

KANSAS FEEDS FOR SHEEP .

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May 1905.

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Indexed.

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INTRODUCTORY REMARKS.

I.

KANSAS AS A SHEEP FEEDING STATE.

1. The importance of the sheep feeding industry in the state results from a combination of natural conditions that has made Kansas one of the great meat producing states of the Union. This is well established by the facts that we are situated in a great alluvial plain noted for its production of cheap feed and surrounded by the climatic conditions which favor the grazing and feeding industry in all parts of the state. A long list of varieties of forage and grain crops are produced here at a minimum cost.

Another great natural advantage is that our state lies between the great range country and the point where the meat grown on the range is consumed. Kansas has several great systems of railways traversing the state, entering the range country on our north, south and west, and converging at the commercial centers where are situated the great abattoirs which slaughter two-thirds of the meat produced for the world.

Of these three natural conditions climate is the one of most importance. We have in Kansas that excellent climate that is just what a sheep needs to make the most gain out of every pound of feed eaten.

Furthermore every scientific man knows that all feed produced on the farm must be consumed on it if the fertility of the land be maintained. We have not yet learned to appreciate the extent to which the employment of farm labor in the care of live-stock during the

winter season when it would otherwise be idle, has increased prosperity and made our agriculture stable.

The possibility of feeding in transit has been of great benefit to the feeders, and this privilege, with some modification, is likely to continue. Although Kansas should produce a large number of lambs yearly, yet, with the present wide ratio between the value of the range land and the grain producing land together with the small expense of transportation it is altogether in line with modern ideas to believe that there will be fed in the state annually many times the number of lambs produced within her borders.

II.

OBJECT of THIS PAPER.

2. The object of this paper is to show the results of feeding the common feeds of Kansas to sheep as reported by the several state experiment stations.

It has been my purpose to speak of all these feeds singly, in as far as data can be obtained, and also a few of the many combined rations that have been made. The latter only in sufficient number however to present proof for the conclusions drawn at the close.

III.

PLAN of WORK.

3. In preparing the paragraphs on the different rations the plan has been to mention the following points in connection with each experiment, as being of interest; (a), reference; (b), number of animals in trial; (c), length of time the trial was conducted; (d), results obtained; (e), conclusions; (f), any causes of abnormal irregularities in the results. Numbers in parenthesis refer to references which are given at the close of the work, unless otherwise noted.

COMPARISONS of KANSAS FEEDS for SHEEP, as REPORTED by STATE EXPERIMENT STATIONS, OTHER than KANSAS.

4. INDIAN CORN (Zea Mays).— Since a large proportion of the sheep fed in Kansas are fattened on corn for the greater part of their grain ration it is interesting to learn the quantity of this grain required for a given gain. Below are presented the results of eight average trials with corn as the grain ration for fattening lambs:

Fattening Lambs on Corn and Hay - Colorado, Michigan, Minnesota and Wisconsin Stations.

Where Fed.	No. of Lambs	No. of days Fed.	Feed Eaten		Av. Wt. at Beginning	Gain	Av. Daily Gain	Feed for 100 lbs. Gain.	
			Corn	Hay				Corn	Hay
			Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Colorado (1) -	4*	99	1266	1657	84	275	0.27	353	460
Colorado (1) -	5*	90	804	1606	54	246	0.27	326	652
Michigan (2) -	10	105	1579	1097	82	328	0.31	481	334
Michigan (2) -	20*	105	1506	961	82	248	0.24	607	387
Michigan (3) -	10	91	1208	1142	85	233	0.26	518	490
Minnesota (4) -	16*	84	1103	849	71	211	0.25	523	402.
Wisconsin (5) -	5*	56	856	576+	86	208	0.37	411	277
Wisconsin (6) -	25*	56	861	1057	76	150	0.25	574	705
Average of 8 Trials.	11	87	1148	1118	78	236	0.28	474	463

* Reduced to 10 lambs in table. + Corn Fodder.

From this table we learn that 89 lambs averaging 78 pounds each, during feeding trials averaging 87 days in length made gains of 0.28 pounds per head daily; requiring 474 pounds of corn and 463 pounds

of hay for 100 pounds of increase in live weight.

To further show the value of corn as a far producer let us value it at 50 cents per hundred weight which is a fair average for Kansas, and hay at \$4.00 per ton. We now find that 100 pounds of gain was produced at a cost of \$2.37 for the corn and 93 cents for the hay, or a total of \$3.30 for the feed required. This is equal to 3.3 cents per pound for each pound of gain.

5. DRY VERSUS SOAKED CORN for SHEEP.- According to literature there is but one experiment recorded along this line, Mueller, (Braunschur Landu. Zeit.) 1885, p. 209; Jahresb. Agr. - Chemic, 1885, p.576), (7) fed sheep on dry and soaked corn. Twenty sheep nearly two years old were fed 1.4 pounds of whole corn per day per head, ten animals receiving the grain dry and ten receiving it soaked with as much water as it would absorb. At the end of a period of ten weeks the live weight of the sheep fed dry corn had increased 6.6 pounds more per head than the lot receiving soaked corn; after four weeks more, the live weight of the former lot had increased 12.1 pounds per head more than the second lot. The author explains the poorer utilization of the soaked corn with the decreased secretion of saliva when grain so treated was fed.

6. WHEAT (Triticum Vulgore).- In as much as it is sometimes found desirable to feed whole wheat the following trials are reported to show what may be expected of it as a sheep feed when it is the only grain in the ration:

FEEDING LAMBS on WHEAT and HAY - MINNESOTA and MONTANA STATIONS.

When Fed.	No. of Lambs Fed.	Days Fed.	Feed Eaten		Av. Wt. at Beginning.	Av. Gain	Av. Daily Gains	Feed for 100 lbs. Gain.	
			Wheat	Hay.				Wheat	Hay.
			Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Minnesota (4) -	10	84	1505	742	72	20	0.24	745	367
Montana (8) -	22*	95	768	3145	124	23	0.24	331	1363
Average of Two Lots.	16	89	1137	1949	98	21.5	0.24	538	865.

*Reduced to 10 lambs in table.

By the above we learn that the lambs fed wheat required more feed for a given gain and did not make quite so large daily gains as those fed on corn. Valuing wheat at 1 cent per pound and hay at \$4.00 per ton we find then 100 pounds of gain would be produced at a cost of \$5.38 for the wheat and \$1.91 for the hay, or a total of \$7.29 for the feed required, which is equal to 7.29 cents per pound for each pound of gain. These figures indicate that wheat alone as the grain ration can be fed proportionately only when it is very low in value for milling purposes.

7. MACARONI WHEAT, (*Triticum Durum*).- In view of the fact that there is a larger average of this variety of wheat being sown annually it may be of interest to note the following results that have been obtained by feeding this grain to fattening sheep.

At the South Dakota Station (9), 36 lambs divided into 4 equal lots were fed the following grain rations and the same kind of hay; upland prairie hay during the first part of the experiment and *Bromus inermis* the last part; (a), wheat; (b) macoroni wheat; (c) macoroni wheat and bran; (d) ground macoroni wheat and bran. As a result

of this trial which lasted 109 days we find; first, whole macaroni wheat was cheaper feed for lambs than ground macaroni wheat and bran, or the whole macaroni wheat and bran; second, macaroni wheat was equal to bread wheat, pound per pound, when fed to lambs.

8. OATS (*Avena sativa*).— Oats is not a very common feed to use for fattening sheep although it is often said to be good for breeding flocks. For an idea of its value as a sheep fattening feed the following data from the Montana Station (8) will be of interest. Twenty-two lambs were fed 95 days on a ration of clover hay and oats. They made an average daily gain of 0.33 pounds, requiring 321 pounds of oats and 1352 pounds of hay to produce 100 pounds of gain. Valuing oats at 75 cents per hundred weight and clover hay at \$4.00 per ton; 100 pounds of gain will cost \$2.41 for the grain and \$2.71 for the hay or a total of \$5.12. This is equal to 5.12 cents per pound for each pound of gain.

9, OATS as a FACTOR in FEEDING LAMBS.— At the Minnesota Station (10) 16 lambs were separated into two equal lots and fed for 84 days to test the advantage of adding oats to the ration in fattening lambs. Both lots were fed corn, wheat bran, and clover hay; and one lot oats in addition. The following table shows a comparison of the results:

FEEDING OATS to LAMBS - MINNESOTA STATION.

Rations Fed.	FEED EATEN.		Gains.
	Hay	Grain.	
	Lbs.	Lbs.	Lbs.
Oats Lot - - - - -	515	1555	105
Opposing Lot (Minus Oats) - - - - -	517	1510	67
Differences - - - - -	2	45	38

This table shows us that in this case the oats had a very material effect on the gains of the lambs. The oats lot increased 16 per cent more than those fed bran, corn and hay. This only helps to prove that variety is a great factor in successful sheep feeding.

10. BARLEY (*Hordeum Vulgare*).— At the Montana Station several experiments have been carried out in which barley was the only grain feed in the ration. The following table summarizes 3 of these trials:

FEEDING SHEEP BARLEY and HAY - MONTANA STATION.

Where Fed.	No. of Lambs Fed	No. of Days Fed.	Feed Eaten		Av. Wt. At Be- gin- ing. Lbs.	Av. Gain	ly Ga- in. Lbs.	Feed for 100	
			Barley Lbs.	Hay Lbs.				Lbs. Gain. Barley	Lbs. Gain. Hay.
Montana (8)	23*	95	790	298	119	28	0.29	279	1190
Montana (11)	55*	88	601	1811	63	24	0.27	250	750
Montana (11)	51*	88	625	3325	95	24	0.27	260	1385
Average of 3 Trials	43	90	672	2371	76	25	0.28	263	1108

*Reduced to 10 Lambs in table.

It is learned from this table that 129 sheep averaging 76 pounds each, during feeding trials averaging 90 days in length made a gain of 0.28 pounds per head daily requiring 263 pounds of barley and 1108 pounds of hay for 100 pounds of increase in live weight. If barley can be properly valued at 75 cents per hundred weight and hay at 20 cents per hundred weight the total cost of feed for one pound of gain will be 4.58 cents.

11. EMMER (*Triticum dicoccum*).— For facts regarding this comparatively new grain as a sheep feed we are indebted to the South

Dakato Station (9). One lot of lambs was fed whole emmer, a second lot ground emmer, and a third lot whole emmer and bran; also one lot was fed corn. In the case of the ground emmer the sheep would not eat all of the husks. It required one-fourth more emmer by weight to produce a pound of gain than it did corn. The addition of bran does not lessen the cost of making gains when emmer is fed.

12. SOY BEANS (*Dalichas soja*).-- Ten sheep were fed on soy beans and clover hay at the Iowa Station (12) for 56 days, consuming in that time 1078 pounds of hay and 752 pounds of soy beans; also 48 pounds of bran at the beginning of the trial; from this feed they made a gain of 228 or 0.40 pounds per head daily. There was 473 pounds of clover hay and 229 pounds of soy beans, together with 21 pounds of bran consumed to produce 100 pounds of gain.

Along with this lot, 2 other lots were fed to compare the value of soy beans with corn and emmer. From the data given it appears that pound for pound soy beans are of but little more value than corn for fattening sheep when fed with hay. Also that soy beans on account of their high protein content should not form the sole grain ration in conjunction with clover hay for sheep feeding purposes.

13. MILLET (*Panicum miliaceum*).-- Millet was fed to nine lambs from Jan. 2 to Apr. 22, 1904 at the South Dakota Station (13). These lambs weighed 636 pounds at the beginning of the experiment and 917 pounds at the close, gaining 281 pounds. They consumed during this time 1631 pounds of grain and 1332 pounds of mixed prairie hay and *Bromus inermis*. The lambs made an average daily gain of 0.28 pounds. By valuing hay at \$5.00 per ton and millet at 40 cents per bushel we find from the figures given that the cost of the feed per pound gain is 5.3 cents. This test indicates that this variety of millet seed,

when ground coarsely, as it was in this experiment, is excellent feed for lambs. We should remember that since this grain is becoming favorably known to crop producers of the state on account of its large yields, it may also prove to be a very valuable addition to our list of grains for the production of mutton.

14. CORN VERSUS WHEAT.- At the South Dakato Station (14) two lots of 9 lambs each were fed from November 28 to March 27 to compare these grains. The following table shows the results:

CORN Vs. WHEAT - SOUTH DAKATO STATION.

Rations Fed.	Feed Consumed.			Gain.
	Hay	Oats	Corn or Wheat	
	Lbs.	Lbs.	Lbs.	Lbs.
Corn Lot - - - - -	851	717	717	225
Wheat Lot - - - - -	862	718	718	195
Differences	11	1	1	30

This table shows us that pound for pound corn has a higher feeding value for sheep than has wheat, since both lots ate almost the same amount of feed and the corn lot produced 30 pounds the largest gains.

15. CORN Vs. BARLEY.- These feeds were compared at the South Dakato Station (14) by feeding two lots of 9 lambs each for a period of 17 weeks. The following figures are reported.

CORN Vs. BARLEY : - SOUTH DAKATO STATION.

Rations Fed.	Feed Consumed.			Gains.
	Hay	Oats	Corn or Barley.	
	Lbs.	Lbs.	Lbs.	Lbs.
Corn Lot - - - - -	851	717	717	225
Barley Lot - - - - -	865	718	718	206
Differences	14	1	1	19

Pound for pound, this table shows us that, corn has a slightly higher feeding value for sheep than has barley. Comparing paragraphs 4 and 10 we find that they will make the same daily gains where corn is fed as when barley is fed, but that they will not eat as many pounds of barley as they will corn and hence eat more hay when fed barley than when fed corn. At the Minnesota Station (15) lambs when feeding bran, oil cake and oats along with corn and barley on prairie hay, the barley lot made slightly the better gain; 16 per cent on 30 lambs in 12 weeks. With but few exceptions, however, the corn has given the best results.

16. CORN VERSUS OATS.-- Wilson and Skinner of the South Dakota Station (13) compared these feeds by feeding one lot of 10 lambs oats and hay and another lot of 9 lambs corn and hay. This trial lasted 110 days. The results are here shown:

CORN Vs. OATS - South Dakota Station.

Rations Fed.	Feed Consumed.		Gain.
	Grain	Hay.	
	Lbs.	Lbs.	Lbs.
Corn Lot - - - - -	1540.5	1332	275.
Oats Lot - - - - -	1796.5	1480	277
Differences - - - - -	256.0	148	2

As the table stands it shows that a given amount of corn will produce more gain than the same amount of oats. However, since the oats lot contained 10 lambs and the corn lot only 9 a closer comparison is shown when we figure out the pounds of grain required for a pound of gain. We find now that the corn lot required 5.7 pounds of grain and the oats lot 6.5 pounds of grain for one pound gain. Since

they ate practically the same amount of hay per head in each lot we must conclude that the cheapest gains are produced by the corn ration.

17. CORN VERSUS EMMER.- One lot of 9 lambs was fed corn and another lot of 8 lambs was fed emmer at the South Dakota Station (9) to compare the value of these feeds as fat producers. The following table summarizes the trial:

CORN VS. EMMER - SOUTH DAKOTA STATION.

Rations Fed.	Feed Consumed		Gain.
	Grain	Hay	
	Lbs.	Lbs.	Lbs.
Corn Lot - - - - -	1635	1526*	351
Emmer Lot - - - - -	1799	1526*	309
Difference - - - - -	164		42

*Weight of hay estimated.

This experiment lasted 109 days and we learn from the table that the corn lot ate less grain and made more gain than the emmer lot, from this we must believe that corn is the better of the two feeds.

Later these feeds were again tested at the same station (13). The record of the lot fed on emmer in this test confirms the results obtained by feeding this grain in former experiments that it requires from one to two pounds more to produce a pound of gain than with the other grains.

18. CORN VERSUS MILLET.- Wilson and Skinner (13) fed one lot of 9 lambs corn and another lot of equal number ground millet. The trial lasted 107 days. The following table shows a summary of the trial:

CORN Vs. MILLET - SOUTH DAKOTA STATION.

Ration Fed	Feed Consumed		Gain Lbs.
	Hay Lbs.	Grain Lbs.	
Corn Lot - - - - -	1332 - - -	1541 - - -	275
Millet Lot - - - - -	<u>1332</u> - - -	<u>1631</u> - - -	<u>281</u>
Difference - - - - -	- - -	90 - - -	6

This table shows that corn and millet are of practical equal value for fattening lambs. By reducing these figures down to a basis of total pounds of gain required to produce one pound of gain, we find that 5.7 pounds of corn and 5.8 pounds of millet produce this gain; hence corn is slightly the more profitable food pound for pound.

19. WHEAT VERSUS BARLEY.- Burnett and Chilcott (14) compared these feeds by feeding them to two flocks of 9 lambs each, for a period of 17 weeks. They secured the following results:

WHEAT Vs. BARLEY - SOUTH DAKOTA STATION.

Ration Fed.	Feed Consumed.			Gain. Lbs.
	Hay - - Lbs.	Oats - - Lbs.	Barley or Wheat - - - Lbs.	
Barley Lot - - - - -	865 - - -	718 - - -	718 - - -	206
Wheat Lot - - - - -	<u>862</u> - - -	<u>718</u> - - -	<u>718</u> - - -	<u>195</u>
Differences - - - - -	3			11

From the table we see that the barley lot ate three pounds more hay and made eleven pounds the most gain, hence we must conclude that barley is a better feed for sheep than wheat. Linfield (8) found barley very much superior to wheat for fattening sheep, as has almost every one who has compared them.

20. WHEAT VERSUS OATS.- At the Montana Station (8) after feeding two lots of 22 lambs each, for 95 days to compare these feeds

Linfield finds that oats is a little better than wheat for a sheep feed, the difference in its favor however is very slight as shown below:

WHEAT Vs. OATS - Montana Station.

Ration Fed.	Feed Consumed		Gain
	Hay	Grain	
	Lbs.	Lbs.	Lbs.
Oats Lot - - - - -	7100	1689	525
Wheat Lot - - - - -	<u>6840</u>	<u>1689</u>	<u>508</u>
Difference - - - - -	260		17

21. WHEAT VERSUS EMMER.- The following table shows the results of feeding two lots of ten lambs, each for a period of 110 days, at the South Dakota station, (13) in a trial to compare the feeds:

WHEAT Vs. EMMER - SOUTH DAKATO STATION.

Ration Fed	Feed Consumed		Gain
	Hay	Grain	
	Lbs.	Lbs.	Lbs.
Wheat Lot - - - - -	1480	1678	315
Millet Lot - - - - -	<u>1480</u>	<u>1835</u>	<u>249</u>
Difference - - - - -	148	157	66

This shows us that the lot receiving wheat ate 157 pounds less grain and made 66 pounds more gain than did the lot receiving emmer, which places wheat well above emmer as a fat producer.

22. WHEAT VERSUS MILLET.- Up to date then has been only one trial reported where these feeds were compared. Wilson and Skinner (13) secured the following results by feeing two lots of lambs, (wheat lot 10, Millet lot 9), 110 days:

WHEAT Vs. MILLET - SOUTH DAKATO STATION.

Ration Fed.	Feed Consumed.		Gain.
	Hay	Grain	
	Lbs.	Lbs.	Lbs.
Wheat Lot - - - - -	1480 - - - - -	1678 - - - - -	-315
Millet Lot - - - - -	<u>1332v</u> - - - - -	<u>1631</u> - - - - -	<u>281</u>
Difference - - - - -	148 - - - - -	47 - - - - -	34

By figuring out the pounds of grain required to produce a pound of gain, we find that it takes 7.0 pounds of wheat and 5.3 pounds of millet which places millet easily above wheat for sheep fattening purposes.

23. WHEAT VERSUS WHEAT SCREENING.- At the Montana Station (8) two lots of 22 lambs each were fed for 95 days to compare the value of wheat screenings with good wheat. Below is given a summary of the experiment:

WHEAT Vs. WHEAT SCREENINGS - MONTANA STATION.

Ration Fed	Feed Consumed		Gain.
	Hay	Grain	
	Lbs.	Lbs.	Lbs.
Wheat Lot - - - - -	6920 - - - - -	1689 - - - - -	215
Wheat Screenings Lot -	<u>6925</u> - - - - -	<u>1689</u> - - - - -	<u>220</u>
Differences - - - - -	5		5

By the above we learn that the wheat screenings lot ate 5 pounds more hay and made 5 pounds more gain than did the whole wheat lot.

At the Minnesota Station (16) it was found that it required about 18 per cent more wheat screenings than wheat to produce a given

gain. The high feeding value of screenings for sheep in comparison with high grade wheat is well illustrated here.

24. OATS VERSUS BARLEY.- For 17 weeks (14) two lots of 9 lambs each were fed to compare these two feeds. They consumed the following feed and made the following gain:

OATS Vs. BARLEY - SOUTH DAKOTA STATION.

Ration Fed.	Feed Consumed.			Gain
	Hay	Wheat	Barley or Oats	
	Lbs.	Lbs.	Lbs.	Lbs.
Barley Lot - - - - -	897	-718	718	217
Oats Lot - - - - -	<u>862</u>	<u>-718</u>	<u>718</u>	<u>195</u>
Differences - - - - -	35			22

This table shows that the barley lot ate 35 pounds the most hay but they made 22 pounds more gain which proved that barley is the better of the two feeds. At several other stations parallel results have been obtained.

25. OATS VERSUS WHEAT BRAN.- Two lots of 16 lambs each were fed at the Nebraska station (17) for 98 days to test the comparative value of these feeds. The accompanying table summarizes the results obtained:

OATS Vs. WHEAT Bran - NEBRASKA STATION.

Ration Fed	Feed Consumed			Gain
	Hay	Corn	Oats or Bran	
	Lbs.	Lbs.	Lbs.	Lbs.
Oats Lot - - - - -	2096	1179	400	502
Bran Lot - - - - -	<u>2056</u>	<u>1149</u>	<u>388</u>	<u>483</u>
Differences - - - - -	46	30	12	19

The table shows that those fed bran ate 46 pounds less hay, 30 pounds less corn, and 12 pounds less bran than the other lot did oats; making 19 pounds less gain. While the difference is slight in this trial yet oats is the better feed of the two. It is generally so reported by the different stations. Barnett figures that the oats lot produced a net profit of 8 cents a head more than the wheat bran lot. In a later trial (18) feeding 72 lambs in 6 equal lots for 98 days he found that oats invariably gave better results as a sheep feed than did wheat bran.

26. THE VALUE of SOY BEANS as a PART of a GRAIN RATION for LAMBS.- Richards and Klemheine (19) tested this ration with 20 ewe lambs of different breeds. They were divided into two equal lots and fed for 12 weeks. The following table shows the important facts of this trial:

SOY BEANS Vs. OATS - Wisconsin Station.

	Feed- soy Beans & Corn.	: Feed- Oats & c
	Lbs.	: Lbs.
Average weight per head at beginning of experiment	103.0	102.5
Average weight per head at end of experiment	119.3	116.2
Average gain per head during experiment	16.3	13.7
Average weekly gain during experiment	1.4	1.14
Total Grain Consumed	997.5	997.5
Total Roughness Consumed	1159.8	1181.9
Roughness Consumed per pound of gain	7.11	8.62
Grain Consumed per pound of gain	6.11	7.78

This shows that 1 pound of soy beans is equal to 1.9 pounds of oats in feeding value.

27. ALFALFA HAY.- While feeding any one variety of roughness alone is not in line with scientific principles of feeding yet it is

often done and it will be of interest to note here the results obtained by feeding alfalfa hay alone to sheep at two of the experiment stations:

FEEDING ALFALFA ALONE to SHEEP - NEW MEXICO and ARIZONA ATATIONS.

Where Fed	No. of Lambs	Days Fed.	Hay Eaten	Av. Wt. At Be-gining	Av. Gain	Av. Daily Gain.	Hay required for 100 lbs. gain.
			Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
New Mexico (20)	-10	- 128	- 2811	- 45	- 24	- 0.19	- - 1184.5
Arizona (21)	- - 8	- 28	- 1120	- 62	- 5.2	0.19	- - 4700.0
- Average - - -	9	78	1966	54	15	0.19	2942

In commenting upon these experiments the reports say that the lambs fed at the New Mexico station were in excellent condition for the local market at the end of the test, those at the Arizona station were not. It seems altogether possible, however, that store sheep may be kept over very satisfactorily on alfalfa hay alone.

28. CLOVER HAY.- Shaw (22) fed 53 lambs from Nov. 16, 1900 to Feb. 13 1901 on clover hay alone. They consumed a total of 15875 pounds of hay and made 1121 pounds of gain or an average of 21.15 pounds gain per head. They ate 3.32 pounds of clover per head daily and were in good condition at the close of the trial.

29. SORGHUM HAY.- At the Arizona station (21) eight yearling lambs were fed 28 days on sorghum hay alone. They used 944 pounds of hay and gained 28 pounds or 1/8 of a pound per day per head, using 34 pounds of hay to produce 1 pound of gain.

30. ALFALFA VERSUS CLOVER HAY.- At the Michigan station (23) two lots of 10 lambs each were fed for 14 weeks to compare alfalfa and clover hay. The following table summarizes the trial:

ALFALFA Vs. CLOVER HAY - Michigan Station.

Feed Compared.	Feed Consumed.			Gain. Lbs.
	Corn Lbs.	Hay Lbs.	Roots. Lbs.	
Alfalfa Lot - - - - -	1358	-1283	1168	-344.
Clover Lot - - - - -	<u>1370</u>	<u>1173</u>	<u>1181</u>	<u>324.</u>
Differences - - - - -	12	110	13	20

It will be noticed that the clover lot ate 12 pounds more ϕ corn and 13 pounds more roots than did the alfalfa lot, while the latter ate 110 pounds more hay and made 20 pounds the most gain. It is quite evident, from these figures, that with good hay and mutton at the prices that they must be to make sheep feeding pay at all that the alfalfa ration produces the cheapest gains.

31. ALFALFA VERSUS PRAIRIE HAY.- Burnett (17) feeding two lots of 16 lambs each on these feeds for 98 days to compare their feeding value, secured the following data:

ALFALFA Vs. PRAIRIE HAY - Nebraska Station.

Feeds Compared.	Feeds Consumed.		Gain. Lbs.
	Corn Lbs.	Hay Lbs.	
Alfalfa hay lot - - - - -	1564	-2104	511.
Prairie Hay Lot - - - - -	<u>-678</u>	<u>670</u>	<u>158</u>
Differences - - - - -	-886	1534	353.

This table shows some other large differences for a period of only 98 days in the growth of 16 lambs of equal weight and vigor at the beginning of the trial. In another trial conducted at the same time as this one where wheat bran was added to both rations the results are even stronger in favor of alfalfa than those given in this table. Burnett shows that ^{the} alfalfa hay lot netted 62 cents more per head than did the prairie hay lot. The decision must be in favor of the alfalfa hay.

32. ALFALFA VERSUS MILLET HAY.- At the Michigan station (23) two lots of 10 lambs each were fed for 14 weeks to compare alfalfa and millet hay. The following table summarizes the trial:

ALFALFA VERSUS MILLET HAY - MICHIGAN STATION.

Feed Compared	Feed Consumed			Gain. Lbs.
	Corn Lbs.	Hay Lbs.	Roots Lbs.	
Alfalfa Hay Lot - - - - -	1358	1283	1168	-344
Millet Hay Lot - - - - -	<u>1351</u>	<u>959</u>	<u>1168</u>	<u>258</u>
Differences - - - - -	7	324		86

The above table shows that the millet hay lot did not eat as much as the alfalfa hay lot by 7 pounds of corn and 324 pounds of hay, they however did not make as much gain, by 86 pounds, as the alfalfa lot. We know that 7 pounds of corn and 324 pounds of millet hay will not produce 86 pounds of mutton hence we must conclude that as here given alfalfa hay is a better sheep feed than millet hay.

33. ALFALFA VERSUS SORGHUM HAY.- Seventy-two lambs were divided into 6 equal lots and fed for 98 days at the Nebraska station (11) to compare the value of sorghum and alfalfa. The following figures will show the results:

ALFALFA Vs. SORGHUM HAY - NEBRASKA STATION.

Feeds Compared	Feeds Consumed.				Gain. Lbs.
	Hay Lbs.	Corn Lbs.	Oats Lbs.	Bran Lbs.	
Alfalfa hay Lots - - - - -	5847	4066	398	327	1196
Sorghum Hay Lots - - - - -	<u>5964</u>	<u>3765</u>	<u>385</u>	<u>318</u>	<u>745</u>
Differences - - - - -	117	301	13	9	441

This table shows that the alfalfa hay lots ate 117 pounds less hay, 301 pounds more corn, 13 pounds more oats, 9 pounds more bran and made a gain of 441 pounds more live weight in the 98 days. These

results are very much in favor of alfalfa hay for feeding purposes.

34. ALFALFA HAY VERSUS OATS STRAW.- AFTER A 14 weeks trial with two lots of 10 lambs each at the Michigan Station (23) they reported the following figures:

ALFALFA HAY Vs. OATS STRAW - MICHIGAN STATION.

Feeds Compared	Feed Consumed				Gain
	Hay	Corn	Roots	Bran	
	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Alfalfa Hay Lots - - - - -	1283	1358	1168	- - - - -	344
Oats Straw Lot - - - - -	1394	1364	1170	- - - - -	285
Differences - - - - -	-111	6	6		59

We learn from these figures that the oats straw lot ate 6 pounds more corn and 2 pounds more roots than the alfalfa hay lot. Also 111 pounds more straw than the opposing lot did of hay. On this feed they made 59 pounds less gain. From these facts we must place oats straw as of lower feeding value than alfalfa, pound for pound, yet as it is often a by-product on the farm and no special use for it is known, the wise herdsman will make use of it to fatten his sheep if he is short of feed.

35. ALFALFA VERSUS CORN FODDER.- At the Michigan Station (23) after feeding 20 lambs in two equal lots for 14 weeks on these as opposing rations the following figures are reported:

ALFALFA Vs. CORN FODDER - MICHIGAN STATION.

Feeds Compared	Feeds Consumed			Gains
	Corn	Roughness	Roots	
	Lbs.	Lbs	Lbs.	Lbs.
Alfalfa Hay Lot - - - - -	1358	1283	1168	344
Corn Fodder Lot - - - - -	1363v	1395	1168	302
Differences - - - - -	5	112		42

We here see that the corn fodder lot ate but slightly more than the alfalfa hay lot making 42 pounds less gain. While alfalfa pound for pound is the best feed we know that oftentimes the market value of it is much above corn fodder, hence every feeder should study closely the relative prices of the two and remember that corn fodder has considerable value as a sheep feed.

36. CLOVER VERSUS MILLET HAY.- These two feeds were compared (23) with 10 lambs in each lot. The experiment extended over a period of 14 weeks. The following table summarizes the trial:

CLOVER Vs. MILLET HAY - MICHIGAN STATION.

Feeds Compared	Feeds Consumed			Gain.
	Corn	Hay	Roots.	
	Lbs.	Lbs.	Lbs.	Lbs.
Clover Hay Lot - - - - -	1370	1177	1181	324
Millet Hay Lot - - - - -	1351	959	1168	258
Differences - - - - -	19	214	13	76

We learn that the millet hay lot in all cases ate less and then produced much less gains. The decision from this evidence must be in favor of the clover hay ration.

37. CLOVER HAY VERSUS OATS STRAW.- ^{For} a comparison of these two feeds let us turn to some work at the Michigan Station (23) where 2 lots of 10 lambs each were fed on the opposing rations for 98 days giving the following results:

CLOVER HAY Vs. OATS STRAW - Michigan Station.

Feeds Compared	Feeds Consumed			Gain.
	Corn	Roughness	Roots	
	Lbs.	Lbs.	Lbs.	Lbs.
Clover Hay Lot - - - - -	1370	1173	1181	324
Oats Straw Lot - - - - -	1364	1394	1170	285
Differences - - - - -	6	221	11	39

From this table we see that the oats straw lot ate 6 pounds of corn less, 221 pounds more of roughness, and 11 pounds less roots; making 39 pounds less gain than the clover hay lot. These figures indicate that oats straw is slightly inferior to clover hay as a sheep feed, yet it made profitable gains and should be used whenever possible rather than let go to waste.

38. CLOVER HAY VERSUS CORN FODDER.- At the Michigan Station (23) these two feeds were compared with 20 lambs fed in 2 equal lots for a period of 98 days. Comparative figures are shown below:

CLOVER HAY Vs. CORN FODDER - MICHIGAN STATION.

Feeds Compared	Feed Consumed			Gain. Lbs
	Corn Lbs.	Roughness Lbs.	Roots Lbs.	
Clover Hay Lot - - - -	1370	1173	1181	324
Corn Fodder Lot - - - -	1363	1395	1168	302
Differences - - - - -	7	222	13	22

This table shows us that the corn fodder lot consumed 7 pounds less corn, 222 pounds more roughness, and 13 pounds less roots than did the clover hay lot, and also made 22 pounds less gain. Pound for pound clover hay is worth the most for feeding to sheep but as corn fodder is often of much less value per ton it can at such times be fed with profit as a part or all the roughness in the ration.

39. CLOVER HAY VERSUS GRAIN HAY.- As it is sometimes found desirable to raise and feed grain hay this paragraph is placed here to show the results obtained by feeding a mixture of wheat, barley, oats, and pea hay at the Montana Station, (22) in comparisons with clover hay. Fifty-two lambs were used in each lot. They were fed from Nov., 16, 1900 to Jan., 14, 1901, both lots being fed practically

the same amount of hay, a little over 5 tons:

INCREASE in WEIGHTS.

Nov.,16, 1900, weight clover fed lambs 3245 lbs., average 61.22 lbs.
 Jan.,14, 1901, weight clover fed lambs 3987 lbs., average 75.22 lbs.
 Total gain - - - - - 742 lbs. - - - - 14.00 lbs.

Nov.,16, 1900, weight hay fed lambs 3210 lbs., average 60.56 lbs.
 Jan.,14, 1901, weight clover fed lambs 3776 lbs, average 71.24 lbs.
 Total gain - - - - - 566 - - - - - 10.68.

This shows us that during the 60 days trial the clover fed lambs made a gain of 14 pounds per head while those receiving grain hay gained only 10.68 pounds each, or the clover hay lot gained 3.34 pounds more per head than the gran hay lot.

40. MILLER HAY VERSUS OATS STRAW.- At the Michigan station (23) after a trial with 2 lots of 10 lambs each which lasted 14 weeks the following data is reported:

MILLET HAY Vs. OATS STRAW - MICHIGAN STATION.

Feeds Compared	Feed Consumed.			Gain. Lbs.
	Corn Lbs.	Roughness Lbs.	Roots Lbs.	
Millet Hay Lot - - - -	1351	959	1168	258
Oats Straw Lot - - - -	<u>1364</u>	<u>1394</u>	<u>1170</u>	<u>285</u>
Differences - - - -	13	435	2	27

We see that in this trial the oats straw lot ate 13 pounds more corn, 435 pounds more roughness, 2 pounds more roots, and made 27 pounds more gain. This places oats straw easily above millet as a feed for fattening sheep.

41. MILLET HAY VERSUS CORN FODDER.- After a 98 days trial at the Michigan station (23) with 20 lambs divided in 2 equal lots, the following figures are given in regard to the feed consumed and the gains made:

MILLET HAY Vs. CORN FODDER - MICHIGAN STATION.

Feeds Compared	Feed Consumed.			Gains.
	Corn	Roughness	Roots.	
	lbs.	Lbs.	Lbs.	Lbs.
Corn Fodder Lot - - - - -	1363	1395	1168	302
Millet Hay Lot - - - - -	<u>1350</u>	<u>959</u>	<u>1168</u>	<u>258</u>
<u>Differences</u>	13	436		44

This comparison shows us that the miller hay lot ate 13 pounds less corn, 436 pounds less roughness, and made 44 pounds less gain. The figures plainly show that corn fodder in this trial is a better feed than millet hay. Of all the trials that have come to notice where millet hay formed a part of the roughness the sheep did not do as well as on other feed, showing conclusively that millet hay is a poor sheep feed.

42. CORN FODDER VERSUS OATS STRAW.- At the Michigan Station (23) these two feeds were compared by feeding 2 lots of 10 lambs each for a period of 14 weeks. The following figures were reported:

CORN FODDER Vs. OATS STRAW - MICHIGAN STATION.

Feeds Compared	Feeds Consumed .			Gains.
	Corn	Roughness	Roots.	
	Lbs.	Lbs.	Lbs.	Lbs.
Corn Fodder Lots - - - - -	1363	1395	1168	302
Oats Straw Los - - - - -	<u>1364</u>	<u>1394</u>	<u>1170</u>	<u>285</u>
<u>Differences</u> - - - - -	1	1	2	17

We see from the table that the 2 lots ate practically the same amount of feed and that the corn fodder lot made 17 pounds the most gain. From this we must conclude that pound for pound corn fodder has more value as a sheep feed than oats straw.

43. COW PEA HAY VERSUS MIXED TIMOTHY AND CLOVER HAY.- With

corn as the basal ration the feeding value of cow-pea hay was compared with mixed timothy and clover at the West Virginia Station (24) by feeding two equal lots of 37 lambs each for a period of 43 days. The following results are reported:

COW PEA HAY Vs. MIXED TIMOTHY and CLOVER HAY - WEST VIRGINIA STATION.

Feeds Compared	Feeds Consumed.		Gain.
	Hay	Corn.	
	Lbs.	Lbs.	Lbs.
Cow-pea hay lot - - - - -	3345	998	270
Timothy and Clover Hay Lot -	<u>2975</u>	<u>998</u>	<u>48</u>
Differences - - - - -	370		222

This table shows us that while the cowpea hay lot ate 370 pounds the most hay they were making 222 pounds the most gain. The figure indicates that cowpea hay is a good feed for sheep, while the clover and timothy mixture is very poor indeed.

44. CORN SILAGE VERSUS CORN FODDER FOR SHEEP.- At the Utah Station (25) six sheep were divided into two lots, one of which received silage and the other field-cured fodder throughout the trial, each lot receiving a basal ration of wheat, bran, oats, and ground wheat. The conclusions drawn are unfavorable to the silage system. Another comparison (26) of silage and corn fodder on 2 lots of 3 sheep each, from Dec., 22 to Apr., 4 shows that the corn fodder made slightly larger gains and the carcasses of these animals contained less water and more fat than did the ones that had been fed on silage. In summarizing this trial the author says, "The results in favor of the dry fodder are very emphatic - so much so that contrast need not be drawn further than to note that though one small ration, a fraction of which only was ensilage, the greater part of the small gain made

by those fed on ensilage was that of water."

The results of other experiments also point in this direction. It seems very doubtful if it will pay, all things being equal, to put up fodder in the form of ensilage for fattening sheep.

45. SUGAR BEET PULP for SHEEP.- Since there is a growing tendency to produce sugar in Kansas from the sugar beet and, from this industry we have left large amounts of beet pulp, which is a by-product and of no special value to the sugar manufacturers it will be of interest to note what has been gained by feeding it to lambs.

At the Colorado Station (27) a car load of lambs was secured and half of them fed on corn, the other lot was fed beet pulp in lieu of corn; both lots were fed alfalfa hay.

The results indicate that equal pounds of gain were made per 100 pounds of dry matter in the corn and beet pulp, when alfalfa was fed as the roughness. That one ton of pulp is equal to 200 pounds of corn. Owing to the bulky nature of the pulp not enough can be consumed by lambs to produce sufficient fat to finish them; hence it should be fed to the greatest extent at the commencement of feeding. Pulp fed in large quantities produces soft flesh.

46. PRAIRIE GRASS FOR FATTENING SHEEP.- The object of this paragraph is to show the results of feeding grain to sheep on grass in the fall with a view to finishing them for the early winter market.

At the South Dakota Station (9) this experiment was tried with 6 lots of 10 sheep each. The trial ran from Sept., 20 to Nov., 27. The results are plainly shown in the following table:

FEEDING SHEEP on PRAIRIE GRASS - South DAKOTA STATION.

Feed received by sheep
on pasture.

Table on following page.

Feed Received by Sheep on Pasture.	No. of Sheep.	Grain Eaten Lbs.	Gains Made Lbs.	Grain Per lb. Gain. Lbs.	Average gain Per head daily. Lbs.
Lot 1, Corn - - - - -	10	757	196	3.9	0.44
Lot 2, Oats - - - - -	10	859	197	4.4	0.44
Lot 3, Wheat - - - - -	10	774	137	5.6	0.31
Lot 4, Emmer - - - - -	10	925	129	7.2	0.29
Lot 5, Barley - - - - -	10	837	168	5.0	0.38
Lot 6, (Grass Only) - -	10	-	52	-	-

The lot on grass only gained 38 pounds between Sept. 19 and Oct., 6, lost 31 pounds between Oct. 6 and Oct. 19, and 59 pounds between Oct., 19 and Nov. 2. These figures indicate that prairie grass when allowed to cure on the ground is not sufficiently nutritive to keep sheep from losing weight, and also that the natural conditions of the grass in an average season are well suited for the cheap production of mutton, when grain is fed in addition.

47. BLUEGRASS for FATTENING SHEEP.- Since this grass is coming to be more frequently found in this state of late years a few words may be of interest to show what it will do producing gain on sheep. At the Iowa Station (12) a trial was conducted which is summarized in the following table:

FEEDING SHEEP on BLUEGRASS - IOWA STATION.

Feed received by Sheep on Pasture.	No. of Sheep.	Days Fed.	Grain Eaten. Lbs.	Gains Made. Lbs.	Grain Per lb. Gain. Lbs.	Ave. gain Per head Daily. Lbs.
Lot 1, (Grass Only) - -	15	63	-	384	-	0.406
Lot 2, Corn, - - - - -	15	63	756	436	1.7	0.46
Lot 3, Oats, - - - - -	15	63	748	398	1.9	0.42
Lot 4, Barley - - - - -	15	63	741	372	2.0	0.39
Lot 5, Oats & Corn --	101	60	5407	2642	2.0	0.44

This table shows, (a), that sheep will make practically as large gains on grass alone as on grain and grass. (b), that in economy of grain, grass alone gave the best results.

48. ALFALFA for PASTURING SHEEP.- Cooke (28) made an extended study to test the value of alfalfa pasture for sheep. He pastured a flock at the station and also secured the experience of a number of sheep raisers in the Arkansas Valley. In the test at the station 11 ewes and 11 lambs were pastured on alfalfa from April 20 to Sept. 6. One ewe and one lamb died of bloat. The practical side of this study is based on the opinion of 26 practical sheep men.

In answer to the question, "Is pasturing alfalfa profitable?" Prof. Cooke shows that it is very questionable whether under normal conditions an acre of alfalfa produces any more net profit as pasture than it would cut and fed as hay.

Considering the question, "Is pasturing alfalfa safe?", he says; "The answer must be given in the negative." If, however, it be found necessary or desirable to pasture alfalfa for any reason he gives the following precautions that he believes, if observed, will reduce loss by bloating to the minimum .

"1. Have the sheep in small bunches, or if in a large bunch, divide into several lots in separate fields."

"2. Have a large enough field to supply them ^{with an abundance of food with} little effort. "

"3. Leave them in the field day and night and do not remove them when the field is irrigated."

"4. Have water and salt before them all the time, and if there are no trees in the field provide some sort of shelter from the sun."

"5. Be sure they are filled up with some other food and not thirsty when first turned on the alfalfa."

"6. Do not attempt to pasture on alfalfa anything but old ewes and their lambs."

Prof. Cooke believes that by following the above suggestions the loss by bloat with old ewes can be reduced to 55 per cent.

49. RAPE for SHEEP.- The rape plant is especially valuable for feeding sheep. Craig (29) found that 0.7 of an acre of rape together with 154 pounds of oats and 98 pounds of corn produced a gain of 149 pounds on a flock of lambs. They gained at the rate of 2.2 pounds per head per week. He figured that in this trial the rape was worth \$14.48 per acre.

At the Michigan Station one trial (30) with 125 lambs on 12 acres of rape for 35 days shows a gain of 1875 lbs., or 1 acre of rape produced 155 pounds of gain. The lambs gaining 15 pounds per head in the 35 days. Another lot of 128 lambs pastured on 15 acres made a gain of 2890 pounds, or each acre of rape produced 192 pounds of gain. In a third trial (23) 135 lambs produced 1080 pounds of gain from 7 acres of rape or 154 pounds per acre. Valuing mutton at 5 cents per pound rape would be worth from \$7.70 to \$9.60 per acre for each crop.

50. RAPE VERSUS BLUEGRASS.- At the Wisconsin Station (29) two lots of 48 lambs each were fed to test these feeds. The following table summarizes the results:-

RAPE Vs. BLUEGRASS - WISCONSIN STATION.

Feeds Compared.	Wt. at Beginning of Experiment	Wt. at end of Experiment	Gain.
	Lbs.	Lbs.	Lbs.
Rape Lots - - - - -	3023	3524	501
Bluegrass Lot - - - - -	3233	3558	325
Differences - - - - -	210	34	176

The experiment lasted 4 weeks. Both lots were fed a basal ration of grain yet the rape lot shows a much larger gain for so short a time. 176 pounds.

51. SOILING EWES and LAMBS to ASCERTAIN how MUCH FOOD THEY CONSUMED.- (31) "Ten ewes and ten lambs were kept in barn-yard during the whole summer and all the feed they consumed weighed out to them. The experiment was conducted with much difficulty as sheep do not like grass or clover which has grown long enough to be cut with the scythe, nor do they like green feed which has been handled. With much patience the trial was carried through successfully. The lambs were about a month old at the beginning of the trial June 3d. In 57 days the ewes gained 55 pounds and the lambs 192 pounds, or 1/10 of a pound a day for the ewes and 1/3 of a pound daily for the lambs." For 100 pounds of increase the ewes and lambs together consumed:

- Green Clover - - - - - 2822 lbs.
- Green Corn - - - - - 478 lbs.
- Oats (grain) - - - - - 45 lbs.

52. FEED REQUIRED to PRODUCE 100 POUNDS GAIN.- Henry (31) in a trial with three lots of three lambs each found that the following amounts of the following rations were required to produce 100 pounds of gain:

- LOT 1.
- 384 pounds of Corn;
- 296 pounds silage;
- 158 pounds corn fodder;
- 22 pounds potatoes;

- LOT 2.
- 89 pounds oil meal;
- 569 pounds Oats;
- 302 pounds clover hay;
- 416 pounds clover silage;
- 27 pounds potatoes.

- LOT 2.
- 422 pounds oil meal;
- 532 pounds corn silage;
- 90 pounds clover hay;
- 25 pounds potatoes.

- CANADA - PROF. BROWNE.
- 210 pounds oil cake;
- 139 pounds oats;
- 290 pounds peas;
- 87 pounds bran;
- 1028 pounds roots;
- 410 pounds hay.

At the Colorado Station (1) the following amounts of feed are reported as necessary to produce 100 pounds of gain:

FEED REQUIRED TO PRODUCE 100 POUNDS OF GAIN - COLORADO STATION.

LOT 1.

Alfalfa - - - - -617 Lbs.
Corn - - - - - 309 lbs.

LOT 2.

Alfalfa - - - -626 Lbs.
Emmer - - - - -303 Lbs.

LOT 3.

Alfalfa - - - -759 Lbs.
Barley - - - - 343 Lbs.

LOT 4.

Alfalfa - - - - -650 Lbs.
Barley - - - - - 169 Lbs.
Wheat - - - - -169 Lbs.

LOT 5.

Alfalfa - - - -820 Lbs.
Wheat - - - - -214 Lbs.
Emmer - - - - -214 Lbs.

It will be interesting to compare these last rations on a money value basis as they are all common feeds with us. Let us value alfalfa at \$4.00 per ton, corn at 50 cents per hundred weight and the other grains at \$1.00 per hundred weight. On this basis the above rations will cost the following:

- Lot 1, - \$2.78;
- Lot 2, - \$4.28;
- Lot 3, - \$5.00;
- Lot 4, - \$4.68;
- Lot 5, - \$5.96.

While there is not always as much as a half cent per pound difference in the value of corn and the other grains here used yet there often is more. The difference is so great however, that there is no doubt but that the corn and alfalfa ration is the cheapest.

53. CARBONACEOUS VERSUS NITROGENOUS RATIONS for SHEEP.- At the Wisconsin Station (32) two lots of 6 weathers each were fed carbonaceous and nitrogenous rations for twelve weeks. The cheapest gain in live weight was made on the carbonaceous ration, although a larger gain in weight and slightly more wool were produced on the nitrogenous rations. The following table shows the amount of feed eaten and the increase in live weight:

physical property, and palatability to the sheep, ~~of~~ at least within the limits of variation given above.

54. LINSEED MEAL.- The following table shows some interesting data concerning linseed meal as a sheep feed:

FEEDING LINSEED MEAL to LAMBS - Minnesota Station.

	Feed Consumed.			Average Weight.		Gain.
	Grain	Hay	Ensilage.	Beginning -	End.	
(15)	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
Fed Linseed Meal	.6256	2773	1026	01.2	93	31.8
Not						
Fed Linseed Meal	<u>6005</u>	<u>2735</u>	<u>1034</u>	<u>64.4</u>	<u>90.5</u>	<u>29.1</u>
Differences.	251	38	8	32	2.5	2.7
(4)						
Fed Linseed Meal	.1591	603		75.7	103.1	27.4
Not						
Fed Linseed Meal	<u>1268</u>	<u>630</u>		<u>73.3</u>	<u>93.2</u>	<u>19.9</u>
Differences	323	27		2.4	9.9	75

At the first experiment there were 30 lambs in each lot, fed for 112 days. In the second, 10 lambs fed for 84 days. Both experiments show that the linseed meal is a valuable addition to the ration for feeding sheep. As the lots not receiving it did not consume as much feed as those that ~~did~~ it would seem that a small amount of linseed meal added to the mixture has a stimulating effect on the appetite.

55. NEW PROCESS LINSEED MEAL VERSUS OLD PROCESS LINSEED MEAL for LAMBS.- Since the question is sometimes asked as to which is the better of these two feeds to use in connection with out grains, the results of a test at the Massachusetts (34) station are here given. The test also included experiments to learn if possible whether new pro-

cess linseed meal had any bad effect upon the physical properties of the carcass. The comparative value of new process linseed meal and old process linseed meal was tested with 10 grade Southdown lambs, divided into two lots of 5 each. Except for the contrasted feeding stuffs the two lots received the same rations and care. The test lasted 8 days. The following conclusion was drawn: That new process linseed meal had no injurious effects either upon the growth or dressed appearance of the lambs. Both sets of lambs produced the same average daily growth, and were both in the same average condition when slaughtered.

56. COTTON SEED MEAL VERSUS LINSEED MEAL for LAMBS.- Prof. Craig (35) reports an experiment along this line with 10 Shropshire grade lambs, slightly over 3 months old at the beginning of the test. The experiment lasted ten weeks. The lambs were divided into two lots both fed the same, except that one received oil meal and the other cottonseed meal. The results show that the lambs fed the oil meal made a greater gain than those receiving the cottonseed mixture. During the 10 week's trial the lambs fed the oil meal ration each made a weekly gain of 3.30 pounds, while those getting the cotton seed ration each made a weekly gain of 2.95 pounds. Valuing oil meal at \$20.00 per ton and cottonseed meal at \$25.00 per ton, the oil meal ration was in addition much cheaper. Both lots received in addition corn meal and pasture.

57. (a) Corn, (b) corn and oats; (c) corn and peas; and (d) corn, peas and oats.- At the WISCONSIN STATION (5) the value of corn, corn and oats, corn and peas, and oats as the grain portion of a fattening ration was tested with 20 Shropshire lambs. The lambs were selected from about 2,000 as representing the average lambs used for feeding purposes in that state. They were 9 weeks old at the begin-

ning of the test which lasted 8 weeks. "In feeding the ration of corn it was found very difficult to keep the sheep in good health. - - - The results which have been obtained clearly indicate that the cheapest gain is made by feeding corn. "' It would seem that the addition of oats to the corn ration is advisable simply to lessen the risk of feeding and to help the appetites of the sheep. "' A comparison of all the results indicate that for profitable feeding, corn is certainly most conducive to gain, but considering all things, the safety of the sheep, and the profit as well, the mixture of corn and peas is superior to any mixture tried in this experiment.

The next year Prof. Craig (6) reported another test with the same grain rations, made with 100 grade Shropshire lambs divided into 4 equal lots. The test lasted 8 weeks. The lambs received corn fodder ad libitum instead of hay, as the first lot had. In this experiment as in the proceeding one the best gains were made on corn and peas, and the gains were ~~made~~ cheaply made than on any other ration except corn. Adding oats to the ration had very little influence on the gain, while it increased the cost. When corn was the only grain fed it was found as before that the lambs were apt to lose their appetites, ~~though~~ though digestive disorders were not observed.

58 CORN MEAL VERSUS BRAN and OATS for LAMBS before and after WEANING.- The value of corn meal, oats and bran as a food for lambs before and after weaning was tested at the Wisconsin Station (5) with 18 two-months-old grade Dorset lambs for a period of 8 weeks. "Corn meal is indicated to be decidedly better than oats or bran for feeding lambs before and after weaning in respect to the rate of gain, cost of gain, and the amount required to produce 100 pounds of increase." Oats fed in a whole condition rank superior to bran but below corn as

a food for feeding lambs over such period. Bran, while seemingly inferior to oats for lambs before they were weaned, was decidedly better when fed to the same lambs on pasture after weaning.

Prof. Craig says "It may be that oats or bran in a mixture of foods would give better results than they have given here, but it is very apparent that if any of them are to be fed alone, corn meal should be given the preference for fattening lambs.

59. (1) ALFALFA and BEET PULP, (2) ALFALFA, BEET PULP and GRAIN (grain = part barley and wheat) (3) ALFALFA and SUGAR BEETS PULP, and (4) ALFALFA, SUGAR BEET and GRAIN.-- Comparing 1 and 2 "We find that 9.14 pounds of alfalfa; 19.3 pounds of pulp, and .04 pounds of grain in 1 was equal to 7.97 pounds of alfalfa; 6.9 pounds of pulp and 2.72 pounds of grain in 2. In lot 3 where sugar beets took the place of the pulp in the ration of lot 1 it required 6.28 pounds of alfalfa, 9.31 pounds of beets and 1.04 pounds of grain to produce one pound of gain; or it took 9.31 pounds of beets and 1.00 pounds of grain in lot 3 to replace 19.3 pounds of pulp, and 2.86 pounds of alfalfa in lot 1.

Lot 4, which had a similar ration to lot 2, except that the pulp in lot 2 was replaced with beets in lot 4, required 5.4 pounds of alfalfa, 5.35 pounds of beets and 2.72 pounds of grain for one pound of gain. The extra grain in lot 4 of 1.68 pounds for each pound of gain replaced .88 pounds of alfalfa and 3.96 pounds of sugar beets in the ration of lot 3.

Valuing alfalfa at \$4.00 per ton, beet pulp at \$1.00 per ton, sugar beets (on the farm) at \$4.00 per ton and wheat and barley at \$1.00 per hundred weight, the beet pulp and alfalfa made the gains cheaper than the other rations (1).

60. WINTER RATIONS for BREEDING EWES.-

(1) Corn fodder, (2) tame hay, (mostly blue grass), (3) and oat straw. At the WISCONSIN STATION (32) .

The ~~above~~^{above} feeds were compared, all the lots were fed the same quantities of grain and sugar beets. Craig drew the following conclusions from his trial: "... Cut corn fodder gave the best results as the ewes so fed were maintained cheaply, they kept in the best health, their fleeces were in the best condition and after lambing they gave the most abundant supply of milk. Oats straw as a fodder for sheep is shown by this experiment to have a higher feeding value than is commonly credited to it. Combined with a small quantity of grain and succulent food it offers the best ration for carrying breeding ewes over winter at the least expense. Ewes were kept in good condition on a ration consisting largely of it at a cost of less than a cent a day. (straw was valued at \$3.00 per ton.) It is shown in the table giving of the food consumed, that the amounts of corn fodder and oat straw refused were similar; as the ewes fed corn fodder left 20% of the fodder that was fed to them, and those that received oats straw left 22 per cent of waste. While it would not be proper to recommend an exclusive straw and grain ration on this trial alone yet it is evident that oats straw may be with profit more largely used with other fodders.

While hay is a good dry fodder for sheep, yet looking for the best results and closest economy, it would be better to give the preference to oats straw and corn fodder, where these fodders are available at the valuation given in our scale of prices."

61. (1) Corn silage, (2) clover silage and (3) sugar beets. Prof. Craig (32) compared these feeds with ewes feeding the lots equal

amounts of hay and grain besides. He remarks on the experiment thus: "Corn silage is a valuable feed for breeding ewes and comparing it with other succulent fodders used in this experiment it is found to be cheaper by keeping the sheep in good thriving condition, and develops a good flow of milk. Clover silage, if properly preserved, is a good sheep food. The sheep, after getting used to it, ate it with avidity, and did well. Against it is the cost of making and the difficulty in preserving.

Sugar beets are liked by sheep, but they cannot be said to equal either of the others of the succulent fodders experimented with. They are apt to induce scouring if fed in quantities of over four pounds daily to each ewe.

62. (a), Corn fodder; (b), Corn fodder and corn silage; (c), Corn silage and hay; (d), roots and hay.- At The WISCONSIN STATION (36). Carlyle compared these feeds. Bran and oats were fed in addition in each case. The experiment included 47 sheep and lasted 10 weeks. Among the conclusions drawn are the following: "Well cured corn fodder, of which about 65 per cent has had the ears removed was a satisfactory feeding stuff. . . . Corn silage fed in conjunction with either corn fodder or mixed hay and the same ration of bran and oats is a very satisfactory and very cheap ration for wintering breeding ewes that are pregnant. . . . Hay and roots are a very expensive feed ration for wintering breeding ewes, also corn fodder containing a large proportion of ears should not be fed largely to breeding ewes."

63. (a), Corn fodder and corn stover; (b), corn silage and corn stover; (c) corn silage and blue grass hay; (d) sugar beet pulp and blue grass hay.- The next year Carlyle (37) continued this work by testing the above rations with 48 ewes fed in four equal lots.

Bran and oats were fed in addition to each lot.

1.- From this experiment it would seem that corn fodder, corn stover and 1/2 pound of equal parts bran and oats per ewe daily for 12 weeks before lambing was a satisfactory food so far as the physical condition of the ewes was concerned, until the lambing period arrived when there was a marked deficiency in the milk secretion as compared with the ewes in the other lots. We further find that the lambs by the ewes fed these feeds were smaller in size and a larger proportion of weak and dead ones at birth than in the other lots.

2. Corn stover and corn silage with 1/2 pound per head of bran and oats was found to be a most satisfactory ration in every respect for breeding ewes bearing lambs. The ewes were healthy, a good supply of milk in their udders at lambing time, and the lambs were of good size, strong and vigorous at birth.

3. A ration composed of corn silage, hay and the grain mixture was equally as satisfactory in every way as the ration composed of corn stover and corn silage

4. A ration of roots and hay with the grain mixture was not as satisfactory as the ration containing corn silage, but gave better results than the ration of corn stover and corn silage. Many of the ewes did not have a satisfactory milk supply at lambing time and a number of the lambs were weak and goitered.

5. With conditions as given in this experiment we find the ration of corn fodder, corn stover and corn silage to be the cheapest and the ration containing roots and hay the most expensive ration fed.

Where the roots and hay were combined in the same ration the cost was approximately double that where the ewes were fed on silage and corn fodder or corn stover and corn fodder.

6. From this experiment and the one reported last year (Par.62) we conclude that corn silage is one of the cheapest and most satisfactory foods for breeding ewes in winter and that a ration, the roughness of which is composed entirely of corn fodder is not entirely satisfactory under the same conditions.

COMPARISON of KANSAS FEEDS for SHEEP as REPORTED by the KANSAS EXPERIMENT STATION.

64. On Dec., 9, 1904 the first experiment in sheep feeding at our Station was begun with 50 head of Mexican lambs and an equal number from Montana. The experiment continued to March, 27, 1905; 128 days.

This proved to be a very successful and gratifying test and shows some very interesting figures. One of the most important facts brought out is that the two lots of lambs, Montana and Mexican, on an average, both produced the same net gain in dollars and cents. Following is a detailed account of the feeds consumed and gains made.

EXPERIMENTAL PERIOD.- 65. During the experiment the lambs were divided into lots and fed according to the following outline:

Lot 1 contained 10 Montana lambs which received a ration of corn and alfalfa.

Lot 2, contained 10 Mexican lambs which received a ration of corn and alfalfa.

Lot 3 contained 10 Montana lambs which received a ration of kafir corn and alfalfa.

Lot 4 contained 10 Mexican lambs which received a ration of kafir corn and alfalfa.

Lot 5 contained 10 Montana lambs which received a ration of corn and prairie hay with a small allowance of cottonseed meal and linseed meal added.

Lot 6 contained 10 Mexican lambs which received a ration of corn and prairie hay with a small allowance of cottonseed meal and linseed meal added.

Lot 7 contained 20 Montana lambs which received a ration of corn and alfalfa with ensilage in addition.

Lot 8 contained 20 Mexican lambs which received a ration of corn and alfalfa with ensilage in addition.

66. The following table shows the total amount of feed eaten by the 100 lambs:

FEED EATEN by 100 LAMBS in 128 DAYS - KANSAS STATION.

Lot.	No. of Lambs.	Corn.	Kafir Corn	Cotton-seed Meal.	Linseed meal.	Alfalfa Hay.	Prairie Hay.	Ensilage.
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
1 -	10 - -	1316				1604		
2 -	10 - -	1397				1722		
3 -	10 - -		1373			1546		
4 -	-10 - -		1397			1946		
5 -	10 - -	1092		89	93		950	
6 -	10 - -	1174		91	107		1177	
7 -	20 - -	2620				2680		1840
8 -	20 - -	2730				2680		1970
Total 100		10330	2770	180	200	12198	2127	3810

67. Below is shown the weight of the lambs at beginning and end of trial, gains made, feed required per 100 pounds gain, and cost of feed per 100 pounds gain.

Lot

Lot	Weight Dec.9.	Weight Mch.27.	Total Gain.	Average Daily Gain.	Feed per 100# Gain.			Cost of feed per cwt.gain.
					Grain	Hay	Ensilage	
1	520	830	310	.287	424.5	517.4		\$4.39
2	600	990	390	.361	358.3	441.5		\$3.72
3	510	810	300	.277	457.6	515.3		\$4.39
4	570	980	410	.379	340.8	474.6		\$3.52
5	420	670	250	.231	530.0	290.9		\$4.98
6	437	764	327	.303	381.2	327.2		\$3.78
7	1040	16660	620	.287	422.5	432.2	296.7	\$4.37
8	1170	1910	740	.342	368.9	362.2	266.2	

PRICES of FEED.

Shelled Corn - - - -70¢ per cwt.

Kafir-Corn - - - -65¢ per cwt.

Alfalfa Hay - - - -27-1/2¢ per cwt.

Ensilage - - - - -7-1/2¢ per cwt.

Summary of Kansas Experiments.

68. SUMMARY.- 1. We find that kafir corn and alfalfa produced the cheapest gains, averaging 0.1¢ per pound more.

2. That corn and alfalfa also produced very cheap gains, averaging 0.1¢ per pound more than kafir corn and alfalfa.

3. That the addition of corn silage to the ration does not increase the gains while it does increase the cost.

4. That the addition of linseed meal and cotton seed meal to the ration produced the lowest average daily gain and the gains cost on an average 31¢ per hundred weight more.

C O N C L U S I O N S .

69. From what is herein shown we must conclude:

1. That the following grains rank in the order named as profitable feeds for feeding sheep.

- 1. Kafir Corn.
- 2. Indian Corn.
- 3. Barley.
- 4. Wheat.
- 5. Emmer.

2. That for roughness -

- 1. Alfalfa.
- 2. Clover.
- 3. Mixed tame Hay.
- 4. Oats Straw.
- 5. Corn Fodder.

rank in the order named.

3. That the addition of feeds such as linseed meal and cottonseed meal to the ration are profitable when the cost is not too great.

4. That the addition of succulent feeds as silage and roots to the ration daily increases the gains but does not decrease the cost per 100 pounds gain.

R E F E R E N C E S .

1. Colorado - - - - - Bulletin 75.
2. Michigan - - - - - Bulletin 113.
3. Michigan - - - - - Bulletin 128
4. Minnesota - - - - - -Bulletin 31.
5. Wisconsin - - - - - -Annual Report 1895.
6. Wisconsin - - - - - -Annual Report 1896
7. Henry's Feeds and Feeding -Page 498.
8. Montana - - - - - -Bulletin 47.
9. South Dakota - - - - - Bulletin 80.
10. Minnesota - - - - - -Bulletin 75.
11. Montana - - - - - -Bulletin 35.
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13. South Dakota - - - - - Bulletin 86.
14. Minnesota - - - - - Bulletin 44.
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18. Nebraska - - - - - Bulletin 71.
19. Wisconsin - - - - - -Annual Report 1904.
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21. Arizona - - - - - -Annual Report 1900.
22. Montana - - - - - -Bulletin 31.
23. Michigan - - - - - Bulletin 136.
24. West Virginia - - - - - Bulletin 50.
25. Utah - - - - - Bulltin 8.
26. Utah - - - - - Bulletin 19.
27. Colorado - - - - - Bulletin 76.
28. Colorado - - - - - Bulletin 52.
29. Wisconsin - - - - - -Annual Report 1903.

I N D E X .

Numbers refer to Paragraphs.

Alfalfa, - Hay - - - - -	27, 30 -35, 59, 64-68.
Pasture - - - - -	48.
Barley - - - - -	10, 15, 19, 24, 59.
Bluegrass, pHay - - - - -	63.
Pasture - - - - -	47, 50
Carbonaceous Vs. Nitrogenous Rations -	53.
Clover, -Hay - - - - -	28, 30, 36, 39, 43.
Ensilage - - - - -	61, 63.
Corn, - Grain - - - - -	4-5, 15, 18, 57, 64, 68.
Ensilage - - - - -	44, 61, 62, 64, 68.
Fodder - - - - -	35, 38, 41, 42, 44, 60, 62, 63.
Kafir - - - - -	64-68.
Meal - - - - -	53.
Soaked - - - - -	5.
Stover - - - - -	63.
Cotton Seed meal - - - - -	56, 64-68.
Cow Pea Hay - - - - -	43, 57.
Emmer - - - - -	11, 17, 21.
Feed required to produce 100% gain	51-52.
Grain Hay - - - - -	39
Linseed Meal - - - - -	54-56, 64-68.
Millet, - Grain - - - - -	13, 18, 22.
Hay - - - - -	32, 36, 40, 41.
Oats, - Grain - - - - -	8, 9, 16, 20, 24, 26, 57-58, 62.
Straw - - - - -	34, 37, 40, 42, 60.
Prairie Hay, - - - - -	31, 64-68.
Pasture - - - - -	46.

Rape, - - - - -	45,50
Sorghum Hay, - - - - -	29,33.
Soy Bean (grain), - - - - -	-12,26.
Sugar Beets - - - - -	-59, 61.
Timothy, - - - - -	-43.
Wheat, Grain - - - - -	6,14,19,-23,59.
Bran - - - - -	-25,58,62.
Macorina - - - - -	-7.
Screenings - - - - -	-23.