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SOME COMPARISONS OF METHODS OF
FATTENING WESTERN LAMBS

By W. G. KAMMLADE



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SOME COMPARISONS OF METHODS OF FATTENING WESTERN LAMBS

By W. G. KAMMLADE, Assistant Chief in Sheep Husbandry

That many farmers in Illinois are interested in sheep feeding is evidenced by the fact that each year thousands of feeder lambs come into Illinois feedlots from public stockyards.¹

Approximately 75 percent of the range lambs fed in the state each year are fed partly or wholly in the fields. On a significant number of farms these lambs may be an important means of utilizing and converting portions of otherwise unmarketable crops into salable commodities. The best methods of field feeding and the relative advantages and disadvantages of this practice compared to dry-lot feeding are, therefore, matters of frequent concern on a considerable number of corn-belt farms. Yet very few experiments dealing with the field feeding of western lambs have been reported by corn-belt experiment stations.

This bulletin reports experiments with various methods both of field feeding and dry-lot feeding, using different rations with each type of feeding. The success with which legumes were used in the rations will be of particular interest, since the growing of them as a part of cropping systems had been demonstrated conclusively to be sound practice for the maintenance of soil fertility and the production of high crop yields. Nine lots of western lambs fed on corn and alfalfa hay gained an average of 100 pounds for every 350 pounds of corn and 458 pounds of alfalfa hay. The average daily gain in these trials was .34 pound per lamb daily. When combined with corn, the legumes, particularly alfalfa, clover, or soybeans, furnished a balance of nutrients well suited to produce gains. Further details about this and other phases of the experiments, which extended over four years and involved twenty lots of lambs, are given in the following pages.

LAMBS USED AND EXPERIMENTAL PROCEDURE

Choice Feeder Lambs in All Trials. Choice feeder lambs, averaging about 60 pounds, were purchased on the Chicago market for all of the experiments. In the 1925 and 1927 tests the lambs were from Oregon shipments. Those used in 1926 were from Washington, and

¹In 1925 the number was 248,000; in 1926, 320,000; in 1927, 193,000; and in 1928, 216,000. These figures from the Bureau of Agricultural Economics, U. S. Department of Agriculture, do not include sheep brought in direct from ranges.

those used in 1928 came from Idaho. All were typical of the black-faced lambs secured by mating Hampshire rams with western ewes carrying about 75 percent Rambouillet blood. All lambs had good health, good constitutions, and dense fleece.

Roughage or Pasture in Preliminary Feeding. In each experiment the lambs were at the farm a few days before the experimental feeding began. During this time each lamb in the 1925 trial received about 1.25 pounds of alfalfa hay daily. In 1926 all of the lambs were pastured on a mixed pasture during the preliminary period. In 1927 the lambs were on a small area of bluegrass and a little clover during the daytime and received some alfalfa hay in the evening when in the lots. The lambs grazed on bluegrass and a little clover during the preliminary period of the 1928 experiment.

Quality of Feeds. All the alfalfa hay used in the experiments was of good quality. The soybean hay was leafy and well cured. This and the soybeans interplanted with the corn were of the Midwest variety. Practically all of the corn fed in dry lot in the first experiment graded No. 2. In the 1926, 1927, and 1928 experiments all but a small amount graded No. 4. The Illinois grown barley used in the 1928 test was very low grade, much of it infested with scab.¹ It averaged about 42 pounds to the bushel. The northern grown barley was very free of scab, of good quality and weighed 49 pounds per bushel.

Field Feeding. When corn is left on the stalks and lambs are turned into the field, the method is referred to as field feeding or "lambing down" of corn. This method of feeding is often modified, and in these experiments included: (1) feeding in a field of corn in which soybeans had been interplanted; (2) feeding in a field of corn and permitting a free run on adjacent alfalfa or mixed pasture; or (3) providing dry roughage when pasture was not available.

Dry-Lot Feeding. The sheep confined in dry lot were fed a variety of rations: (1) shelled corn and alfalfa hay; (2) shelled corn and soybean hay; (3) Illinois grown barley and alfalfa hay; (4) northern grown barley and alfalfa hay; and (5) Illinois grown barley, corn, and alfalfa hay.

There are two methods of dry-lot feeding. *Hand-feeding* is more common and was used in all of the experiments. *Self-feeding* has not been practiced extensively in Illinois. In these tests the lambs were self-fed on: (1) shelled corn and alfalfa hay; (2) ground corn and ground alfalfa hay mixed; (3) ground Illinois barley and ground alfalfa mixed; and (4) ground corn, ground Illinois barley, and ground alfalfa hay mixed.

¹Barley grown in Illinois is usually of better quality than that used in this test and would generally compare much more favorably with the northern grown barley.

In dry lot, the grain and roughages were fed twice a day and were divided equally for the two feedings except when self-fed. In the latter case, grain was fed first, and as soon as it was eaten, roughage was placed in the racks. The appetites of the lambs were the chief guide in feeding. Water and salt were always available in all lots. Straw was used as bedding for the lambs fed in dry lot.

All the grain and roughages fed and all refused feeds were weighed separately for each lot of lambs.

Weighing the Lambs. Individual weights of all lambs were taken on three consecutive days at the beginning of the experiments and at the close. The averages of these weights for each animal were taken as the initial and final weights respectively. Individual weights were taken also at the end of each 28-day period.

Shelter Provided. All lambs fed in dry lot in the first three groups of experiments (1925, 1926, 1927) were fed in an open shed with a southern exposure. Small yards adjoined the sheds. None of the lambs fed in the fields in these years were provided with shelter altho at times the weather was severe. In the last group of experiments (1928) the sheds used had small yards on the east or west side but were not so open as those previously used.

THE 1925 EXPERIMENTS

The first group of experiments, carried on in 1925, was undertaken with three objects in view: (1) to compare rations of shelled corn and alfalfa hay with shelled corn and soybean hay fed in dry lot; (2) to compare "lambing down" of corn alone with field feeding of corn and soybeans interplanted; (3) to compare "lambing down" of corn and soybeans with dry-lot feeding of shelled corn and soybean hay and also with shelled corn and alfalfa hay.

The experiments extended from September 11 to December 14, a period of 95 days. During this time six lots of lambs were fed. Lots 1 and 2 were fed in dry lot, Lots 3 and 5 in the field, and Lots 4 and 6, having been fed in the field for 28 days, were put in dry lot for the remaining 67 days of the test.

SHELLED CORN AND ALFALFA HAY COMPARED WITH SHELLED CORN AND SOYBEAN HAY

Shelled Corn and Alfalfa Hay. The lambs of Lot 1 were fed shelled corn and alfalfa hay during the entire 95-day period in the dry lot. This ration has been used as a standard for comparisons in lamb-feeding work for a number of years, and it is expected that lambs receiving it will gain about one pound every three days. These lambs gained .32 pound per head daily, making a total gain of 30.8 pounds for the 95-day period (Table 1). Each lamb consumed on

an average just 7 pounds less than 2 bushels of corn, along with 138 pounds of alfalfa hay. A small portion of the hay was not eaten.

TABLE 1.—COMPARISON OF FEEDS AND FEEDING METHODS IN FATTENING WESTERN LAMBS, SEPTEMBER 11 TO DECEMBER 14, 1925: 95 DAYS

Ration and method of feeding	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6
	Shelled corn and alfalfa hay, 45 days	Shelled corn and soybean hay, 45 days	Corn and soybean field, ¹ 28 days; soybean hay in field, 67 days	Corn and soybean field, ¹ 28 days; shelled corn and soybean hay in dry lot, 67 days	Cornfield ² 28 days; alfalfa hay in field, 67 days	Cornfield ² 28 days; shelled corn and alfalfa hay in dry lot, 67 days
	dry lot	dry lot	field	lot	field	lot
Number of lambs ³	25	26	25	25	25	26
Weights	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Average initial weight.....	60.3	60.0	60.2	59.7	60.0	60.3
Average final weight.....	91.1	94.3	87.3	91.3	92.7	88.9
Gains						
Average gain.....	30.8	34.3	27.1	31.6	32.7	28.6
Average daily gain.....	.32	.36	.29	.33	.34	.30
Average daily feed						
Corn.....	1.10	1.10	—	1.37 ⁴	—	1.36 ⁴
Haylage.....	1.46	1.82	1.02 ⁴	1.90 ⁴	.80 ⁴	1.60 ⁴
Total feed per lamb						
Corn.....	116.3	118.3	—	161.7 ⁴	—	161.8 ⁴
Haylage.....	138.3	173.3	68.2	211.2 ⁴	55.4 ⁴	167.0 ⁴
Haylage refused ⁴ percent.....	3.2	17.2	—	17.0	—	6.8
Feed for 100 pounds gain						
Corn.....	340.3	341.8	—	565.4 ⁴	—	576.0 ⁴
Haylage.....	449.3	502.3	—	508.0 ⁴	—	490.3 ⁴
Weight in Chicago.....	86.3	86.3	85.3	87.3	86.3	86.2
Slaughter ⁵ in marketing.....	4.7	7.8	4.0	7.7	4.3	4.7
Dressing percentage ⁶	50.3	51.3	50.3	51.3	52.0	50.1
Carcass grades ⁶						
Number choice carcasses.....	1	2	0	3	0	2
Good carcasses.....	18	20	8	15	14	21
Medium carcasses.....	1	0	10	0	3	1
Heavy carcasses.....	1	2	1	2	1	0

¹Area, 2 acres. ²All lots contained 25 lambs at the start; the numbers given are for the close of the experiment. ³These figures refer to the last 67 days; all other figures are for the entire period of 95 days. ⁴Grain not weighed for field-fed lambs. ⁵Based on Chicago weights and on warm carcass weights. ⁶The slaughter data in all experiments were secured from the courtesy of Swift & Company, Chicago.

For every 141 pounds of corn and 449 pounds of hay, these lambs made 100 pounds gain in weight.

The Lot 1 lambs averaged 91.1 pounds at the close of the test at Urbana, 86.4 pounds at Chicago,⁵ and dressed a little over 50 percent.

All lambs received their last feed in the morning of December 14. They were driven about three-fourths of a mile to be loaded on the car. Chicago weights were taken about noon on December 15. The lambs were slaughtered December 16. Dressing percentages are based on warm carcass weights and Chicago live weights.

Shelled Corn and Soybean Hay. The lambs in Lot 2, also fed in dry lot throught the experiment, were given a ration of shelled corn and soybean hay in order to get a direct comparison of the two legume roughages. These lambs gained 34.6 pounds during the 95 days, compared with 30.8 pounds for those of Lot 1 fed shelled corn and alfalfa hay. This is 12 percent greater gain for the soybean lot.² Both lots were fed the same amounts of corn, but the soybean lot received 26 percent more soybean hay than the other lot received of alfalfa hay. Twelve percent more soybean hay than alfalfa hay was weighed back as refuse.

CORN ALONE vs. CORN AND SOYBEANS "LAMBED DOWN"

The other four lots in this group of experiments were fed partly or wholly in the field (Table 1). Lots 3 and 4 were run together in a four-acre field of corn and soybeans for 28 days and Lots 5 and 6 were fed together in a similar field of corn alone for the same length of time. During these 28 days the lambs on the corn and soybeans gained an average of 6.1 pounds compared with an average of 3.0 pounds for the lambs in the corn alone. The soybeans and corn, therefore, produced twice the gain secured by the corn alone. During the first week the soybeans proved to be laxative even tho the lambs were removed to bluegrass lots each evening while becoming accustomed to the feeds in the field.

SUPPLEMENTED FIELD FEEDING vs. DRY-LOT FEEDING

At the end of the first 28-day period almost all the soybeans were eaten. Lots 4 and 6 were removed to dry lots for the remainder of the time, where Lot 4 was fed shelled corn with soybean hay and Lot 6 shelled corn with alfalfa hay. Lots 3 and 5 were left in the fields and fed soybean hay and alfalfa hay respectively. This supplemented feeding of hay was given Lots 3 and 5 because the lambs previously fed corn alone had made very little gain and, since all of the soybeans had been eaten from the field, there was no reason to suppose that the lambs would do well on corn alone. Accordingly the lambs in Lot 3 were given, in a rack in the field, an average of 1.02 pounds of soybean hay daily for each lamb. This was to take the place of the soybeans growing in the field, which the lambs had been eating up to this time.

It was impossible in this test to get a record of the yields of corn and soybeans before the lambs were turned into the fields, and consequently the amounts consumed could not be determined. The data pertaining to the field feeding are interesting and valuable, how-

²This is the third comparison made of these two rations at this Station but is the first time that the soybean lot made the larger gains (see Illinois Station Bulletin 260, "The Soybean Crop for Fattening Western Lambs").

ever, in showing what gains in weight may be expected when lambs are fed under these conditions. No shelter was provided for the lambs in the field, altho the season was rainy and cold.

Shelled Corn and Soybean Hay in Dry Lot Compared With Same Ration in Field. The lambs in Lot 4 were fed a ration of shelled corn and soybean hay in dry lot for 67 days after being removed from the field (Table 1). These lambs made a little larger gain during the 28 days in the field than did those of Lot 3, and for the 95 days they averaged 6.13 pounds a head more gain. During the 67 days that the lambs of Lot 4 were fed in dry lot, they were given .94 pound more soybean hay a head daily than was given to the Lot 3 lambs in the field. They were also fed 1.35 pounds of corn a head daily during this time.

In shipping, the lambs from Lot 3 averaged 1.7 pounds less shrinkage than those from Lot 4 fed in dry lot for a part of the time. However, the dressing percentages and the carcass grades for Lot 4 were higher than for Lot 3.

Alfalfa Hay as Supplement to Corn Alone. The lambs in both Lots 5 and 6 were in a field of corn alone for a period of 28 days, during which time they made very little gain. After this period the lambs in Lot 5 were left in the field and fed an average of .8 pound of alfalfa hay per head in addition to the corn which they gathered. The average daily gains for the lambs in this lot were .15 pound for the first 28 days, .62 pound for the second 28 days and .29 pound for the last 39 days, or an average of .34 pound for the entire 95 days of the test. The very marked increase in rate of gain for the second and third periods compared with that of the first period may be taken as showing the value of the supplementary feeding of alfalfa hay when lambing-down corn alone.

Similar gains were made by the lambs of Lot 6, which were handled under combined field and dry-lot feeding, altho the total gains for the field-fed lambs (Lot 5) exceeded the gains made by those of Lot 6 by 4.1 pounds per lamb even tho the lambs in Lot 6, when in dry lot, were fed twice as much alfalfa hay as those in Lot 5.

More Soybean Hay Than Alfalfa Used as Supplement. Comparisons between Lots 3 and 5 show that the cornfield alone supplemented after the first 28 days with .8 pound of alfalfa hay daily per lamb produced greater gains than corn and soybeans similarly supplemented with 1.02 pounds of soybean hay daily per lamb, after the first 28 days. In making this comparison of the two lots fed in the fields, it is assumed that both lots ate similar quantities of corn during the 95 days.

Lambs fed in dry lot on corn and soybean hay after 28 days in a cornfield with soybeans interplanted (Lot 4), made greater gains

than lambs fed in corn alone for 28 days and then fed corn and alfalfa hay in dry lot (Lot 6), altho the amounts of corn and hay required per 100 pounds of gain were considerably less in the latter lot.

Additional comparisons between field and dry-lot feeding are readily made from Table 1 by comparing Lot 1 with Lots 5 and 6 and Lot 2 with Lots 3 and 4. It will be found that, in so far as rate of gain and the amounts of harvested legume roughages fed are concerned, field feeding compares favorably with dry-lot feeding when similar rations are used.

DRESSING PERCENTAGES IN 1925 EXPERIMENTS

The dressing percentages and carcass grades for each lot in the 1925 experiments are shown in Table 1. While there is a range of 1.9 percent between the high- and low-dressing lots, these differences, because of the value of the pelt, are not so significant as the carcass grades. Lots 1, 2, 4 and 6 contained a large percentage of good to choice carcasses. Those of Lot 3 were most lacking in finish. The heavy carcasses are not desired because of the strong demand for small cuts of lamb. The initial weight of a lamb, however, is a factor in the weight of the carcass; feeding is not alone responsible.

THE 1926 EXPERIMENTS

The purposes of the 1926 experiments were: (1) to compare hand-feeding and self-feeding of a ration of corn and alfalfa hay in dry lot; (2) to compare field feeding of lambs in corn in which soybeans had been planted with free range of a cornfield and alfalfa pasture; and (3) to compare these field rations with a ration of shelled corn and alfalfa hay fed in dry lot.

The tests began on September 17 and ended December 6, a total of 80 days. The lambs were fed for a shorter period than in 1925 because they were heavier at the start of the tests. Five lots of lambs were used. Lots 1, 2, and 3 fed in dry lot contained 25 lambs each and Lots 4 and 5 fed in the fields, 50 lambs each. Table 2 contains a summary of the important data for all lots.

CORN AND LEGUME HAY HAND-FED AND SELF-FED

Corn and Legume Hay Hand-Fed in Dry Lot. The same standard ration used in the 1925 test, shelled corn and alfalfa hay hand-fed, was used in Lot 1 as the basis for comparisons. In the case of these lambs it will be seen that they just about made the expected gain of one pound every three days on this standard ration. The corn used was not over No. 4 grade and this may explain the reduced gain, altho it is too slight to be considered significant. One lamb in this lot made only 14 pounds gain in the 80 days, which reduces the

average gain of the other 24 lambs from 27.8 pounds to 25.7 pounds when this lamb is included.

The daily feed consumption and the feed per 100 pounds gain are almost identical with the corresponding figures in the 1925 experiment except in the case of hay. These figures on feed consumption are important because it is from them that the feeder may figure the probable cost of the gains in weight at any feed prices existing at a particular time.

Corn and Legume Hay Self-Fed in Dry Lot. Twenty-five lambs in Lot 2 were hand-fed the same as Lot 1 for three weeks and then were put on a ration of shelled corn and alfalfa hay placed in two self-feeders; one for the corn and another for the hay. This test of

TABLE 2.—COMPARISON OF FEEDS AND FEEDING METHODS IN FATTENING WESTERN LAMBS, SEPTEMBER 17 TO DECEMBER 6, 1926: 80 DAYS

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5
Ration and method of feeding	Shelled corn, alfalfa hay hand-fed 80 days <i>dry lot</i>	Shelled corn, alfalfa hay hand-fed 21 days, self-fed 45 days ¹ <i>dry lot</i>	Shelled corn, alfalfa hay hand-fed 21 days; ground corn, and alfalfa hay mixed self-fed 59 days <i>dry lot</i>	5.3 acres corn and soybeans 28 days; 1.62 acres corn and .5 lb. alfalfa hay daily last 52 days <i>corn field</i>	1.62 acres corn and 15 acres alfalfa pasture 49 days; same cornfield and .6 lb. alfalfa hay daily last 31 days <i>corn field</i>
Number of lambs ²	25	12	25	50	47
	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>
Weights					
Average initial weight.....	63.3	63.4	63.8	63.5	63.9
Average final weight.....	89.0	....	94.8	85.2	89.3
Gains					
Average gain.....	25.70	....	31.00	21.70	25.50
Average daily gain.....	.32	....	.39	.27	.32
Average daily feed					
Corn ³	1.10	....	1.44	....	....
Roughage.....	1.52	....	1.90	....	....
Total feed per lamb					
Corn.....	87.8	....	115.6	109.0 ⁴	94.8 ⁴
Roughage.....	121.7	....	153.6	25.4 ⁵	18.3 ⁵
Roughage refused.....	4.1%	....	2.3%	....	....
Feed for 100 pounds gain					
Corn.....	341.9	....	373.1	462.0	372.2
Roughage.....	473.7	....	495.9	117.3	71.7
Weight in Chicago.....	82.0	....	89.6	82.2	85.9
Shrinkage in marketing.....	7.0	....	5.2	3.0	3.4
Dressing percentage (warm)...	50.2	....	48.3	49.3	49.9
Carcass grades					
Number good carcasses.....	19	....	24	45	35
Medium carcasses.....	1	....	1	5	6
Heavy carcasses.....	4	....	....	....	6
Cull carcasses.....	1	....	....	....	....

¹Owing to high death loss in Lot 2, no figures are given. ²Lots 1, 2, and 3 contained 25 lambs and Lots 4 and 5, 50 lambs each at the start; these numbers are for the close of the experiment. ³Daily feed figures would not be significant in Lots 3, 4, and 5 as most of the corn was eaten in the last month of feeding. ⁴Calculated to 16-percent moisture basis from carefully estimated yield. ⁵These amounts were fed in the time given in heading. Unknown amounts of roughage were consumed from the fields.

self-feeders was made because in many parts of the state experienced, competent labor is not available for lamb feeding, and while self-feeders are being used in certain sections of the country, the rations fed are different from the one used in this experiment.

At the time the lambs were started on the self-feeders they were eating about .75 pound of corn daily. There was over a 50 percent death loss within a week from overeating. The remaining twelve lambs were continued on the self-feeder without any change for 45 days. During the 66 days, the entire time that these twelve lambs were on feed, they made an average gain of 24.6 pounds, or a daily gain of .37 pound. This result suggests that perhaps the chief difficulty in self-feeding lambs on shelled corn and alfalfa hay may be in starting them on the feed, since these lambs did not show any ill effects of self-feeding after the first week.

Rapid Gains on Mixed Ration Self-Fed in Dry Lot. After 21 days of hand-feeding, as in Lot 1, the lambs of Lot 3 were also put on a self-feeder. In this case the corn and alfalfa hay were ground and the two feeds mixed together and fed in the same proportion of corn to hay as was used in Lot 1. Because of the bulky ration there was no difficulty in Lot 3 from overeating. The gain in this lot was 20.6 percent higher than in Lot 1 for the same period. Likewise the total feed consumption and the feed required per 100 pounds gain were larger than for Lot 1 lambs. The lambs in Lot 3 ate 9.1 percent more corn and 4.03 percent more hay per 100 pounds gain. The greater feed consumption per 100 pounds gain may be explained partly by the higher finish of the Lot 3 lambs. These lambs gained an average of 5.3 pounds more than the lambs of Lot 1.

FIELD FEEDING OF CORN AND SOYBEANS COMPARED WITH FREE RUN OF CORNFIELD AND ALFALFA PASTURE

Small Gains in Field of Corn and Soybeans. Lots 4 and 5 were field fed. The lambs of Lot 4 were first turned into a field of approximately 5.3 acres of corn interplanted with soybeans. There was a 45 to 50 percent stand of soybeans. The lambs were in this field 28 days, during which time they gained only 2.9 pounds per head, or .1 pound per day. This is a small gain, as the lambs in Lot 1 fed in dry lot gained over 7 pounds per head in the same time. The lambs had eaten all of the soybeans by the end of this 28-day period and they then were put in 1.62 acres of corn. Since there were no soybeans in this field, the lambs were fed .5 pound of alfalfa hay a head each day in a rack in the field. The gain during the next 28-day period was 14.9 pounds per lamb. The total gain for the 80 days in this lot amounted to 21.7 pounds, 4 pounds less than the gain for the lambs of Lot 1 receiving the standard ration.

During the first 28 days that the Lot 4 lambs were in the larger field, they ate very little corn. The exact amount eaten could not be determined and is not included in the figures in Table 2 on feed consumption for this lot. The corn in the smaller field was all consumed three days before the close of the test. During these three days the lambs were fed shelled corn and the amounts included in the figures on feed consumption. These lambs required 462 pounds of corn per 100 pounds gain. This is 120 pounds more than for Lot 1. As an average, each lamb in the field ate 12 pounds more corn and gained 4 pounds less in weight than each lamb hand-fed in dry lot.

Good Gains in Cornfield Adjoining Alfalfa. Lot 5 is one of the most interesting groups in the 1926 experiments. These lambs were put in a field of 1.62 acres of corn on September 17. There was no intercrop with the corn, but the lambs were allowed to run on an adjoining field of 15 acres of alfalfa until November 5.

It would have been very inconvenient to remove the lambs of either Lot 4 or Lot 5 from the fields while they were getting accustomed to the feeds. Contrary to what is usually advocated for the first week in starting lambs on feed, the Lot 5 lambs were not taken from the alfalfa after being turned on, but were permitted to pasture on it continuously from September 17 to November 5. In spite of pasturing wet and frozen alfalfa, there were only a few mild cases of bloat and no severe cases of scours. While pasturing on the alfalfa, the lambs ate practically no corn.

During the first 28 days these lambs made an average gain of 12.1 pounds per lamb compared with 2.9 pounds per lamb in Lot 4 on corn and soybeans. The total gain for the 80 days was 25.5 pounds per lamb in Lot 5, practically the same as for the Lot 1 lambs fed in dry lot. As nearly as could be determined, each of these lambs ate 94.8 pounds of corn, including a small amount of shelled corn fed during the last few days as in Lot 4. The corn consumed per 100 pounds gain was 372.2 pounds, which includes the small amount wasted. This is 30.3 pounds more than was fed for 100 pounds gain in Lot 1. Because the lambs of Lot 5 harvested the major portion of their roughage, and alfalfa hay was fed only after the alfalfa pasture had been plowed under, the total alfalfa hay consumed per lamb was 18.3 pounds, and per 100 pounds gain was only 71.7 pounds. If all of the corn and alfalfa hay fed is charged to the lambs and the alfalfa pasture is not charged, the Lot 5 lambs were fed much more economically than any other lot.

These lambs brought the same price per pound as the others and dressed practically the same—49.9 percent as compared with 50.2 percent for the lambs of Lot 1. The carcass grades may be taken as indicating the possibilities of securing a good "finish" with this type of feeding.

THE 1927 EXPERIMENTS

A third group of experiments was carried out in 1927 for the purpose of comparing: (1) a ration of shelled corn and alfalfa hay hand-fed with ground corn and ground alfalfa hay, self-fed, and (2) to compare field feeding on mixed pasture and in a cornfield with a hand-fed ration of corn and alfalfa in dry lot. Other experimental work at this time prevented the use of more than three lots of western range lambs in this project. Experimental feeding started on September 23 and continued until December 17; thus the lambs were on feed for 85 days.

SHELLED CORN AND ALFALFA HAY HAND-FED

Twenty-five lambs, weighing 59.0 pounds, were used in Lot 1 and were hand-fed shelled corn and alfalfa hay. These lambs were good feeders, eating on an average 1.2 pounds of corn and 1.7 pounds of alfalfa hay daily. This is a larger daily consumption than was shown in either of the two previous trials and is reflected in the larger gain in weight made by these lambs (Table 3). Each lamb gained 32.2 pounds in the 85-day period, which represents a daily gain of .38 pound. These lambs were fed 308.8 pounds of shelled corn and 435.7 pounds of alfalfa hay for each 100 pounds gain in weight. This lot of lambs made rapid and economical gains in so far as pounds of feed per 100 pounds gain is concerned, requiring less corn and hay than similar lots in the 1925 and 1926 trials.

The average dressing percentage of the lambs in this lot when slaughtered in Chicago, was 51.2. Except for the fact that some of the carcasses were too heavy, they were a satisfactory lot.

GROUND CORN AND GROUND ALFALFA HAY SELF-FED

The results secured in Lot 2 are unusual in several respects. The 24 lambs in this lot were hand-fed for five days at the start. This was necessary because the construction of the self-feeder was delayed. They were then self-fed ground corn and ground alfalfa hay for 80 days. The proportion of corn to hay was as nearly the same as the proportion fed in Lot 1 as was possible. This reduced the differences in the two lots to the uncontrollable differences in the lambs themselves and to the difference in the way the rations were fed.

The lambs on the self-feeder ate .09 pound more corn and .17 pound more hay daily than the hand-fed lambs. They also gained .05 pound more each day, which amounted to 4.1 pounds more for the 85 days. The fact that the self-fed lambs each weighed a little over 5 pounds more than the lambs of Lot 1 in Chicago and dressed a like percentage shows that the greater feed-lot gain was due not to extra "fill" but to actual body weight.

The proportions of corn to hay fed each week were approximately as follows:

Week	Pounds of corn	Pounds of hay
1	1	35
2	1	28
3	1	26
4	1	16
5	1	15
6	1	13
7	1	11
8 to 12	1	10

TABLE 3.—COMPARISON OF FEEDS AND FEEDING METHODS IN FATTENING WESTERN LAMBS, SEPTEMBER 26 TO DECEMBER 17, 1927: 85 DAYS

Factor and method of feeding	Lot 1	Lot 2	Lot 3
	Shelled corn, alfalfa hay hand-fed	Ground corn, ground alfalfa hay, mixed self-fed	Mixed pasture and access to corncfield 35 days; put into corncfield and fed alfalfa hay 25 days, in shed 5 days
Number of lambs ¹	25	26	44
Weights	lbs.	lbs.	lbs.
Average initial weight	38.0	38.7	38.0
Average final weight	101.2	101.0	85.5
Gains			
Average gain	63.2	62.3	47.5
Average daily gain	.76	.62	.56
Average daily feed			
Corn	1.57	1.26	2.80 ²
Haylage	1.65	1.82	.77 ³
Total feed per lamb			
Corn	99.6	117.1	66.75
Haylage	141.3	133.3	22.95
Haylage refused	2.19 ⁴	—	—
Feed for 100 pounds gain			
Corn	208.8	294.9	227.3
Haylage	423.7	426.3	66.6 ⁴
Weight in Chicago	66.8	62.1	62.9
Shrinkage in marketing	4.4	3.9	1.6
Dressing percentage (warm)	73.2	71.2	69.7
Carcass grades			
Number good carcasses	16	11	20
Medium carcasses	—	—	2
Heavy carcasses ⁵	9	16	12

¹Lots 1 and 2 contained 25 lambs and Lot 3, 44 lambs at the start. One died in Lot 2 from pneumonia; 2 in Lot 3 from the same cause and 1 as a result of attack by dogs. ²Average for last 30 days; very little corn eaten prior to this time. ³Average for last 30 days. ⁴Pasture in addition. ⁵Even the well finished, the heavy carcasses do not grade good.

The self-fed lambs required 294.9 pounds of corn and 428.3 pounds of hay per 100 pounds gain in weight. This is a saving of 13.9 pounds of corn and 7.4 pounds of hay per 100 pounds gain compared with the amounts required in the hand-fed lot.

Apparently there is little danger of digestive disturbances when lambs are self-fed on a ration of this kind, and it may prove an economical and safe method for many feeders.

FIELD FEEDING COMPARED WITH DRY LOT

The 44 remaining lambs in this group of experiments were fed in the fields without shelter, except during the night of November 30 and from December 13 to 17 (Lot 3, Table 3). These were extremely severe storm periods and at the latter period it was necessary to keep the lambs in the shed to facilitate weighing.

The lambs were on 15 acres of mixed pasture, consisting chiefly of clovers and timothy, during the first 55 days of the experiment. Altho they had access to standing corn, they would not eat corn until they were penned in a small area of the cornfield. This was done on November 18, after which alfalfa hay was fed in a rack in the field.

The gain in weight per lamb for the 85 days was 26.5 pounds. This very probably would have been larger had it not been for an attack by dogs during which three lambs were killed and the rest thereby exhausted.

Each lamb in this lot ate 86.75 pounds of corn, or a daily average for the 85 days of 1.02 pounds. However, all but a very small amount of this corn was eaten during the last 30 days, so that the amount of corn eaten daily during this time amounted to over 2.8 pounds per lamb, which is an extremely large amount. How to control the amount of corn eaten is one of the main difficulties encountered in "lambling-down" corn. Altho a number of lambs did overeat on corn, there were no losses. The amount of corn wasted was very small.

The lambs were thin and densely fleeced and withstood severe weather. They made good gains on pasture and when lambling-down corn with alfalfa hay self-fed in a rack in the field. The gains averaged 5.7 pounds less per lamb in this lot than were secured by hand-feeding on shelled corn and alfalfa hay in dry lot (Lot 1).

THE 1928 EXPERIMENTS

The experiments conducted in 1928 were planned: (1) to compare corn and barley as feeds; (2) to compare the feeding value of Illinois with northern-grown barley; and (3) to compare hand-feeding of shelled corn and alfalfa hay or whole barley and alfalfa with self-feeding of ground corn and ground alfalfa mixed, ground Illinois barley and ground alfalfa mixed, and ground corn, ground barley and ground alfalfa mixed.

After the lambs had been weighed and divided into six lots, they were turned together as one group on a pasture of about 15 acres

which was mainly bluegrass but contained some other grasses and clovers. The lambs were on pasture during the day for four weeks but were kept in dry lot at night. They were given no extra feed except on one occasion when fed 1.2 pounds of alfalfa hay per lamb. The average daily gain for all lots while on pasture was .147 pound. The smallest gain during this time was made by the lambs of Lot 3, .12 pound daily, and the largest by those of Lot 2, .17 pound. These six lots of lambs similar in every respect and all on the same pasture show as much variation in rate of gain during this preliminary period as is sometimes found and considered significant when lambs are fed differently. Thus, rather larger differences should exist or the small differences must be repeatedly demonstrated before one ration or method of feeding is proved superior to another.

After this period on pasture, the lambs were separated into their respective lots and each lot fed a definite ration (Table 4).

COMPARISON OF CORN AND BARLEY AS FEEDS

Usual Result Obtained With Standard Ration. During the 80 days in dry lot the lambs in Lot 1, hand-fed on shelled corn and alfalfa hay, responded in about the usual way, gaining .31 pound daily and carrying a good finish at the close of the experiment. The lambs were started on .25 pound of corn daily and when on full feed ate about 1.6 pounds of corn per day, averaging 1.21 pounds per day for the 80 days. The average daily hay consumption amounted to 1.52 pounds. These lambs ate 390 pounds of corn and 463 pounds of hay for each 100 pounds of gain. These amounts are higher than the requirements generally found at this Station when this ration is used. However, the figures are not unduly large.

These experiments indicate that farmers who have legume roughage and corn are well equipped to fatten lambs in so far as feeds are concerned. Of course, this ration may be modified in various ways by the use of silage and other feeds.

Self-Feeding Produced Faster Gains. The lambs of Lot 2 were self-fed on a mixture of ground corn and ground alfalfa hay. Compared with the hand-fed lambs of Lot 1, the self-fed lambs of Lot 2 gained more rapidly and carried a better finish, the gain being 16 percent greater in Lot 2. Each lamb in the lot was fed 28.4 percent more corn and 28.7 percent more hay than was fed per lamb in Lot 1. The amount of feed per 100 pounds gain was larger in the self-fed than in the hand-fed lot, consisting of 6.4 percent more corn and 13.4 percent more hay. There are conditions, however, under which the lambs of Lot 2 would return a somewhat larger profit than the lambs of Lot 1 even tho' the feed cost per unit of gain is greater. This happened to be true in the test, because of the greater total gain and the selling margin.

TABLE 4.—COMPARISON OF FEEDS AND FEEDING METHODS IN FATTENING WESTERN LAMBS, SEPTEMBER 30, 1928 TO JANUARY 15, 1929: 108 DAYS
(28 days pasture, 80 days dry lot)

Ration and method of feeding	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6
	Shelled corn, alfalfa hay	Corn and alfalfa ground, mixed	Whole Illinois barley, alfalfa hay	Whole northern barley, alfalfa hay	Illinois barley and alfalfa ground, mixed	Corn, Illinois barley, alfalfa hay, equal parts ground, mixed
	hand-fed	self-fed	hand-fed	hand-fed	self-fed	self-fed
Number of lambs	25	25	25	24 ¹	25	25
Weights	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>	<i>lbs.</i>
Average initial weight	661.7	661.8	661.3	661.4	661.3	661.9
Average final weight	868.7	941.4	885.1	865.8	941.7	961.3
Gains (on pasture)						
Average gain	4.135	4.655	3.337	4.033	4.337	4.137
Average daily gain	.135	.157	.122	.134	.143	.135
Gains (in dry lot)						
Average gain	24.875	29.041	23.306	24.341	29.455	25.255
Average daily gain	.311	.366	.293	.304	.377	.322
Average daily feed						
Grain	11.211	11.769	11.225	11.229	11.566	11.455
Roughage	11.522	11.961	11.541	11.588	11.966	11.855
Total feed a lamb						
Grain	97.0	124.6	106.0	112.0	124.3	116.3
Roughage	121.6	156.6	123.0	126.6	156.3	146.3
Feed for 100 pounds gain						
Grain	3040	4115	4228	4225	4122	4200
Roughage	4465	5225	5075	4495	5220	5080
Weight in Chicago	84.6	91.2	92.0	86.1	97.5	97.5
Shrinkage in marketing	4.1	3.2	5.2	2.7	7.2	2.8
Dressing percentage ²	52.0	52.1	51.2	52.0	56.2	51.4
Carcass grades ³						
Number choice carcasses	3	2	5	4 ⁴	5	1
Good carcasses	7	2	10	6	8	4
Medium carcasses	0	0	0	1	0	1
Heavy carcasses	2	0	0	4	3	2
Strong-weight	12	10	8	8	8	13

¹Numbers refer to lambs completing test. Death of the lamb in Lot 4 was due to pneumonitis.

²Based on warm carcass weight; shrink 2 1/2 percent. ³Carcasses weighing over 50 pounds were classed as heavy and those weighing from 40 to 50 pounds as strong-weight. These heavier carcasses all showed good finish. One average lamb of each lot was killed at Urbana. ⁴It is possible that there is a slight error in this data for Lots 4 and 6 as one lamb from Lot 6 got into Lot 4 when being driven to the killing plant.

The proportion of corn to hay was the same in both lots. There was some difficulty in keeping the lambs of Lot 1 on feed at all times. Because of the bulkiness of the ground-corn ground-hay ration fed to the lambs of Lot 2, they seemed always to be on feed, showing no signs of serious digestive disturbances. Careful grinding of the corn and hay so that there will not be a large amount of very fine material is necessary since this is not attractive to lambs. The latter statements apply to all the lambs which were self-fed (Lots 2, 5, and 6) in this group of experiments.

Lambs Ate "Scabby" Barley. The lambs in Lot 3 were fed Illinois-grown barley in place of the corn fed to the lambs of Lot 1.

Alfalfa hay was the roughage fed in both cases. Altho the barley was of low grade, much of it being infested with scab, and weighed about 42 pounds a bushel, it did not prove unpalatable to the lambs. Lambs hand-fed on this whole barley gained only 1.5 pounds less per head during the 80-day period than the lambs of Lot 1 fed shelled corn. The two lots did not vary much in the amounts of grain and hay eaten, altho the barley-fed lambs ate 38 pounds more barley and 42 pounds more hay per 100 pounds gain than the corn-fed lambs. The finish on the barley-fed lambs was not so firm as on the corn-fed lambs, and the barley-fed lambs shrank more in shipping. Little difference in other respects was noted between the two lots.

NORTHERN BARLEY LITTLE BETTER THAN ILLINOIS

A comparison between good quality northern-grown barley weighing 49 pounds per bushel and the Illinois barley was made with the lambs of Lots 3 and 4. The lambs of Lot 4 fed the good barley gained only .1 pound, or 4.7 percent, more per head in the 80 days and ate 2.9 percent more barley and 2.9 percent more hay than the lambs of Lot 3. There was little difference in the amounts consumed per 100 pounds gain in the two lots. Apparently there was little difference in the gain-producing value of the low-grade barley and the good barley when fed with alfalfa hay, altho the good barley produced a firmer finish and the lambs lost less in shipping. The barley was fed whole to both lots of lambs.

HAND- AND SELF-FEEDING WITH AND WITHOUT BARLEY

Self-Feeding With Barley Compared With Corn. A further comparison of Illinois grown barley and corn was made. The lambs in Lot 5 were self-fed on a mixture of ground Illinois barley and ground alfalfa hay. Thus Lots 2 and 5 afforded a direct comparison between corn and barley and Lots 3 and 5 a comparison of the two methods of feeding barley and alfalfa hay. There was practically no difference in rate of gain, feed consumed, or feed required per 100 pounds of gain for the two self-fed lots (Table 4). It would seem that good results are possible with low-grade barley when a liberal amount of good alfalfa hay is fed. The results in both Lots 3 and 5 bear out this statement, altho the average gain per lamb of Lot 5, self-fed, was 26 percent greater than that for the lambs of Lot 3, hand-fed. The self-fed lambs ate 16 pounds less barley but 15 pounds more alfalfa hay per 100 pounds gain in weight than the hand-fed lambs. The shrinkage in the lambs of Lot 5 during shipment was excessive, amounting to 7.2 pounds per head. The lambs of Lot 3 also showed a big shrinkage but dressed higher than those of Lot 5.

Mixed Grain Self-Fed. In planning the experiment it was thought that the scabby barley might be unpalatable to the lambs and that

they might eat it more readily and do better if it was mixed with corn. Lot 6 was included for this reason. The ration consisted of a mixture of equal parts, by weight, of ground Illinois barley and ground corn self-fed when mixed with ground alfalfa hay.

The results show, however, that the lambs did not gain as well as when barley or corn was self-fed with alfalfa hay. The lambs in Lot 6 did not eat as much feed as did those in either of the other self-fed lots and gained but little more than the lambs that were hand-fed. This poor showing was due largely to the low gains made by three lambs, and there is no apparent reason to expect a mixture of two feeds to produce lower gains than the poorer one alone. The lambs fed both corn and scabby barley shrank less in shipping than did those in any of the other lots except Lot 4.

The slaughter data show a high percentage of strong and heavy-weight carcasses in all lots. However, when these lambs were sold there was but slight discrimination against the heavier lambs. Lambs somewhat lighter than those of Lot 2 especially are usually preferred.

FINANCIAL CONSIDERATIONS

No financial tables are included in this bulletin, as data from experimental projects such as these are of value to the lamb feeder only when he interprets the results in accordance with his own conditions. The data given herein are useful in showing what may be expected under similar conditions of feeding. The cost of feeding a lamb and the cost per 100 pounds gain are easily calculated from the data on feed consumption, using any prevailing prices for feeds.

It may be of interest to feeders to know, however, that the lambs used in the 1925 tests cost \$15.60 per hundredweight in Chicago and all lots sold for \$16.15. In 1926 the corresponding figures were \$14.75 and \$13.25. In 1927 the cost per hundredweight was \$13.75. Lot 1 sold for \$13.00, Lot 2 for \$12.75 and Lot 3 for \$13.25. While Lots 1 and 2 were better finished than Lot 3 they were too heavy when marketed. In the 1928 experiments the lambs cost \$14.00 per hundredweight in Chicago and all lots sold for \$17.25 altho Lots 1, 3 and 4 were valued previous to shipping at 15 cents per hundredweight less than the lambs of Lots 2, 5, and 6.

SUMMARY AND CONCLUSIONS

Alfalfa Hay Compared With Soybean Hay. Compared with alfalfa hay, soybean hay was less efficient pound for pound when fed with shelled corn in dry lot. Taking two previous comparisons (see Bulletin 260 of this Station) and the 1925 experiments into consideration, the lamb feeder might expect to secure approximately the same

gain on western lambs from either roughage, but because of the greater amount of refuse in the soybean hay he would need to feed about 15 percent more of it than of alfalfa hay to get similar results.

Self-Feeding Compared With Hand-Feeding. Self-feeding western lambs on shelled corn and alfalfa hay resulted in a very high loss of lambs. It was difficult to start the lambs on such a ration when self-fed, and unless lambs can be kept from overeating, this method of feeding is likely to be accompanied with heavy losses.

Self-feeding on a mixture of ground corn and ground alfalfa hay, however, proved to be a safe method of feeding, resulting in more rapid gains and better finished carcasses than hand-feeding on shelled corn and alfalfa hay. The feed required per 100 pounds gain was greater in the self-fed lots. As an average for the three experiments in which this comparison was made, the hand-fed lambs required 347 pounds of shelled corn and 457 pounds of alfalfa hay for 100 pounds gain, and the self-fed lambs required 361 pounds of ground corn and 483 pounds of ground alfalfa hay.

Ground barley and ground alfalfa hay mixed and self-fed may be expected to produce faster gains than whole barley and alfalfa hay hand-fed, altho the feed required per 100 pounds gain is apt to be less when lambs are hand-fed for the same length of time.

Barley Compared With Corn. Altho only based on one test it may be said that Illinois grown barley of poor quality, hand-fed whole or self-fed ground and mixed with ground alfalfa hay was palatable to lambs. Lambs fed Illinois barley were softer fleshed, made slower gains, and had a higher feed requirement per 100 pounds gain than lambs fed corn. There was little difference between the Illinois barley and northern barley.

Field Feeding. Corn alone is not satisfactory for field feeding western lambs. Soybeans planted in the corn, an adjoining pasture of alfalfa, a mixed pasture, or dry legume roughages fed to lambs in cornfields proved satisfactory supplements. Field feeding in this way may be expected to produce gains somewhat below the gains secured in dry-lot feeding on corn and alfalfa hay.

Almost as good gains were secured by "lambing down" corn when the corn was supplemented with legume hays as were obtained by field feeding during the early part of the feeding period and then finishing in dry lot on shelled corn and alfalfa hay or shelled corn and soybean hay. Death losses in field feeding are likely to be greater than in dry-lot feeding.

Individual differences in lambs, variations in climate and in available feeds, and changes in these factors within a locality from year to year make each lot of lambs a special problem which must be studied as feeding operations are being planned.

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