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DIVISION OF ANIMAL INDUSTRY

## GRAIN SORGHUMS VERSUS CORN FOR FATTENING LAMBS



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†As of January 1, 1922.

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## GRAIN SORGHUMS VERSUS CORN FOR FATTENING LAMBS

BY

J. M. JONES AND R. A. BREWER.\*

"Can the grain sorghums, which are produced to the extent of 144,000,000 bushels annually in the United States, be substituted in the place of corn in the rations of fattening live stock in the grain-sorghums area?" is a pertinent question in the minds of Texas farmers and stockmen, and one which, if correctly answered, would tend to stimulate the finishing of an increased number of beeves, lambs, and hogs for market in those sections annually.

Texas has for years been recognized in live stock circles as holding premier rank in the production of beef cattle, but only during the past year did she reach first place in the production of sheep. At the same time an increasing West Texas acreage is being planted in grain sorghums during each succeeding year, and the farmers producing these crops are demanding information and assistance in the direction of marketing their crops via the live stock route rather than to be forced to ship them from the farms to the elevators and other feed centers, and thus permit the depletion of West Texas soils. Statistics indicate that West Texas is annually producing 60,000,000 bushels of the grain sorghums. This is conceded to be only a partial showing of the possible production because the area planted in them is limited to the popular annual estimate of the farmers as to how much production the market will absorb.

It is an acknowledged fact the world over that live stock farming is the most permanent and well-rounded system of agriculture; therefore since an increasing acreage of the Southwestern range lands is annually passing into the hands of the small farmers, the latter should be encouraged to feed their grain crops at home as has long been the practice of many of the most successful farmers residing in the corn-belt section of the United States. It is believed by many that the grain sorghums have approximately the same feeding value as corn. At the same time it is a well-known fact that the grain sorghums are quoted at wholesale prices considerably under those of corn. According to the Monthly Crop Reporter for December, 1921, the wholesale price for Texas corn December 1, was 54 cents per bushel, while the grain sorghums sold for 41 cents per bushel, or 24 per cent. lower than corn. Granting that the grain sorghums have somewhat the same feeding value as corn, it is then obvious that the feeding of grain sorghums in Texas Panhandle is due for a tremendous increase.

### A REVIEW OF PREVIOUS TESTS

During the 1919-20 feeding season the first of a series of tests, the object of which was to compare the gains and economy of gains made

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by lambs, fattened on milo, on feterita, and on corn, was conducted through a ninety-day period and brought to a satisfactory termination. The following feeds were fed to a uniform lot of Rambouillet lambs:

- Lot 1. Ground milo heads, cottonseed meal, and alfalfa hay.
- Lot 2. Ground threshed feterita, cottonseed meal, and alfalfa hay.
- Lot 3. Ground shelled corn, cottonseed meal, and alfalfa hay.
- Lot 4. Ground threshed milo, cottonseed meal, and alfalfa hay.
- Lot 5. Ground feterita heads, cottonseed meal, and alfalfa hay.
- Lot 6. Ground threshed kafir, cottonseed meal, and alfalfa hay.

In the 1919-20 lamb-feeding test, which is summarized in Table 1, it will be observed that (1) each of the respective lots made exceptionally good gains throughout the ninety-day feeding period; (2) Lot 4, fattened on ground threshed milo, made a slightly increased gain over Lot 3, which was fed ground shelled corn; (3) the lots fattened on the grain sorghums made much more economical gains than the lambs fattened on corn which had been shipped into Texas; (4) corn shipped into Texas from out-of-state points cannot compete profitably with the locally grown grain sorghums for fattening lambs.

Table 1. Summary of ninety-day feeding test.

	Lot I. Ground Milo Heads, Cottonseed Meal, Alfalfa Hay.	Lot II. Ground Threshed Feterita, Cottonseed Meal, Alfalfa Hay.	Lot III. Ground Corn, Cottonseed Meal, Alfalfa Hay.	Lot IV. Ground Threshed Milo, Cottonseed Meal, Alfalfa Hay.	Lot V. Ground Feterita Heads, Cottonseed Meal, Alfalfa Hay.	Lot VI. Ground Threshed Kafir, Cottonseed Meal, Alfalfa Hay.
Number of lambs per lot.....	20	20	20	20	20	20
Average initial weight, lbs.....	59.33	59.00	59.88	59.73	59.96	58.63
Average final weight, lbs.....	91.91	91.42	95.25	95.16	90.46	92.13
Average total gain, lbs.....	32.58	32.42	35.37	35.43	30.50	33.50
Average daily gain, lbs.....	0.362	0.36	0.393	0.394	0.339	0.372
Average daily ration:						
1. Grain, lbs.....	1.08	1.08	1.08	1.08	1.08	1.08
2. Cottonseed meal, lbs.....	0.14	0.14	0.14	0.14	0.14	0.14
3. Alfalfa hay, lbs.....	1.89	1.89	1.89	1.89	1.89	1.89
Total feed consumed per lamb:						
1. Grain, lbs.....	97.211	97.211	97.211	97.211	97.211	97.211
2. Cottonseed meal, lbs.....	12.588	12.588	12.588	12.588	12.588	12.588
3. Alfalfa hay, lbs.....	170.4	170.4	170.4	170.4	170.4	170.4
Concentrates per 100 lbs. gain, lbs.....	337.01	338.66	310.43	309.89	359.99	327.75
Hay per 100 lbs. gain, lbs.....	523.02	525.60	481.76	480.94	558.68	508.65
Cost of feed per 100 lbs. gain.....	\$ 13.828	\$ 15.66	\$ 17.284	\$ 14.329	\$ 14.771	\$ 15.155
Average feed cost per lamb.....	4.50	5.08	6.11	5.08	4.50	5.08
Initial cost per lamb at feed lot at 13½ cents per pound.....	8.01	7.97	8.08	8.06	8.09	7.92
Interest, labor, shipping and selling charges per head, estimated....	1.20	1.20	1.20	1.20	1.20	1.20
Total cost per lamb.....	13.71	14.25	15.39	14.34	13.79	14.20
Estimated selling weight at Fort Worth, lbs.....	84.56	84.11	87.63	87.55	83.22	84.76
Selling price per lamb at Fort Worth at \$19.50 per cwt.....	\$ 16.49	\$ 16.40	\$ 17.09	\$ 17.07	\$ 16.23	\$ 16.53
Estimated net profit per lamb.....	2.78	2.15	1.70	2.73	2.44	2.33
Necessary selling price per cwt. to break even.....	16.21	16.94	17.56	16.38	16.57	16.75

The Kansas Experiment Station has conducted several tests to compare the feeding value of kafir and corn for fattening lambs, and in a test conducted in 1914, the Kansas Station compared shelled corn, whole kafir, and ground kafir, fed to three lots of fifty 56-pound lambs, fed 0.9

pound grain, 0.19 pound cottonseed meal, 1.4 pounds alfalfa hay, and 1.1 pounds sweet sorghum silage. In this test the lambs fattened on shelled corn made an average daily gain of 0.4 pound during the sixty-day trial; those fattened on whole kafir made an average daily gain of 0.35 pound; while those fattened on ground kafir made an average daily gain of 0.36 pound.

In a similar test conducted at the Kansas Station in 1915-16 with 75 lambs to the lot, the lambs fattened on an average daily ration consisting of corn 1.01 pounds, cottonseed meal 0.16 pound, alfalfa hay 0.95 pound, and silage 1.24 pounds, made an average daily gain of 0.274 pound. The lambs fattened on an average daily ration consisting of whole kafir 1.01 pounds, cottonseed meal 0.16 pound, alfalfa hay 0.95 pound, and silage 1.26 pounds, made an average daily gain of 0.275 pound. The lambs fattened on an average daily ration consisting of ground kafir heads 1.16 pounds, cottonseed meal 0.16 pound, alfalfa hay 0.993 pound, silage 1.09 pounds, made an average daily gain of 0.247 pound.

In 1917-18, the Kansas Station conducted a test in which shelled corn and alfalfa hay were compared with whole kafir and alfalfa hay for fattening lambs. The corn-fed lot received an average daily ration of corn 1.46 pounds, alfalfa hay 1.54 pounds, and made an average daily gain of 0.43 pound. The kafir lot received an average daily ration of kafir 1.39 pounds, alfalfa hay 1.74 pounds, and made an average daily gain of 0.41 pound. The Kansas experiment also pointed to the conclusion that lambs fattened on kafir, which is one of the grain sorghums, make almost the same gains as lambs fattened on corn.

## THE 1920-1921 LAMB FEEDING EXPERIMENT

### OBJECT

The object of this feeding experiment was to compare the gains and economy of gains made by lambs fattened on the grain sorghums and on corn.

### RATIONS

The following rations were supplied:

- Lot 1. Ground milo heads, cottonseed meal, and alfalfa hay.
- Lot 2. Ground threshed feterita, cottonseed meal, and alfalfa hay.
- Lot 3. Ground shelled corn, cottonseed meal, and alfalfa hay.
- Lot 4. Ground threshed milo, cottonseed meal, and alfalfa hay.
- Lot 5. Ground feterita heads, cottonseed meal, and alfalfa hay.
- Lot 6. Ground threshed kafir, cottonseed meal, and alfalfa hay.
- Lot 7. Ground kafir heads, cottonseed meal, and alfalfa hay.
- Lot 8. Ground threshed milo, whole cottonseed, and alfalfa hay.
- Lot 9. Ground threshed milo, cottonseed meal, and sorghum hay.

Representative samples of the several feeds utilized in this test were taken in accordance with instructions from the Station Chemist and submitted to him for analyses, the composition of the several feeds being tabulated in Table 2 below:

Table 2. Composition of feeds used during experiment. (Per cent.)

Name	Protein	Fat	Crude fibre	Nitrogen free extract	Water	Ash	No. of analyses
Ground corn, shelled.....	9.70	4.08	2.66	71.46	10.90	1.28	2
Ground milo heads.....	10.41	2.31	6.92	64.80	12.01	3.57	2
Ground feterita heads.....	11.28	2.14	6.77	65.03	12.00	2.79	2
Ground kafir heads.....	9.45	2.47	7.43	66.42	11.25	2.99	2
Threshed milo, ground.....	10.40	2.58	2.74	70.14	12.38	1.82	2
Threshed feterita, ground.....	11.82	2.73	2.11	67.27	14.33	1.76	2
Threshed kafir, ground.....	10.19	3.05	2.02	70.33	12.95	1.48	2
Cottonseed.....	22.08	20.51	20.66	25.14	7.99	3.63	2
Cottonseed meal.....	42.68	7.56	8.86	25.75	7.04	6.11	2
Alfalfa hay.....	14.27	1.76	30.48	36.02	8.88	8.49	3
Sorghum hay.....	5.79	1.96	26.48	50.22	9.30	6.26	2

A good grade of Kansas corn consisting of a mixture of the yellow and white varieties, selected especially for this test, was used as the basis of the standard ration in Lot 3. This corn was practically the same grade as that utilized in the test conducted during the season of 1919-20, and reported in Texas Experiment Station Bulletin No. 269. The milo fed during the test reported in this bulletin was inferior to that used in the experiment conducted during the previous season. The growing season of 1920 was unusually wet and the grain sorghums were late in maturing, owing to a general setback sustained by the crops in the vicinity of Substation No. 7 on account of severe hail storms. This accounts for the high percentage of water in the grain sorghums used in the test reported in this bulletin. The feterita and kafir utilized in this test were grown locally at Substation No. 7, as was the milo and the analyses show each of the grain sorghums to be about a grade below those fed in the 1919-20 test. A portion of the alfalfa hay utilized in this test was grown at Substation No. 7, while one carload came from Southern New Mexico. The New Mexico hay was a number three grade, while that produced at the Station was a number one grade.

#### COST OF FEEDS

The feeds utilized during the experiment herein reported are based on local feed prices prevailing in the Panhandle of Texas during the fall of 1920, as follows:

Ground milo heads, per ton.....	\$14.00
Ground threshed feterita, per ton.....	17.50
Ground shelled corn, per ton.....	37.22
Ground threshed milo, per ton.....	17.50
Ground feterita heads, per ton.....	14.00
Ground threshed kafir, per ton.....	17.50
Ground kafir heads, per ton.....	14.00
Cottonseed meal, per ton.....	38.00
Alfalfa hay, per ton.....	25.00
Sorghum hay, per ton.....	6.50
Cottonseed, per ton.....	18.00

Threshing tests of the grain sorghums at the Spur and Lubbock Substations show representative yields of threshed grain as follows:



Table 3. Threshed yields of grain sorghums.

Grain sorghums	Number of tests	Average yield threshed grain, per cent	Head stems per cent
Milo.....	8 at Spur	76.38	23.62
Feterita.....	8 at Spur	76.68	23.32
Kafir.....	10 at Lubbock	75.17	24.83

## DURATION OF EXPERIMENT

The feeding experiment reported in this bulletin extended over a period of ninety days, beginning November 29, 1920, and closing February 27, 1921.

## THE LAMBS

The lambs used in this test were of Rambouillet-Delaine breeding. They were bred by W. C. Gay, Coleman County, from whom they were purchased at a price of \$7.00 per head before the break occurred in the lamb market in the latter part of November. They were shipped from Coleman, November 24, the shipment arriving at Spur on the 26th. The lambs were given access to the pasture the day following delivery to the Station. They were divided into nine lots of twenty head each, November 28, and placed on preliminary feed.

These lambs averaged about fifty pounds at the Experiment Station after delivery. The average shipping cost per head from Coleman to the Station at Spur was 44 cents. These lambs were of uniform type and breeding, and were all wethers. They were in a good, thrifty condition at the inception of the test.

## WEATHER CONDITIONS DURING TEST

Table 4. Showing maximum and minimum temperatures, also the precipitation at Substation No. 7 during period of feeding test.

Year	Month	Maximum temperature degrees F.	Minimum temperature degrees F.	Precipitation inches
1920	November*	68	31	None
1920	December.....	74	12	0.38
1921	January.....	78	6	0.30
1921	February.....	82	18	1.08

\*Including and after November 29.

Each of the nine lots of lambs fed in this experiment had access to shelter; hence the general weather conditions prevalent were apparently not a vital factor. It is true that when the temperature hovers around 80 degrees Fahrenheit the attendant must take proper precaution in feeding the lambs so that all will remain on feed. On unusually warm days while this test was under way the attendant would delay the evening feeding until the temperature of the prevailing atmosphere had cooled somewhat. Such instances were few in number and the feeding was in no instance delayed for more than an hour. During sudden cold snaps (northers) the lambs did not take their normal fill of water, but they remained on feed throughout the ninety-day test and in not a single instance did a lamb go off feed.



## FEED LOTS, WATER SUPPLY AND EQUIPMENT

The nine lots in which the feeding test was conducted were provided with ample open-shed shelter of southern exposure. All lots were approximately of the same size. The feed racks were of equal dimension and of similar structure. Each lot of lambs was given access to water three times daily, viz., in the forenoon, after having consumed the morning feed; during the middle of the afternoon; and at night after the evening feed had been consumed. The water was supplied from a shallow well, and an analysis by the Station Chemist showed that it contained 1240 parts of salt (chloride of soda) per million of water. Salt was accessible in each of the respective lots at all times throughout the entire test. Owing to the amount of salt in the water the lambs did not consume as much as they would have, had they not consumed the salt that was in solution in the supply of stock water.

## WEIGHT RECORDS

Each of the respective lots was weighed on three consecutive days at the beginning and end of the experiment, the respective averages of the three initial and final weighings being considered the initial and final weights. Each of the respective lots was weighed at regular fifteen-day intervals throughout the test. The weighing was begun promptly at 1 p. m. on the regular assigned weighing dates.

## THE EXPERIMENT

The lambs were divided into nine lots of twenty head each, with the exception of Lots 8 and 9, which contained only fifteen head, the test proper being started November 29, 1920. The concentrated portion of the ration at the outset consisted of seven parts, by weight, of grain to three parts of choice cottonseed meal. The lambs fed in this test reported in this bulletin averaged nine pounds less in weight at the inception of the experiment than did the Rambouillet lambs that were fed during the previous season; hence there was a smaller daily consumption of feed per head in this test than in that reported in Texas Bulletin No. 269.

The lambs were fed regularly at 7 a. m. and 5 p. m. daily, the only exception being that in a few isolated instances on unusually warm days, the evening feeding was delayed approximately an hour until the atmosphere cooled.

The feeds for each of the respective lots of lambs were weighed in advance of the regular feeding periods in order to avoid any delay in the distribution of the feed to each lot promptly at the regular assigned hour. Combination hay and grain racks were successfully utilized in each lot.

Waste hay was removed from the feed racks twice daily, a record of all unconsumed roughage being kept.

None of the lambs had been accustomed to concentrates; therefore, several days were required to get them on feed nicely. The initial ration consisted of a mixture of grain and cottonseed meal in a proportion of seven parts grain to three parts cottonseed meal, and alfalfa hay of choice

quality. At the end of the first week on feed, the average daily ration per head consisted of the following:

Concentrates (grain and cottonseed meal) in a 7:3 proportion, 0.75 pound; alfalfa hay, 1.50 pounds.

At the end of the fourth week the concentrated portion of the ration was changed to a proportion of nine parts of grain to each part of cottonseed meal. The attendant was at all times cautious to observe that the lambs were on feed, and very gradually increased the concentrated portion of the ration, at the same time slightly decreasing the daily allowance of roughage until at the end of the ninety-day feeding period the lambs which, at that time, averaged around 78 pounds, were receiving the following daily ration:

Concentrates (grain and cottonseed meal) in a 9:1 proportion, 1.5 pounds; alfalfa hay, 1.3 pounds.

Table 5. Comparison of ground milo heads with ground shelled corn for fattening lambs November 29, 1920, to February 27, 1921.

Rations	Lot 1.	Lot 3.
	Ground milo heads, cottonseed meal alfalfa hay	Ground shelled corn, cottonseed meal, alfalfa hay
Number of lambs per lot.....	20	20
Average initial weight, lbs.....	50.633	50.283
Average weight at feed lot, lbs.....	78.633	78.333
Average gain, lbs.....	28.000	28.050
Average daily gain, lbs.....	0.311	0.312
Average daily feed per lamb:		
Grain, lbs.....	0.877	0.877
Cottonseed meal, lbs.....	0.156	0.156
Hay, lbs.....	1.477	1.471
Feed required per pound of gain:		
Concentrates, lbs.....	3.321	3.315
Roughage, lbs.....	4.750	4.719
Cost of feed per 100 pounds gain.....	\$ 8.86	\$12.08
Initial cost per lamb at feed lot.....	7.44	7.44
Interest, labor, selling and shipping cos per lamb.....	1.20	1.20
Average feed cost per lamb.....	2.48	3.39
Total cost per lamb.....	11.12	12.03
Selling value of lambs per 100 lbs. at Fort Worth.....	8.00	8.00
Average weight at Fort Worth, lbs.....	73.00	74.00
Loss per lamb.....	\$ 5.28	\$ 6.11

Table 5 shows that the lambs in Lot 1, fattened on ground milo heads, made practically the same gains as were made by Lot 3, which received ground shelled corn, the average gain made by the former being 28.0 pounds, while that made by the corn-fed lot was 28.05 pounds per head. The amount of feed required to produce a pound of gain was practically the same in each lot; however, the cost of the feed required to make a hundred pounds of gain was \$8.86 for the lot receiving ground milo heads, and \$12.08 for the lot receiving ground shelled corn. The average daily gains made by the lambs of the two lots were satisfactory, being 0.311 pound in Lot 1, and 0.312 pound in Lot 3. In a similar test conducted at Substation No. 7 the year previous, the lot fattened on ground milo heads made an average daily gain of 0.363 pound per head while the corn-fed lot gained 0.393 pound per head daily.

Table 6. Comparison of ground threshed feterita with ground shelled corn for fattening lambs. November 29, 1920, to February 27, 1921.

Rations	Lot 2	Lot 3
	Ground threshed feterita, cottonseed meal, alfalfa hay	Ground shelled corn, cottonseed meal, alfalfa hay
Number of lambs per lot.....	20	20
Average initial weight, lbs.....	50.516	50.283
Average final weight at feed lot, lbs.....	78.566	78.333
Average gain, lbs.....	28.050	28.050
Average daily gain, lbs.....	0.312	0.312
Average daily feed per lamb:		
Grain, lbs.....	0.877	0.877
Cottonseed meal, lbs.....	0.156	0.156
Hay, lbs.....	1.475	1.471
Feed required per pound of gain:		
Concentrates, lbs.....	3.315	3.315
Roughage, lbs.....	4.733	4.719
Cost of feed per 100 lbs. gain.....	\$ 9.30	\$12.08
Initial cost per lamb at feed lot.....	7.44	7.44
Interest, labor, selling and shipping cost per lamb.....	1.20	1.20
Average feed cost per lamb.....	2.61	3.39
Total cost per lamb.....	11.25	12.03
Selling value of lambs per 100 lbs. at Fort Worth.....	8.00	8.00
Average weight at Fort Worth, lbs.....	74.00	74.00
Loss per lamb.....	\$ 5.33	\$ 6.11

Table 6 shows that the lambs in Lot 2, fattened on ground threshed feterita, made identically the same gain in this test as was made by Lot 3, which received ground shelled corn, the average gain per head in each lot being 28.05 pounds, or an average daily gain of 0.312 pound per head. The amount of feed required to produce a hundred pounds of gain was practically the same in each lot; however, the cost of feed required to produce one hundred pounds of gain was \$2.78 less in the lot receiving the ground threshed feterita than in the ground shelled corn lot. In a similar test conducted at Substation No. 7 during the previous season the lot that received ground threshed feterita made an average daily gain of 0.36 pound as compared to a 0.393 pound gain made by the corn-fed lot.

Table 7. Comparison of ground threshed milo with ground shelled corn for fattening lambs. November 29, 1920, to February 27, 1921.

Rations	Lot 4	Lot 3
	Ground threshed milo, cottonseed meal, alfalfa hay	Ground shelled corn, cottonseed meal, alfalfa hay
Number of lambs per lot.....	20	20
Average initial weight, lbs.....	50.350	50.283
Average final weight at feed lots, lbs.....	78.633	78.333
Average gain, lbs.....	28.280	28.050
Average daily gain, lbs.....	0.314	0.312
Average daily feed per lamb:		
Grain, lbs.....	0.877	0.877
Cottonseed mea, lbs.....	0.156	0.156
Hay, lbs.....	1.469	1.471
Feed required per pound of gain:		
Concentrates, lbs.....	3.288	3.315
Roughage, lbs.....	4.677	4.719
Cost of feed per 100 lbs. gain.....	\$ 9.23	\$12.08
Initial cost per lamb at feed lot.....	7.44	7.44
Interest, labor, selling and shipping cost per lamb.....	1.20	1.20
Average feed cost per lamb.....	2.61	3.39
Total cost per lamb.....	11.25	12.03
Selling value of lambs per 100 lbs. at Fort Worth.....	8.00	8.00
Average weight at Fort Worth, lbs.....	71.00	74.00
Loss per lamb.....	\$ 5.57	\$ 6.11

Table 7 shows that the lambs in Lot 4, fattened on ground threshed milo, made a slightly increased gain over Lot 3, which received ground shelled corn; the average gain made by the milo-fed lot being 28.28 pounds per head, while that made by the corn fed lot was 28.05 pounds, or an average daily gain of 0.314 pound for the former and 0.312 pound per head daily for the latter. The cost of feed per hundred pounds gain was \$2.85 less for the lot fed ground threshed milo, than in the lot fattened on corn. In a similar test conducted at Substation No. 7 during the previous feeding season, the lambs fattened on ground threshed milo made an average daily gain of 0.394 pound as compared to 0.393 pound per head made by the corn-fed lot.

Table 8. Comparison of ground feterita heads with ground shelled corn for fattening lambs. November 29, 1920, to February 27, 1921.

Rations.	Lot 5	Lot 3
	Ground feterita heads, cottonseed meal, alfalfa hay.	Ground shelled corn, cottonseed meal, alfalfa hay.
Number of lambs per lot.....	20	20
Average initial weight, lbs.....	50.483	50.283
Average final weight at feed lots, lbs.....	76.433	78.333
Average gain, lbs.....	25.950	28.050
Average daily gain, lbs.....	0.288	0.312
Average daily feed per lamb:		
Grain, lbs.....	0.877	0.877
Cottonseed meal, lbs.....	0.156	0.156
Hay, lbs.....	1.473	1.471
Feed required per pound of gain:		
Concentrates, lbs.....	3.583	3.315
Roughage, lbs.....	5.107	4.719
Cost of feed per 100 lbs. gain.....	\$ 9.52	\$12.08
Initial cost per lamb at feed lot.....	7.44	7.44
Interest, labor, selling and shipping cost per lamb.....	1.20	1.20
Average feed cost per lamb.....	2.47	3.39
Total cost per lamb.....	11.11	12.03
Selling value of lambs per 100 lbs. at Fort Worth.....	8.00	8.00
Average weight at Fort Worth, lbs.....	71.00	74.00
Loss per lamb.....	\$ 5.43	\$ 6.11

Table 8 shows that the lambs in Lot 5, fattened on ground feterita heads, made an average gain per head of 25.95 pounds, while Lot 3, which was fattened on ground shelled corn, gained 28.05 pounds, or an average daily gain of 0.288 pound for the former and 0.312 pound for the latter. The amount of feed required to produce a hundred pounds of gain was somewhat greater in the lot fattened on the ground feterita heads. The cost of feed required to produce a hundred pounds of gain was \$2.56 less in the lot receiving the feterita heads. In a similar test conducted at Substation No. 7 during the previous feeding season, the lambs fattened on ground feterita heads made an average daily gain of 0.339 pounds as compared to 0.393 pounds per head made by the lot fattened on ground shelled corn.



Table 9. Comparison of ground threshed kafir with ground shelled corn for fattening lambs. November 29, 1920, to February 27, 1921.

Rations	Lot 6	Lot 3
	Ground threshed kafir, cottonseed meal, alfalfa hay	Ground shelled corn, cottonseed meal, alfalfa hay
Number of lambs per lot.....	20	20
Average initial weight, lbs.....	50.600	50.283
Average final weight at feed lots, lbs.....	79.483	78.333
Average gain, lbs.....	28.880	28.050
Average daily gain, lbs.....	0.321	0.312
Average daily feed per lamb:		
Grain, lbs.....	0.877	0.877
Cottonseed meal, lbs.....	0.156	0.156
Hay, lbs.....	1.481	1.471
Feed required per pound of gain:		
Concentrates, lbs.....	3.219	3.315
Roughage, lbs.....	4.613	4.719
Cost of feed per 100 lbs. gain.....	\$ 9.07	\$12.08
Initial cost per lamb at feed lot.....	7.44	7.44
Interest, labor, selling and shipping cost per lamb.....	1.20	1.20
Average feed cost per lamb.....	2.62	3.39
Total cost per lamb.....	11.26	12.03
Selling value of lambs per 100 lbs. at Fort Worth.....	8.00	8.00
Average weight at Fort Worth, lbs.....	75.5	74.00
Loss per lamb.....	\$ 5.22	\$ 6.11

Table 9 shows that the lambs in Lot 6, fattened on ground threshed kafir, made a slightly larger gain than Lot 3, which was fattened on ground shelled corn, although it will be noted that the difference was small. The average daily gain per head made by lambs receiving the ground threshed kafir was 0.32 pound, while the average daily gain per head in the corn-fed lot was 0.312 pound. The kafir-fed lot required less feed to produce a hundred pounds of gain than the corn-fed lot. In a similar test conducted at Substation No. 7 during the previous feeding season the lambs fattened on ground threshed kafir made a daily gain of 0.372 pound as compared to 0.393 pound per head made by the lot fattened on ground shelled corn.

Table 10. Comparison of ground kafir heads with ground shelled corn for fattening lambs. November 29, 1920, to February 27, 1921.

Rations	Lot 7	Lot 3
	Ground kafir heads, cottonseed meal, alfalfa hay	Ground shelled corn, cottonseed meal, alfalfa hay
Number of lambs per lot.....	20	20
Average initial weight, lbs.....	50.200	50.283
Average final weight at feed lot, lbs.....	75.700	78.333
Average gain, lbs.....	25.500	28.050
Average daily gain, lbs.....	0.283	0.312
Average daily feed per lamb:		
Grain, lbs.....	0.877	0.877
Cottonseed mea, lbs.....	0.156	0.156
Hay, lbs.....	1.451	1.471
Feed required per pound of gain:		
Concentrates, lbs.....	3.646	3.315
Roughage, lbs.....	5.122	4.719
Cost of feed per 100 lbs. gain.....	\$ 9.61	\$12.08
Initial cost per lamb at feed lot.....	7.44	7.44
Interest, labor, selling and shipping cost per lamb.....	1.20	1.20
Average feed cost per lamb.....	2.45	3.39
Total cost per lamb.....	11.09	12.03
Selling value of lambs per 100 lbs. at Fort Worth.....	8.00	8.00
Average weight at Fort Worth, lbs.....	71.00	74.00
Loss per lamb.....	\$ 5.41	\$ 6.11



Table 10 shows that the lambs in Lot 7, fattened on ground kafir heads, made an average gain per head of 25.5 pounds as compared with 28.05 pounds gain made by Lot 3, which received ground shelled corn. The average daily gain made by Lot 7, fattened on kafir heads, was 0.283 pound, while that made by Lot 3, which received ground shelled corn, was 0.312 pound. The amount of feed required to produce a hundred pounds of gain was somewhat greater in the lot fattened on ground kafir heads; however, the cost of feed required to produce a hundred pounds of gain in Lot 7 was \$2.47 less than in Lot 3, which received the ground shelled corn.

Table 11. Comparison of ground threshed milo and cottonseed with ground shelled corn and cottonseed meal for fattening lambs. November 29, 1920, to February 27, 1921.

Rations	Lot 8	Lot 3
	Ground milo, cottonseed, alfalfa hay	Ground shelled corn, cotton- seed meal, alfalfa hay
Number of lambs per lot.....	15	20
Average initial weight, lbs.....	50.310	50.283
Average final weight at feed lots, lbs.....	80.910	78.333
Average gain, lbs.....	30.600	28.050
Average daily gain, lbs.....	0.340	0.312
Average daily feed per lamb:		
Grain, lbs.....	0.363	0.877
Cottonseed mea, lbs.....	0.615*	0.156
Hay, lbs.....	1.489	1.471
Feed required per pound of gain:		
Concentrates, lbs.....	2.878	3.315
Roughage, lbs.....	4.379	4.719
Cost of feed per 100 lbs. gain.....	\$ 8.04	\$12.08
Initial cost per lamb at feed lot.....	7.44	7.44
Interest, labor, selling and shipping cost per lamb.....	1.20	1.20
Average feed cost per lamb.....	2.46	3.39
Total cost per lamb.....	11.10	12.03
Selling value of lambs per 100 lbs. at Fort Worth.....	8.00	8.00
Average weight at Fort Worth, lbs.....	73.30	74.00
Loss per lamb.....	\$ 5.24	\$6.11

\*Cottonseed.

Table 11 shows a comparison of the gains made by fattening lambs when fed on a concentrated ration consisting of ground threshed milo and whole cottonseed, as compared to those fattening on ground shelled corn and cottonseed meal. At the beginning of this test the lambs that were to be fattened on ground threshed milo and cottonseed were supplied with 0.5 pound per head daily of the above ration mixed in the proportion of two parts of milo to one part of whole cottonseed. The feed was gradually increased as the feeding period progressed, and at the end of the first month the lambs in this lot were consuming 0.9 pound per head daily of a mixture of seven parts of milo to five parts of cottonseed. At the end of the ninety-day feeding period the lambs in this lot were consuming 1.5 pounds per head daily of a mixture of one part of ground threshed milo to seven parts of whole cottonseed.

It will be observed that the lambs in Lot 8, fattened on ground threshed milo and whole cottonseed, made an average daily gain of 0.34 pound as compared with a gain of 0.312 pound per head in Lot 3, fattened on ground shelled corn and cottonseed meal. The cost per hundred pounds of gain in live weight was \$8.04 for the lot fed ground threshed milo and whole cottonseed, while the lambs in Lot 3, fattened on corn, cost \$12.08 per hundred pounds of gain in live weight, a dif-

ference of \$4.04 in favor of the ground threshed milo and whole cottonseed.

In this test there apparently was no ill effect as a result of feeding 1.3 pounds of whole cottonseed to eighty-pound lambs at the close of the ninety-day feeding period. The cottonseed portion of the ration was gradually increased as the feeding period progressed, and there was no laxative tendency produced in this lot at any time throughout the experiment.

Table 12. Comparison of sorghum hay with alfalfa hay for fattening lambs. November 29, 1920, to February 27, 1921.

Rations	Lot 9	Lot 1
	Ground milo heads, cottonseed meal, sorghum hay	Ground milo heads cottonseed meal, alfalfa hay
Number of lambs per lot.....	15	20
Average initial weight, lbs.....	50.080	50.633
Average final weight at feed lot, lbs.....	73.200	78.633
Average gain, lbs.....	23.120	28.000
Average daily gain, lbs.....	0.257	0.311
Average daily feed per lamb:		
Grain, lbs.....	0.822	0.877
Cottonseed meal, lbs.....	0.156	0.156
Roughage, lbs.....	1.412	1.477
Feed required per pound of gain:		
Concentrate, lbs.....	3.809	3.321
Roughage, lbs.....	5.497	4.750
Cost of feed per 100 lbs. gain.....	\$ 5.19	\$ 8.86
Initial cost per lamb at feed lot.....	7.44	7.44
Interest, labor, selling and shipping cost per lamb.....	1.20	1.20
Average feed cost per lamb.....	1.26	2.48
Total cost per lamb.....	9.84	11.12
Selling value of lambs per 100 lbs. at Fort Worth.....	8.00	8.00
Average weight at Fort Worth, lbs.....	68.60	73.00
Loss per lamb.....	\$ 4.35	\$ 5.28

Table 12 shows that the lambs in Lot 9, fattened on ground milo heads, cottonseed meal, and sorghum hay, made an average gain of 23.12 pounds per head, as compared with an average gain of 28 pounds made by Lot 1, which received ground milo heads, cottonseed meal, and alfalfa hay. The average daily gain made by Lot 9, which received sorghum hay, was 0.257 pound, while that made by Lot 1, receiving alfalfa hay, was 0.311 pound. The amount of feed required to produce 100 pounds of gain was greater in Lot 9, which received sorghum hay, than in Lot 1, receiving alfalfa hay; however, the cost per hundred pounds of gain was only \$5.19 for Lot 9, receiving sorghum hay; while the cost per hundred pounds of gain in Lot 1, receiving alfalfa hay, was \$8.86. This is due to the wide difference in the cost of these two roughages. Alfalfa hay used in this test cost \$25 per ton, while the sorghum hay was valued at \$6.50 per ton. Lot 9, which received the sorghum hay, did not finish as well as did Lot 1; however, they sold at the same figure on the Fort Worth market.

Table 13. Summary of 90-day lamb-feeding test, 1920-21, Substation No. 7, Spur, Texas.

Rations	Lot 1 Ground milo heads, cottonseed meal, alfalfa hay	Lot 2 Ground threshed feterita, cottonseed meal, alfalfa hay	Lot 3 Ground shelled corn, cottonseed meal, alfalfa hay	Lot 4 Ground threshed milo, cottonseed meal, alfalfa hay	Lot 5 Ground feterita heads, cottonseed meal, alfalfa hay	Lot 6 Ground threshed kafir, cottonseed meal, alfalfa hay	Lot 7 Ground kafir heads, cottonseed meal, alfalfa hay	Lot 8 Ground threshed milo, cottonseed, alfalfa hay	Lot 9 Ground milo heads, cottonseed meal, sorghum hay
Number of Lambs Per Lot.....	20	20	20	20	20	20	20	15	15
Average Initial Weight, Pounds.....	50.633	50.516	50.283	50.350	50.483	50.600	50.200	50.310	50.080
Average Final Weight, Pounds.....	78.633	78.566	78.333	78.633	76.433	79.483	75.700	80.910	73.200
Average Gain, Pounds.....	28.000	28.050	28.050	28.280	25.950	28.880	25.500	30.600	23.120
Average Daily Gain, Pounds.....	0.311	0.312	0.312	0.314	0.288	0.321	0.283	0.340	0.257
<b>Average Daily Ration:</b>									
Grain, Pounds.....	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.363	0.822
Cottonseed Meal, Pounds.....	0.156	0.156	0.156	0.156	0.156	0.156	0.156	*0.615	0.156
Hay, Pounds.....	1.477	1.475	1.471	1.469	1.473	1.481	1.451	1.489	** 1.412
<b>Total Feed Consumed Per Lamb:</b>									
Grain, Pounds.....	78.93	78.93	78.93	78.93	78.93	78.93	78.93	32.67	74.00
Cottonseed Meal, Pounds.....	14.06	14.06	14.06	14.06	14.06	14.06	14.06	*55.40	14.06
Hay, Pounds.....	133.00	132.78	132.37	132.27	132.55	133.25	130.63	134.02	**127.10
Concentrates Per Hundred Pounds Gain, Pounds.....	332.10	331.51	331.51	328.80	358.31	321.98	364.66	287.81	380.96
Hay Per Hundred Pounds Gain, Pounds.....	475.00	473.36	471.90	467.72	510.78	461.39	512.27	437.97	549.74
Average Feed Cost Per Lamb.....	\$ 2.48	\$ 2.61	\$ 3.39	\$ 2.61	\$ 2.47	\$ 2.62	\$ 2.45	\$ 2.46	\$ 1.26
Initial Cost per Lamb at Feed Lot.....	7.44	7.44	7.44	7.44	7.44	7.44	7.44	7.44	7.44
Cost of Feed Per Hundred Pounds Gain.....	8.86	9.30	12.08	9.23	9.52	9.07	9.61	8.04	5.19
Interest, Labor, Shipping and Selling Charges Per Head.....	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20	1.20
Total Cost Per Lamb.....	11.12	11.25	12.03	11.25	11.11	11.26	11.09	11.10	9.84
Weight at Fort Worth, Pounds.....	73.00	74.00	74.00	71.00	71.00	75.50	71.00	73.30	68.60
Selling Price at 8c Per Pound.....	\$ 5.84	\$ 5.92	\$ 5.92	\$ 5.68	\$ 5.68	\$ 6.04	\$ 5.68	\$ 5.86	\$ 5.49
Loss Per Lamb.....	5.28	5.33	6.11	5.57	5.43	5.22	5.41	5.24	4.35
Price Necessary to Break Even.....	15.23	15.20	16.25	15.84	15.64	14.91	15.61	15.14	14.34
Per Cent Shrinkage En route.....	7.16	5.81	5.53	9.71	7.10	5.01	6.21	9.41	6.28

\*Cottonseed. \*\*Sorghum hay.

Table 13 summarizes the 1920-21 experiment, in which a comparison of the grain sorghums versus corn for fattening lambs was made. It will be observed that Lots 2, 4, and 6, receiving the ground threshed grain sorghums, made practically the same gains daily as the corn-fed lambs in Lot 3. In this particular test, ground threshed milo and ground threshed kafir proved slightly superior to ground shelled corn in the production of gains. The 1920-21 test reported in this bulletin substantiates a similar experiment conducted in 1919-20, in which test ground threshed milo produced an average daily gain of 0.394 pound, while lambs fattened on ground shelled corn made an average daily gain of 0.393 pound.

It will be observed from the foregoing table that the lambs in Lot 6, which received ground threshed kafir, made a slightly larger gain than did Lot 4, which was fattened on ground threshed milo. In the 1919-20 test the lot fattened on ground threshed milo made a slightly larger gain than did the lot which received ground threshed kafir; however, the difference in each instance is slight. In this test as in the 1919-20 experiment, the lambs in Lot 1, fattened on ground milo heads, made a more economical gain than those in Lots 4 and 6, fattened on ground threshed milo and kafir, respectively. The cost per hundred pounds of gain in Lot 1, fattened on ground milo heads, was \$8.86, while in Lots 4 and 6 the cost of gains per hundred pounds was \$9.23 and \$9.61, respectively. The cost of feed per hundred pounds of gain was highest in Lot 3, fattened on corn, and lowest in Lot 9, in which sorghum hay was substituted for alfalfa.

The lambs in Lot 9 did not finish as well as did those in other lots, and should have commanded a lower price on the market. However, all lots sold at the same price.

Table 13 reveals that a heavy financial loss was entailed in each of the several lots of lambs in the 1920-21 test. Heavy losses in lamb-feeding operations during the past feeding season were almost universal.

Table 14. Showing average weights of lambs at the regular weighing periods throughout the ninety day test.

Weighing Period	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8	Lot 9
Nov. 29 (Initial Weight)*	50.63	50.52	50.28	50.35	50.48	50.60	50.20	50.31	50.08
Dec. 14.....	57.62	57.53	56.67	57.05	57.34	57.16	56.20	57.01	55.50
Dec. 29.....	62.48	60.42	61.90	62.33	61.80	63.03	60.17	61.01	61.08
Jan. 13.....	64.59	66.49	66.06	64.13	65.30	66.56	63.96	63.51	63.65
Jan. 28.....	68.99	69.58	70.56	70.57	68.06	70.90	66.60	69.06	65.91
Feb. 12.....	74.09	75.16	75.04	74.56	73.18	75.33	72.26	77.75	68.84
Feb. 27*.....	78.63	78.57	78.33	78.63	76.43	79.48	75.70	80.91	73.20
Gain per lamb.....	28.00	28.05	28.05	28.28	28.95	28.38	25.50	30.60	23.12

\*Average of three weighings.

An examination of Table 14 shows that with the exception of Lot 9, the average gains made by the lambs in the respective lots were quite consistent throughout the test. The Lot 9 lambs showed a much smaller total gain than did the other lots which were fed alfalfa hay. It was not expected that the Lot 9 lambs, which received sorghum hay as



roughage, would make as good a showing as the alfalfa hay-fed lots. This comparison was made for the purpose of comparing the two roughages when the concentrated portion of the ration was practically the same for each lot. Table 12 shows that even though Lot 9 made a much smaller gain than did Lot 1, which received the same concentrated feeds, the gains made by the former lot were much more economical with sorghum hay, valued at \$6.50 per ton than Lot 1, which received alfalfa hay, valued at \$25 per ton.

#### THE MANURE VOIDED

While no attempt has been made in the preparation of the data presented in this bulletin to assign a definite value to the manure voided by the experimental lots of lambs, amateur feeders are urged not to lose sight of the fact that sheep manure has a higher fertilizing value per ton than either horse, cow, or hog manure. According to Henry & Morrison's "Feeds and Feeding," page 278, the total daily production of manure by sheep is 3.4 pounds per hundred pounds live weight. Therefore, owing to its high fertilizing value the manure should not be wasted, but applied to the farm lands in accordance with the latest information upon this subject.

#### PRODUCTIVE VALUES CALCULATED FROM FEEDING TESTS

The productive values of the feeds used in this experiment were calculated by G. S. Fraps, Chief, Division of Chemistry. As stated in Dr. Fraps' "Principles of Agricultural Chemistry," page 434, the productive value of a feed is the best measure so far devised for the net value of a feed for production of fat, heat, energy, or similar purposes. Rations have heretofore been calculated on the assumption that all digestible nutrients of the same group have the same value to the animal, regardless of the origin of the material. We now know, however, that the net value of a feed may vary widely from its value based upon the digestible nutrients and that the value of a feed for the purpose of producing energy is best measured by its productive value. For example, one pound of digested material in the form of corn is worth much more to an animal than a pound of digested material in the form of alfalfa hay.

The productive value may be expressed in terms of fat, or as therms. In most of our work, we have expressed the value in terms of fat, but shall in the future express the values in therms, as proposed by the late Dr. H. P. Armsby, for the sake of uniformity.

When the productive value of a feed is stated in terms of therms this definite value can be compared with similar values of other feedstuffs. To ascertain the productive value of a feed in feeding tests, it is necessary to take one feed as a standard, to calculate the productive value of the other feeds fed with this feed, and to assume a definite maintenance requirement for the animal. In this experiment with lambs, corn was taken as the unit, and the productive values of cottonseed meal and alfalfa hay were calculated, the coefficients used being those given in Dr. Fraps' "Principles of Agricultural Chemistry," page 434, and Bulletins 185 and 203 of the Texas Experiment Station, and the mainte-



nance requirements given by Armsby in his "Principles of Animal Feeding."

Although the above assumptions may be claimed to lead to some uncertainty, yet since these figures are also used in connection with the other feeds compared with the standard, comparative results should be secured. This is especially the case if there is little difference between the quantity of the additional feeds fed, and no great difference in the average weights of the animals.

The calculations of the productive values from the feeding tests with sheep are given in Table 15. The maintenance requirements for a hundred pounds of the average weight were assumed, after Armsby, as 0.933 therms. The therms required for one pound of gain in weight when corn was fed were 2.526. The same figure was used when the value of the gains with other feeds in terms of therms was calculated.

The milo heads fed to Lot 1 had very nearly the same feeding value as the threshed milo fed to Lot 4. This is not what we would expect, and introduces uncertainty into the results of Lot 9, where milo heads were fed for the purpose of ascertaining the feeding value of sorghum hay. If the productive value found in Lot 1 is used for the calculations of Lot 9, the productive value of sorghum hay is 24.22 therms, but if the productive value of 76 therms per hundred pounds is assumed for the milo heads in this lot, the productive value of the sorghum hay is 30.02. We are inclined to believe that the latter figure is more nearly correct.

Table 15. Method of calculation of productive values from feeding tests with sheep.

	Lot 1 Milo heads	Lot 2 Feterita	Lot 3 Corn	Lot 4 Milo	Lot 5 Feterita heads	Lot 6 Kafir	Lot 7 Kafir heads	Lot 8 Cottonseed	Lot 9 Sorghum hay	Lot 9 Sorghum hay
Average weight (W).....	64.63	64.54	64.26	64.49	63.46	65.04	62.95	65.61	61.64	.....
Average daily gain (G).....	0.311	0.312	0.312	0.314	0.288	0.320	0.283	0.340	0.257	.....
Daily ration:										
Grain (S).....	0.877	0.877	0.877	0.877	0.877	0.877	0.877	0.363	0.822	.....
Cottonseed meal.....	0.156	0.156	0.156	0.156	0.156	0.156	0.156	†0.615	0.156	.....
Hay.....	1.477	1.475	1.471	1.469	1.473	1.481	1.451	1.489	1.412	.....
Productive value:										
Grain.....			0.757					*0.317	**0.706	†0.624
Cottonseed meal (C).....	0.114	0.114	0.144	0.144	0.114	0.114	0.114		0.114	0.114
Hay (C).....	0.520	0.519	0.517	0.516	0.518	0.521	0.510	0.524		
Total (T).....			1.388						0.820	0.738
Maintenance requirements (W × H = M).....	0.603	0.602	0.600	0.602	0.602	0.607	0.587	0.612	0.513	.....
Productive Balance (T - M = B).....			0.788							
Maintenance per 100 pounds (H = 0.933).....										
Therms per pound gain (B ÷ G = K).....			2.526							
Value of gain in therms (G × K = L).....	0.786	0.788		0.793	0.727	0.808	0.715	0.859	0.649	.....
Valuation of ration in therms (M + L = O).....	1.389	1.390		1.395	1.329	1.415	1.302	1.471	1.162	1.162
Value of grain in therms (O - C = X).....	0.755	0.757		0.765	0.697	0.780	0.678	0.630	0.342	0.424
Productive value [(X ÷ S) × 100] therms.....	86.07	86.30		87.21	79.46	88.92	77.29	102.43	24.22	30.02
Productive value fat.....	20.09	20.14		20.35	18.54	20.75	18.04	23.90	5.65	7.00

\*Calculated from 87.2 productive value Lot 4.

\*\*From Lot 1.

†Productive value assumed 76 therms.

‡Cottonseed.

Table 16. Comparison of productive values secured by feeding tests with sheep.

	Productive value per hundred pounds			Productive value found compared to corn as 100
	Found as		Calculated Therms	
	Fat	Therms		
Ground corn (Standard)			86.35	100
Ground corn (1920)			87.82	100
Ground feterita (1921)	20.14	86.30	85.68	99.9
Ground feterita (1920)	18.00	77.11	88.25	87.8
Ground feterita heads (1921)	18.54	79.46	75.88	92.0
Ground feterita heads (1920)	16.50	70.68	68.54	80.5
Ground kafir (1921)	20.75	88.92	72.11	102.9
Ground kafir (1920)	18.80	80.53	61.68	91.7
Ground kafir heads (1921)	18.04	77.29	68.44	89.5
Ground milo (1921)	20.35	87.21	77.06	100.9
Ground milo (1920)	20.60	88.25	79.25	100.5
Ground milo heads (1921)	20.09	86.07	75.70	99.7
Ground milo heads (1920)	18.00	77.11	69.82	89.2
Whole cottonseed (1921)	23.90	102.43	76.61	118.6
Sorghum hay (milo heads 86, 1921)	5.65	24.22	37.32	
Sorghum hay (milo heads 76, 1921)	7.00	30.02	37.32	
Alfalfa hay (1921)			35.18	

Table 16 contains a comparison of the productive values secured by feeding tests with sheep. The first column contains the productive value found as fat, for the tests described in this bulletin, and also the averages described in Bulletin 269 of 1920. The second column contains the same results found as therms. The third column contains the calculated productive values in therms. These values were calculated from the production coefficients given in Bulletins 185 and 203. They were based upon the average results given in digestion experiments, and we can expect to find variations from these averages in individual cases, especially since the average is made up from deviating figures. The feeding tests here described give us data to correct these calculated values, and to ascertain how nearly they represent the correct figures. In other words, the production coefficients secured by digestion experiments can be tested by feeding tests and corrected if necessary. Table 16 also contains the productive values as found by the feeding experiments of 1920.

As one could expect, there is a considerable difference in the productive values found in 1920 and 1921. This variation can be expected with feeding experiments on account of variations in conditions which can hardly be controlled, as well as variations in digestibility of different lots of feed.

Ground feterita in 1921 had 99.9 per cent. of the productive value of corn, and only 87.8 per cent in 1920. Ground feterita heads in 1921 had 92 per cent. of the productive value of corn, and 80.5 per cent. in 1920. Ground kafir in 1921 had a productive value of 102.9 per cent. of the productive value of corn, and 91.7 per cent. in 1920. Ground milo in 1921 had 100.9 per cent. of the productive value of corn, and 100.5 per cent. in 1920. The corn fed in 1920 was a little better in feeding value than that fed in 1921. Ground milo heads had 99.7 per cent. of the productive value of corn in 1921 and 89.2 per cent. in 1920.

A study of these figures shows that it is not possible to secure exact feeding values by means of a single series of experiments. Only by conducting a number of tests, and preparing the averages, can accurate

results be secured. The results of one test may come out decidedly better than those of another. It can also be expected that some individual feeding tests would vary decidedly from the average productive values calculated from digestion experiments. The productive values can be corrected by comparison with the feeding tests. But since the productive values are average values, and deviations from the average may be expected, close agreement can be expected only between averages, and not between individual tests.

The feeding value of cottonseed was considerably higher than was expected, and that of sorghum hay was lower than was expected from the calculated productive values. Further tests are needed on these feeds.

SUMMARY 1920-21 TEST

1. The nine respective lots made the following average daily gains per head during the ninety-day feeding period:

Lot 1, fed ground milo heads, cottonseed meal, and alfalfa hay..	0.311 lb.
Lot 2, fed ground threshed feterita, cottonseed meal and alfalfa hay .....	0.312 lb.
Lot 3, fed ground shelled corn, cottonseed meal, and alfalfa hay..	0.312 lb.
Lot 4, fed ground threshed milo, cottonseed meal and alfalfa hay.	0.314 lb.
Lot 5, fed ground feterita heads, cottonseed meal and alfalfa hay.	0.288 lb.
Lot 6, fed ground threshed kafir, cottonseed meal and alfalfa hay.	0.321 lb.
Lot 7, fed ground kafir heads, cottonseed meal and alfalfa hay..	0.283 lb.
Lot 8, fed ground milo, whole cottonseed, and alfalfa hay.....	0.340 lb.
Lot 9, fed ground milo heads, cottonseed meal, sorghum hay....	0.257 lb.

2. In this test as in that conducted during the previous season, Lot 4, fattened on ground threshed milo, made a slightly larger average daily gain than did Lot 3, fattened on ground shelled corn.

3. In this test Lot 6, fattened on ground threshed kafir, made a larger gain than did Lot 4, fattened on ground threshed milo.

4. Lot 8, fattened on ground threshed milo, whole cottonseed, and alfalfa hay, made the largest daily gain of any of the lots. At the close of the experiment, Lot 8 was receiving 1.3 pounds of cottonseed per head daily without any evidence of deleterious symptoms.

5. In this test a heavy loss was entailed on each lot due to the fact that the lambs were purchased at a time when feeders were commanding around \$13 per cwt., but delivered to the packers at a sacrificing price of \$8.00 per cwt., after one of the most serious breaks in the history of the lamb trade had occurred.

6. The respective lots sold straight through at 8 cents per pound on the Fort Worth market.

7. With the exception of Lot 9, which did not finish, all lots carried practically the same degree of finish.