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W. M. Larson
South Dakota State University

L. B. Embry

R. M. Luther

South Dakota State University
Brookings, South Dakota

Department of Animal Science
Agricultural Experiment Station

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Performance of Lambs Fed Rations With Oyster Shells or Various Levels of Hay

W. M. Larson[1], L. B. Embry and R. M. Luther

High-concentrate rations have been shown to have several advantages in large cattle feeding operations because they produce high rates of gain with low feed requirements. It has been a common practice to feed lambs rations with relatively high levels of roughage. However, lamb feeders might also benefit under many conditions if results similar to those with cattle fed high-concentrate rations could be obtained with lambs. Little research has been reported on the relative value for lambs of all-concentrate rations and those with low levels of roughage or roughage replacers such as oyster shells. Two experiments were conducted to study feedlot performance of lambs fed rations which contained oyster shells or various levels of hay.

Procedures

Experiment 1

Three hundred sixty lambs with an equal number of ewes and wethers were used in the experiment. Five experimental treatments included an all-concentrate ration and rations which contained 3% oyster shells or 3, 10 or 20% alfalfa hay. Lambs of each sex were allotted into three weight groups giving six pens with 12 lambs for each of the five ration treatments. Average initial weights for the three weight groups were 68.4, 77.4 and 84.7 lb., respectively, for the light, medium and heavy groups.

Ingredient composition of the rations fed as a complete mix is shown in table 1. All rations were formulated to contain about 12% protein, 0.25% phosphorus and 0.3% calcium, disregarding the calcium in the oyster shells. The alfalfa hay was good quality second-cutting, and it was ground in a hammer mill using a 1-inch screen.

Lambs in all treatment groups were started on feed with 0.5 lb. of the appropriate feed mix and 1.5 lb. of hay per head daily. The hay was gradually reduced until eliminated over a 10-day period and the experimental rations were increased by 0.2 lb. per head daily until a full feed was reached. Thereafter, feed was offered in amounts to be available at times. The lambs were drenched with thiabendozole, vaccinated for control of enterotoxemia and implanted with 3 mg. of diethylstilbestrol.

[1]Present address: Kansas Agricultural Experiment Station, Colby Branch Station - Colby, Kansas.

The lambs were marketed when each weight group reached an average weight of about 130 lb. This resulted in feeding periods of 70 to 100 days from the beginning of the experiment on November 9. Kidneys and bladders were collected from the lambs at slaughter and examined for incidence of calculi. Weight gain and feed data are presented only for lambs completing the experiment. When a loss occurred, an average amount of feed for one lamb was deducted from the total up to that time.

Experiment 2

Three hundred twenty-four lambs averaging about 70 lb. were used in the second experiment. They were divided into three groups which consisted of ewe lambs from Texas, ewe lambs from western South Dakota and wether lambs from western South Dakota. Two replicated pens of 9 lambs from each group were assigned to six ration treatments giving six pens for each of the experimental treatments. Experimental rations were the same as for experiment 1 except oyster shells were omitted and two higher levels of hay (40 and 60%) were added (table 2).

Source of ingredients and preparation of the rations were as in experiment 1. All rations were formulated to contain at least 0.5% calcium in an attempt to reduce the problem from urinary calculi which was encountered in the first experiment. The lambs were started on feed with 1 lb. of the appropriate feed mix and 1.5 lb. of alfalfa hay per head daily. The hay was gradually reduced until eliminated over an 8-day period. Experimental rations were increased by 0.2 lb. daily until the lambs were on full-feed. Other feeding and management procedures were essentially the same as for experiment 1.

Due to severe weather conditions, all lambs were marketed on January 13 after 102 days from the beginning of the experiment. This resulted in some variation in final weights between treatment groups. However, these lambs were not allotted into weight groups initially as for experiment 1. Data were collected at slaughter as for the first experiment.

Results

Experiment 1

Data pertaining to feedlot performance, carcass characteristics and incidence of urinary calculi are presented in table 3. The experiment was initiated with 72 lambs in each ration treatment group. Three lambs died from overeating disease in each of the 3% oyster shells, 10% hay and 20% hay treatments. Two losses occurred from this cause in the all-concentrate group but none in the group fed the ration with 3% hay. The remaining losses were from urinary calculi with numbers shown in table 3 as clinical cases.

The lambs gained exceptionally well on all rations with only small differences between treatment groups. Feed consumption was increased by including oyster shells or hay in the ration with the increase being most pronounced at the two high levels of hay. Total concentrates (corn and supplement) required per pound of gain varied only slightly between levels of hay. Therefore, the alfalfa hay fed at 3, 10 or 20% of the ration resulted in relatively small savings in concentrates in comparison to the all-concentrate ration, but total feed requirements increased with increasing levels of hay. Oyster shells resulted in a slight saving of concentrates per unit of gaining, amounting to 0.57 lb. per pound of the oyster shells.

Only small differences were observed between treatments for the carcass characteristics studied. Incidence of urinary calculi was high in the all-concentrate group, amounting to 22 of the lambs. The incidence of this condition was less in the presence of 3% oyster shells and higher in lambs fed rations with 3% hay. In groups fed higher levels of hay, incidence of calculi was about the same as for those fed the all-concentrate ration.

Data pertaining to weight groups and sex are presented in table 4. When live weights were used as the basis for calculating average daily gain, lambs with heavier initial weights appeared to gain more rapidly during the experiment. The heavier lambs had a lower dressing percent but were graded about the same as the light lambs. When rate of gain was adjusted to an equal dressing percent, heavy and medium weight lambs gained at about the same rate and only slightly more than for the light lambs.

Wether lambs averaged 6.6 lb. more initially than ewe lambs and gained at an 8% faster rate. Wethers consumed more feed than ewes resulting in only small differences in feed efficiency between them. Dressing percent and carcass grade were about the same for ewes and wethers.

Experiment 2

There were 54 lambs initially in all treatment groups in experiment 2 (table 5). Some losses occurred with all being diagnosed as resulting from overeating. Increasing the level of hay appeared to have no effect in reducing the losses from this disease.

Lambs fed the all-concentrate ration had the highest rate of gain. Weight gains were reduced slightly by including hay at 3, 10 or 20% of the ration, but there were only small differences between these levels of hay. There was a marked reduction in rate of gain when the level of hay was increased from 20 to 40% of the ration. A further reduction, but to a smaller extent, occurred when the level of hay was increased to 60%.

Feed consumption was about the same for rations with 0, 3 or 10% hay but increased with increasing levels of hay. Total feed requirements increased with increasing levels of hay. Levels of hay up to 40% of the ration appeared to have only a slight effect on concentrates (corn and supplement) required per unit of gain. With hay at 60% of the ration, there was a reduction in concentrate requirements. However, the higher hay requirement resulted in a low concentrate replacement value even for this level of hay.

There were no large differences in dressing percent except lambs fed the ration with 60% hay dressed lower than the other lambs. Degree of finish and carcass grade did not appear to be affected up to the 20% level of hay. These carcass characteristics were lowered by the higher levels of hay. However, lambs on the 40 and 60% level of hay were somewhat lighter at slaughter.

No clinical cases of urinary calculi were encountered in this experiment. Incidence of calculi found at slaughter did not appear to be related to level of hay and was considerably lower than in experiment 1.

Discussion

Death losses from enterotoxemia amounted to 3.0 and 6.5% in experiments 1 and 2, respectively. The incidence of this disease did not appear to be reduced by increasing the level of hay. Although the lambs were vaccinated for control of enterotoxemia and were fed chlortetracycline, it appears quite likely that immunity had not developed sufficiently and that the antibiotic intake had not reached adequate levels during the first few days of the experiments when most of the losses occurred. It would appear, however, that lambs can be fed rations with low levels or even no conventional roughage with no more problems from enterotoxemia than when fed diets with more common levels (40 to 60%) of roughage.

Oyster shells appeared to offer little, if any, benefit as an addition to the all-concentrate ration. Levels of hay up to 20% of the ration had only a slight effect on rate of gain in comparison to the all-concentrate ration. However, there was a pronounced reduction in gain with higher levels of hay.

Lambs with heavier initial weights appeared to respond to the all-concentrate ration better than the lighter lambs in experiment 1. On the other hand, the light lambs gained faster than the heavy lambs when fed rations which contained hay. Wether lambs also gained best on the all-concentrate ration while the lighter ewes did not perform as well on this ration as on those containing hay. These results would be in agreement with cattle research involving steers and heifers and cattle of various weights and finish. Large animals lacking in finish or those maturing at heavier weights appear to be benefited more by high-energy rations.

There was little effect on concentrate requirements per unit of gain of hay up to 20% of the ration in experiment 1. Therefore, the hay had a low replacement for concentrates. In experiment 2, gains were lower and feed requirements were higher; but the results were in general agreement with experiment 1 as to the effect of roughage level of rate of gain, feed consumption and feed requirements with levels of hay up to 20% of the ration. At the two higher levels of hay in experiment 2 where gains were substantially reduced, feed requirements were markedly high. Only with the 60% level of hay were concentrate requirements per unit of gain reduced to any appreciable extent, but the higher hay requirements with this ration still resulted in a low replacement value of hay for the concentrates.

Levels of hay up to 20% of the ration had little effect on carcass characteristics studied in the experiments. Apparently, there was little difference in amount of carcass fat with hay up to this level as measured by finish score and carcass grade. Lambs fed higher levels of hay had lower scores for finish and grade, but they were slaughtered at lighter weights.

In experiment 1, the rations were calculated to contain 0.3% calcium, excluding calcium in oyster shells. Incidence of urinary calculi was high in all treatments except in the one which contained 3% oyster shells. It would thus appear that the elevated level of calcium in this ration was effective in reducing calculi formation. Calcium levels were increased to 0.5% in experiment 2 and no death losses were attributed to calculi. The calculi founded in the kidneys of these lambs at slaughter were primarily silicious in nature and were considered to have been formed prior to the start of the experiment. Lambs fed rations with 3% hay in experiment 1 had a higher incidence of calculi than those fed rations with higher levels of hay. This apparent difference between various levels of hay in rations which were about equal in calcium content needs further investigation.

Summary

Two feeding trials involving 684 lambs were conducted to study the effect of adding 3% oyster shells or 3, 10, 20, 40 or 60% alfalfa hay to an all-concentrate ration based on rolled shelled corn with supplements. Several death losses occurred from enterotoxemia, but they did not appear to be related to the level of hay in the ration.

Weight gains were similar in experiment 1 for lambs fed rations with 0 to 20% hay. In experiment 2, gains decreased slightly with increasing levels of hay up to 20% and were markedly reduced with 40 and 60% levels of hay. Feed requirements increased with increasing levels of hay while concentrate requirements remained relatively constant, resulting in a low value for alfalfa hay in terms of concentrate replacement value at all levels of hay tested in these experiments.

Carcass characteristics were not affected by the level of hay up to 20% of the ration. However, finish and grade were lower for lambs fed rations with 40 to 60% hay and marketed at lighter weights.

Oyster shells offered little improvement over the all-concentrate ration in terms of gain and carcass characteristics. They did reduce concentrate requirements slightly resulting in a replacement value of 0.57 lb. of concentrates per pound of oyster shells.

Incidence of urinary calculi was high in experiment 1 when rations were calculated to contain 0.3% calcium. A higher level of calcium provided by oyster shells reduced the incidence of calculi. The incidence was higher in presence of 3% hay than at the other levels. Phosphatic calculi was not a problem in the second experiment when the calcium level of rations was increased to 0.5%.

Table 1. Percentage Composition of Rations[a] - Experiment 1.

Ingredients	0 Hay	3% O.S.	3% Hay	10% Hay	20% Hay
Rolled shelled corn	89.5	86.0	87.0	81.8	74.0
Soybean meal	9.0	9.5	8.5	7.0	5.0
Oyster shells	----	3.0	----	----	----
Alfalfa hay	----	----	3.0	10.0	20.0
Ground limestone	0.7	0.7	0.7	0.4	0.2
Trace mineral salt	0.5	0.5	0.5	0.5	0.5
Potassium chloride	0.3	0.3	0.3	0.3	0.3

[a] All rations contained 1500 I.U. vitamin A, 300 I.U. vitamin D, 8.0 I.U. vitamin E and 4 mg. chlortetracycline per lb.

Table 2. Percent Composition of Rations[a] - Experiment 2.

Ingredients	0 Hay	3% Hay	10% Hay	20% Hay	40% Hay	60% Hay
Rolled shelled corn	88.6	86.3	80.6	72.9	56.9	39.1
Soybean meal	9.2	8.6	7.5	5.5	2.0	----
Alfalfa hay	----	3.0	10.0	20.0	40.0	60.0
Ground limestone	1.3	1.2	1.0	0.7	0.2	----
Trace mineral salt	0.6	0.6	0.6	0.6	0.6	0.6
Potassium chloride	0.3	0.3	0.3	0.3	0.3	0.3

[a] All rations contained 1000 I.U. vitamin A, 8.0 I.U. vitamin E and 10 mg. chlortetracycline per lb.

Table 3. Effect of Oyster Shells or Level of Hay in Rations for Lambs - Experiment 1

Item	0 Hay	3% O.S.	3% Hay	10% Hay	20% Hay
No. of lambs	69	69	61	63	66
Av. days fed	85	85	85	85	85
Initial wt.,lb.	76.3	77.2	76.6	76.6	77.2
Final wt.,lb.	131.1	132.9	132.0	131.1	130.0
Av. daily gain,lb.	0.65	0.67	0.66	0.65	0.63
Av. daily ration,lb.	3.06	3.15	3.15	3.30	3.50
Feed/lb. gain,lb.					
Corn	4.03	3.92	4.00	4.02	3.98
Supplement	0.47	0.50	0.46	0.40	0.32
Alfalfa hay[a]	0.17	0.17	0.31	0.66	1.26
Oyster shells	------	0.14	------	------	------
Total	4.67	4.73	4.77	5.08	5.56
Dressing percent	48.5	48.5	49.2	48.4	49.3
Finish[b]	6.1	6.3	5.8	6.2	6.0
Carcass grade[c]	21.2	21.9	21.2	21.6	21.2
Urinary calculi incidence,%					
Clinical[d]	1	0	11	6	3
Total[e]	22	7	43	26	25

[a]10 lb. hay per lamb fed in all treatment groups during first 10 days.
[b]Small, 5; modest, 6.
[c]Choice, 20; prime, 23.
[d]Death due to urine blockage.
[e]Included losses due to urine blockage and animals having mineral deposits in kidneys and bladder at termination of the experiment.

Table 4. Effects of Initial Weight and Sex on Feedlot Performance and Carcass Characteristics of Lambs Fed High-Concentrate Rations - Experiment 1

Item	Light	Medium	Heavy	Ewes	Wethers
No. of lambs	114	115	113	169	159
Av. days fed	100	84	70	82	87
Initial wt.,lb.	68.4	77.4	84.7	73.4	80.0
Final wt.,lb.	130.5	131.1	132.9	124.5	138.4
Av. daily gain,lb.					
Observed live	0.62	0.64	0.69	0.63	0.68
Adjusted[a]	0.62	0.64	0.64	-----	------
Av. daily ration,lb.	3.19	3.19	3.30	3.12	3.32
Feed/lb. gain,lb.					
Observed live	5.14	4.98	4.78	5.01	4.92
Adjusted [a]	5.14	4.98	5.17	------	------
Dressing percent	49.3	49.2	47.9	48.8	48.7
Carcass grade[b]	20.9	21.8	21.5	21.3	21.5

[a]Gain adjusted to 49.2% carcass yield.
[b]Choice, 20; prime, 23.

Table 5. Effect of Level of Hay in Rations for Lambs - Experiment 2 (102 Days)

Item	0 Hay	3% Hay	10% Hay	20% Hay	40% Hay	60% Hay
No. of lambs	49	53	49	51	51	50
Initial wt.,lb.	69.5	69.3	69.5	69.3	69.3	69.3
Final wt.,lb.	128.3	124.5	123.6	124.1	106.0	100.1
Av. daily gain,lb.	0.58	0.54	0.53	0.54	0.36	0.30
Av. daily ration,lb.	3.17	3.12	3.21	3.45	3.32	3.41
Feed/lb. gain,lb.						
Corn	4.81	4.89	4.81	4.64	5.10	4.43
Supplement	0.62	0.61	0.57	0.46	0.29	0.11
Alfalfa hay[a]	0.11	0.29	0.71	1.40	3.76	7.02
Total	5.54	5.79	6.09	6.50	9.15	11.56
Dressing percent	50.5	51.2	50.5	49.9	50.4	49.1
Finish[b]	5.7	5.9	5.9	5.2	4.7	4.4
Carcass grade[c]	20.5	20.8	20.9	20.7	19.8	19.3
Urinary calculi incidence,%[d]	12.2	13.2	18.4	13.7	5.9	16.0

[a]6.6 lb. hay per lamb fed in all treatment groups during first 8 days.
[b]Slight, 4; Small,5; Modest,6.
[c]Choice,20; Prime,23.
[d]Percent of animals yielding calculi after 102 days on treatment.