COMPARATIVE EFFICIENCY OF UTILIZATION OF PELLETED AND UNPELLETED RATIONS OF VARYING CONCENTRATIONS FOR FATTENING LAMBS

by

LEONARD EVERETTE HAYS

B. S., University of Missouri, 1948

A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Husbandry

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1956

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INTRODUCTION

The pelleting of finely ground grain, feed concentrates, and forages has become a fairly common practice. Interest has been shown by commercial lamb feeders in completely pelleted lamb fattening rations varying in proportion of roughages to concentrates. Several studies have been conducted at different experiment stations to determine the feed efficiency and rate of gain of pelleted rations versus non-pelleted rations for lambs. The results of these studies indicate that pelleted rations produce greater gains with greater feed efficiency than similar, but non-pelleted, rations.

Very little is reported in the literature comparing dehydrated alfalfa meal with suncured alfalfa hay when used in pellet form and only one report has been recorded showing the comparisons of digestion trials and balance studies with lambs fed completely pelleted rations and similar unpelleted rations. This experiment was performed to further study the feed-lot efficiency and utilization of pelleted and unpelleted rations with varying concentrations of hay and grain for fattening lambs. The comparative value of suncured alfalfa hay and dehydrated alfalfa meal in the pellet form was also studied.

REVIEW OF LITERATURE

Neale (8) of the New Mexico Agricultural Experiment Station has conducted some of the most extensive tests with pelleted rations for sheep. Neale's original interest in 1950 was to utilize low quality alfalfa hay by combining it with grain and molasses into a pellet form.

In 1953 Neale (8) published the results of three years of feeding trials in which self-fed pellets were made from the low quality alfalfa hay, sorghum grain and molasses. The non-pelleted ration was composed of bright green, fairly fine stemmed alfalfa hay and sorghum grain. The pelleted ration, in spite of the low quality hay used, produced an average increase of 0.13 pound daily gain per head and saved an average of 3.47 pounds of feed per 100 pounds of gain. The feeding period was also reduced by an average of 20 days by self-feeding the pelleted rations. The cost of labor for self-feeding was much lower than for hand-feeding.

In later trials by Neale (9), different levels of alfalfa (50 percent, 60 percent, and 70 percent) in the pellets were tested with both light and heavy lambs. In terms of daily gains and feed efficiency, the light lambs did better on the pellets containing 60 percent or 70 percent alfalfa than they did on the pellets containing 50 percent alfalfa. With heavy lambs the performance was definitely better with the pellets containing the higher percentage of alfalfa. The percentage roughage and concentrate that seemed most efficient was 73 and 27, respectively. A crude fiber percentage of 15 to 20 percent, a nitrogen-free extract of 48 to 50 percent, and a calculated total digestible nutrient percentage below 60 percent seemed to be best in these self-fed cubed mixtures.

Similar results were obtained at the Illinois Agricultural Experiment Station (Cate, et al., 3). Feeding trials with lambs in which pelleted rations containing timothy hay as well as alfalfa hay were studied. These studies were conducted to determine the effect of self-fed pelleted and self-fed meal rations of varied quality on the rate and economy of gain. The full-fed rations in all lots contained 60 percent concentrates and 40 percent

roughage. Considerable improvement in daily gain and feed efficiency was obtained when timothy hay was the roughage. Lambs on pelleted timothy rations outgained lambs on loose rations of corn and alfalfa. This agrees with Neale's report in that pelleting offers a means of using low quality, low cost roughages to an advantage, but pelleting of the ration containing alfalfa meal and corn was of slight value, hardly enough to warrant the cost of pelleting.

Thomas, et al. (12) reported that lambs fed either partially pelleted or completely pelleted rations gained faster than lambs fed the whole grains; but, although the selling price was higher for lambs fed the pellets, the returns were less because of the increased cost of pelleting the rations. The carcass grades obtained indicated that more choice lambs were produced from lambs fed the complete pellet. The authors reported that the lambs fed the complete pelleted rations appeared to go on feed quicker and have less digestive trouble than the other lambs.

The Sutter Basin Land Company of California (5) made one of the first attempts at large scale feeding of pellets to feeder lambs. The Company had 30,000 feeder lambs on a pelleted ration consisting of 70 percent roughage and 30 percent concentrate mix that contained 57 percent dehydrated alfalfa meal, 35 percent barley and eight percent molasses. The lambs on the pelleted ration gained an average of 0.48 pound per day and were upgraded from strictly commercials to better than 90 percent choice grade. The results of the large scale feeding showed an 800 pound consumption of loose feed compared to 625 pounds of pellets for the same number of sheep fed for the same number of days.

It should be pointed out that the studies of Neale (8, 9), Cate, et al. (3), Thomas, et al. (12) and the Sutter Basin Land Company (5) were complicated by the presence of molasses in the rations fed. Thomas stated that dried beet pulp apparently added to the palatability of a ration and helped prevent digestive disorders. Lambs fed a ration containing dried beet pulp made more economical gains than lambs fed rations without dried beet pulp.

In a different type of study excluding molasses from the rations, Bell, et al. (1) found that pelleting a ration with a ratio of either 65 percent alfalfa hay to 35 percent corn or 55 percent alfalfa hay to 45 percent corn, resulted in greater gains per lamb. However, at the price level used, the lambs fed the non-pelleted rations gave the greatest returns. A ratio of 55 percent roughage to 45 percent concentrates produced greater and more efficient gains than the 65-35 ratio in both pelleted and unpelleted rations.

John (6) obtained uniform results in digestion studies. He reported that the percentage of fiber digested in the pelleted rations was only half as great as the percentage of fiber digested in the unpelleted rations. Digestion coefficients of the pelleted feeds were higher for protein and ether extract; therefore, there were no noticeable differences in the total digestible nutrients in the pelleted and unpelleted rations. John also reported that the lambs fed the pelleted rations retained a much higher average percent of nitrogen than the lambs on similar but unpelleted feeds. This could be expected as the feeding trials showed an increase in rate of gain over the lambs fed the unpelleted rations. Also there was a higher percentage of protein digested in the pelleted feeds which would make more nitrogen available for retention.

Results of pelleting a ration of kafir and alfalfa hay for fattening lambs from the feeding trials conducted by Noble, et al. (10) of the Oklahoma Agricultural Experiment Station showed a very slight increase in rate and efficiency of gain from lambs given pelleted rations compared to the gains made by lambs given similar, unpelleted rations. At the price level used, the feed cost per hundred pounds of gain was slightly more economical on the pelleted ration. The lambs fed pellets sold for a higher price per hundred weight and returned slightly more profit.

Jordan, et al. (7) of the Minnesota Agricultural Experiment Station reported that, despite the saving in feed, the cost of gain in the lots fed the pelleted corn and alfalfa was greatly increased and the profit per lamb decreased due to the high cost of pelleting. Jordan and his co-workers observed during the feeding trails that the lambs getting their ration entirely in the form of pellets built up a ravenous appetite for some roughage. During the latter part of the feeding period they were gnawing on the wooden feed bunks and fence posts.

Tests at Washington State College (Schneider, et al., 11) showed no increase in the rate of gain or efficiency of gain from lambs hand- or self-fed pelleted rations when compared to lambs getting unpelleted rations.

Bowstead of the University of Alberta (2) compared the two methods of fattening lambs, (a) hand-feeding limited amounts of long hay with full-feeding of whole grain, and (b) self-feeding a pelleted mixture of 45 percent ground hay and 55 percent ground grain. He also compared an alfalfa ration and a non-legume hay ration when hand-fed and when pelleted and self-fed. The results of these trials, which indicate that self-fed pelleted rations were not utilized as efficiently as the hand-fed long hay-whole grain rations,

are not in agreement with similar experiments conducted elsewhere. In most cases reported by other scientists, results have shown that lambs self-fed pelleted rations consumed less feed, made more rapid gains, and required less feed per unit of gain than lambs hand-fed long hay and grain in the same proportion.

FEEDING TRIAL

Experimental Procedure

One-hundred-forty white-faced and black-faced ewe and wether lambs, originating in Colorado, were purchased in late October on the Kansas City market for use in the feed-lot and metabolism studies. Upon arrival at the feed-lot, the lambs were placed in a large lot with an open shed. During the adjustment period, the lambs had access to prairie hay and water for the first three days, followed by a few days of a ration of long alfalfa hay. Finally, to accustom the lambs to full feed, each lamb was fed daily one pound of pellets containing 60 percent roughage and 40 percent corn plus free access to long alfalfa hay.

The lambs were ear tagged, weighed, and randomly placed into six lots, each consisting of 22 lambs averaging approximately 78 pounds. The eight heaviest white-faced wether lambs were reserved for use in the metabolism trials.

The 79-day feeding period began on November 8 when each of the six different lots received its assigned ration. Each lot of lambs was confined throughout the trial to its own pen which extended from the open shed. All

rations were hand-fed morning and evening. The animals on the unpelleted rations were allowed at each feeding 15 to 20 minutes to clean up the cracked corn portion and as much time as needed to consume the chopped alfalfa hay. The amount of feed for each lot, with the exception of the cracked corn in the unpelleted rations, was determined by the amount the lambs could clean up before the next feeding period. Two feeding racks per pen were located under the protection of the shed with water and salt available at all times.

The lots received the following rations:

Lot 1. Pellets consisting of 60 percent suncured alfalfa hay and 40 percent corn plus 0.4 pound alfalfa hay per lamb daily.

Lot 2. Pellets consisting of 60 percent dehydrated alfalfa meal and 40 percent corn plus 0.4 pound alfalfa hay per lamb daily.

Lot 3. Unpelleted ration consisting of 65 percent chopped alfalfa hay and 35 percent cracked corn.

Lot 4. Unpelleted ration consisting of 55 percent chopped alfalfa hay and 45 percent cracked corn.

Lot 5. Pellets consisting of 50 percent suncured alfalfa hay and 50 percent corn plus 0.4 pound alfalfa hay per lamb daily.

Lot 6. Pellets consisting of 50 percent dehydrated alfalfa meal and 50 percent corn plus 0.4 pound alfalfa hay per lamb daily.

Enough chopped alfalfa hay (0.4 pound) was fed daily to each lamb on the pelleted rations to change the ratios of roughage to corn, thus making the 60-40 and 50-50 pelleted rations equivalent to 65-35 and 55-45, respectively.

The majority of the lambs in each lot went to a full feed of their respective ration within 7 to 14 days. In Lot 4 one lamb died of pneumonia

and three lambs refused to eat on the fifteenth day of the test. The amount fed was adjusted to the decreased number of lambs but it was two full weeks before a stable amount of feed was fed daily. A lamb in Lot 6 died of enterotoxemia during the eighth week of the feeding trial and the feed was reduced accordingly.

Second-cutting alfalfa, taken from the same field at the Kansas State College Farm, was used in all the rations of this test. A part of the alfalfa was dehydrated at the time of cutting and used later in the dehydrated pellets. The remainder was suncured in the field, baled, and stored in a barn until the suncured alfalfa and corn pellets were made in September. All the chopped alfalfa hay used in the test came from the stored bales and was chopped with an ensilage cutter. The corn for each ration was taken from the same bulk lot at the Manhattan Mill.

A chemical analysis was made of each of the pelleted feeds, the corn, and the alfalfa hay. The percentage of moisture, protein, ether extract, crude fiber, nitrogen-free extract, mineral matter and carbohydrates found in each feed is shown in Table 1.

The lambs were individually weighed at the beginning of the study, once every two weeks, and at the termination of the study on January 26, 1956. The lambs were individually graded by three experienced college staff members. Each grade was assigned a numerical value in order to determine the average grade for each lot. Following is a listing of the values assigned the different grades:

Choice plus	1	Good plus	4	Utility plus	7
Choice	2	Good	5	Utility	8
Choice minus	3	Good minus	6	Utility minus	9

Table 1. Chemical analysis of feeds used in the feed-lot tests and the metabolism studies.

Feeds	Moisture	Protein	Ether Extract	Fiber	N-free Extract	Mineral Matter	Carbohydrates
	%	%	%	%	%	%	%
Pellets 60-40[1]	5.14	14.88	3.02	16.91	53.43	6.62	70.34
Pellets 60-40[2]	4.98	15.63	3.45	18.80	49.28	7.86	68.08
Alfalfa hay[3]	5.44	14.94	1.52	30.61	39.15	8.34	69.76
Corn[4]	9.41	10.50	3.45	2.12	73.33	1.29	75.35
Pellets 50-50[5]	6.36	14.13	2.95	12.48	59.48	4.60	71.96
Pellets 50-50[6]	5.38	14.14	3.63	13.42	58.18	4.95	71.60
Alfalfa hay[7]	5.70	15.19	1.71	29.56	39.50	8.34	69.06

1 Pellets consisting of 60 percent suncured alfalfa hay and 40 percent corn used in metabolism trials 1-3.
2 Pellets consisting of 60 percent dehydrated alfalfa meal and 40 percent corn used in metabolism trials 1-3.
3 The alfalfa hay in the pelleted and unpelleted rations came from the same area. This analysis was used in metabolism trials 1-3.
4 Corn used in metabolism trials 1-3. Corn used in the pelleted and unpelleted rations was taken from the same bulk at the Manhattan Mill.
5 Pellets consisting of 50 percent suncured alfalfa hay and 50 percent corn used in metabolism trials 4 and 5.
6 Pellets consisting of 50 percent dehydrated alfalfa meal and 50 percent corn used in metabolism trials 4 and 5.
7 Hay used in metabolism trials 4 and 5.

Records were kept daily of each lot's feed intake. At the end of the study, records were made of the averages of the daily gain, of the daily feed intake per lamb and feed intake per hundredweight of gain, and of the financial results.

The lambs were sold on the St. Joseph, Missouri, market on January 30. The carcasses were graded by a United States Department of Agriculture grader. The carcass grades, choice and good, were assigned numerical values of 2 and 5, respectively, in order to determine the average grade for each lot.

Results and Discussion

Lambs fed the pelleted rations gained faster than the lambs fed similar, unpelleted rations. The increased rates of gain apparently resulted from greater efficiency of feed utilization rather than increased feed consumption, since the quantity of the pelleted rations consumed was similar to, or smaller than, that of the unpelleted rations.

The pellets made of dehydrated alfalfa meal and corn did not produce as large or as efficient gains as the pellets made of suncured alfalfa hay and corn. The gains made by the lambs fed dehydrated alfalfa pellets cost approximately $3.00 more per 100 pounds of gain than when the suncured alfalfa pellets were used.

Slightly larger gains were produced by the pellets containing the higher proportion of roughage, but the advantage in efficiency and economy was not consistent. When unpelleted rations were fed, the ration consisting of 55 percent roughage and 45 percent corn was more efficient and economical.

This agrees with results of previous years. Despite larger gains and greater feed efficiency on pelleted rations containing 55 percent roughage and 45 percent corn, the cost of gain was higher than on similar, unpelleted rations. When the rations contained 65 percent roughage and 35 percent corn, the pelleted ration containing suncured alfalfa hay and corn produced the cheapest gains, followed by the 65-35 unpelleted ration.

All lambs sold at the same market price. There were no consistent differences in live market grades and carcass grades of the lambs fed the different rations. A summary of the feed-lot performance of lambs fed pelleted and unpelleted rations of varying concentrations is shown in Table 2.

METABOLISM STUDIES

Experimental Procedure

Eight white-faced wether Western feeder lambs, averaging 84.5 pounds, were used in the metabolism trials of this study. Their preliminary feeding period was the same as for the lambs in the feed-lot. The eight lambs were transferred to the metabolism room on November 9 where they were confined in individual crates, especially designed for this type of experiment, until five metabolism trials had been run. At the end of the trials the lambs were returned to the feed-lot.

The crates were constructed with a screen covered metal pan which sloped toward the rear to facilitate the collection of urine in a bottle. The feces-collection-screen, which was removable, set five inches from the floor grating of the crate. An illustration of one of the crates used in

Table 2. Feed-lot performance of lambs fed pelleted and unpelleted rations of varying concentrations.

Lot number	1	2	3	4	5	6
Ration	60% sun. alf. hay 40% corn Pellets[1]	60% dehy. alf. meal 40% corn Pellets[1]	65% chop. alf. hay 35% crack corn	55% chop. alf. hay 45% crack corn	50% sun. alf. hay 50% corn Pellets[2]	50% dehy. alf. meal 50% corn Pellets[2]
No. lambs per lot	22	22	22	21	22	21
Days on feed	79	79	79	79	79	79
Initial wt/lamb,lbs.av.	77.54	77.32	78.14	77.43	77.96	78.47
Final wt/lamb, lbs.av.	110.45	107.40	104.68	105.47	109.41	108.28
Total gain/lamb,lbs.av.	32.91	30.08	26.54	28.04	31.45	29.81
Daily gain/lamb,lb.av.	.416	.381	.336	.355	.398	.377
Feed/lamb daily, lbs.						
Pellet	2.70	2.65			2.48	2.52
Cracked corn			1.21	1.24		
Chopped hay	.48	.44	2.28	1.70	.55	.38
Feed/cwt. of gain						
Pellet	649.0	697.0			623.3	668.9
Cracked corn			360.1	349.1		
Chopped hay	116.0	114.8	677.7	478.2	138.1	101.6
Feed cost per cwt.	$14.89	$18.58	$17.62	$14.85	$15.32	$18.13
Feed cost per lamb	4.90	5.59	4.68	4.16	4.82	5.40
Live market grade, av.[3]	4.55	5.06	4.12	4.12	4.08	4.08
Carcass grade, av.[3]	3.33	3.57	3.45	3.35	3.63	3.74
No. lambs died				1		1

1 0.4 lb. of chopped alfalfa hay per lamb was fed daily to make a 65-35 ratio.
2 0.4 lb. of chopped alfalfa hay per lamb was fed daily to make a 55-45 ratio.
3 Grades based on numerical values, the lower values indicate better lambs or carcasses.

this study is shown in Plate I.

Each lamb was immediately assigned to a specific ration and was started on a 6-day adjustment feeding period. During the digestion trials the lambs were individually fed twice daily. The rations fed were the same as those fed at the feed-lot with the exception that the 60-40 pelleted rations did not receive any additional chopped alfalfa hay.

During the first three metabolism trials, the 60-40 pelleted and unpelleted rations were used simultaneously in order to eliminate environmental influences. These rations were used in rotation until all lambs had been on each of the rations for one collection period. The last two metabolism trials used the same rations Lots 5 and 6 received at the feed-lot and again the rations were fed simultaneously and rotated until all lambs had been on both rations for a 7-day collection period. An adjustment period of four to five days was allowed between each of the five metabolism trials. During the adjustment period the lambs were fed the ration they were to receive in the subsequent trial. Water was available to the lambs at all times, and a trace of coarse, granular salt was sprinkled over the individual rations once daily.

In the course of the third trial one lamb had to be removed from the test because of scours but he was on full feed in time to be included in the two remaining trials. Another lamb refused to eat before the beginning of the fourth trial and had to be removed from the last two metabolism trials.

Feces and urine were collected separately and quantitatively from each animal daily at 4:00 p.m. for the seven consecutive days of the metabolism trial. The first collection was made on November 15.

EXPLANATION OF PLATE I

Picture of a metabolism crate designed for the collection of feces and urine which was used for the metabolism studies.

PLATE I

Feces Collection. Each 24 hour feces collection was weighed and a 10 percent aliquot was placed in a porcelainized pan. This pan was placed in a drying oven set at 95 degrees Centigrade. On the following afternoon another 10 percent aliquot was added to the pan and the pan returned to the drying oven. This procedure continued until seven consecutive collections were made. After the final aliquot was added, the feces remained in the drying oven for five to seven days or until the feces were completely dry. The dry feces of the individual lambs were weighed, transferred to glass jars, sealed, and taken to the college chemical laboratory for quantitative analysis. The feces were analyzed to determine the percentage of protein, ether extract, crude fiber, moisture, mineral matter, nitrogen-free extract, and carbohydrate found in the separate samples.

Urine Collection. The 24 hour urine collections of individual lambs were measured each afternoon. An approximate five percent aliquot of each was transferred to glass jars. Toluene was added as a preservative before the jars were sealed and set in a cool place until the following day when another five percent aliquot was added. This procedure continued until seven consecutive collections had been made. The urine was also taken to the college chemical laboratory for a quantitative analysis of nitrogen content.

Method of Calculations. The coefficients of digestibility and percentage of the total digestible nutrients were determined. To determine the amount of each nutrient that was consumed, the total weight of feed eaten was multiplied by the percentage composition of each nutrient. The values for excreted nutrients were obtained by multiplying the dry weight of the total amount of feces collected by the percentage composition of each

nutrient. To obtain the amount of each nutrient apparently digested, the amount of each nutrient voided was subtracted from the amount of the nutrient consumed. Dividing the amount of the nutrient apparently digested by the amount of that nutrient consumed, the apparent digestibility was obtained, which when multiplied by 100, is expressed as a percentage. To obtain the total digestible nutrients the percentages of digestible protein, nitrogen-free extract, crude fiber, and ether extract x 2.25 were added together. This sum of digested nutrients when divided by the total weight of feed eaten gave the percentage of total digestible nutrients (T.D.N.).

The percentage of nitrogen retained by the individual lambs were determined. To determine the amount of nitrogen in the feces, the dry weight of the total amount of feces collected was multiplied by the percentage of nitrogen in the feces sample. Dividing the amount of nitrogen in the feces by the amount of nitrogen consumed, the percentage of nitrogen in the total dry feces was obtained. To determine the amount of nitrogen in the urine, the total amount of urine collected was multiplied by the amount of nitrogen per milliliter of urine. Dividing the amount of nitrogen in the urine by the amount of nitrogen consumed, the percentage of nitrogen in the total urine was obtained. The percentage of nitrogen in the feces and urine was obtained by adding together the percentage of nitrogen in the total dry feces collection and the percentage of nitrogen in the total urine collection. This sum when subtracted from 100 gave the percentage of nitrogen retained by the lamb.

Results and Discussion

Results of the metabolism studies are shown in Table 3. With the exception of the pelleted ration containing 60 percent dehydrated alfalfa meal and 40 percent corn, the pelleted rations produced higher protein and nitrogen-free extract digestion coefficients and a higher percentage of total digestible nutrients than was produced by the unpelleted ration. The ether extract digestion coefficient of the pelleted rations was higher than the unpelleted ration. The pelleted rations containing 60 percent roughage and 40 percent corn were lower in the percentage of crude fiber digested than in the unpelleted ration, but the pelleted rations containing 55 percent roughage and 45 percent corn were higher in the percentage of crude fiber digested than the unpelleted. The percentage of the nitrogen retained was higher in all pelleted rations than in the unpelleted ration.

The pelleted rations containing 60 percent roughage and 40 percent corn were not different in the percentage of crude fiber digested. This was also true of the pelleted ration containing 55 percent roughage and 45 percent corn. However, the 60-40 and 55-45 pelleted rations differed in the percentage of protein, ether extract, and nitrogen-free extract digested. The suncured alfalfa and corn pellets of both proportions produced a higher protein digestion coefficient than the dehydrated alfalfa and corn pellets of both proportions. The two dehydrated alfalfa and corn pellet rations produced a higher ether extract digestion coefficient than the suncured alfalfa and corn pellets. The percentage of total digestible nutrients was higher in the pelleted ration containing 60 percent suncured alfalfa hay and 40 percent corn than in the pelleted ration containing 60 percent dehydrated alfalfa meal

Table 3. Averages of digestion and nitrogen balance studies with lambs using varying ratios of roughage to concentrate in pelleted and unpelleted rations.

No. of Lambs	Ration	Digestion Coefficient				T.D.N.[1]	Nitrogen retained[2]
		Protein	E. Extract	Fiber	N.F.E.		
		%	%	%	%	%	%
8	60-40 SP[3]	59.46	64.62	20.64	77.58	58.37	7.53
8	60-40 DP[4]	51.55	69.26	21.56	72.72	53.32	9.75
7[5]	60% Alf. hay[6] 40% corn	54.87	57.69	27.11	75.16	55.08	-15.25
7[7]	55-45 SP[8]	69.32	69.42	33.59	83.51	65.85	21.79
7[7]	55-45 DP[8]	65.92	75.52	35.63	82.59	66.03	16.96

1 Individual lamb results are shown in Appendix Tables 4-9.
2 Individual lamb results are shown in Appendix Table 10.
3 SP represents suncured alfalfa hay and corn pellets.
4 DP represents dehydrated alfalfa meal and corn pellets.
5 One lamb removed because of scours.
6 Unpelleted ration of chopped alfalfa hay and cracked corn.
7 One lamb removed because of failure to eat.
8 Pellets were 50 percent roughage and 50 percent corn but enough chopped alfalfa hay was added to make a 55-45 ratio.

and 40 percent corn. There was no difference between the nitrogen-free extract digestion coefficient and the percentage of total digestible nutrients in the pelleted rations containing 55 percent roughage and 45 percent corn. The percentage of nitrogen retained was higher in the pellated ration containing 60 percent dehydrated alfalfa meal and 40 percent corn than in the pelleted ration containing suncured alfalfa hay and corn of the same proportions. The reverse was true in the percentage of nitrogen retention of the pellets containing 55 percent roughage and 45 percent corn.

The results of the metabolism studies definitely confirmed the greater feed efficiency of the pelleted ration of 55 percent roughage and 45 percent corn over the rations containing 60 percent roughage and 40 percent corn. The pellets containing 55 percent roughage and 45 percent corn had a higher percentage of total digestible nutrients, higher digestion coefficients, and a higher percentage of nitrogen retained than the other rations tested in this study.

Since results of previous trials using the 55 percent roughage and 45 percent corn pellets have indicated the greater feed efficiency over other proportions of roughage and corn, it may be assumed that an optimum physical balance actually exists in the 55-45 ratio. It was apparent that, as the percentage of concentrates decreased, the efficiency of feed utilization turned downward (Cox, 4).

The effect of protein content of the rations on the digestibility is not clear since the rations with a lower protein content appeared to have greater feed efficiency. This feed efficiency is apparently correlated with the digestion of crude fiber. The animals that digested the greatest percentage of total digestible nutrients, utilized a greater percentage of

the crude fiber content of their rations. Partially, as a result of the higher protein digestion coefficients, these animals also retained the greatest percentage of nitrogen. Accordingly, these lambs should have shown the highest average daily gains in the feed-lot, but apparently due to large individual variation or to the small number of animals used in the test, the correlation between rate of gain and nitrogen retention was not evident.

One of the most significant figures presented in Table 3 is the negative nitrogen retention percentage of the lambs fed the unpelleted ration. This negative nitrogen balance and the negative balance of one of the lambs fed the 60-40 pelleted rations gave indications of the depletion of the protein reserves of the lambs. It was observed during the metabolism trials that the lambs on the unpelleted 60-40 ration lost protein through the sloughing and bleeding of the mucous membrane of the intestine. The depletion of the protein reserve may have been due to starvation as the lambs fed the unpelleted ration in the metabolism study would consume only an average of 0.617 pound of cracked corn and 0.925 pound chopped alfalfa hay daily, while at the feed-lot, the lambs on the unpelleted ration containing 65 percent chopped alfalfa hay and 35 percent cracked corn consumed 1.21 pounds of corn and 2.28 pounds hay daily. Thus, the lambs in the metabolism study consumed 1.95 pounds less feed daily or were eating 44 percent of the total amount of feed being eaten at the feed-lot. The lambs on the other four metabolism rations consumed 69 to 76 percent of the total amount of feed consumed per animal at the feed-lot.

The negative nitrogen balance could also be due to the non-conversion in the rumen of part of the nitrogen intake to protein thus requiring further

enzymatic action for absorption. The non-converted nitrogen would then be absorbed, possibly as ammonia, and eliminated through the kidneys.

The lamb, that was removed from the last two trial periods of metabolism studies, refused to eat for no apparent reason. During the course of the metabolism studies this lamb lost 15 pounds of body weight.

After the third day, an interesting observation was the absence of rumination by lambs fed the pelleted ration without the addition of chopped alfalfa hay. Rumination recurred almost immediately when the ration included chopped alfalfa hay.

SUMMARY

Six different pelleted and unpelleted rations of varying concentrations were fed to 132 Western feeder lambs. Eight additional lambs were used for metabolism studies. The lambs were randomly separated into six lots of equal number and approximately equal weight. Three rations, two pelleted and one unpelleted, consisting of 65 percent roughage and 35 percent corn were compared with three rations, two pelleted and one unpelleted, consisting of 55 percent roughage and 45 percent corn. The roughage compared in the pelleted rations were suncured alfalfa hay and dehydrated alfalfa meal.

Lambs fed the pelleted rations gained faster than the lambs fed similar, unpelleted rations. The dehydrated alfalfa meal and corn pellets did not produce as efficient gains as the suncured alfalfa hay and corn pellets. Slightly larger gains were produced by the pellets containing the higher proportion of roughage. Conversely, the unpelleted ration of lower roughage content was more efficient and economical than the unpelleted ration

using a higher proportion of roughage. There were no differences in live market grades and carcass grades.

In the metabolism studies the 7-day collection method was followed. The digestion coefficients, total digestible nutrients, and nitrogen retention were higher in the pelleted rations containing 55 percent roughage and 45 percent corn. There was a slight difference in the digestion coefficients and the total digestible nutrients but a greater difference in the amount of nitrogen retained between pelleted and unpelleted rations containing 60 percent roughage and 40 percent corn. No consistent metabolic differences were determined between the suncured alfalfa hay and corn pellets and the dehydrated alfalfa meal and corn pellets. The unpelleted ration produced a definite negative nitrogen balance which could have been the result of protein loss through the sloughing and bleeding of the mucous membrane of the intestines, of starvation, or could be due to the non-conversion of part of the nitrogen intake thus causing an increased nitrogen elimination as ammonia through the kidneys.

CONCLUSIONS

From the data presented in this report the following conclusions were made:

1. In the feed-lot trials the lambs fed pelleted rations gained faster than lambs fed similar, unpelleted rations.
2. In the feed-lot trials the pellets made of dehydrated alfalfa meal and corn did not produce as large or as efficient gains as the pellets made of suncured alfalfa hay and corn.

3. In the feed-lot trials the 55-45 unpelleted ration was more efficient and economical than the 65-35 unpelleted ration.
4. The lambs that digested the greatest percentage of total digestible nutrients, utilized a greater percentage of the crude fiber content of their rations.
5. The results of the metabolism studies definitely confirmed the greater feed efficiency of the pelleted rations of 55 percent roughage and 45 percent corn over the rations containing 60 percent roughage and 40 percent corn.
6. Since results of previous trials using 55 percent roughage and 45 percent corn pellets have indicated the greater feed efficiency over other proportions of roughage and corn, it may be assumed that an optimum physical balance actually exists in the 55-45 ratio.

ACKNOWLEDGMENTS

The author wishes to acknowledge his indebtedness to Dr. T. Donald Bell, major instructor, for his invaluable help and counsel during the experimental phases of the work and preparation of the manuscript; to Dr. Rufus F. Cox, Head, Department of Animal Husbandry, for providing research facilities for use in this experiment; to Dr. Draytford Richardson for valuable suggestions throughout the metabolism studies and preparation of the manuscript; and to Tom Dean, college shepherd, for his work in connection with the feed-lot trials.

Finally, but not in any measure least deserving of mention, is the author's wife, Bette J. Hays, to whom he is indebted, not only for inspiration, but for her assistance in the preparation and typing of the manuscript.

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APPENDIX

Table 4. Digestibility study with lambs using a pelleted ration consisting of 60 percent suncured alfalfa hay and 40 percent corn.

Lamb		Total grams fed	% Protein	Grams crude protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	% N.F.E.	Grams N.F.E.	Total digested	% T.D.N.
9	Pellets	7650	14.88	1138.32	3.02	231.03		16.91	1293.61	53.43	4087.40		
	Feces	2837.52	16.13	457.69	2.62	74.34		36.75	1042.79	31.29	887.86		
	Am't digested			680.63		156.69	352.55		250.82		3194.53	4478.53	58.54
	Dig. coefficient			59.79		67.82			24.05		78.25		
37	Pellets	7550	14.88	1123.44	3.02	228.01		16.91	1276.71	53.43	4033.97		
	Feces	3278.94	16.19	530.86	2.60	85.25		33.26	1090.58	32.72	1072.87		
	Am't digested			592.58		142.76	321.21		186.13		2961.10	4061.02	53.79
	Dig. coefficient			52.75		62.61			14.58		73.40		
43	Pellets	7136	14.88	1061.84	3.02	215.51		16.91	1206.70	53.43	3812.76		
	Feces	3165.50	16.44	520.41	2.79	88.32		33.84	1071.21	31.64	1001.56		
	Am't digested			541.43		127.19	286.18		135.49		2811.20	3774.30	52.89
	Dig. coefficient			50.99		59.02			11.23		73.73		
52	Pellets	6101	14.88	907.83	3.02	184.25		16.91	1031.68	53.43	3259.64		
	Feces	2038.99	16.44	335.21	3.40	69.33		35.14	716.50	32.03	653.09		
	Am't digested			572.62		114.92	258.57		315.18		2597.55	3743.92	61.37
	Dig. coefficient			63.08		62.37			30.55		79.69		
78	Pellets	6300	14.88	937.44	3.02	190.26		16.91	1065.33	53.43	3366.09		
	Feces	2129.29	16.19	344.73	2.64	56.21		37.08	789.54	33.09	704.58		
	Am't digested			592.71		134.05	301.61		275.79		2661.51	3831.62	60.82
	Dig. coefficient			63.23		70.46			25.89		79.07		
80	Pellets	7600	14.88	1130.88	3.02	229.52		16.91	1285.16	53.43	4060.68		
	Feces	2757.33	15.94	439.52	2.40	66.18		37.77	1041.44	31.89	879.31		
	Am't digested			691.36		163.34	367.52		243.72		3181.37	4483.97	59.00
	Dig. coefficient			61.13		71.17			23.40		78.35		
85	Pellets	7550	14.88	1123.44	3.02	228.01		16.91	1276.71	53.43	4033.97		
	Feces	2835.32	14.56	412.82	3.36	95.27		36.03	1021.57	30.50	864.77		
	Am't digested			710.62		132.74	298.67		255.14		3169.20	4433.63	58.72
	Dig. coefficient			63.25		58.22			19.98		78.56		

Table 4. (concl.)

Lamb:		Total grams fed	% pro-tein	Grams crude protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	% N.F.E.	Grams N.F.E.	Total digested	% T.D.N.
98	Pellets	5788	14.88	861.25	3.02	174.80		16.91	978.75	53.43	3092.53		
	Feces	1879.90	16.63	312.63	3.19	59.97		37.09	697.25	31.41	590.48		
	Am't digested			548.62		114.83	258.37		281.50		2502.05	3590.54	62.03
	Dig. coefficient			63.70		65.69			28.76		80.91		
Total fed		55,675		8292.44		1681.39			9413.65		29747.04		
Total digested				4930.57		1086.52	2544.68		1942.77		23078.51	32496.53	58.37
Digestion coefficient				59.46		64.62			20.64		77.58		

Table 5. Digestibility study with lambs using a pelleted ration consisting of 60 percent dehydrated alfalfa hay and 40 percent corn.

Lamb		Total grams fed	% Protein	Grams crude protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	% N.F.E.	Grams N.F.E.	Total digested	% T.D.N.
9	Pellets	6400	15.63	1000.32	3.45	220.80		18.80	1203.20	49.28	3153.92		
	Feces	3029.44	14.13	428.06	2.76	83.61		34.97	1059.40	32.79	993.35		
	Am't digested			572.26		127.19	308.68		143.80		2160.57	3185.31	49.77
	Dig. coefficient			57.21		62.13			11.95		68.50		
37	Pellets	6019	15.63	940.77	3.45	207.66		18.80	1131.57	49.28	2966.16		
	Feces	2640.78	17.25	455.53	2.80	73.94		36.60	966.53	30.35	801.48		
	Am't digested			485.24		133.72	300.87		165.04		2164.68	3115.83	51.77
	Dig. coefficient			51.58		64.39			14.59		72.98		
43	Pellets	7450	15.63	1164.43	3.45	257.02		18.80	1400.60	49.28	3671.36		
	Feces	2983.51	18.50	551.95	2.70	80.55		34.98	1043.63	30.55	911.46		
	Am't digested			612.48		176.47	397.06		356.97		2759.90	4126.41	55.39
	Dig. coefficient			52.60		68.66			25.49		75.17		
52	Pellets	6484	15.63	1013.45	3.45	223.70		18.80	1218.99	49.28	3195.32		
	Feces	2977.06	18.81	559.98	2.41	71.75		32.24	959.80	31.96	951.47		
	Am't digested			453.47		151.95	341.89		259.19		2243.85	3298.40	50.87
	Dig. coefficient			44.75		67.93			21.26		70.22		
78	Pellets	7055	15.63	1104.11	3.45	243.40		18.80	1326.40	49.28	3476.70		
	Feces	2670.50	18.19	485.76	2.66	71.04		35.17	939.21	29.85	797.14		
	Am't digested			618.35		172.36	387.81		387.19		2679.56	4072.91	57.73
	Dig. coefficient			56.00		70.81			29.19		77.07		
80	Pellets	7000	15.63	1094.10	3.45	241.50		18.80	1316.00	49.28	3449.60		
	Feces	3063.14	18.06	553.20	2.46	75.35		34.55	1058.31	29.53	904.55		
	Am't digested			540.90		166.15	373.84		257.69		2545.05	3717.48	53.11
	Dig. coefficient			49.44		68.80			19.58		73.78		
85	Pellets	7750	15.63	1211.32	3.45	267.37		18.80	1457.00	49.28	3819.20		
	Feces	3145.80	18.13	570.33	2.02	63.55		35.70	1123.05	31.80	1000.36		
	Am't digested			640.99		203.82	458.60		333.95		2818.84	4252.38	54.87
	Dig. coefficient			52.92		76.23			22.92		73.81		

Table 5. (concl.)

Lamb:		Total grams fed	% Protein	Grams crude Protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	% N.F.E.	Grams N.F.E.	Total digested	% T.D.N.
98	Pellets	6375	15.63	996.41	3.45	219.94		18.80	1198.50	49.28	3141.60		
	Feces	2778.07	18.88	524.50	2.11	58.62		32.11	892.04	34.94	970.66		
	Am't digested			471.91		161.32	362.97		306.46		2170.94	3312.28	51.96
	Dig. coefficient			47.36		73.35			25.57		69.10		
Total fed		54,533		8524.91		1881.39			10252.26		26873.86		
Total digested				4394.88		1302.98	2931.72		2210.29		19543.39	29078.70	53.32
Dig. coefficient				51.55		69.26			21.56		72.72		

Table 6. Digestibility study with lambs using an unpelleted ration consisting of 60 percent chopped alfalfa hay and 40 percent cracked corn.

Lamb		Total grams fed	% Pro-tein	Grams crude protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	% N.F.E.	Grams N.F.E.	Total digested	% T.D.N.
9	Alf.hay	3960	14.94	591.62	1.52	60.19		30.61	1212.16	39.15	1550.34		
	Corn	2640	10.50	277.20	3.45	91.80		2.12	55.97	73.23	1933.27		
	Total	6600		868.82		151.99			1268.13		3483.61		
	Feces	2887.88	16.00	462.06	2.60	75.08		34.37	992.56	34.89	1007.58		
	Am't digested			406.76		76.91	173.05		275.57		2476.03	3331.41	50.48
	Dig. coefficient			46.82		50.60			21.73		71.08		
37	Alf.hay	3584	14.94	535.45	1.52	54.58		30.61	1097.06	39.15	1403.14		
	Corn	2400	10.50	252.00	3.45	82.80		2.12	50.88	73.23	1757.52		
	Total	5984		787.45		137.28			1142.94		3160.66		
	Feces	2126.75	13.69	291.15	2.45	52.11		37.57	799.02	33.82	719.27		
	Am't digested			496.30		85.17	191.63		343.92		2441.39	3473.24	58.04
	Dig. coefficient			63.03		62.04			30.09		77.24		
43	Alf.hay	3120	14.94	466.13	1.52	47.42		30.61	955.03	39.15	1221.48		
	Corn	2080	10.50	218.40	3.45	71.76		2.12	44.10	73.23	1523.18		
	Total	5200		684.53		119.18			999.18		2744.66		
	Feces	1752.36	14.94	261.80	2.73	47.84		36.05	631.73	33.21	581.96		
	Am't digested			422.73		71.34	160.52		367.45		2162.70	3113.40	59.87
	Dig. coefficient			61.75		59.86			36.78		78.80		
52	Alf.hay	2604	14.94	389.04	1.52	39.58		30.61	797.08	39.15	1019.47		
	Corn	1736	10.50	182.28	3.45	59.89		2.12	36.80	73.23	1271.27		
	Total	4340		571.32		99.47			833.88		2290.74		
	Feces	1866.36	17.13	319.71	2.43	45.35		34.73	648.19	31.64	590.52		
	Am't digested			251.61		54.12	121.77		185.69		1700.22	2259.29	52.06
	Dig. coefficient			44.04		54.41			22.27		74.22		
78	Alf.hay	2544	14.94	380.07	1.52	38.67		30.61	778.72	39.15	995.98		
	Corn	1696	10.50	178.08	3.45	58.51		2.12	35.96	73.23	1241.98		
	Total	4240		558.15		97.18			814.68		2237.96		
	Feces	1746.39	15.81	276.10	2.44	42.61		34.05	594.65	33.33	582.07		
	Am't digested			282.05		54.57	122.78		220.03		1655.89	2280.75	53.79
	Dig. coefficient			50.53		56.15			27.01		73.99		

Table 6. (concl.)

Lamb		Total grams fed	% Protein	Grams crude protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	% N.F.E.	Grams N.F.E.	Total digested	% T.D.N.
80	Alf.hay	4110	14.94	614.03	1.52	62.47		30.61	1258.07	39.15	1609.06		
	Corn	2740	10.50	287.70	3.45	94.53		2.12	58.09	73.23	2006.50		
	Total	6850		901.73		157.00			1316.16		3615.56		
	Feces	2788.73	15.56	433.93	2.58	71.95		34.88	972.71	33.93	946.22		
	Am't digested			467.80		95.05	213.86		343.45		2669.34	3694.45	53.93
	Dig. coefficient			51.88		60.54			26.09		73.83		
85	Alf.hay	3600	14.94	537.84	1.52	54.72		30.61	1101.96	39.15	1409.40		
	Corn	2400	10.50	252.00	3.45	82.80		2.12	50.88	73.23	1757.52		
	Total	6000		789.84		137.52			1152.84		3166.92		
	Feces	2149.95	13.25	284.87	2.59	55.68		39.37	846.44	33.21	714.00		
	Am't digested			504.97		81.84	184.14		306.40		2452.92	3448.43	57.47
	Dig. coefficient			63.93		59.51			26.58		77.45		
98*													
Total fed		39,214		5161.84		899.62			7532.81		20700.11		
Total digested				2832.22		519.00	1167.75		2042.51		15558.49	21600.97	55.08
Dig. coefficient				54.87		57.69			27.11		75.16		

* This lamb scoured and was removed from trial.

Table 7. Digestibility study with lambs using a pelleted ration consisting of 50 percent suncured alfalfa hay and 50 percent corn plus enough chopped alfalfa hay to make a 55-45 ratio.

Lamb:		Total fed: grams:	% Protein	Grams crude protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	%	Grams N.F.E.	Total digested: grams	% T.D.N.
9	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.13	791.28	2.95	165.20		12.48	698.88	59.48	3330.88		
	Total	7000		1003.94		189.14			1112.72		3883.88		
	Feces	2014.09	15.25	307.15	2.98	60.02		37.44	754.08	32.08	646.12		
	Am't digested			696.79		129.12	290.52		358.64		3237.76	4583.71	65.48
	Dig. coefficient			69.41		68.27			32.23		83.36		
37*													
43	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.13	791.28	2.95	165.20		12.48	698.88	59.48	3330.88		
	Total	7000		1003.94		189.14			1112.72		3883.88		
	Feces	2048.23	15.25	312.36	3.21	65.75		35.87	734.70	32.56	666.90		
	Am't digested			691.58		123.39	277.63		378.02		3216.98	4564.21	65.20
	Dig. coefficient			68.89		65.24			33.97		82.83		
52	Alf.hay	1396	15.19	212.05	1.71	23.87		29.56	412.66	39.50	551.42		
	Pellets	5600	14.13	791.28	2.95	165.20		12.48	698.88	59.48	3330.88		
	Total	6996		1003.33		189.07			1111.54		3882.30		
	Feces	2012.23	16.19	325.78	2.74	55.14		36.72	738.89	32.50	653.97		
	Am't digested			677.55		133.93	301.34		372.65		3228.33	4579.87	65.46
	Dig. coefficient			67.53		70.84			33.53		83.16		
78	Alf.hay	1301	15.19	197.62	1.71	22.25		29.56	384.58	39.50	513.90		
	Pellets	5600	14.13	791.28	2.95	165.20		12.48	698.88	59.48	3330.88		
	Total	6901		988.90		187.45			1083.46		3844.78		
	Feces	1842.27	15.63	287.95	2.63	48.45		36.70	676.11	32.36	596.16		
	Am't digested			700.95		139.00	312.75		407.35		3248.62	4669.67	67.67
	Dig. coefficient			70.88		74.15			37.60		84.49		
80	Alf.hay	1395	15.19	211.90	1.71	23.85		29.56	412.36	39.50	551.03		
	Pellets	5200	14.13	734.76	2.95	153.40		12.48	648.96	59.48	3092.96		
	Total	6595		956.66		177.25			1061.32		3643.99		
	Feces	1945.83	15.13	294.40	2.65	51.56		36.54	711.01	33.65	654.77		
	Am't digested			662.26		125.69	282.80		350.31		2989.22	4284.59	64.97
	Dig. coefficient			69.23		70.91			33.01		82.03		

Table 7. (concl.)

Lamb:		Total grams fed	% Protein	Grams crude protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	% N.F.E.	Grams N.F.E.	Total digested	% T.D.N.
85	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.13	791.28	2.95	165.20		12.48	698.88	59.48	3330.88		
	Total	7000		1003.94		189.14			1112.72		3883.88		
	Feces	1714.62	13.63	233.70	3.02	51.78		38.78	664.93	32.17	551.59		
	Am't digested			770.24		137.36	309.06		447.79		3332.29	4859.38	69.42
	Dig. coefficient			76.72		72.62			40.24		85.80		
98	Alf.hay	1396	15.19	212.05	1.71	23.87		29.56	412.66	39.50	551.42		
	Pellets	5600	14.13	791.28	2.95	165.20		12.48	698.88	59.48	3330.88		
	Total	6996		1003.33		189.07			1111.54		3882.30		
	Feces	2192.26	17.13	375.53	3.10	67.96		38.23	838.10	29.93	656.14		
	Am't digested			627.80		121.11	272.50		273.44		3226.16	4399.90	62.89
	Dig. coefficient			62.57		64.06			24.60		83.10		
Total fed		48,488		6964.04		1310.26			7706.02		26905.01		
Total digested				4827.17		909.60	2046.60		2588.20		22469.36	31931.33	65.85
Dig. Coefficient				69.32		69.42			33.59		83.51		

* Lamb removed from trial because of refusal to eat.

Table 8. Digestibility study with lambs using a pelleted ration consisting of 50 percent dehydrated alfalfa meal and 50 percent corn plus enough chopped alfalfa hay to make a 55-45 ratio.

Lamb		Total grams fed	% Protein	Grams crude protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	% N.F.E.	Grams N.F.E.	Total digested	% T.D.N.
9	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.44	808.64	3.63	203.28		13.42	751.52	58.18	3258.08		
	Total	7000		1021.30		227.22			1165.36		3811.08		
	Feces	1781.47	15.56	277.20	2.74	48.81		37.76	672.68	30.81	548.87		
	Am't digested			744.10		178.41	401.42		492.68		3262.21	4900.41	70.01
	Dig. coefficient			72.86		78.52			42.28		85.60		
37*													
43	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.44	808.64	3.63	203.28		13.42	751.52	58.18	3258.08		
	Total	7000		1021.30		227.22			1165.36		3811.08		
	Feces	2003.08	16.44	329.31	2.54	50.88		36.27	726.52	31.78	636.58		
	Am't digested			691.99		176.34	396.77		438.84		3174.50	4702.10	67.17
	Dig. coefficient			67.76		77.61			37.66		83.30		
52	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.44	808.64	3.63	203.28		13.42	751.52	58.18	3258.08		
	Total	7000		1021.30		227.22			1165.36		3811.08		
	Feces	2198.07	16.94	372.35	2.49	54.73		35.43	778.78	32.93	723.82		
	Am't digested			648.95		172.49	388.10		386.58		3087.26	4510.86	64.44
	Dig. coefficient			63.54		75.91			33.17		81.01		
78	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.44	808.64	3.63	203.28		13.42	751.52	58.18	3258.08		
	Total	7000		1021.30		227.22			1165.36		3811.08		
	Feces	2137.26	17.00	363.33	2.28	48.73		36.12	771.98	31.51	673.45		
	Am't digested			657.97		178.49	401.60		393.38		3137.63	4590.58	65.65
	Dig. coefficient			64.42		78.45			33.66		82.32		
80	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.44	808.64	3.63	203.28		13.42	751.52	58.18	3258.08		
	Total	7000		1021.30		227.22			1165.36		3811.08		
	Feces	2176.30	16.00	348.21	2.65	57.67		37.14	808.28	31.61	687.93		
	Am't digested			673.09		169.55	381.49		357.08		3123.15	4534.81	64.78
	Dig. coefficient			65.91		74.62			30.64		81.95		

Table 8. (concl.)

Lamb		Total grams fed	% Protein	Grams crude protein	% Ether extract	Grams ether extract	x2.25	% crude fiber	Grams crude fiber	% N.F.E.	Grams N.F.E.	Total digested	% T.D.N.
85	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.14	808.64	3.63	203.28		13.42	751.52	58.18	3258.08		
	Total	7000		1021.30		227.22			1165.36		3811.08		
	Feces	2118.92	15.44	327.16	2.44	51.70		38.82	822.56	29.87	632.92		
	Am't digested			694.14		175.52	394.92		342.80		3178.16	4610.02	65.86
	Dig. coefficient			67.97		77.25			29.42		83.39		
98	Alf.hay	1400	15.19	212.66	1.71	23.94		29.56	413.84	39.50	553.00		
	Pellets	5600	14.44	808.64	3.63	203.28		13.42	751.52	58.18	3258.08		
	Total	7000		1021.30		227.22			1165.36		3811.08		
	Feces	2358.00	17.75	418.55	3.26	76.87		36.07	850.53	31.44	741.36		
	Am't digested			602.75		150.35	338.29		314.83		3069.72	4325.59	61.79
	Dig. coefficient			59.02		66.17			27.02		80.55		
Total fed		49,000		7149.10		1590.54			8157.52		26677.56		
Total digested				4712.99		1201.15	2702.59		2906.19		22032.57	32354.34	66.03
Dig. coefficient				65.92		75.52			35.63		82.59		

* Lamb removed from trial because of refusal to eat.

Table 9. Nitrogen balance study with lambs.

Lamb	Total dry feces	N in feces sample	N content	N in total feces sumed	N in total feces	Total urine	N per ml. urine	N in total urine	N in total urine	Total N in feces & urine	Total N in feces & urine	N retained by lamb
	g.	%		g.	g.	%	ml.	g.	g.	%	g.	%	%
Suncured Pellets (60-40)													
9	2837.52	2.58	182.13	73.21	40.20	6120	.01610	98.53	54.10	171.74	94.30	5.70
37	3278.94	2.59	179.75	84.92	47.24	6730	.01440	96.91	53.91	181.83	101.15	- 1.15
43	3162.50	2.63	169.89	83.17	48.96	3637	.01859	67.61	39.80	150.78	88.76	11.18
52	2038.99	2.62	145.25	53.42	36.78	2350	.03598	84.55	58.21	137.97	94.99	5.01
78	2129.29	2.59	150.00	55.15	36.77	17770	.00396	70.37	46.91	125.52	83.68	16.32
80	2757.33	2.55	180.94	70.31	38.86	7850	.01278	100.32	55.44	170.63	94.30	5.70
85	2835.32	2.32	179.75	65.78	36.60	6807	.01397	95.09	52.90	160.87	89.50	10.50
98	1879.90	2.65	137.80	49.82	36.15	4720	.01622	76.56	55.56	126.38	91.71	8.29
Total			1325.51	535.78				689.94		1225.72		
Average					40.42				52.05		92.47	7.53
Dehydrated Pellets (60-40)												
9	3029.44	2.26	160.05	68.47	42.78	5110	.01580	80.74	50.45	149.21	93.23	6.77
37	2640.78	2.75	150.52	72.62	48.25	8260	.01060	87.56	58.17	160.18	106.42	- 6.42
43	2983.51	2.96	186.31	88.31	47.40	4840	.01146	55.47	29.77	143.78	77.17	22.83
52	2977.06	3.00	162.15	89.31	55.08	1845	.03063	56.51	34.85	145.82	89.93	10.07
78	2670.50	2.90	176.66	77.44	43.84	9220	.00806	74.31	42.06	151.75	85.90	14.10
80	3063.14	2.87	175.06	87.51	50.22	5940	.01364	81.02	46.28	168.93	96.50	3.50
85	3145.80	2.90	193.81	91.23	47.07	6100	.01300	79.30	40.92	170.53	87.99	12.01
98	2778.07	3.02	159.43	83.90	52.62	2475	.02299	56.90	35.69	140.80	88.31	11.69
Total			1363.99	659.19				571.81		1239.00		
Average					48.33				41.92		90.25	9.75

Table 9. (cont.).

Lamb:	Total dry feces	N in feces sample:	N consumed	N in total feces	N in total feces	Total urine	N per ml. urine	N in total urine	N in total urine	Total N in feces: & urine	Total N in feces: & urine	N retained by lamb
	g.	%	g.	g.	%	ml.	g.	g.	%	g.	%	%
					Chopped Alfalfa Hay and Cracked Corn (60-40)							
9	2887.88	2.55	139.01	73.64	52.97	4585	.01672	76.56	55.15	150.30	108.12	- 8.12
37	2126.75	2.19	125.99	46.58	36.97	4990	.01686	84.13	66.78	130.71	104.75	- 4.75
43	1752.36	2.39	109.52	41.88	38.24	3740	.01872	70.01	63.92	111.89	102.16	- 2.16
52	1866.36	2.74	91.41	51.14	55.95	2240	.02974	66.62	72.88	117.76	128.83	-28.83
78	1746.39	2.51	89.30	43.83	49.08	18150	.00450	81.68	91.47	125.51	140.55	-40.55
80	2788.73	2.48	144.28	69.16	47.93	6995	.01310	91.63	63.51	160.79	111.44	-11.44
85	2149.95	2.12	126.37	45.58	36.07	4580	.01906	87.29	69.07	132.87	105.14	- 5.14
98*												
Total			825.88	393.81				558.02		929.83		
Average					47.68				67.57		115.25	-15.25
					Suncured Pellets (55-45)***							
9	2014.09	2.44	160.63	49.14	30.59	11420	.00714	81.54	50.76	130.68	81.35	18.65
37**												
43	2048.33	2.50	160.63	51.21	31.88	3225	.01802	58.11	36.18	109.32	68.06	31.94
52	2012.23	2.60	160.45	52.32	32.61	2080	.03416	71.05	44.28	123.37	76.89	23.11
78	1842.27	2.50	158.22	46.06	29.11	14390	.00554	79.72	50.39	125.78	79.50	20.50
80	1945.83	2.42	153.07	47.07	30.76	5480	.01450	79.46	51.91	126.55	82.67	17.33
85	1714.62	2.18	160.63	37.38	23.27	8975	.01066	95.67	59.56	133.05	82.83	17.17
98	2192.26	2.74	160.45	60.07	37.44	3055	.02048	62.57	39.00	122.64	76.44	23.56
Total			1114.08	343.28				528.12		871.39		
Average					30.81				47.40		78.21	21.79

Table 9. (concl.).

Lamb	Total dry feces	N in feces sample	N consumed	N in total feces	N in total feces	Total urine	N per ml. urine	N in total urine	N in total urine	Total N in feces & urine	Total N in feces & urine	N retained by lamb
	g.	%	g.	g.	%	ml.	g.	g.	%	g.	%	%
					Dehydrated Pellets (55-45)***							
9	1781.47	2.49	163.25	44.36	27.17	21065	.00416	87.63	53.68	131.99	80.85	19.15
37**												
43	2003.08	2.63	163.25	52.68	32.25	4840	.01358	65.73	40.26	118.41	72.51	27.49
52	2198.07	2.71	163.25	59.57	36.49	2205	.03104	68.44	41.92	128.01	78.41	21.59
78	2137.26	2.72	163.25	58.13	35.61	13260	.00528	70.02	42.89	128.15	78.50	21.50
80	2176.30	2.56	163.25	55.71	34.12	4080	.01910	77.93	47.74	133.64	81.86	18.14
85	2118.92	2.63	163.25	55.73	34.14	6180	.01444	89.24	54.66	144.97	88.80	11.20
98	2358.00	2.84	163.25	66.97	41.02	4600	.01510	69.46	42.55	136.43	83.57	16.43
Total			1142.75	420.58				528.45		949.03		
Average					36.80				46.24		83.04	16.96

* This lamb scoured and was removed from trial.
** This lamb refused to eat and was removed from trial.
*** Pellets were 50 percent alfalfa hay and 50 percent corn but enough chopped alfalfa hay was added to make a 55-45 ratio.

COMPARATIVE EFFICIENCY OF UTILIZATION OF PELLETED AND UNPELLETED RATIONS OF VARYING CONCENTRATIONS FOR FATTENING LAMBS

by

LEONARD EVERETTE HAYS

B. S., University of Missouri, 1948

AN ABSTRACT OF A THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Animal Husbandry

KANSAS STATE COLLEGE
OF AGRICULTURE AND APPLIED SCIENCE

1956

This experiment was designed to study the feed-lot efficiency and utilization of pelleted and unpelleted rations of varying concentrations for fattening lambs, and to compare the utilization of suncured alfalfa hay and dehydrated alfalfa meal in the pellet form.

One-hundred-forty white-faced and black-faced ewe and wether Western lambs were used in feed-lot trials and metabolism studies. The lambs were randomly placed in six lots, each consisting of 22 lambs averaging approximately 78 pounds. The eight heaviest white-faced wether lambs were used in the metabolism studies.

Six different pelleted and unpelleted rations of varying proportions of roughage and corn were hand-fed twice daily during a 79-day feeding period. The roughages compared in the pelleted rations were suncured alfalfa hay and dehydrated alfalfa meal.

The six lots were fed the six rations with one lot of lambs on each ration. Two lots received unpelleted rations, one of the two rations consisted of 65 percent chopped alfalfa hay and 35 percent cracked corn, and the other consisted of 55 percent chopped alfalfa hay and 45 percent cracked corn. Two of the lots received the 60-40 pellets, one of the pelleted rations contained suncured alfalfa hay as the roughage and the other contained dehydrated alfalfa meal. Two lots received the 50-50 pellets, one of the pelleted rations contained suncured alfalfa hay as the roughage and the other contained dehydrated alfalfa meal. In addition to the pellets in the pelleted rations, 0.4 pound of chopped alfalfa hay was fed daily to each lamb to change the ratios of roughage to corn, thus making the 60-40 and 50-50 pelleted rations equivalent to 65-35 and 55-45, respectively.

Lambs fed the pelleted rations gained faster than the lambs fed similar, unpelleted rations. The dehydrated alfalfa meal and corn pellets of both proportions did not produce as efficient gains as the suncured alfalfa hay and corn pellets of both proportions. The pellets containing the higher proportion of roughage (65-35) produced slightly higher gains. Conversely, the unpelleted ration consisting of the lower proportion of roughage (55-45) produced more efficient and economical gains. No consistent differences were evident in the live market grades and carcass grades.

Eight white-faced wether Western feeder lambs, averaging 84.5 pounds, were used in the five metabolism trials. The lambs were confined to individual, especially designed crates. The rations fed twice daily were the same as those fed at the feed-lot with the exception that the 60-40 pelleted ration did not receive any additional chopped alfalfa hay. During the first three metabolism trials, the 60-40 pelleted and unpelleted rations were used simultaneously and in rotation until all lambs had been on each of the rations for one collection period. The last two metabolism trials used the two 50-50 pelleted rations, one of the two rations contained suncured alfalfa hay and the other contained dehydrated alfalfa meal. Enough additional chopped alfalfa hay was fed daily to change the 50-50 ratio to 55-45. The 55-45 pelleted rations were fed simultaneously and rotated until all lambs had been on both rations for one collection period.

A twenty-four hour feces and urine collection was made daily for the seven days of each trial.

The digestion coefficients, total digestible nutrients and the percentage of nitrogen retained were higher in the 55-45 pelleted rations than in the 60-40 pelleted and unpelleted rations. There was a slight difference

between the digestion coefficients and total digestible nutrients of the 60-40 pelleted and unpelleted rations. The amount of nitrogen retained was higher in the 60-40 pelleted rations than in the 60-40 unpelleted ration. There were no consistent metabolic differences between the suncured alfalfa hay and corn pellets of both proportions and the dehydrated alfalfa meal and corn pellets of both proportions. The results of the metabolism studies showed a greater feed efficiency for the 55-45 pelleted rations over the 60-40 pelleted and unpelleted rations.