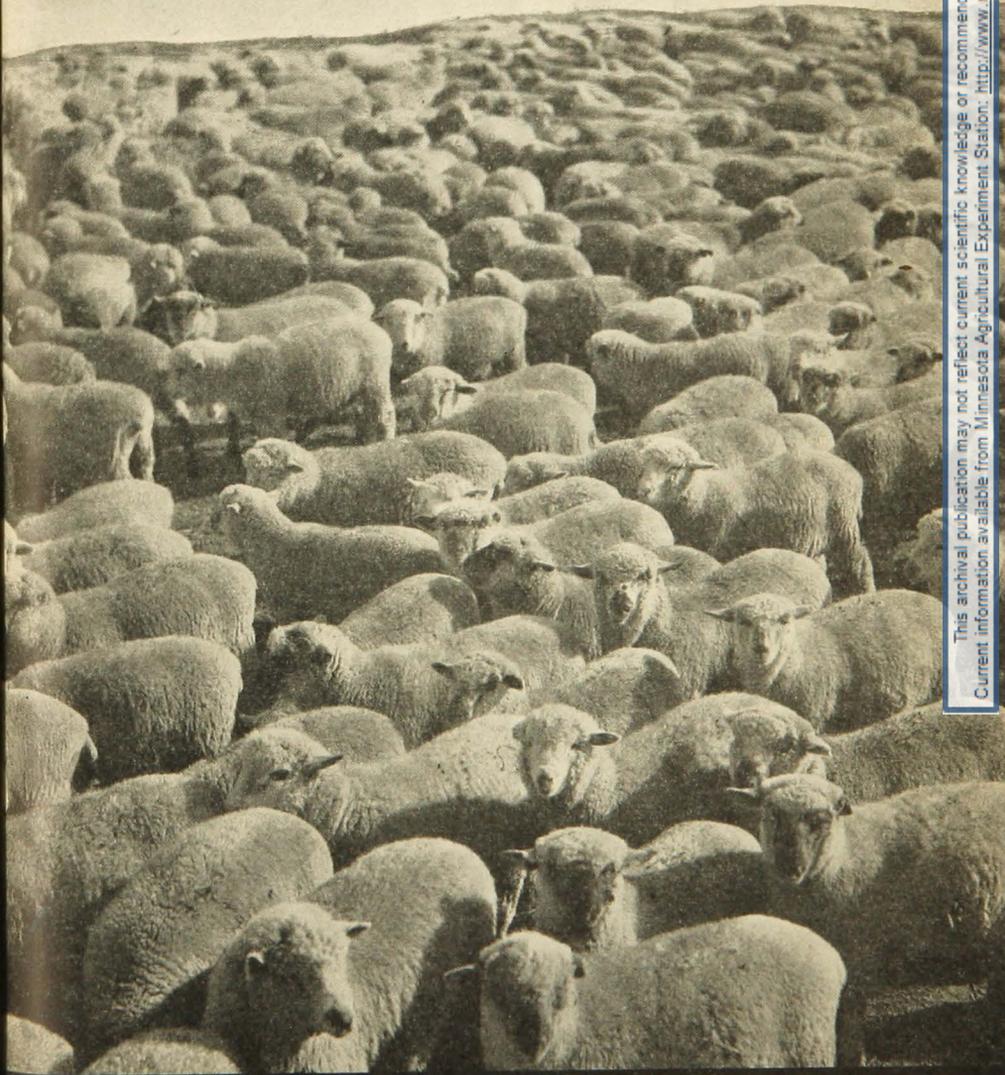


# *Feeding Methods and Rations for Fattening Lambs*

P. S. Jordan and W. H. Peters



This archival publication may not reflect current scientific knowledge or recommendations.  
Current information available from Minnesota Agricultural Experiment Station: <http://www.maes.umn.edu>

# Feeding Methods and Rations for Fattening Lambs

P. S. Jordan and W. H. Peters

**T**HERE ARE ABOUT 1,400,000 sheep on Minnesota farms. About 800,000 are ewes of reproducing age. In addition to the lambs raised from the farm flocks each year, about 400,000 thin feeder lambs are brought into the state to be fattened. To secure dependable information on the selection of feeds and methods of feeding fattening lambs, investigations have been carried on at the West Central Branch of the Minnesota Experiment Station at Morris during the last 16 years. Complete results of the earlier trials are reported in Bulletin 306, May 1934, and in the July 1938 revision. In this bulletin the results secured in the experiments completed since 1938 are reported in detail, and results secured in experiments completed before 1938 are briefly summarized.

## METHOD OF PROCEDURE

*Purchase of lambs*—In some of the experiments the lambs used were typical white faced feeder lambs purchased direct from the western ranges. In others "native lambs," comprising the feeder end from lambs raised on Minnesota and North Dakota farms, were purchased at the market at South St. Paul or at West Fargo. The groups of native lambs were usually mixed in type and breeding and purchased below the prevailing price for uniform western feeder lambs. Most of the native feeders showed indications of crossing of Shropshire or Hampshire

rams with western white faced range ewes.

*Starting on feed*—Upon arrival at Morris each group of lambs was placed in the experimental feeding shed and allowed to rest for two or three days before they were given any grain. During this period they were fed only upland prairie hay and were allowed free access to water and salt. They were then started on a light feed of grain amounting for the first day to only .2 to .4 of a pound of grain per lamb. The grain used was oats or a mixture of oats and barley or oats and corn containing not less than 50 per cent oats. In each experiment the lambs were divided into uniform lots of 30 lambs each and started on the experimental rations as soon as they were thoroughly rested and ready to begin eating larger amounts of grain. Some lambs were started on the experimental rations as early as ten days after arrival, while others required three weeks to settle down.

*Equipment and yards*—All lots were sheltered in a large shed divided into eight pens, 14 x 22 feet, with a feed rack down the center. Each lot always had access to an automatic self-waterer inside the shed. In cold weather the waterers were heated by an electric immersion heater. Salt was kept before the lambs in each lot at all times. Each section of the shed opened to the south into a lot 14 x 100 feet by means of a large sliding door. This door was always open except in the most severe stormy weather.

*Weight and feed records*—All weights and feed records were taken and records kept according to standard methods of experiment stations in conducting group feeding trials.

*Shearing*—Two double-decked carloads of lambs were usually fed each winter. The first load was purchased in October or November and marketed in January. The second was purchased in January immediately after the first one was sold. Lambs fattened in the fall were sold with the wool on. Those purchased in January were usually shorn during the first warm spell in March and lambs and wool sold separately.

*Financial statement*—The financial statements for the trials do not include a charge for labor, equipment, or interest. In fattening lambs the fertility value of the manure generally offsets these cost items. The primary purpose of the trials was to test the feeding value of the various feeds and the most efficient methods of feeding them; hence, the financial statement is incidental.

### SELF-FEEDING CORN AND CUT ALFALFA HAY MIXED

The results of several experiments before the summer of 1938 indicated the ration of shelled corn, linseed meal, alfalfa hay, salt, and water as one of the most satisfactory tried. In those trials the corn, linseed meal, and alfalfa hay were hand-fed twice daily.

Growing interest in the cutting or grinding of alfalfa hay to be mixed with grain in feeding farm animals gave rise to the thought that results from the corn-alfalfa ration might be improved by cutting the hay, mixing it with the corn and linseed meal, and self-feeding the mixture. Consideration of the possible advantages from this plan over hand-feeding twice daily led to a trial during the winter of 1938-39 to determine:

1. If cutting of the alfalfa hay in itself was advantageous or profitable.
2. If the mixture of cracked corn and cut alfalfa would feed satisfactorily from a self-feeder.
3. If the protein supplement was needed with the corn-alfalfa hay ration.
4. The most favorable proportion of corn to alfalfa.

Results of the first trial carried on through the fall of 1938 are reported in table 1, and results of the second trial, a complete repetition of the first, carried on during the early winter of 1939, are reported in table 2.

Tables 1 and 2 reveal several general differences in the results. All lots in the second trial maintained a higher daily rate of gain than the corresponding lots in the first trial. Lambs fed during the winter months gain a little faster than those fed during the fall months. Also in the winter less feed at a lower cost is required to produce 100 pounds gain than in the fall, with consequent greater profits. The probable explanation for the higher rate of gain and lower feed cost in the winter-fed lambs is that while they weigh only a little more at the beginning than the fall lambs, they are older, larger framed, and thinner. Such animals are capable of gaining rapidly and efficiently when liberally fed. The lower feed cost and higher selling price per pound account for the larger profit.

A comparison of figures under lots 1 and 2 in table 1 shows that the lambs in lot 2 receiving cut hay hand-fed had a slight advantage over those fed whole hay. Comparison of lots 7 and 8 in table 1 shows a similar result favoring cut hay. In lots 1 and 2 and 7 and 8 (table 2) the lambs receiving whole hay hand-fed had a slight advantage. The reason for the reversal of results in the two trials could not be determined. The only conclusion is that the

Table 1. Results of First Trial, Conducted October 13, 1938 to December 29, 1938 (77 Days), to Determine the Comparative Value of Hand-feeding and Self-feeding Various Proportions of Corn and Cut or Whole Alfalfa

Thirty lambs per lot	Rations*							
	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8
	Hand-fed Whole alfalfa Corn Linseed Oil meal	Hand-fed Cut alfalfa Corn Linseed Oil meal	Self-fed Cut alfalfa 60 per cent Corn and Linseed Oil meal 40 per cent	Self-fed Cut alfalfa 50 per cent Corn and Linseed Oil meal 50 per cent	Self-fed Cut alfalfa 40 per cent Corn and Linseed Oil meal 60 per cent	Self-fed Cut alfalfa 30 per cent Corn and Linseed Oil meal 70 per cent	Hand-fed Whole alfalfa Corn	Hand-fed Cut alfalfa Corn
Initial weight per lamb, lb.	63.88	65.24	64.66	65.17	64.40	63.22	63.20	63.06
Final weight per lamb, lb.	89.64	94.82	89.53	93.71	96.45	97.33	86.37	88.44
Average gain per lamb, lb.	25.75	29.57	24.86	28.53	32.05	34.11	23.17	25.37
Average daily gain, lb.	.335	.384	.323	.371	.416	.443	.301	.330
Average daily ration, lb.								
Alfalfa hay	1.02	1.02	1.85	1.55	1.33	1.05	1.02	1.02
Cracked corn	1.50	1.50	1.11	1.37	1.56	1.83	1.55	1.55
Linseed meal	.166	.166	.123	.152	.173	.203		
Total feed	2.686	2.686	3.083	3.072	3.063	3.083	2.57	2.57
Feed per 100 pounds gain, lb.								
Alfalfa hay	303.0	264.0	574.0	418.0	319.0	237.0	338.0	308.0
Cracked corn	447.0	389.0	344.0	370.0	375.0	413.0	515.0	470.0
Linseed meal	49.7	43.2	38.3	41.1	41.7	45.8		
Feed cost per 100 pounds gain†	\$5.61	\$5.15	\$6.08	\$5.64	\$5.26	\$5.27	\$5.14	\$5.00
Initial cost of lamb per 100 pounds, Morris	6.77	6.77	6.77	6.77	6.77	6.77	6.77	6.77
Initial cost per lamb	4.32	4.42	4.38	4.41	4.36	4.28	4.28	4.27
Feed cost per lamb	1.44	1.52	1.51	1.61	1.69	1.80	1.19	1.27
Total cost per lamb	5.76	5.94	5.89	6.02	6.05	6.06	5.47	5.54
Selling price per 100 pounds, South St. Paul‡	8.75	8.75	8.75	8.75	8.75	8.75	8.75	8.75
Selling price per 100 pounds, Morris‡	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Selling price per lamb, Morris‡	7.17	7.59	7.16	7.50	7.72	7.79	6.91	7.08
Margin per lamb	1.41	1.65	1.27	1.48	1.67	1.71	1.44	1.54

\* In all lots except 7 and 8, linseed meal was fed as 10 per cent of the cracked corn and cut alfalfa mixture. Lot 2 was held to the same daily feed consumption as Lot 1, and Lot 8 to the same feed consumption as Lot 7.

† Feed prices: Whole alfalfa hay, \$7 per ton; shelled corn, 40 cents per bushel; linseed meal, \$45 per ton. The cost of cracking corn was 3 cents per bushel; cost of cutting alfalfa hay, \$2 per ton.

‡ Selling price: Selling price at Morris determined by deducting 75 cents per 100 pounds from selling price at South St. Paul to cover freight, selling expense, and shrink.

Table 2. Results of Second Trial, Conducted January 19, 1939 to May 4, 1939 (75 Days) to Determine the Comparative Value of Hand-feeding and Self-feeding Various Proportions of Corn and Cut or Whole Alfalfa

	Rations*							
	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7	Lot 8
	Hand-fed Whole alfalfa Corn Linseed Oil meal	Hand-fed Cut alfalfa Corn Linseed Oil meal	Self-fed Cut alfalfa 60 per cent Corn and Linseed Oil meal 40 per cent	Self-fed Cut alfalfa 50 per cent Corn and Linseed Oil meal 50 per cent	Self-fed Cut alfalfa 40 per cent Corn and Linseed Oil meal 60 per cent	Self-fed Cut alfalfa 30 per cent Corn and Linseed Oil meal 70 per cent	Hand-fed Whole alfalfa Corn	Hand-fed Cut alfalfa Corn
Thirty lambs per lot								
Initial weight per lamb, lb.....	66.66	66.97	66.97	67.22	67.26	67.11	66.91	66.91
Final weight per lamb, lb.....	98.66	98.82	95.08	102.24	106.22	106.66	95.42	96.02
Average gain per lamb, lb.....	32.00	31.85	28.11	35.02	38.93	39.56	28.16	29.10
Average daily gain, lb.....	.427	.424	.375	.467	.519	.527	.375	.388
Average daily ration, lb.								
Alfalfa hay .....	1.30	1.30	1.68	1.56	1.37	1.11	1.24	1.24
Cracked corn .....	1.49	1.49	1.00	1.40	1.77	2.00	1.55	1.55
Linseed meal .....	.165	.165	.112	.156	.197	.223	.....	.....
Total feed .....	2.955	2.955	2.792	3.116	3.337	3.333	2.79	2.79
Feed per 100 pounds gain, lb.								
Alfalfa hay .....	305.0	306.0	448.0	334.0	265.0	211.0	330.0	319.0
Cracked corn .....	348.0	350.0	269.0	301.0	342.0	380.0	413.0	400.0
Linseed meal .....	38.7	38.9	29.9	33.4	37.8	42.2	.....	.....
Feed cost per 100 pounds gain†.....	\$4.61	\$4.94	\$4.76	\$4.56	\$4.69	\$4.82	\$4.23	\$4.51
Initial cost of lamb per 100 pounds,								
Morris .....	8.09	8.09	8.09	8.09	8.09	8.09	8.09	8.09
Initial cost per lamb.....	5.39	5.42	5.42	5.44	5.44	5.43	5.41	5.41
Feed cost per lamb.....	1.48	1.57	1.34	1.60	1.82	1.91	1.19	1.31
Total cost per lamb.....	6.87	6.99	6.76	7.04	7.26	7.34	6.60	6.72
Selling price per 100 pounds, South								
St. Paul‡ .....	9.90	9.90	9.90	9.90	9.90	9.90	9.90	9.90
Selling price per 100 pounds,								
Morris‡ .....	9.05	9.05	9.05	9.05	9.05	9.05	9.05	9.05
Selling price per lamb, Morris‡.....	8.93	8.94	8.64	9.25	9.61	9.65	8.64	8.69
Margin per lamb.....	2.06	1.95	1.84	2.21	2.35	2.31	2.04	1.97

\* In all lots except 7 and 8, linseed meal was fed as 10 per cent of the cracked corn and cut alfalfa mixture. Lot 2 was held to the same daily feed consumption as Lot 1, and Lot 8 to the same feed consumption as Lot 7.

† Feed prices: Whole alfalfa hay, \$7 per ton; shelled corn, 40 cents per bushel; linseed meal, \$45 per ton. The cost of cracking corn was 3 cents per bushel; cost of cutting alfalfa hay, \$2 per ton.

‡ Selling price: Selling price at Morris determined by deducting 85 cents per 100 pounds from selling price at South St. Paul to cover freight, selling expense, and shrink.

cutting of alfalfa hay in itself had no significant advantage when the lambs were hand-fed twice daily.

In both tables 1 and 2, lots 1 and 2 which received linseed meal made slightly larger gains than lots 7 and 8 which received no protein supplement. Feed costs for lots 7 and 8, however, were lower than for lots 1 and 2. In each trial there was no significant difference between the margin per lamb over feed cost for lots 1 and 2 and 7 and 8. The lambs receiving linseed meal in these two trials gained a trifle more rapidly than those not receiving it. This advantage, however, was cancelled by the higher feed cost for the lots receiving linseed meal and resulted in no financial advantage from the feeding of the linseed meal at \$45 per ton compared to the rather low prices of the farm-grown feeds. Had the farm-grown feeds cost double and the linseed meal price remained the same, as is sometimes the case, the financial advantage would have favored the feeding of the linseed meal.

Lots 3, 4, 5, and 6 in both tables 1 and 2 were self-fed varying proportions of cut alfalfa hay and a mixture of 90 per cent cracked corn and 10 per cent linseed meal. The cut hay and the cracked corn-linseed meal mixture were mixed together and fed from self-feeders. In each trial lot 3 received 60 per cent cut hay and 40 per cent cracked corn-linseed meal mixture; lot 4 received 50 per cent cut hay, 50 per cent cracked corn-linseed meal mixture; lot 5 received 40 per cent cut hay, 60 per cent cracked corn-linseed meal mixture; and lot 6 received 30 per cent cut hay, 70 per cent cracked corn-linseed meal mixture. In each trial all four lots were allowed to eat all the whole alfalfa hay they wanted in addition to the cut alfalfa in the self-fed mixture. Lot 6 in each trial was the only lot in which the lambs ate an appreciable amount of the whole alfalfa

hay, though those in lot 5 ate a little additional hay. In each trial the daily rate of gain increased as the percentage of the cracked corn-linseed meal mixture increased. However, the groups of lambs receiving the mixture of 70 per cent cracked corn-linseed meal to 30 per cent hay gained very little faster than those receiving 60 per cent cracked corn-linseed meal and 40 per cent hay. Likewise, there was little difference either in feed cost per 100 pounds gain or in margin per lamb over feed cost between lots 5 and 6 in either trial.

The conclusion can be drawn that fattening lambs can be successfully and profitably fed from self-feeders using a mixture of cracked corn-linseed meal and cut alfalfa hay. It would be safest to start with the lighter mixtures containing 60 to 70 per cent of hay and then gradually increase the percentage of grain until a mixture of 60 to 70 per cent grain and 40 to 30 per cent cut hay is reached after the lambs have been on feed about four weeks. As long as the mixture contains 40 per cent or more of cut hay, there is no advantage in feeding additional hay, but if the mixture is made heavier than this by using more than 60 per cent grain, then additional hay should be provided.

### PROPORTION OF CUT ALFALFA HAY TO CORN

The most satisfactory proportion of cut alfalfa hay to cracked corn to use in self-feeding fattening lambs was not fully determined by the two trials, 1938-39. To determine this proportion an experiment was conducted during the winter of 1939-40. Five lots of 30 lambs each were fattened during the fall. The trial was repeated with five lots receiving exactly the same rations during the winter. No protein supplement was fed. In each trial lot 1 was self-fed a mixture of cracked corn 90 per cent, cut alfalfa 10 per cent; lot 2

**Table 3. Results of First Trial, Conducted November 3, 1939 to January 7, 1940 (65 Days), to Determine Comparative Value of Self-feeding Cut Alfalfa Hay and Cracked Corn With Varying Proportions of Hay to Corn**

Thirty lambs per lot	Rations				
	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
	Self-fed Cracked corn 90 per cent Cut alfalfa 10 per cent Whole alfalfa	Self-fed Cracked corn 80 per cent Cut alfalfa 20 per cent Whole alfalfa	Self-fed Cracked corn 70 per cent Cut alfalfa 30 per cent Whole alfalfa	Self-fed Cracked corn 60 per cent Cut alfalfa 40 per cent Whole alfalfa	Self-fed Cracked corn 60 per cent Cut alfalfa 40 per cent Whole alfalfa
Initial weight per lamb, lb.....	67.14	67.00	66.97	65.97	66.04
Final weight per lamb, lb.....	98.36	98.43	97.55	96.71	98.61
Average gain per lamb, lb.....	31.22	31.43	30.58	30.73	32.57
Average daily gain, lb.....	.480	.483	.470	.473	.501
Average daily ration, lb.					
Cracked corn .....	2.02	2.03	1.77	1.68	1.83
Cut alfalfa .....	.22	.50	.76	1.11	1.21
Whole alfalfa .....	.81	.76	.66	.53	.....
Feed per 100 lb. gain, lb.					
Cracked corn .....	422.01	418.56	375.90	354.00	363.66
Total alfalfa .....	216.39	262.24	300.90	346.00	242.44
Cost of feed per 100 lb. gain*	\$4.34	\$4.50	\$4.30	\$4.33	\$4.11
Initial cost of lamb per 100					
lb., Morris .....	8.43	8.43	8.43	8.43	8.43
Initial cost per lamb .....	5.66	5.65	5.65	5.56	5.57
Feed cost per lamb .....	1.32	1.41	1.31	1.33	1.34
Total cost per lamb .....	6.98	7.06	6.96	6.89	6.91
Selling price per 100 lb., So.					
St. Paul† .....	8.75	8.75	8.75	8.75	8.75
Selling price per 100 lb.,					
Morris† .....	8.00	8.00	8.00	8.00	8.00
Selling price per lamb, Morris†	7.87	7.87	7.80	7.74	7.89
Margin per lamb .....	.89	.81	.84	.85	.98

\* Feed prices: Whole alfalfa hay, \$6 per ton; shelled corn, 45 cents per bushel. The cost of cutting alfalfa hay was \$2 per ton; cost of cracking corn, 6 cents per 100 pounds.

† Selling price: Selling price at Morris determined by deducting 75 cents per 100 pounds from selling price at South St. Paul to cover freight, selling expense, and shrink.

was self-fed a mixture of cracked corn 80 per cent, cut alfalfa 20 per cent; lot 3 was self-fed a mixture of cracked corn 70 per cent, cut alfalfa 30 per cent; and lot 4 was self-fed a mixture of cracked corn 60 per cent, cut alfalfa 40 per cent. The above four lots were allowed whole alfalfa hay in addition. Lot 5 was self-fed a mixture of cracked corn 60 per cent, cut alfalfa 40 per cent, and received no alfalfa hay in addition. Results of the two trials are given in tables 3 and 4.

A study of the tables reveals the following results. All lambs in both trials

made large gains. All gains were made at low cost. The lambs in lot 1, second trial, experienced excessive scouring on one or two occasions, which may explain the lower gain in that lot. No advantage can be claimed for the ration of 90 per cent cracked corn, 10 per cent cut alfalfa. In fact, this ration fed lot 1 seemed the least desirable.

The amount of whole alfalfa hay consumed daily per lamb decreased as the percentage of cut alfalfa in the self-fed mixture increased. The amount of corn consumed per 100 pounds gain decreased as the amount of corn in the

Table 4. Results of Second Trial, Conducted February 9, 1940 to May 7, 1940 (87 Days), to Determine Comparative Value of Self-feeding Cut Alfalfa Hay and Cracked Corn With Varying Proportions of Hay to Corn

	Rations				
	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
	Self-fed Cracked corn 90 per cent Cut alfalfa 10 per cent Whole alfalfa	Self-fed Cracked corn 80 per cent Cut alfalfa 20 per cent Whole alfalfa	Self-fed Cracked corn 70 per cent Cut alfalfa 30 per cent Whole alfalfa	Self-fed Cracked corn 60 per cent Cut alfalfa 40 per cent Whole alfalfa	Self-fed Cracked corn 60 per cent Cut alfalfa 40 per cent Whole alfalfa
Thirty lambs per lot					
Initial weight per lamb, lb.....	66.06	65.05	65.20	65.50	65.26
Final weight of shorn lambs, lb. ....	93.93	97.02	98.84	102.33	98.53
Weight of fleece, lb. ....	7.53	7.20	6.93	7.00	7.06
Final weight of lamb plus fleece, lb. ....	101.46	104.22	105.77	109.33	105.59
Average gain per lamb, lb. ....	35.40	39.17	40.57	43.83	40.33
Average daily gain, lb. ....	.407	.450	.466	.504	.463
Average daily ration, lb.					
Cracked corn .....	1.73	1.88	1.81	1.66	1.92
Cut alfalfa .....	.19	.47	.78	1.10	1.27
Whole alfalfa .....	.90	.75	.70	.56	.....
Feed per 100 lb. gain, lb.					
Cracked corn .....	425.25	418.24	389.62	328.38	413.52
Total alfalfa .....	268.95	271.76	316.68	330.32	275.68
Cost of feed per 100 lb. gain*	\$ 4.35	\$ 4.15	\$ 3.88	\$ 3.26	\$ 3.68
Initial cost of lamb per 100 lb., Morris .....	8.62	8.62	8.62	8.62	8.62
Initial cost per lamb .....	5.49	5.61	5.62	5.65	5.62
Feed cost per lamb .....	1.54	1.62	1.57	1.43	1.48
Cost of shearing per lamb .....	.16	.16	.16	.16	.16
Total cost per lamb .....	7.39	7.39	7.35	7.24	7.26
Selling price per 100 lb., So. St. Paul† .....	9.25	9.25	9.25	9.25	9.25
Selling price per 100 lb., Morris† .....	8.30	8.30	8.30	8.30	8.30
Selling price per lamb, Morris†	7.80	8.05	8.20	8.49	8.18
Value of wool per lamb .....	2.10	2.10	2.10	2.10	2.10
Value of lamb plus wool, Morris .....	9.90	10.15	10.30	10.59	10.28
Margin per lamb .....	2.51	2.76	2.85	3.35	3.02

\* Feed prices: Whole alfalfa hay, \$6 per ton; shelled corn, 45 cents per bushel. The cost of cutting alfalfa hay was \$2 per ton, cost of cracking corn, 6 cents per 100 pounds.

† Selling price: Selling price at Morris determined by deducting 95 cents per 100 pounds from selling price at South St. Paul to cover freight, selling expense, and shrink.

self-fed mixture decreased. The amount of alfalfa consumed per 100 pounds gain increased as the amount of cut alfalfa in the self-fed mixture increased. At the feed prices charged, the proportion of corn to alfalfa had little effect on the cost of feed per 100 pounds gain.

The comparison between lots 4 and 5 in each trial is important because

these two lots received the same mixture of 60 per cent cracked corn and 40 per cent cut alfalfa from the self-feeder, and in each trial the lambs in lot 4 were allowed to eat what additional whole alfalfa hay they would. In each trial the lambs in lot 4 ate about one-half pound of whole alfalfa hay per head per day and three tenths of a pound less of the mixture of

Table 5. Results of Trials to Determine Comparative Value of Various Corn and Oats Mixtures When Self-fed  
 First Trial—November 3, 1939 to January 7, 1940 (65 Days)  
 Second Trial—February 9, 1940 to May 7, 1940 (87 Days)

	Rations			
	First trial		Second trial	
	Lot 1	Lot 2	Lot 1	Lot 2
	Self-fed Shelled corn 75 per cent Whole oats 25 per cent Alfalfa	Self-fed Ground corn 75 per cent Ground oats 25 per cent Alfalfa	Self-fed Shelled corn 75 per cent Whole oats 25 per cent Alfalfa	Self-fed Ground corn 75 per cent Ground oats 25 per cent Alfalfa
Thirty lambs per lot				
Initial weight, lb.	66.24	66.02	65.18	65.74
Final weight of shorn lamb, lb.			91.90	92.31
Weight of fleece, lb.			6.60	6.73
Final weight of lamb plus fleece, lb.	93.55	94.13	98.50	99.04
Average gain per lamb, lb.	27.31	28.11	33.32	33.30
Average daily gain, lb.	.420	.432	.382	.382
Average daily ration, lb.				
Corn	1.39	1.46	1.30	1.47
Oats	.46	.49	.43	.49
Alfalfa	.90	.90	.84	.87
Feed per 100 lb. gain, lb.				
Corn	330.40	338.50	338.70	383.33
Oats	110.00	112.80	112.90	127.77
Alfalfa	211.80	208.80	218.40	226.70
Cost of feed per 100 lb. gain*	\$4.26	\$4.60	\$4.07	\$5.18
Initial cost of lamb per 100 lb., Morris	8.43	8.43	8.62	8.62
Initial cost per lamb	5.58	5.57	5.62	5.67
Feed cost per lamb	1.16	1.29	1.36	1.72
Cost of shearing per lamb			.16	.16
Total cost per lamb	6.74	6.86	7.14	7.55
Selling price per 100 lb., South St. Paul	8.75	8.75	9.25	9.25
Selling price per 100 lb., Morris†	8.00	8.00	8.30	8.30
Selling price per lamb, Morris†			7.63	7.66
Value of wool per lamb			2.10	2.10
Value of lamb plus wool, Morris	7.48	7.53	9.73	9.76
Margin per lamb	.74	.67	2.59	2.21

\* Feed prices: Whole alfalfa hay, \$6 per ton; shelled corn, 45 cents per bushel; oats, 28 cents per bushel. The cost of grinding corn and oats was 6 cents per 100 pounds.

† Selling price: Selling price at Morris determined by deducting 75 cents per 100 pounds from selling price at South St. Paul, for the first trial, and 95 cents per 100 pounds for the second trial to cover freight, selling expense, and shrink. Difference in shrink accounts for the difference in deduction for the two trials.

cracked corn and cut alfalfa than those in lot 5. Those in lot 4 ate a trifle more total feed than those in lot 5 but the lot 5 lambs ate the larger amount of cracked corn. Differences in results were not large enough to be significant.

It may be concluded from the two trials that fattening lambs can be successfully self-fed mixtures ranging from 90 per cent cracked corn, 10 per cent

cut alfalfa hay to 60 per cent cracked corn, 40 per cent cut alfalfa. Additional whole alfalfa hay must be provided with all mixtures containing less than 40 per cent cut alfalfa so that the lambs may eat as much whole hay as they choose. While lambs will eat some whole alfalfa when receiving the mixture of 60 per cent corn, 40 per cent cut alfalfa, it seems unimportant whether

Table 6. Results of Trials, Conducted October 29, 1941 to January 22, 1942 (85 Days), to Determine Comparative Value of Several Plans of Feeding Fattening Lambs

	Rations					
	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6
	Hand-fed Shelled corn Alfalfa	Self-fed Shelled corn 70 per cent Whole oats 30 per cent Alfalfa	Self-fed Ground corn 80 per cent Cut alfalfa 20 per cent Alfalfa	Self-fed Ground corn 70 per cent Cut alfalfa 30 per cent Alfalfa	Self-fed Ground corn 60 per cent Cut alfalfa 40 per cent Alfalfa	Self-fed Ground corn 60 per cent Cut alfalfa 40 per cent
Thirty lambs per lot						
Initial weight, lb. ....	62.66	62.98	64.22	64.11	63.06	62.97
Final weight, lb. ....	96.78	97.97	101.93	101.92	100.61	103.81
Average gain per lamb, lb. ....	34.12	34.99	37.71	37.80	37.54	40.93
Average daily gain, lb. ....	.401	.416	.443	.444	.441	.480
Average daily ration, lb.						
Corn .....	1.55	1.30	1.90	1.69	1.52	1.80
Oats .....	.....	.55	.....	.....	.....	.....
Cut alfalfa .....	.....	.....	.58	.72	1.02	1.20
Whole alfalfa .....	1.31	1.11	.96	.95	.93	.32*
Total .....	2.86	2.95	3.44	3.36	3.47	3.32
Feed per 100 lb. gain, lb.						
Corn .....	387.00	314.79	421.70	384.2	345.9	374.7
Oats .....	.....	134.91	.....	.....	.....	.....
Cut alfalfa .....	.....	.....	105.40	164.6	230.6	249.9
Whole alfalfa .....	327.10	271.20	216.50	213.8	212.1	68.1*
Total .....	714.10	720.90	743.60	762.6	788.6	692.7
Cost of feed per 100 lb. gain†.....	\$ 5.80	\$ 6.39	\$ 6.54	\$ 6.56	\$ 6.22	\$ 6.09
Initial cost of lamb per 100 lb., Morris....	11.09	11.09	11.09	11.09	11.09	11.09
Initial cost per lamb .....	6.95	6.98	7.12	7.11	6.99	6.98
Feed cost per lamb .....	1.98	2.23	2.46	2.47	2.33	2.49
Total cost per lamb .....	8.94	9.21	9.58	9.58	9.32	9.47
Selling price per 100 lb., South St. Paul‡	12.00	12.00	12.00	12.00	12.00	12.00
Selling price per 100 lb., Morris‡.....	11.00	11.00	11.00	11.00	11.00	11.00
Selling price per lamb, Morris‡.....	10.65	10.78	11.21	11.21	11.07	11.42
Margin per lamb .....	1.71	1.57	1.63	1.63	1.77	1.95

\* A little whole alfalfa was fed to Lot 6 during the early part of the trial before the lambs were allowed access to the self-feeder.

† Feed prices: Whole alfalfa hay, \$8 per ton; shelled corn, 65 cents per bushel; oats, 40 cents per bushel. The cost of cutting alfalfa hay was \$2 per ton; cost of cracking corn, 6 cents per 100 pounds.

‡ Selling price: Selling price at Morris determined by deducting \$1 per 100 pounds from selling price at South St. Paul to cover freight, selling expense, and shrink.

the additional hay is provided or not. Feeding is simplified a little if the 60 per cent corn, 40 per cent alfalfa mixture is self-fed and the feeding of additional hay omitted. This plan is highly recommended as a method of feeding fattening lambs.

### SELF-FEEDING A CORN AND OATS MIXTURE

During the fall and winter of 1939-40 two lots of 30 lambs each were self-fed a mixture of shelled corn 75 per cent, whole oats 25 per cent, and two were fed ground shelled corn 75 per cent and ground oats 25 per cent. All lots were allowed what whole alfalfa hay they cared to eat. The object was to determine if a light bulky grain such as oats could be used instead of cut alfalfa hay to dilute the corn for self-feeding. Two lots were fed whole corn and oats and two ground corn and oats to determine if it was necessary or advantageous to grind these two grains for self-feeding. See table 5.

It was shown by this trial that lambs may be successfully self-fed a grain mixture of 75 per cent corn, 25 per cent oats using the grain either whole or ground. The lambs on both rations remained on feed in a highly satisfactory manner in both trials. In both trials the daily rate of gain was slightly lower, the amount of grain consumed per 100 pounds gain slightly higher, the feed cost per 100 pounds gain slightly higher, and the margin per lamb slightly smaller when the corn and oats mixture was self-fed than when cracked corn and cut alfalfa was self-fed in mixtures of 60 to 70 per cent cracked corn and 40 to 30 per cent cut

alfalfa as in lots 3, 4, and 5 in tables 3 and 4. The cut alfalfa probably possesses a slight advantage over oats for mixing with corn for self-feeding because of its higher protein content and lower cost per ton.

### CRACKED SHELLED CORN AND CUT ALFALFA HAY

The feeding experiment carried on during the fall of 1941 further studied fattening lambs by self-feeding a mixture of cracked corn and cut alfalfa hay. The experiment included one lot of 30 lambs hand-fed shelled corn and whole alfalfa hay, one lot self-fed shelled corn and oats, and four lots self-fed varying proportions of cracked shelled corn and cut alfalfa hay. Two of the four receiving cracked corn and cut alfalfa were self-fed cracked corn 60 per cent, cut alfalfa 40 per cent, one receiving additional whole alfalfa, the other no additional hay. Results are given in table 6.

Results of this experiment verify those secured in previous experiments. Again the self-fed ration of corn and oats failed to show quite as satisfactory as the self-fed rations of cracked corn and cut alfalfa hay. The ration of 60 per cent cracked shelled corn and 40 per cent cut alfalfa hay either with additional whole alfalfa hay allowed or without additional hay proved highly satisfactory from every standpoint. When this proportion of corn to hay is used in the self-fed mixture, it is unimportant whether additional hay is fed or not. Gains are made on slightly less total feed and at slightly lower cost when no additional hay is allowed than when hay is allowed.



## *Results of Previous Experiments*

**B**ECAUSE they are just as applicable now as when the trials were made, the results secured in experiments carried on between 1926 and 1938 are briefly summarized as follows.

**Feeding ear corn**—Two lots of 30 lambs each fed shelled corn made more rapid gains with a lower feed consumption and feed cost per 100 pounds gain and returned a slightly larger net profit per lamb than two similar lots fed ear corn. But the lambs receiving ear corn made very satisfactory gains. They soon learned to get the corn off the cob and could clean up their full feed in a short time. While the feeding of shelled corn proved a trifle more profitable than the feeding of ear corn, the difference was small. The lamb feeder need not worry over the outcome if for any reason it seems desirable to feed ear corn rather than shelled corn, especially during early fall when new crop corn is still too soft and green to shell readily.

**Ground ear corn**—Two lots of 30 lambs each fed ground ear corn were compared with two lots receiving whole ear corn. Grinding the ear corn into corn-and-cob meal showed no advantage over feeding whole ear corn. The rate of gain was practically the same, with the cost of gains slightly higher for the lots fed the ground ear corn. If corn is high in moisture content, grinding is not desirable because such corn-and-cob meal tends to heat in the bin necessitating frequent grinding. The lambs receiving ground ear corn left practically all of the small particles of cob in the feed trough.

**Barley as the grain**—Two lots of 30 lambs each were fed whole barley as their grain ration and compared with two lots fed shelled corn. The lambs

fed shelled corn made slightly larger daily gains than those fed whole barley, required a trifle less feed per 100 pounds gain, made their gains at slightly lower cost, and sold at slightly higher price. Although barley was about 10 per cent less efficient than shelled corn, pound for pound, the lambs fed whole barley made rapid gains and demonstrated whole barley to be highly satisfactory for fattening.

**Ground barley**—Because barley is a rather hard grain and covered with a close-fitting, fibrous husk, it seems logical that grinding would improve its palatability and possibly its digestibility. Results contradicted this assumption. The lambs receiving whole barley ate more barley per day, made more rapid daily gains, required less feed per 100 pounds gain, and returned an appreciably larger margin over feed cost than those fed ground barley. The most logical explanation for this is that sheep like clean feed and prefer to eat the whole barley rather than the dusty ground barley. Apparently the lambs were able to digest the whole barley as well as the ground barley. The superior results from feeding the whole barley were due to the larger daily consumption of feed.

**Oats as all or part of the grain**—Two lots of lambs fed oats of normal weight per measured bushel as the only grain throughout a fattening period failed to gain or fatten as rapidly as lambs receiving corn or barley. Lack of sufficient finish resulted in a lower selling price per pound and an appreciably lower profit for the oats-fed lambs than those receiving corn or barley. The lambs receiving oats made fair gains but made their gains in growth rather than fat. It appeared from their condition after 75 days on a full feed that

they would need to be carried to excessive weights before they would show satisfactory slaughter condition.

Two plans were followed to determine whether there might be an advantage in adding some oats to the grain ration of corn or barley. In one plan, oats was fed as the only grain during the first half of the feeding period and shelled corn during the last half. In the second plan, a mixture of 60 per cent corn or barley and 40 per cent oats was fed throughout the feeding period.

The two plans of feeding oats with corn or barley were tried because it has always been supposed that lambs would start on feed better if they were fed a high percentage of oats during the early part of the feeding period, the assumption being that lambs started on a more bulky grain ration could be brought to full feed with less digestive disturbance than if they were started right out on such heavy grains as barley or corn. Twelve lots of 30 lambs each were fed in this trial. The results showed no apparent advantage in feeding oats during the first half and corn or barley during the last half of the feeding period as contrasted with feeding part corn or barley and part oats throughout the feeding period.

The lots receiving corn or barley as the only grain throughout the entire feeding period returned a larger margin over feed cost than did those fed oats in addition by either plan. The results justify the conclusion that where corn or barley is available, there is no advantage in adding any oats to the ration unless they are 25 per cent lower in price, pound for pound, than corn, or 15 per cent lower in price than barley. Oats are unquestionably the best grain on which to start lambs on feed, but the oats can be eliminated from the ration in ten days' to two weeks' time without risk of digestive disturbances. With very little risk a

careful feeder can start lambs on corn or barley without the addition of any oats.

**Rye and wheat as grains for fattening lambs**—Rye and wheat, the bread grains, are usually higher in price pound for pound than corn, barley, or oats. However, it occasionally happens that both sell lower than the coarse grains for short times. In two trials testing the comparative feeding value of rye and wheat to the other grains it was found that either could be fed alone or in combination with oats, barley, or corn as the grain ration with satisfactory results. Rye and wheat have about the same feeding value, pound for pound, as corn or a good quality of barley. Results were slightly in favor of feeding both grains whole rather than ground.

In feeding rye always make sure that it is not high in ergot content. Nearly all rye contains some ergot, but occasionally the ergot content will be so high as to cause poisoning. An ergot content above .5 per cent is considered dangerous. The rye fed in the above experiments contained only .03 to .06 per cent of ergot.

**Millet seed as a grain for fattening lambs**—Two trials were made using millet seed as the grain for fattening lambs. To one lot the millet seed was fed whole; for the other it was finely ground. Both lots were compared to others receiving corn as the grain. Results showed that lambs could be fairly satisfactorily fattened by feeding millet seed. The millet seed was fed in rations in which prairie hay was the roughage. To insure sufficient protein and calcium, one fifth of a pound of linseed meal per lamb per day and one pound of ground limestone to each 100 pounds of grain were added.

The ground seed gave considerably better results than the whole seed, indicating that millet seed should always be ground when used as all or a part

of the grain ration. While no digestive disturbances were experienced in the lambs receiving millet seed, the results indicate that the ground seed can be given a value only about 70 per cent and the whole seed a value only 50 per cent the value of corn as a grain for fattening lambs.

**Dry beet pulp and beet molasses—**

Two trials in each of which eight lots of 30 lambs were fattened were made to study the suitability of beet molasses, dry beet pulp, and molasses pulp as substitutes for farm-grown grains. Each of the three feeds was fed with barley comprising one half of the grain ration. In some lots linseed meal was added; in others no protein supplement was fed. Alfalfa was the roughage fed to all lots. The above rations were compared with one composed of corn and alfalfa and one composed of corn, linseed meal, and alfalfa.

In both trials, good gains were secured when clear molasses, clear dry pulp, or molasses pulp replaced one half of the barley in the ration of barley, linseed meal, and alfalfa hay. When the beet by-product feeds were added to the ration of alfalfa hay and barley only, without linseed meal, the gains were lower and the margin of profit smaller than when linseed meal was included. This indicates that the beet by-product feeds are low in protein, requiring a protein supplement when they are fed.

There was little difference in the degree of fatness secured from the rations using the different beet by-products compared to the grain ration of barley only or corn only. The results showed that from the standpoint of rate of gain, thrift, and finish secured, beet molasses, dry beet pulp, or a combination of the two, as prepared by the beet sugar factories and called molasses pulp, may satisfactorily be used to replace one half the grain in the usual ration. If beet products are to be used to advantage, they must be purchased

at a price delivered at the farm no higher, ton for ton, than the farm-grown grains, corn and barley.

**The protein supplements—**One of the questions most frequently asked by lamb feeders is, does it pay to feed a protein supplement? A protein supplement must be purchased and that means a cash outlay and the use of less home-grown feed. During the 16 years of experimenting with lamb fattening, a protein supplement was added to some rations and not to others. Several trials were made to study specifically the importance of a protein supplement. The results of these and a study of all of the trials indicate that faster gains are always made and a higher finish attained through a normal feeding period of 75 to 90 days when a protein supplement is added to the ration of farm-grown grains and hay, whether the hay be leguminous or non-leguminous.

Usually there is a slightly larger net profit when the protein supplement is added to the ration of grain and a legume hay, but this is not always the case. If the farm feeds are low in value and the protein supplement high, the grain and legume hay ration is likely to show a slightly larger profit without the protein supplement than when the protein supplement is added. In all of the trials, adding a protein supplement to the grain and nonlegume roughage resulted in appreciably faster gains, a higher finish, and a larger profit. A protein supplement should always be fed with a nonlegume roughage.

Linseed meal, corn gluten meal, cottonseed meal, and dry rendered tankage were tried as protein supplements. The first three were fed singly and in combinations of two or all three. Usually one fifth of a pound per head per day was allowed. Differences in results that could be credited to the specific protein supplement that was used were of minor significance. A good plan to follow in buying a protein supple-

ment is to buy the one that will supply digestible protein at the lowest cost per pound. There was no advantage in using dry rendered tankage as compared to the other protein supplements. When fed in quantity to supply as much digestible protein as linseed meal, the results were almost identical.

**Mineral supplements for fattening lambs**—The mineral needs of fattening lambs were studied in a trial in which eight lots of 30 lambs each were fattened. Lamb fattening rations composed of farm-grown grains and a legume hay do not require additional minerals. In Minnesota it is often desirable to feed prairie hay or some other nonlegume roughage. In these trials prairie hay was selected as a fair representative of the average nonlegume roughage that might be used. Corn was fed as the grain. All lots received one-fifth pound of linseed meal per lamb per day. Ground limestone was fed to one lot, monobasic phosphate to one lot, bonemeal to one lot, and a complex mineral mixture containing bicarbonate of soda, iron sulphate, copper sulphate, potassium iodide, and sulphur to one lot. The above rations were checked against one lot receiving shelled corn and alfalfa and another lot receiving shelled corn, alfalfa, and linseed meal.

Results showed that the addition of ground limestone or bonemeal to the ration of corn, prairie hay, and linseed meal improved the ration appreciably. No improvement was secured from adding the monobasic phosphate or the complex mineral mixture without the lime or bonemeal. The evidence indicates that the one mineral element needed as a supplement to the corn, prairie hay, and linseed meal ration is calcium and that this can be supplied satisfactorily in either ground limestone or bonemeal. Calcium is usually secured at lower cost in limestone, so limestone may be recommended as the compound that should be used.

Lambs will not eat either limestone or bonemeal if it is fed in a box by itself. If the mineral supplement is used in lamb feeding, it is preferable to mix it with the grain ration at the rate of one pound of mineral to each 100 pounds of grain. Lambs will readily eat a mixture of 50 per cent salt, 50 per cent limestone if they are salt hungry.

**Roughage for fattening lambs**—From one third to one half, by weight, of the lamb-fattening ration may be composed of dry roughage. The kind and quality of roughage fed is important. A study of all the experiments reveals that alfalfa or prairie hay was generally used as the roughage. This was because these two roughages were available at low cost. Several trials were conducted in which the kind of roughage used was the subject of the experiment. It was found from the trials that alfalfa and good quality sweet clover hay produce almost identical results and have the same value ton for ton. When good quality alfalfa or sweet clover hay is available, either one can be fed to the extent of 40 to 50 per cent of the total weight of the ration and when of good quality and fed heavily, neither a protein nor a mineral supplement is needed. If only low quality legume hay is available, it would be a better feeding plan to feed about two thirds of the total weight of the ration in grain and only one third the weight in hay. In this case a protein supplement in the amount of about one fifth of a pound per lamb per day should be fed.

If prairie hay or some other nonlegume roughage is used, the best feeding plan would be a ration of two thirds grain and one third roughage. In this case one-fifth pound per head per day of a protein supplement should be fed and one pound of limestone should be added to each 100 pounds of grain to make sure there will be no deficiency of protein or calcium.

## PURCHASE OF FEEDER LAMBS

The farmer who decides to fatten purchased thin lambs is first confronted with the problem of securing the lambs. The principal source of supply for feeder lambs to be fattened in Minnesota is the northwest range area. It seems logical that feeder lambs originating in the northwest should be secured by Minnesota feeders for direct shipment to the feed lot, with through freight rate and stop-over privilege for fattening. There are many ways in which feeder lambs can be secured for shipment direct to the farm. Among them are the following:

1. The farmer may go out west himself or commission someone to represent him through the summer and contract for lambs for delivery later, or he may go later in the fall and buy for immediate delivery. In securing lambs in this way, he might deal directly with the owner, or he might deal with a livestock commission firm doing business in the west.

2. He may purchase by mail order direct to a rancher or western commission firm.

3. He may place an order with a commission firm doing business in a large central market. Many such firms have reliable representatives stationed in the west during the feeder-lamb market season and are prepared to fill orders for direct shipment from ranch to feed lot.

4. He may place his order with a cooperative selling agency representing a group of ranchers in the west.

5. He may arrange with some rancher in the west to feed a group of lambs "on contract." Under the contract plan of feeding, the rancher retains ownership of the lambs until they are fat and marketed, and the feeder gets a share of the receipts when they are sold. The advantage of this plan to the farmer feeder is that it relieves him of furnishing money to buy feeder lambs. The disadvantage is that he must share profits with the owner.

6. Many feeder lambs are sent to central markets to be sold, and one of the best plans for buying is to go to the central market or place an order with a commission firm to be filled whenever the lambs can be secured at the market.

