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MINERAL SUPPLEMENTS FOR LAMB FATTENING RATIONS

Progress Report of Livestock Feeding Experiment 1934

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Summary

1. In a grain-roughage ration, cut cane fodder showed 62.9 percent the value of alfalfa hay.

2. Supplementing a ground corn-cut cane fodder ration with cottonseed cake increased gains 45.3 percent and decreased cost of gains 12.9 percent. If cane fodder is to be substituted for alfalfa hay in lamb-fattening rations, it must be supplemented with some protein concentrate if best results are to be obtained from its usage.

3. Grinding of medium-to-fine-stalked cane fodder did not pay. The greater utilization of the cut cane fodder was more than offset by its increased cost.

4. There was no advantage for feeding minerals to lambs fed on a corn and alfalfa ration. Legume hays such as alfalfa are usually high in their mineral content and do not need mineral reinforcement unless grown in areas noticeably low in mineral matter.

5. Lambs did not respond markedly to the addition of minerals when the ration fed was ground corn, cottonseed cake and cane fodder.

6. Mineral mixtures composed of 2, 3 or 4 parts calcium oxide to 1 part of phosphoric acid increased gains slightly when added to a ration of ground corn, cottonseed cake and cut cane fodder. The 5-1 mixture depressed gains and increased costs when added to the same ration.

Objects of the Experiment

1. To compare cane fodder and alfalfa hay in a grain-roughage ration.

2. To compare cut and whole cane fodder.

3. To determine the value of cottonseed cake when added to a ration of ground corn and cut cane fodder.

4. To determine whether or not minerals are necessary in lamb rations when the roughage is alfalfa hay.

5. To determine whether or not minerals are necessary in lamb rations when the roughage is cane fodder.

6. To determine what is the best source of calcium and phosphorus, and the relationship that should exist between these minerals to obtain maximum gains in feeding lambs.

Lambs Used

Three hundred and eighty lambs were used in this test. These lambs were loaded at Wagon Mound, New Mexico, and averaged around 51 pounds at the start. They showed mostly Rambouillet breeding. They were divided into 19 lots which were made as uniform as possible by balancing the factors of weight, type, degree of fleshing, sex and breeding.

Rations Fed

Group I.—

Lot 1. Ground corn, alfalfa hay, salt.

Lot 2. Ground corn, alfalfa hay, bonemeal, salt.

Lot 4. Ground corn, alfalfa hay, Dicapho, salt.

Lot 16. Ground corn, alfalfa hay, Calcarbo, salt.

Lot 17. Ground corn, alfalfa hay, Shell Marl Meal, salt.

Lot 18. Ground corn, alfalfa hay, refuse lime, salt.

Lot 19. Ground corn, alfalfa hay, Anaconda, salt.

Group II.—

Lot 9. Ground corn, cut cane fodder, salt.

Lot 7. Ground corn, cut cane fodder, cottonseed cake, salt.

Lot 13. Ground corn, whole cane fodder, cottonseed cake, salt.

Lot 6. Ground corn, cut cane fodder, cottonseed cake, bonemeal, salt.

Lot 5. Ground corn, cut cane fodder, cottonseed cake, Dicapho, salt.

Lot 3. Ground corn, cut cane fodder, cottonseed cake, Calcarbo, salt.

Lot 8. Ground corn, cut cane fodder, cottonseed cake, Shell Marl Meal, salt.

Lot 10. Ground corn, cut cane fodder, cottonseed cake, Anaconda, salt.

Lot 11. Ground corn, cut cane fodder, cottonseed cake, 2-1 CaP mix, salt.

Lot 12. Ground corn, cut cane fodder, cottonseed cake, 3-1 CaP mix, salt.

Lot 14. Ground corn, cut cane fodder, cottonseed cake, 4-1 CaP mix, salt.

Lot 15. Ground corn, cut cane fodder, cottonseed cake, 5-1 CaP mix, salt.

Feeds Used and Methods of Feeding

Grain, cottonseed cake, minerals and the cut cane fodder were fed twice daily. Whole cane, alfalfa and salt were self-fed. The lambs were started on .1 pound of grain per head daily, .05 pound cake, and 2.0 pounds cut cane fodder. The grain and cake were gradually increased until a maximum feed of 1.13 pounds of corn and .25 pound of cake were received per lamb. The amount of cut cane fodder was reduced to 1.5 pounds per head daily when the grain and cake were increased in order that the lambs would clean up. Minerals were fed at the rate of .01 pound per head daily at the start but as the lambs would not eat this much, the amount fed was halved and then gradually increased until a maximum feed of .01 pound per head daily was being consumed.

Corn used in this test was purchased from a local elevator. It weighed 55.8 pounds per bushel, averaged 12.77 percent moisture during the feeding test and was graded No. 3 yellow according to U. S. Standards. In order to have a carrier for the minerals fed to the different lots, all corn fed was ground medium fine.

Cottonseed Cake, pea-size, of a guaranteed analysis of 43 percent protein was fed. The average moisture content was 7.09 percent.

Cane Fodder was locally grown and was medium to small in size of stalk. It was cut for all cane lots except one so that the amount of feed fed to these lots could be kept the same. Lot 13 was fed whole cane to check on the value of grinding. The cane used contained 6.71 percent protein.

Alfalfa Hay, second cutting, was fed in this test. It was a good-quality hay containing 13.51 percent protein.

Minerals used with the exception of refuse lime and the 2-1, 3-1, 4-1, and 5-1 mixtures were products of various commercial concerns that are being sold in this feeding area. Refuse lime is a by-product of beet-sugar factories and was obtained from the local sugar factory. The different mixtures were made by mixing Anaconda and refuse lime so that the calcium oxide (CaO) content was 2 parts of calcium oxide to 1 part of phosphoric acid (P_2O_5), 3 parts of calcium oxide to 1 part of phosphoric acid, 4 parts of calcium oxide to 1 part of phosphoric acid, and 5 parts of calcium oxide to 1 part of phosphoric acid.

Discussion of Results

Cut Cane Fodder vs. Alfalfa Hay.—In recent years, because of poor stands and reduced yields of alfalfa in many instances, many feeders have been using cane fodder as a substitute roughage in lamb-fattening rations.

The value of cut cane fodder and alfalfa hay as roughages is shown by comparing Lots 9 and 1. Lot 1 fed a ration of ground corn and alfalfa made .07 pound greater daily gain per lamb, required less

Table 1.—MINERAL CONTENT OF FEEDS USED*

	Percentage CaO	Percentage P_2O_5
Corn	0.055	0.719
Cottonseed cake	0.371	2.207
Alfalfa hay	1.530	0.446
Cane fodder	0.601	0.308
Shell Marl Meal	50.120	Trace
Calcarbo	52.860	Trace
Anaconda	21.200	42.960
Dicapho	17.010	20.480
Refuse lime	67.040	0.150
Bonemeal	39.910	30.990
2-1 Mix	43.744	21.906
3-1 Mix	49.575	16.461
4-1 Mix	53.077	13.192
5-1 Mix	55.351	11.067

Table 2.—CHEMICAL ANALYSES OF FEEDS USED*

				Carbohydrates			
	Water	Ash	Crude protein	Fiber	N. F. Extract	Fat	Number of analyses
Corn	12.15	1.44	10.55	2.11	70.07	3.68	2
Cottonseed cake	7.18	5.70	42.45	12.12	26.22	6.33	2
Alfalfa hay	7.43	8.19	13.51	38.52	31.47	0.88	2
Cane fodder	11.12	7.02	6.71	29.83	44.12	1.20	1

*Analysis of the feeds used in this test was made by the chemistry section of the experiment station, Professor J. W. Tobiska in charge.

corn, less roughage and less salt per cwt. gain, and showed $2.21 less feed cost per cwt. gain than did Lot 9 fed ground corn and cut cane fodder. Each ton of alfalfa fed replaced 408.2 pounds of corn, 2238.3 pounds of cut cane fodder, and 7.4 pounds of salt, and was worth $11.92 in this comparison. The lower value for the cut cane fodder may be attributed to the fact that it contained slightly less than one-half as much crude protein as did the alfalfa hay which was fed. (See Table 2.)

Cut Cane Fodder Supplemented with Cottonseed Cake vs. Cut Cane Fodder Unsupplemented.—Lot 7 which was fed ground corn, cottonseed cake and cut cane fodder made a .06-pound greater daily gain per lamb at a lower feed cost per cwt. gain than did Lot 9 fed ground corn and cut cane fodder. The lambs in Lot 7 also showed more finish when sold. Each ton of cottonseed cake fed with ground corn and cut cane fodder replaced 3247.1 pounds of ground corn, 6226.4 pounds cut cane fodder and 66.1 pounds salt, and was worth $51.45. This comparison shows that if cane fodder is to be substituted for alfalfa hay in lamb-fattening rations it must be supplemented with some protein concentrate as cottonseed cake if best results from its usage are to be obtained.

Table 3.—LAMB-FEEDING EXPERIMENT—Colorado Experiment Station, Fort Collins, Colorado. 20 lambs per lot—fed 131 days—November 28, 1933 to April 8, 1934.
(Table based on one average lamb)

Lot number	1	9	7	6	5	3	8	10
Ration fed Salt self-fed in all lots.	Gr. corn Alfalfa	Gr. corn Cut cane	Gr. corn C. S. cake Cut cane	Gr. corn C. S. cake Cut cane Bonemeal	Gr. corn C. S. cake Cut cane Dicapho	Gr. corn C. S. cake Cut cane Calcarbo	Gr. corn C. S. cake Cut cane Shell Marl	Gr. corn C. S. cake Cut cane Anaconda
Weight at start	51.4	51.2	51.9	51.6	51.6	51.6	51.3	51.7
Final weight at market	79.0	69.1	77.9	79.1	78.5	78.5	78.1	78.3
Total gain at market	27.6	17.9	26.0	27.6	26.9	26.9	26.8	26.5
Daily gain at market	.21	.14	.20	.21	.20	.21	.20	.20
Shipping shrink (percentage)	6.19	6.19	6.19	6.19	6.19	6.19	6.19	6.19
Average daily feed—pounds								
Ground corn	.80	.80	.79	.80	.79	.80	.79	.80
Cottonseed cake	....	....	.22	.22	.22	.22	.22	.22
Cane or alfalfa	2.11	1.53	1.53	1.53	1.53	1.53	1.53	1.53
Mineral	....	....	....	.009	.009	.009	.009	.009
Salt	.014	.014	.013	.014	.014	.014	.014	.014
Maximum daily feed—pounds								
Ground corn	1.13	1.13	1.14	1.13	1.14	1.14	1.14	1.13
Cottonseed cake	....	....	.25	.25	.25	.25	.25	.25
Cane	....	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Mineral	....	....	....	.01	.01	.01	.01	.01
Feed required per cwt. gain at market								
Ground corn	377.5	581.7	401.0	378.0	387.9	387.0	388.4	392.9
Cottonseed cake	....	....	111.3	104.7	107.7	107.3	107.8	108.9
Cane or alfalfa	1000.4	1119.6	773.1	727.3	747.8	745.6	748.7	756.0
Mineral	....	....	....	4.28	4.40	4.35	4.40	4.45
Salt	6.74	10.42	6.74	6.77	6.70	6.71	6.71	7.04
Feed cost per cwt. gain at market	$7.01	$9.22	$8.03	$7.66	$7.90	$7.78	$7.82	$7.96

Table 4.—LAMB-FEEDING EXPERIMENT—Colorado Experiment Station, Fort Collins, Colorado. 20 lambs per lot—fed 131 days—November 28, 1933 to April 8, 1934.

(Table based on one average lamb)

Lot number	1	2	4	16	17	18	19
Ration fed Salt self-fed in all lots.	Gr. corn Alfalfa	Gr. corn Alfalfa Bonemeal	Gr. corn Alfalfa Dicapho	Gr. corn Alfalfa Calcarbo	Gr. corn Alfalfa Shell Marl	Gr. corn Alfalfa Refuse lime	Gr. corn Alfalfa Anaconda
Weight at start	51.4	51.3	51.7	51.7	52.0	52.0	51.8
Final weight at market	79.0	78.5	80.4	77.7	78.8	81.2	78.0
Total gain at market	27.6	27.2	28.8	26.0	26.8	29.3	26.2
Daily gain at market	.21	.21	.22	.20	.20	.22	.20
Shipping shrink (percentage)	6.19	6.19	6.19	6.19	6.19	6.19	6.19
Average daily feed—pounds							
Ground corn	.80	.79	.80	.79	.79	.79	.79
Alfalfa	2.11	2.02	2.21	1.99	2.12	2.14	2.22
Mineral	....	.009	.009	.009	.009	.009	.009
Salt	.014	.014	.014	.013	.013	.014	.012
Maximum daily feed—pounds							
Ground corn	1.13	1.14	1.14	1.14	1.14	1.14	1.14
Mineral	....	.01	.01	.01	.01	.01	.01
Feed required per cwt. gain at market							
Ground corn	377.5	382.4	362.9	400.4	388.8	356.0	397.5
Alfalfa	1000.4	969.4	1007.2	1001.5	1036.1	959.0	1108.8
Mineral	....	4.33	4.11	4.54	4.41	4.03	4.50
Salt	6.74	6.61	6.46	6.34	6.16	6.07	6.20
Feed cost per cwt. gain at market	$7.01	$7.04	$7.04	$7.24	$7.28	$6.68	$7.69
Cost per lamb in feedlot @ $6.25 per cwt.	3.21	3.21	3.23	3.23	3.25	3.25	3.24
Feed cost per lamb	1.93	1.92	2.02	1.88	1.95	1.95	2.01

Estimated fixed costs including interest, labor and equipment	.60	.60	.60	.60	.60	.60	.60
Estimated shipping and selling expense	.34	.34	.34	.34	.34	.34	.34
Total cost at market (Denver)	6.08	6.07	6.19	6.05	6.14	6.14	6.19
Valuation per cwt.	8.23	8.23	8.23	8.25	8.30	8.30	8.30
Estimated return per lamb	6.50	6.46	6.62	6.41	6.54	6.74	6.48
Estimated profit per lamb	.42	.39	.43	.36	.40	.60	.29
Necessary selling price per cwt, to break even	7.69	7.73	7.70	7.78	7.79	7.56	7.93
Margin needed to break even	1.44	1.48	1.45	1.53	1.54	1.31	1.68

Feed costs:

Ground corn ..... $17.00 per ton	Dicapho ..... $65.00 per ton	Refuse lime ..... No charge
Alfalfa ..... 7.50 per ton	Calcarbo ..... 15.00 per ton	Anaconda ..... $45.00 per ton
Bonemeal ..... 45.00 per ton	Shell Marl Meal ..... 18.00 per ton	Salt ..... 15.00 per ton

Table 5.—FINANCIAL STATEMENT BASED ON AVERAGE FEED PRICES AND SALE OF LAMBS
(Table based on one average lamb)

Lot number	1	9	7	6	5	3	8	10
Ration fed Salt self-fed in all lots.	Gr. corn Alfalfa	Gr. corn Cut cane	Gr. corn C. S. cake Cut cane	Gr. corn C. S. cake Cut cane Bonemeal	Gr. corn C. S. cake Cut cane Dicapho	Gr. corn C. S. cake Cut cane Calcarbo	Gr. corn C. S. cake Cut cane Shell Marl	Gr. corn C. S. cake Cut cane Anaconda
Cost per lamb in feedlot @ $6.25 per cwt.	3.21	3.20	3.25	3.22	3.23	3.22	3.20	3.23
Feed cost per lamb	1.93	1.65	2.09	2.11	2.12	2.09	2.10	2.11
Estimated fixed costs including interest, labor and equipment*	.60	.59	.60	.60	.60	.60	.60	.60
Shipping and selling expense	.34	.32	.34	.34	.34	.34	.34	.34
Total cost at market (Denver)	6.08	5.76	6.28	6.27	6.29	6.25	6.24	6.28
Selling price per cwt.**	8.23	8.20	8.25	8.23	8.20	8.20	8.23	8.28
Total return per lamb	6.50	5.67	6.43	6.51	6.43	6.44	6.42	6.48
Profit per lamb	.42	−.09	.15	.24	.14	.19	.18	.20
Necessary selling price per cwt. to break even	7.69	8.33	8.06	7.92	8.02	7.96	7.99	8.02
Margin needed to break even	1.44	2.08	1.81	1.67	1.77	1.71	1.74	1.77

*Based on studies made by the Economics Department, Colorado Agricultural College.

**Based on actual selling price and valuation placed on lambs.

Feed costs:

Ground corn	$17.00 per ton	Dicapho	$65.00 per ton
Cottonseed cake	30.00 per ton	Calcarbo	15.00 per ton
Cut cane	7.50 per ton	Shell Marl Meal (Calfalfa)	18.00 per ton
Alfalfa	7.50 per ton	Anaconda	45.00 per ton
Bonemeal	45.00 per ton	Salt	15.00 per ton

Table 6.—LAMB-FEEDING EXPERIMENT—Colorado Experiment Station, Fort Collins, Colorado. 20 lambs per lot—fed 131 days—November 28, 1933 to April 8, 1934. (Table based on one average lamb)

Lot number	7	13	11	12	14	15
Ration fed	Gr. corn C. S. cake Cut cane	Gr. corn C. S. cake Wh. cane	Gr. corn C. S. cake Cut cane 2-1 CaP Mix	Gr. corn C. S. cake Cut cane 3-1 CaP Mix	Gr. corn C. S. cake Cut cane 4-1 CaP Mix	Gr. corn C. S. cake Cut cane 5-1 CaP Mix
Salt self-fed in all lots						
Weight at start	51.9	50.8	50.9	50.8	50.7	50.7
Final weight at market	77.9	78.8	78.7	77.9	78.8	75.9
Total gain at market	26.0	28.0	27.7	27.1	28.1	25.3
Daily gain at market	.20	.21	.21	.21	.21	.19
Shipping shrink (percentage)	6.19	6.19	6.19	6.19	6.19	6.19
Average daily feed—pounds						
Ground corn	.79	.80	.79	.79	.79	.79
Cottonseed cake	.22	.22	.22	.22	.22	.22	
Cane (whole or cut)	1.53	1.80	1.53	1.53	1.53	1.53
Mineral	.. ....	.. ...	.009	.009	.009	.009
Salt	.013	.015	.014	.014	.014	.014
Maximum daily feed—pounds						
Ground corn	1.14	1.13	1.14	1.14	1.14	1.14
Cottonseed cake	.25	.25	.25	.25	.25	.25
Cane	1.50	.. ....	1.50	1.50	1.50	1.50
Mineral	.. ....	.. ....	.01	.01	.01	.01
Feed required per cwt. gain at market						
Ground corn	401.0	374.1	375.5	384.3	370.1	411.9
Cottonseed cake	111.3	103.2	104.2	106.6	102.7	114.3
Cane (whole or cut)	773.1	839.7	723.8	740.8	713.4	794.1
Mineral	.. ....	.. ....	4.29	4.39	4.23	4.71
Salt	6.74	6.96	6.67	6.64	6.35	7.32
Feed cost per cwt. gain at market	$8.03	$7.09	$7.56	$7.74	$7.45	$8.27
Cost per lamb in feedlot @ $6.25 per cwt.	3.25	3.17	3.18	3.18	3.17	3.17
Feed cost per lamb	2.09	1.99	2.10	2.10	2.10	2.09
Estimated fixed costs including interest, labor and equipment*	.60	.60	.60	.60	.60	.60
Shipping and selling expense	.34	.34	.34	.34	.34	.33
Total cost at market (Denver)	6.28	6.10	6.22	6.22	6.21	6.19
Valuation per cwt.**	8.25	8.28	8.28	8.23	8.25	8.30
Total return per lamb	6.43	6.53	6.51	6.41	6.50	6.30
Total profit per lamb	.15	.43	.29	.19	.29	.11
Necessary selling price per cwt. to break even	8.06	7.74	7.91	7.98	7.88	8.15
Margin needed to break even	1.81	1.49	1.66	1.73	1.63	1.90

*Based on studies made by the Economics Department, Colorado Agricultural College.

**Based on actual selling price and valuation placed on lambs.

Feed costs used:

Ground corn	$17.00 per ton	2-1 CaP mixture	$22.90 per ton
Cut cane fodder	7.50 per ton	3-1 CaP mixture	17.20 per ton
Whole cane fodder	5.50 per ton	4-1 CaP mixture	13.70 per ton
Cottonseed cake	30.00 per ton	5-1 CaP mixture	11.50 per ton
		Salt	15.00 per ton

Whole Cane Fodder vs. Cut Cane Fodder.—Many lamb feeders grind the roughage they feed in their fattening rations. This results in a greater utilization of the feed but increased costs. Grinding is not usually an economical practice except when the cost of the roughage is relatively high or when only a limited amount of roughage is available.

To compare the value of cut and whole cane fodder, Lot 13 was fed whole cane fodder. The rations fed to Lots 13 and 7 were the same with that exception. Greater gains were obtained in Lot 13. The average daily feed of cane was .27 pound greater for Lot 13 than for Lot 7. In feed per cwt. gain, less corn and less cottonseed cake were required by Lot 13 but the amount of cane and salt required was greater. The higher feed cost per cwt. gain for Lot 7 is due to the fact that cutting the cane made a $2.00 per ton greater cost for this feed. Each ton of cut cane fodder replaced 2172.3 pounds whole cane fodder and .6 pound salt but required 21.0 pounds additional cottonseed cake and 69.6 pounds additional corn. Cut cane fodder costing $7.50 had a replacement value of $5.06. The cane used in this year's test was medium-to-fine stalked and grinding slightly decreased its value.

Should Minerals Be Added to a Ground Corn-Alfalfa Ration?—This year's test shows no advantage for minerals when added to a ground corn-alfalfa ration. Blood tests were taken* of lambs in 4 of the 19 lots in the experiment at the beginning. These tests indicate a deficiency of mineral matter in the blood stream of the lambs when started on test. The addition of various minerals to the check ration reduced total gains made by the lambs in 4 out of 6 lots and increased the feed cost per cwt. gain in 5 of the 6 ground corn-alfalfa hay-mineral lots. The corn-alfalfa hay ration provided enough calcium and phosphorus to meet the demands made by the lambs for calcium and phosphorus, and the addition of minerals did not improve the ration.

Should Minerals Be Added to a Ground Corn-Cottonseed Cake-Cut Cane Fodder Ration?—Of the 9 ground corn-cottonseed cake-cut cane fodder lots which were fed different minerals in addition to their ration, 8 showed slightly larger gains than the check lot, Lot 7, fed ground corn, cottonseed cake and cut cane fodder. The increased

*Thru the cooperation of J. W. Tobiska, Chemistry Section, Experiment Station, and Dr. Floyd Cross, Veterinary Pathology Section, Experiment Station.

gains are not significant measured in terms of the length of the feed period, 131 days, and it is doubtful whether minerals are needed with this ration. However, feeder lambs originating in a range area where the soils are noticeably deficient in calcium or phosphorus or both, and fed on a ration low in mineral matter, would probably respond favorably to the addition of minerals.

Value of Different Mineral Mixes.—There was little difference in the value of the 2-1, 3-1, and 4-1 mineral mixtures which were fed Lots 11, 12 and 14 respectively. Blood analyses made at the end of the experiment to determine the calcium and phosphorus content showed that each had stored during the feeding period approximately the same amount of mineral matter. Lot 15, fed the same ration as the other three lots with the exception of receiving the 5-1 mix, made less gains and less economical gains. The analysis of blood of the lambs in this lot showed lower storage of calcium and phosphorus during the feeding period. Evidently the calcium and phosphorus fed in this lot were not in the proper proportions. Much more experimental work needs to be done before general recommendations regarding mineral feeding for lambs can be definitely given.