	.....	1.13	34.36
4	1930-31	90	Ground hegari fodder.....	106.01	33.01	121.29	.....	.....	1.69	33.26
5	1930-31	90	Ground hegari fodder.....	105.88	33.01	121.29	.....	.....	2.25	33.73
2	1930-31	90	Ground hegari fodder.....	107.00	33.01	121.29	.....	.....	2.68	34.07
Average.....				109.98	32.14	118.42	.....	.....	1.85	32.80
2	1931-32	90	Sorgo silage.....	210.98	30.95	113.55	.....	.....	.....	25.79
2	1932-33	98	Sorgo silage.....	234.51	40.67	152.17	.....	.....	.....	28.59
2	1933-34	93	Sorgo silage.....	201.81	35.11	129.94	.....	.....	.....	29.98
Average.....				215.77	35.58	131.89	.....	.....	.....	28.12
3	1931-32	90	Sorgo silage.....	258.85	31.25	114.75	.....	.....	2.25	36.11
3	1932-33	98	Sorgo silage.....	281.22	40.88	153.02	.....	.....	2.45	36.28
3	1933-34	93	Sorgo silage.....	237.15	36.24	134.38	.....	.....	2.32	39.06
Average.....				259.07	36.12	134.05	.....	.....	2.34	37.15
6	1933-34	93	Cottonseed hulls, without grain....	254.71	50.14	.....	.....	.....	.....	25.33
4	1933-34	93	Cottonseed hulls.....	215.31	37.79	85.75	.....	.....	.....	31.41
5	1933-34	93	Cottonseed hulls.....	223.61	43.56	50.96	.....	.....	.....	29.82
Average.....				219.46	40.68	68.36	.....	.....	.....	30.62
2	1929-30	90	Ground alfalfa hay.....	60.45	18.52	122.48	55.04	.....	.....	29.88
3	1929-30	90	Ground alfalfa hay.....	30.23	22.95	118.05	79.72	.....	.....	27.80
Average.....				45.34	20.74	120.26	67.38	.....	.....	28.84
4	1932-33	98	Sorgo silage.....	175.43	39.84	149.58	.....	39.88	.....	27.46
5	1932-33	98	Sorgo silage.....	193.91	39.83	149.57	.....	39.88	2.45	33.18

\*Basis feedlot weights.

\*\*Pulverized limestone.

EFFECT OF CALCIUM SUPPLEMENT ON LAMBS

### Productive Energy of Feeds Used

The productive energy of the feed used was calculated from the feeding experiments by the same methods that have been used and described in Bulletin 461 and other previous Texas Station publications. The energy value of the gain in weight of the standard lot, which received alfalfa, was calculated with the use of the productive energy of the feeds used ascertained from the analysis of the feeds, where available, and the corresponding production coefficients from Texas Station Bulletin 461. The energy required by the gain in therms per pound secured from these calculations was assumed to be the energy required for each pound of the gains made in the other tests. This is not strictly correct, as when the gains per day are appreciably lower, the percentage of fat in the gain is also lower, so that the therms of productive energy required per pound of gain are lower. At present, however, there is no method for correcting for this difference. The calculations for productive energy from the feeding experiments are given in Tables 17 to 22, inclusive.

Table 17. Calculation of productive energy from Spur lamb feeding test, 1928-29. 90 days (Lots 8 and 9—88 days)

	Lot 1 Alfalfa	Lot 2 Sorgo fodder	Lot 3 Feterita fodder	Lot 4 Kafir fodder	Lot 5 Hegari fodder	Lot 6 Milo fodder	Lot 7 Milo fodder	Lot 8 Sorgo fodder	Lot 9 Sorgo fodder
Av. initial weight at feedlot, lbs.	63.02	62.46	63.48	62.74	63.19	62.91	63.48	70.87	71.38
Av. final weight at feedlot, lbs.	95.74	89.39	88.93	88.01	90.43	90.21	94.67	100.64	103.03
Average weight, lbs. W	79.38	75.93	76.21	75.38	76.81	76.56	79.08	85.76	87.21
Av. daily gain, feedlot weight, lbs. G	.364	.299	.283	.281	.303	.303	.347	.338	.360
Av. daily ration consumed, lbs.:									
Ground milo heads	1.62	1.28	1.28	1.28	1.28	1.28	1.28	1.47	1.47
Cottonseed meal	.185	.309	.309	.309	.309	.309	.309	.349	.349
Roughage F	1.33	1.35	1.39	1.24	1.30	1.29	1.39	1.64	1.70
Salt	.016	.023	.018	.021	.014	.020	.024	.018	.019
Pulverized limestone							.015		.015
Productive energy—milo heads (.764)	1.238	.978	.978	.978	.978	.978	.978	1.123	1.123
Cottonseed meal (.702)	.130	.217	.217	.217	.217	.217	.217	.245	.245
Alfalfa (.41)	.545								
Total therms = T	1.913	1.195	1.195	1.195	1.195	1.195	1.195	1.368	1.368
Maintenance W × .0085 = M	.675	.645	.648	.641	.653	.651	.672	.729	.741
Productive value of gain T - M = B	1.238								
Therms for 1 lb. gain in standard B + G = K	3.401								
Productive energy of gain K × G = L		1.017	.962	.956	1.031	1.031	1.180	1.150	1.224
Productive energy of ration M + L = O		1.662	1.610	1.597	1.684	1.682	1.852	1.879	1.965
Productive energy of supplement fed O - T = E		.467	.415	.402	.489	.487	.657	.511	.597
Productive energy of 100 lbs. roughage = E + wt. fed (F) × 100		34.6	29.9	32.4	37.6	37.8	47.3	31.2	35.1

Table 18. Calculation of productive energy from Lubbock lamb feeding test, 1929-30

	Lot 1 Alfalfa	Lot 2 Hegari fodder	Lot 3 Hegari fodder	Lot 4 Hegari fodder with lime	Lot 5 Hegari fodder with lime	Lot 6 Hegari fodder
Av. initial weight at feedlot, lbs. . . .	59.35	59.20	59.46	60.38	59.35	59.58
Av. final weight at feedlot, lbs. . . .	89.70	89.08	87.26	90.65	90.49	81.89
Av. weight, lbs. W . . . . .	74.53	74.14	73.36	75.52	74.92	70.74
Av. daily gain, feedlot weight, lbs. G . . . .	.34	.33	.31	.34	.35	.25
Av. daily ration, consumed:						
Ground milo heads. . . . .	1.41	1.36	1.31	1.25	1.23	1.17
Cottonseed meal. . . . .	.16	.21	.26	.34	.33	.32
Ground alfalfa hay. . . . .	1.26	.67	.34			
Ground hegari fodder F. . . . .		.61	.89	1.29	1.29	1.21
Salt. . . . .	.027	.034	.036	.036	.036	.033
Pulverized oyster shell. . . . .				.013	.025	
Prod. energy—milo head (.772) . . . . .	1.089	1.050	1.011	.965	.950	.903
Cottonseed meal (.743) . . . . .	.119	.156	.193	.253	.245	.238
Alfalfa hay (.413) . . . . .	.520	.277	.140			
Total therms = T. . . . .	1.728	1.483	1.344	1.218	1.195	1.141
Maintenance $W \times .0085 = M$ . . . . .	.634	.630	.624	.642	.637	.601
Productive value of gain $T - M = B$ . . . . .	1.094					
Therms for 1 lb. gain in standard $B + G = K$ . . . . .	3.218					
Productive energy of gain $K \times G = L$ . . . . .		1.062	.998	1.094	1.126	.805
Productive energy of ration $M + L = O$ . . . . .		1.692	1.622	1.736	1.763	1.406
Productive energy of supplement fed $O - T = E$ . . . . .		.209	.278	.518	.568	.265
Productive energy of 100 lbs. roughage = $E + \text{wt. fed (F)} \times$ 100. . . . .		34.3	31.2	40.2	44.0	21.9

Table 19. Calculation of productive energy from Lubbock test, 1930-31

	Lot 1 Ground alfalfa hay	Lot 2 Ground hegari fodder	Lot 3 Ground hegari fodder	Lot 4 Ground hegari fodder	Lot 5 Ground hegari fodder	Lot 6 Ground hegari fodder
Av. initial weight at feedlot, lbs. . . .	53.21	53.30	53.65	53.71	54.61	53.21
Av. final weight at feedlot, lbs. . . .	87.24	87.37	88.01	86.97	88.34	79.76
Av. weight, lbs. W . . . . .	70.23	70.34	70.83	70.34	71.48	66.49
Av. daily gain, feedlot wts., lbs. G . . . .	.38	.38	.38	.37	.37	.30
Av. daily ration, consumed, lbs.:						
Ground milo heads. . . . .	1.50	1.35	1.37	1.35	1.35	1.30
Cottonseed meal. . . . .	.17	.37	.37	.37	.37	.36
Ground alfalfa hay. . . . .	1.08					
Ground hegari fodder F. . . . .		1.19	1.20	1.18	1.18	1.09
Salt. . . . .	.042	.031	.050	.049	.049	.036
Pulverized oyster shell. . . . .		.031	.013	.019	.025	
Productive energy:						
Milo heads (.772) . . . . .	1.158	1.042	1.058	1.042	1.042	1.004
Cottonseed meal (.743) . . . . .	.126	.275	.275	.275	.275	.267
Alfalfa (.413) . . . . .	.446					
Total therms = T. . . . .	1.730	1.317	1.333	1.317	1.317	1.271
Maintenance $W \times .0085 = M$ . . . . .	.597	.598	.602	.598	.608	.565
Productive value of gain $T - M = B$ . . . . .	1.133					
Therms for 1 lb. gain in standard $B + G = K$ . . . . .	2.982					
Productive energy of gain $K \times G = L$ . . . . .		1.133	1.133	1.103	1.103	.895
Productive energy of ration $M + L = O$ . . . . .		1.731	1.735	1.701	1.711	1.460
Productive energy of supplement fed $O - T = E$ . . . . .		.414	.402	.384	.394	.189
Productive energy of 100 lbs. roughage = $E + \text{wt. fed (F)}$ $\times 100$ . . . . .		34.8	33.5	32.5	33.4	17.3

Table 20. Calculation of productive energy from Lubbock test, 1931-32

	Lot 1 Alfalfa hay	Lot 2 Sorgo silage	Lot 3 Sorgo silage	Lot 4 Sorgo fodder	Lot 5 Sorgo fodder	Lot 6 Sorgo fodder
Av. initial weight at feedlot, lbs....	53.88	55.14	53.70	54.21	54.93	53.94
Av. final weight at feedlot, lbs....	89.75	80.93	89.81	87.63	89.10	85.99
Av. weight, lbs. W.....	71.82	68.04	71.76	70.92	72.02	69.97
Av. daily gain, feedlot wt., lbs. G..	.40	.29	.40	.37	.38	.36
Av. daily ration, consumed, lbs.:						
Ground milo heads.....	1.34	1.26	1.28	1.18	1.18	1.18
Cottonseed meal.....	.15	.34	.35	.32	.32	.32
Roughage F.....	1.24	2.34	2.88	1.23	1.23	1.23
Pulverized oyster shell.....			.025	.028	.025	
Salt.....	.04	.05	.05	.44	.07	.05
Productive energy:						
Milo heads (.764).....	1.024	.963	.978	.902	.902	.902
Cottonseed meal (.759).....	.114	.258	.266	.243	.243	.243
Alfalfa (.428).....	.531					
Total therms = T.....	1.669	1.221	1.244	1.145	1.145	1.145
Maintenance $W \times .0085 = M$ .....	.610	.578	.610	.603	.612	.595
Productive value of gain $T - M = B$ .....	1.059					
Therms for 1 lb. gain standard						
$B + G = K$ .....	2.648					
Productive energy of gain						
$K \times G = L$ .....		.768	1.059	.980	1.006	.953
Productive energy of ration						
$M + L = O$ .....		1.346	1.669	1.583	1.618	1.548
Productive energy of supplement						
fed $O - T = E$ .....		.125	.425	.438	.473	.403
Productive energy of 100 lbs.						
roughage = $E + \text{wt. fed (F)}$						
$\times 100$ .....		5.3	14.8	35.6	38.5	32.8

Table 21. Calculation of productive energy from Lubbock test, 1932-33

	Lot 1 Ground alfalfa hay	Lot 2 Sorgo silage	Lot 3 Sorgo silage	Lot 4 Sorgo silage and ground sorgo fodder	Lot 5 Sorgo silage and ground sorgo fodder	Lot 6 Ground sorgo fodder
Av. initial weight at feedlot, lbs....	62.76	62.36	62.87	62.93	62.47	62.22
Av. final weight at feedlot, lbs....	99	91	99	90	96	95
Average weight, lbs. W.....	80.88	76.68	80.94	76.47	79.24	78.61
Av. daily gain, feedlot wt., lbs. G..	.37	.292	.37	.28	.339	.331
Av. daily ration consumed, lbs.:						
Milo head chop.....	1.65	1.55	1.56	1.53	1.53	1.48
Cottonseed meal.....	1.184	.415	.417	.407	.406	.394
Ground alfalfa hay.....	1.21					
Sumac sorghum silage F.....		2.39	2.87	1.79	1.98	
Sumac sorghum fodder F.....				.407	.407	1.10
Salt.....	.033	.044	.046	.022	.025	.030
Pulverized oyster shell.....			.025		.025	.025
Productive energy:						
Milo head chop (.781).....	1.289	1.211	1.218	1.195	1.195	1.156
Cottonseed meal (.800).....	.147	.332	.334	.326	.325	.315
Sumac sorghum fodder (.254).....				.103	.103	
Alfalfa hay (.381).....	.461					
Total therms = T.....	1.897	1.543	1.552	1.624	1.624	1.471
Maintenance $2a \times .0085 = M$ .....	.687	.652	.688	.650	.674	.668
Productive value of gain $T - M = B$ .....	1.210					
Therms for 1 lb. gain in standard						
$B + G = K$ .....	3.270					
Productive energy of gain $K \times G = L$						
.....		.955	1.210	.916	1.109	1.082
Productive energy of ration						
$M + L = O$ .....		1.607	1.898	1.566	1.783	1.750
Productive energy of supplement						
fed $O - T = E$ .....		.064	.346	.058	.160	.279
Productive energy of 100 lbs.						
roughage = $E + \text{wt. fed (F)}$						
$\times 100$ .....		2.7	12.1	0	8.1	25.4

Table 22. Calculation of productive energy from Lubbock test, 1933-34

	Lot 1 Alfalfa hay	Lot 2 Sorgo silage	Lot 3 Sorgo silage	Lot 4 Cotton- seed hulls	Lot 5 Cotton- seed hulls	Lot 6 Cotton- seed hulls
Av. initial weight at feedlot, lbs. . . . .	59.15	60.00	59.39	59.45	59.44	59.42
Av. final weight at feedlot, lbs. . . . .	101.91	89.98	98.45	90.86	89.26	84.75
Av. weight, lbs. W . . . . .	80.53	74.99	78.92	75.16	74.35	72.09
Av. daily gain, feedlot wt., lbs. G . . . .	.46	.322	.42	.338	.321	.272
Av. daily ration consumed, lbs.:						
Milo head chop . . . . .	1.51	1.40	1.44	1.36	1.54	.....
Cottonseed meal . . . . .	.17	.38	.39	.41	.47	.54
Alfalfa hay . . . . .	1.36	.....	.....	.....	.....	.....
Sorgo silage wt. F . . . . .	.....	2.17	2.55	.....	.....	.....
Cottonseed hulls F . . . . .	.....	.....	.....	2.32	2.40	2.74
Salt . . . . .	.035	.023	.033	.032	.03	.033
Pulverized oyster shell . . . . .	.....	.....	.025	.....	.....	.....
Productive energy:						
Milo head chop (.771) . . . . .	1.164	1.079	1.110	1.049	1.187	.....
Cottonseed meal (.771) . . . . .	.131	.293	.301	.316	.362	.416
Alfalfa hay (.43) . . . . .	.585	.....	.....	.....	.....	.....
Total T . . . . .	1.880	1.372	1.411	1.365	1.549	.416
Maintenance $W \times .0085 = M$ . . . . .	.685	.637	.671	.639	.632	.613
Productive value of gain $T - M = B$ . Therms for 1 lb. gain in standard $B + G = K$ . . . . .	1.195	.....	.....	.....	.....	.....
$B + G = K$ . . . . .	2.598	.....	.....	.....	.....	.....
Productive energy of gain $K \times G = L$ . . . . .	.....	.837	1.091	.878	.834	.707
Productive energy of ration $M + L = O$ . . . . .	.....	1.474	1.762	1.517	1.466	1.320
Productive energy of supplement $fed O - T = E$ . . . . .	.....	.102	.351	.152	0	.904
Productive energy of 100 lbs. roughage = $E + wt. fed (F)$ $\times 100$ . . . . .	.....	4.7	13.8	6.6	0	33.0

The values for the productive energy and digestible protein calculated from Tables 1A and 1B are summarized in Tables 23 and 24 respectively and are compared with values calculated from the chemical analyses and the production coefficients in Texas Station Bulletin 461. These values are for the feeds fed in a balanced ration, and for this reason should be compared with the results obtained when pulverized oyster shell was included in the ration, since most of the rations in which sorghum fodder was included as the sole roughage are clearly unbalanced with respect to calcium.

The productive values found for sorgo fodder, as given in Table 25, are close to those calculated. Those found for the hegari fodder are somewhat lower than that calculated from the composition. It is possible that the hegari fodder did not contain as much grain as was present in previous samples. The value found for milo fodder (1928-29) is higher than the calculated value. Two of the values for sorgo silage are lower and another higher than the calculated values.



Table 23. Productive energy and digestible protein, calculated from analyses in Table 1

Name	Year	Productive energy Therms per 100 lbs.	Digestible protein Per cent
Cottonseed meal.....	1928-29	70.73	34.68
Ground milo heads.....	1928-29	76.41	7.86
Alfalfa hay.....	1928-29	40.97	11.86
Ground milo fodder.....	1928-29	51.16	2.78
Ground feterita fodder.....	1928-29	47.93	2.79
Ground kafir fodder.....	1928-29	44.31	3.94
Ground hegari fodder.....	1928-29	48.71	2.32
Ground cane (Red Top) fodder.....	1928-29	36.09	1.78
Pulverized limestone.....	1928-29	.....	.....

Table 24. Productive energy and digestible protein calculated from analyses in Table 2

Name	Year	Productive energy Therms per 100 lbs.	Digestible protein Per cent
Cottonseed meal.....	1931-32	75.91	36.70
Cottonseed meal.....	1932-33	80.00	36.66
Cottonseed meal.....	1933-34	77.15	37.15
Ground milo heads.....	1931-32	76.41	7.48
Ground milo heads.....	1932-33	78.09	8.15
Ground milo heads.....	1933-34	77.11	8.05
Ground alfalfa hay.....	1931-32	42.84	12.11
Ground alfalfa hay.....	1932-33	38.11	9.95
Ground alfalfa hay.....	1933-34	43.01	12.58
Ground sorgo fodder.....	1931-32	39.55	1.73
Ground sorgo fodder.....	1932-33	34.73	1.70
Sorgo silage.....	1931-32	16.53	.40
Sorgo silage.....	1932-33	9.71	.28
Sorgo silage.....	1933-34	15.49	.40
Cottonseed hulls.....	1933-34	20.90	.47
Pulverized oyster shell.....	1931-32	.....	.....
Pulverized oyster shell.....	1933-34	.....	.....
Ground hegari fodder (Spur).....	1928-33	46.81	2.48

The productive energy of feeds, as calculated from these feeding tests, was greater when pulverized oyster shell or pulverized limestone was included in the ration, than when it was absent. The difference was not great for sorgo fodder in 1928-29 or 1931-32, but the differences were large with milo fodder, hegari fodder, and sorgo silage. With hegari fodder (1929-30) the productive energy was 21.9 therms per 100 pounds without the pulverized oyster shell, as compared with 40.2 and 44.0 with this mineral. For hegari fodder in 1930-31, it was 17.3 without and 34.8, 33.5, 32.5, and 33.4 with pulverized oyster shell. With sorgo silage, it was 5.3 and 2.7 without and 14.8 and 12.1 with pulverized oyster shell included in the ration. The productive energy secured with the addition of the pulverized oyster shell was closer to the calculated productive energy than the productive energy without this mineral.

This means that the rations in question are unbalanced with respect to calcium, and under such conditions, the ration is not efficient, so that the feed tested has apparently a productive energy much lower than normal because the ration is not well utilized by fattening lambs. When the ration is balanced by the addition of pulverized oyster shell or pulverized limestone, the ration is used more efficiently and the productive energy is

**Table 25. Productive energy of roughages, in therms per 100 pounds, and effect of oyster shell (calcium carbonate) on productive energy**

Name of roughage	Productive energy		Calculated from analyses	Oyster shell fed per day, oz.
	Without oyster shell	With oyster shell		
1928-29 Sorgo fodder.....	31.2	35.1	36.0	.....
Milo fodder.....	37.8	47.3	41.0	.....
Feterita fodder.....	29.9	.....	47.9	.....
Kafir fodder.....	32.4	.....	44.3	.....
Hegari fodder.....	37.6	.....	48.7	.....
1929-30 Hegari fodder.....	21.9	40.2	48.7	.2
Hegari fodder.....	.....	44.0	.....	.4
Hegari fodder (with alfalfa).....	31.2	.....	.....	.....
Hegari fodder (with alfalfa).....	34.3	.....	.....	.....
1930-31 Hegari fodder.....	17.3	34.8	.....	.5
.....	.....	33.5	.....	.2
.....	.....	32.5	.....	.3
.....	.....	33.4	.....	.4
1931-32 Sorgo fodder.....	32.8	35.6	.....	.44
Sorgo fodder.....	.....	38.5	.....	.4
Sorgo silage.....	5.3	14.8	16.5	.4
1932-33 Sorgo fodder.....	.....	25.4	.....	.4
Sorgo silage.....	2.7	12.1	9.7	.4
Sorgo silage and sorgo fodder.....	0	8.1	.....	.4
1933-34 Sorgo silage.....	4.7	13.8	15.5	.4
Cottonseed hulls (with meal and milo heads).....	6.6	.....	.....	.....
Cottonseed hulls (with meal and milo fodder).....	0	.....	.....	.....
Cottonseed hulls (with cottonseed meal alone).....	33.0	.....	.....	.....

normal. Alfalfa contains enough calcium to balance the rations in which it was used in these experiments. It is possible that the lambs used in these tests did not have sufficient calcium stored in their bodies to overcome the adverse effect of a ration unbalanced in calcium, and that lambs which had received liberal quantities of calcium before they were put on experiment might not require as much calcium as did those lambs used in this work. However, the fact remains that the productive energy of a ration low in calcium may be greatly increased by the addition of calcium in the form of pulverized oyster shell or pulverized limestone.

The total amounts of calcium and phosphorus based on analyses of feeds utilized in these tests are shown in Table 26. It is noted that the calcium-phosphorus ratio in the standard lots ranged from 1:0.45 to 1:0.92, as compared with a ratio of 1:1.21 to 1:2.01 in instances where the calcium supplement was not included in the sorghum roughage.

**Table 26. Showing calcium and phosphorus in grams consumed daily per 100 pounds liveweight, the ratio and percentage of these elements in ration; also amount mineral supplement fed per head**

Year	Lot No.	Kind of roughage fed	Total calcium consumed per 100 lbs. liveweight daily (grams)	Total phosphorus consumed per 100 lbs. liveweight daily (grams)	Ratio calcium to phosphorus in ration	Per cent calcium in ration	Per cent phosphorus in ration	Pulverized limestone or pulverized oyster shell per head daily (ounces)
1928-29	1	Alfalfa hay.....	9.13	4.95	1 : 0.54	0.510	0.276	.....
	2	Sorgo fodder.....	3.17	4.93	1 : 1.55	0.181	0.281	.....
	3	Feterita fodder.....	3.57	4.99	1 : 1.40	0.201	0.282	.....
	4	Kafir fodder.....	2.89	4.91	1 : 1.70	0.169	0.288	.....
	5	Hegari fodder.....	3.02	4.73	1 : 1.57	0.177	0.277	.....
	6	Milo fodder.....	3.94	4.76	1 : 1.21	0.231	0.279	.....
	7	Milo fodder.....	7.19	4.73	1 : 0.66	0.417	0.274	0.25
	8	Sorgo fodder.....	3.33	5.08	1 : 1.53	0.182	0.278	.....
	9	Sorgo fodder.....	6.43	5.05	1 : 0.79	0.350	0.275	0.28
1929-30	1	Alfalfa hay.....	9.21	4.53	1 : 0.49	0.535	0.263	.....
	2	Alfalfa hay and hegari fodder (equal parts).....	6.15	4.62	1 : 0.75	0.353	0.265	.....
	3	Alfalfa hay (2.6 parts), hegari fodder (1 part).....	4.40	4.72	1 : 1.07	0.254	0.273	.....
	4	Hegari fodder.....	5.51	4.89	1 : 0.89	0.317	0.281	0.2
	5	Hegari fodder.....	8.45	4.84	1 : 0.57	0.486	0.278	0.4
	6	Hegari fodder.....	2.62	4.90	1 : 1.87	0.152	0.283	.....
1930-31	1	Alfalfa hay.....	8.57	4.76	1 : 0.56	0.482	0.268	.....
	2	Hegari fodder.....	10.03	5.46	1 : 0.54	0.529	0.288	0.47
	3	Hegari fodder.....	5.91	5.46	1 : 0.92	0.312	0.289	0.2
	4	Hegari fodder.....	7.41	5.45	1 : 0.73	0.394	0.289	0.3
	5	Hegari fodder.....	8.35	5.36	1 : 0.64	0.450	0.289	0.4
	6	Hegari fodder.....	2.74	5.52	1 : 2.01	0.146	0.294	.....

Table 26. Showing calcium and phosphorus in grams consumed daily per 100 pounds liveweight, the ratio and percentage of these elements in ration; also amount mineral supplement fed per head—Continued

Year	Lot No.	Kind of roughage fed	Total calcium consumed per 100 lbs. liveweight daily (grams)	Total phosphorus consumed per 100 lbs. liveweight daily (grams)	Ratio calcium to phosphorus in ration	Per cent calcium in ration	Per cent phosphorus in ration	Pulverized limestone or pulverized oyster shell per head daily (ounces)
1931-32	1	Alfalfa hay.....	9.37	4.52	1 : 0.48	0.543	0.262	.....
	2	Sorgo silage.....	2.58	4.66	1 : 1.81	0.098	0.177	.....
	3	Sorgo silage.....	8.86	4.64	1 : 0.52	0.312	0.163	0.4
	4	Sorgo fodder.....	9.65	4.34	1 : 0.45	0.547	0.246	0.44
	5	Sorgo fodder.....	8.90	4.27	1 : 0.48	0.513	0.246	0.4
	6	Sorgo fodder.....	2.91	4.39	1 : 1.51	0.165	0.248	.....
1932-33	1	Alfalfa hay.....	8.30	4.54	1 : 0.55	0.487	0.266	.....
	2	Sorgo silage.....	2.55	4.97	1 : 1.95	0.099	0.193	.....
	3	Sorgo silage.....	8.06	4.83	1 : 0.60	0.295	0.177	0.4
	4	{ Sorgo silage.....	2.77	4.97	1 : 1.79	0.113	0.203	.....
	5	{ Sorgo fodder.....						
	6	{ Sorgo silage.....	8.32	4.86	1 : 0.58	0.333	0.195	0.4
6	{ Sorgo fodder.....							
6	Sorgo fodder.....	8.21	4.62	1 : 0.56	0.474	0.267	0.4	
1933-34	1	Alfalfa hay.....	9.19	4.50	1 : 0.49	0.537	0.263	.....
	2	Sorgo silage.....	2.36	4.59	1 : 1.94	0.099	0.192	.....
	3	Sorgo silage.....	8.02	4.56	1 : 0.57	0.317	0.180	0.4
	4	Cottonseed hulls.....	3.06	5.27	1 : 1.72	0.124	0.213	.....
	5	Cottonseed hulls.....	3.32	5.94	1 : 1.79	0.123	0.221	.....
	6	Cottonseed hulls.....	3.04	4.31	1 : 1.42	0.148	0.209	.....

## DISCUSSION

Tests to determine the influence of pulverized limestone or pulverized oyster shell, each of high calcium content, on gains and finish of fattening lambs on several different kinds of sorghum roughage in the form of chopped fodder or silage were conducted at Substation No. 7, Spur, during the 1928-29 feeding season and at Lubbock in cooperation with the Division of Agriculture, Texas Technological College, during the 1929-30 to 1933-34 feeding seasons. The average total gains per lamb for the various groups, basis feedlot weights, classified as to the kind of sorghum roughage fed either with or without the calcium supplement during the several tests, are shown in Table 16. Each of the respective feeding periods lasted approximately 90 days.

A good feeder lamb, fed a properly balanced ration, should gain from 28 to 30 pounds during a 90-day period. Table 16 shows that the lambs fed rations properly balanced, with respect to digestible protein, energy, and mineral matter, made satisfactory gains. On the other hand, those groups fed either sorghum fodder or sorghum silage without the calcium carbonate supplement failed in a number of instances to make the normal or expected gain.

The summary data covering feedlot performance for the respective tests by years are shown in detail in Tables 5 and 5A, 7, 9 and 9A, 11 and 11A, 13 and 13A and 15 and 15A.

These results, covering gains and finish on the respective rations fed, clearly indicate the superiority of alfalfa as the roughage portion of the fattening ration over sorghum fodder or sorghum silage fed without the pulverized limestone or pulverized oyster shell supplement. They show further the distinct advantage of using a supplement high in calcium when a sorghum roughage rather than a legume, such as alfalfa hay, is fed. The gains and finish made by the lambs fed the mineral supplement compared favorably with those receiving alfalfa hay as the roughage portion of the ration.

Pelt weights generally averaged heavier in the alfalfa hay and the sorghum groups receiving the mineral supplement than those produced by the sorghum non-mineral groups; however, there were some inconsistencies in this respect.

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## SUMMARY

1. The influence of pulverized limestone or pulverized oyster shell, each of high calcium content, on the gains made by lambs fed sorghum roughage in fattening rations was studied during the period 1928-29 to 1933-34 inclusive. Sorghum silage was not fed in connection with this study until 1931-32. However, lambs fed sorghum silage supplemented with pulverized oyster shell in that and two subsequent tests made feedlot gains comparable to those made by lambs fed alfalfa and showed a desirable finish at the end of the feeding period.

2. Lambs in the check groups fed alfalfa hay as roughage in fattening rations made significantly greater and more consistent gains than those receiving sorghum fodder without a calcium supplement. Furthermore, the alfalfa-fed lambs showed a lower death loss while on feed and a lower shrinkage in shipment to market than lots that received sorghum fodder. No death losses resulted in the lots fed sorghum silage supplemented with 0.4 ounce pulverized oyster shell per head daily.

3. In each of the six tests of this series, fattening lambs fed sorghum fodder or sorghum silage as the roughage portion of the ration and supplemented with pulverized limestone or pulverized oyster shell, consumed larger amounts of roughage, made considerably larger gains, finished better, and yielded heavier carcasses than those that did not receive the calcium supplement. These differences in gains were barely significant in the first test (1928-29) at Spur; however, with the exception of Lot 6 (1931-32) at Lubbock, the differences were highly significant each year.

4. These tests have rather definitely indicated that sorghum silage made from properly matured feed crops, and when supplemented with approximately 0.4 ounce pulverized oyster shell, is more desirable in the lamb fattening ration than sorghum fodder. Sorghum fodder, which often becomes moldy or spoiled in curing, is believed to be particularly fatal to lambs.

5. Since definite calcium and phosphorus requirements in rations for fattening lambs were not known, the levels of these minerals in the check group fed alfalfa hay were used as an empirical standard. In these tests, pulverized limestone or pulverized oyster shell was fed in varying quantities ranging in amounts from 0.2 to 0.47 ounce per head daily. The calcium level for sorghum-fed groups receiving 0.4 ounce of pulverized oyster shell per head daily very closely approximated that of the check groups fed alfalfa hay. Likewise carcasses of lambs that had been fed 0.4 ounce of this supplement per head daily graded practically as high as those produced in the alfalfa-fed groups.

6. The average calcium content in the sorghum fodders used in these studies ranged from 0.21 to 0.34 per cent and in the sorghum silage from 0.07 to 0.11 per cent before supplements were added as compared with 1.01 to 1.18 per cent in the alfalfa hay fed.

7. The productive energy of the feeds used in these tests was calculated from the experiments by the same methods used in previous tests at the Texas Station. The productive energy secured with the addition of pul-

verized limestone or pulverized oyster shell in these tests was closer to the calculated productive energy than the productive energy without the calcium supplement (Texas Station Bulletin 461). This means that lamb fattening rations in which sorghum is used as the sole roughage are unbalanced with respect to calcium and are therefore inefficient.

8. In this series of tests, the total daily intake per 100 pounds liveweight for the check or alfalfa-fed groups ranged from 8.30 to 9.37 grams of calcium and 4.50 to 4.95 grams of phosphorus. In the groups fed sorghum fodder or sorghum silage as the roughage portion of the ration without the pulverized limestone or pulverized oyster shell supplement, the average daily intake per 100 pounds liveweight ranged from 2.36 to 3.94 grams calcium and 4.39 to 5.52 grams phosphorus. When pulverized limestone or pulverized oyster shell was added to the ration in which sorghum fodder or sorghum silage had been included as the roughage, the average daily intake per 100 pounds liveweight ranged from 5.51 to 10.03 grams calcium and 4.27 and 5.46 grams phosphorus.

9. The average daily consumption of sorghum fodder per lamb during the fattening period ranged between 1.1 and 1.7 pounds as compared with 2.2 and 2.9 pounds of sorghum silage. The inclusion of the calcium supplement increased the daily consumption of fodder by approximately .1 pound while the silage consumption was increased approximately 0.5 pound.

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