A STUDY OF METABOLISM AND RATE OF GAIN WITH LAMBS USING PELLETED AND NON-PELLETED RATIONS

by

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B. S., Kansas State College of Agriculture and Applied Science, 1954

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

LD 2668 74 1957 586 C,2

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## INTRODUCTION

Commercial lamb feeders have shown an increased interest in pelleted rations in recent years. Experimental work indicates that these rations generally produce more rapid and efficient gains than similar rations in non-pelleted form. The advantage of preparing feed in pelleted form seems to be most evident when the available roughage is of poor quality. Pelleting apparently improves the palatability of the feedstuff, thereby promoting increased consumption.

In this experiment, a comparison is made between pelleted and nonpelleted rations in regard to feedlot performance, digestibility and nitrogen retention. Although lambs were used in these trials, it is thought that the results obtained can be applied to cattle as well.

Rations with two different ratios of roughage to concentrate were utilised. In addition, the source of roughage in the pelleted rations was either suncured alfalfa hay or dehydrated alfalfa hay.

This study should help provide a clearer understanding as to the relative merits of pelleted and non-pelleted rations in the feeding of ruminant animals.

# REVIEW OF LITERATURE

In recent years, increasing interest has been shown in the pelleting of rations for sheep. Some of the first research work reported on the use of pellets was that conducted at New Mexico A. and M. in 1950. Neale (9) conducted trials over a three year period in which low quality alfalfa hay was combined with sorghum grain and molasses in pelleted form. A nonpelleted ration consisting of high quality alfalfa hay and sorghum grain was used as a control ration. Results from these trials revealed that the lambs on the pelleted ration gained more rapidly and utilised their feed more efficiently than the lambs on the non-pelleted ration. It should be noted, however, that the pelleted ration contained molasses while the nonpelleted ration did not include this ingredient.

Later work by Heale (10) compared pelleted rations of varying proportions of roughage to concentrate. Pellets containing 70 percent, 60 percent and 50 percent roughage were fed to both light and heavy lambs. The light lambs exhibited a slight and the heavy lambs a marked increase in rate of gain and feed efficiency with the pellets of higher roughage level.

Recent studies at the Illinois Agricultural Experiment Station (2) indicated that little or no advantage was to be gained from pelleting rations consisting of alfalfa meal and corn. The pelleting of rations containing timothy meal and corn considerably increased both rate and efficiency of gain. The results of this work and that by Neale (9), (10) indicate that pelleting of low quality roughages provides a means of obtaining more complete and efficient utilization of those types of feed.

Evidence is also available indicating that lambs will show greater performance with pelleted rations than the same ration in non-pelleted form. Thomas, et al. (13) found that lambs on pelleted rations of hay and grain gained faster and more efficiently than lambs fed whole grain and long hay. Similar results were recorded by Jordan, et al. (5) who also reported that the lambs on all pelleted rations developed an apparent oraving for roughage and began to chow on feed bunks and fence posts during the latter stages of the trial.

Work at Kansas State College (1) during the last few years is in accordance with that previously mentioned in that lambs on pelleted rations show an increase in rate of gain and feed efficiency over lambs on similar

non-pelleted rations. In these trials, rations of 55 percent roughage and 45 percent corn were compared to rations of 65 percent roughage and 35 percent corn. It was found that the 55-45 rations gave results superior to those of the 65-35 ration whether the rations were fed in natural form or as pellets.

Lindahl and Davis (6) fed rations consisting of 50 percent alfalfa hay, 45 percent corn and 5 percent blackstrap molasses, in loose form and as pellets to lambs. Lambs on the non-pelleted ration gained 0.34 pound per head per day while those receiving pellets gained 0.42 pound per head per day. Feed required per hundred pounds gain was 906 and 772 pounds respectively for the loose and pelleted ration.

John (4) found that lambs given pelleted rations made faster and more efficient gains than lambs given similar non-pelleted rations. In the work reported by John, there was one instance of a non-pelleted ration producing better results than a similar ration in pelleted form, but the lambs on the pelleted ration had gone off feed during the feeding period. John (4) reported that pelleted rations containing 65 percent alfalfa hay and 35 percent corn gave significantly better results in the feedlot than did pelleted rations containing 55 percent alfalfa hay and 45 percent corn. This is not consistent with the results reported by Bell and co-workers (1). However, non-pelleted 55-45 rations produced faster and more efficient gains than did 65-35 non-pelleted rations.

Hays (3) conducted a feeding trial with lambs using pelleted and nonpelleted rations with varying ratios of roughage to concentrate. In addition, the pelleted rations contained either sumcured or dehydrated alfalfa hay as the source of roughage. Lambs gained faster and more efficiently on the pelleted rations. The pellets containing sumcured alfalfa hay gave better results than those containing dehydrated alfalfa hay. A ratio of 55 percent

roughage and 45 percent concentrate was more efficient and economical than a 65-35 ratio in the non-pelleted rations. Pelleted rations, however, gave slightly larger gains with the higher proportion of roughage, but the advantage in efficiency and economy was inconsistent.

While most workers report more favorable results from feeding pelleted rations than non-pelleted rations, some trials have failed to indicate such results. In experiments conducted at Oklahoma A. and M. College (11) little or no increase in feed efficiency or rate of gain was noted from pelleted rations over similar non-pelleted rations. Schneider, et al. (12) also could detect no benefit from the pelleting of rations.

In a metabolism study by John (4), lambs fed pelleted rations had significantly higher protein and ether extract digestion coefficients than lambs fed non-pelleted rations. The digestion coefficient for erude fiber was much lower in the pelleted rations. There were no noticeable differences between the total digestible mutrient values of the pelleted and non-pelleted rations, but in the 55-45 rations, the total digestible mutrient values were significantly higher than in the 65-55 rations. The average percent nitrogen retained per lamb was much greater in the pelleted rations than in the nonpelleted rations.

Hays (3) conducted a metabolism study with lambs using pelleted and non-pelleted rations having a 60-40 roughage to concentrate ratio and pelleted rations having a 55-45 ratio. In addition, the source of roughage in the pellets was either sumcured or dehydrated alfalfa hay. The digestion coefficients, total digestible mutrients, and nitrogen retention were highest in the pelleted rations containing 55 percent roughage and 45 percent corn. While there were but slight differences in the digestion coefficients and total digestible nutrients between the 60-40 pelleted and non-pelleted

rations, the non-pelleted ration had a significantly lower nitrogen retention than the pelleted rations. There were no consistent differences between the results from pellets containing suncured or dehydrated alfalfa hay.

Digestion trials were conducted by Long, et al. (7) in which wether lambs were fed identical rations in natural, ground and pelleted form. The rations consisted of 30 percent prairie hay, 20 percent alfalfa hay, 34 percent corn, 8 percent cottonseed meal, and 8 percent came molasses. Results indicated that grinding of the feed tended to decrease digestibility while pelleting of the ground ration raised the digestibility to the original level. There was no significant difference in overall digestibility between the rations in pelleted and natural form.

The actual feeding of pelleted rations on a commercial basis has been limited due to the high cost of preparation of the pellets. At the present cost of pelleting, there appears to be little, if any, economic advantage in feeding pellets since the cost of pelleting offsets the saving in feed.

## EXPERIMENTAL PROCEDURE

# Feeding Trial

One hundred and twenty-six lambs were used in this trial. The lambs were purchased at the Kaneas City Stock Yards on October 10, 1956, and upon arrival at the Kaneas State College sheep barns, were put in dry lot. The lambs received prairie hay and water for the first two days and after that, were given long alfalfa hay, corn and cats. This ration was continued until the first day of the feeding period.

In late October, the lambs were individually weighed, car tagged, and divided into six lots of 21 animals each. Assignment to lots was made

according to weight to insure an equal distribution of light and heavy lambs in all lots. The lambs were then placed in six separate pens, all of which were covered on the north by an open-faced shed. The lambs were started on test November 6.

Experimental rations were assigned to the various lots as follows:

Lot 1. Pelleted ration - Pellets consisted of 60 percent sumcured alfalfa hay and 40 percent corn. Chopped alfalfa hay was added to the ration to achieve a ratio of 65 percent roughage to 35 percent concentrate.

Lot 2. Pelleted ration - Pellets consisted of 50 percent sumcured alfalfa hay and 50 percent corn. Chopped alfalfa hay was added to the ration to achieve a ratio of 55 percent roughage to 45 percent concentrate.

Lot 3. Non-pelleted ration - Ration consisted of 65 percent chopped alfalfa hay and 35 percent corn.

Lot 4. Non-pellsted ration - Ration consisted of 55 percent chopped alfalfa hay and 45 percent corn.

Lot 5. Pelleted ration - Pellets consisted of 60 percent dehydrated alfalfa hay and 40 percent corn. Chopped alfalfa hay was added to the ration to achieve a ratio of 65 percent roughage to 55 percent concentrate.

Lot 6. Pelleted ration - Pellets consisted of 50 percent dehydrated alfalfa hay and 50 percent corn. Chopped alfalfa hay was added to the ration to achieve a ratio of 55 percent roughage to 45 percent concentrate.

The alfalfa hay used in this experiment was harvested from the same field. The hay for the dehydrated pellets was taken to the mill for dehydration as soon as it was cut. The hay for the suncured pellets was allowed to cure in the field, baled and then taken to the mill for grinding and pelleting. The hay used in the non-pelleted rations was field cured, baled, and then put through a forage chopper just prior to the start of the feeding trial. All the corn for the trial came from the same bulk lot at the Manhattan mill.

After the lambs were started on the experimental rations, the amount fed daily was gradually increased until each lot was receiving all they would elean up. Feeding was done twice daily and any feed not consumed was weighed back and the amount recorded. Salt and water were kept before the lambs at all times. The lambs were weighed individually at the beginning and at two-week intervals throughout the trial. The feeding period lasted 86 days, terminating on February 2, 1957. Upon completion of the feeding period, the lambs were taken to the St. Joseph Stock Yards and sold. After slaughter, U.S.D.A. carcass grades were obtained for each lamb.

Average daily gain, feed intake, feed consumed per hundred pounds of gain, carcase grades, and feed cost were recorded. Representative samples of all types of pellets, corn and alfalfa hay were taken to the chemistry laboratory for analysis. Results of these analyses are found in Table 1.

#### Metabolism Study

The same rations were used in the netabolism study that were used in the feeding trial. The metabolism study was divided into two phases. The rations in Phase I contained 65 percent roughage and 55 percent concentrate while those in Phase II contained 55 percent roughage and 45 percent concentrate. In both phases, one ration consisted of chopped alfalfa hay and ground yellow corn, another of dehydrated alfalfa hay and yellow corn in pelleted form, and a third of sumoured alfalfa hay and yellow corn in pelleted form. The pellets in Phase I contained 60 percent alfalfa and 40 percent corn. Chopped alfalfa hay was added to the pellets in Phase I in amounts necessary to achieve the 65-35 ratio. Pellets in Phase II

s hvdrates Carbo-70.47 68.80 67.62 74.45 66.41 64.43 68.93 . · Extract W-Free 48.29 53.65 38.32 72.31 38.84 53.42 57.37 Table 1. Chemical analysis of feeds used in the feeding trial and metabolism study. 5.48 8.55 6.43 10.02 6.65 9.28 1.83 · Moisture · Ash 6.85 6.05 6.47 6.58 5.94 8.55 5.77 Crude Fiber 15.15 29.30 13.10 18.12 2.14 25.59 15.51 . Extract Ether 5.65 S.07 2.81 1.66 5.86 1.78 4.39 . Protein 15.38 15.38 15.80 14.15 11.51 18.00 13.56 Dehydrated Pellets (80-40)1 Dehydrated Pellets (50-50)<sup>5</sup> Suneured Pellets (60-40)2 Suncured Pellets (50-50)6 Feeds Alfalfa Hay<sup>5</sup> Alfalfa Hay<sup>4</sup> Yellow Corn

Pellets consisting of 60 percent dehydrated alfalfa hay and 40 percent corn used in the feeding trial and metabolism study. Chopped alfalfs hay was added to make a 65-35 ratio.

Pellets consisting of 60 percent sumoured alfalfa hay and 40 percent corn used in the feeding Chopped alfalfa hay was added to make a 65-35 ratio. trial and metabolism study.

3 Alfalfa hay used in Phase I.

Alfalfa hay used in Phase II.

Pellets consisting of 50 percent dehydrated alfalfa hay and 50 percent corn used in the feeding trial and metabolism study. Chopped alfalfa hay was added to make a 55-45 ratio. 10 9

Pellets consisting of 50 percent summuned alfalfa hay and 50 percent corn used in the feeding Chopped alfalfa hay was added to make a 55-45 ratio. trial and metabolism study.

contained 50 percent alfalfa and 50 percent corn. Chopped alfalfa hay was added to the pellets in Phase II in amounts necessary to achieve the 55-45 ratio.

Eight of the heaviest lambs from the original group purchased in Kansas City were selected for the metabolism trials. These lambs were brought to the metabolism room and placed in metabolism orates on November 10, 1956. They were immediately started on an approximate full feed of the experimental rations. Feeding was done twice daily and water was kept before the lambs at all times. A week was allowed for the lambs to become accustomed to the crates and dist. On November 17, the first collection period of Phase I began. Each collection period covered a span of seven consecutive days. Since only eight metabolism orates were available, three lambs each were on two of the rations and two lambs were on the third ration during each collection period. At the end of each collection period, the rations were rotated and a three day adjustment period was allowed before beginning the next collection period. In this manner, collections were obtained from all the lambs on each ration of the trial.

One lamb of the original eight failed to eat during the initial adjustment period and was replaced by a lamb which soon exhibited signs of illness and also had to be replaced. This accounts for the fact that only seven lambs are shown in the first collection period.

The feces from each lamb was collected every evening during the collection period. This was weighed and a 5 percent aliquot placed in a porcelainised pan which in turn was placed in an oven set at 65 degrees Centigrade. After the seventh day of collection, the oven was turned up to 95 degrees Centigrade until the foces were completely dry. The dry feces were then weighed, transferred to glass jars and taken to the chemistry laboratory for analysis.

The urine was also collected every 24 hours, the volume recorded, and a representative sample placed in a glass jar. A few drops of toluene were added as a preservative. Upon completion of a collection period, the urine samples were taken to the chemistry laboratory for nitrogen analysis.

# RESULTS AND DISCUSSION

## Feeding Trial

It is pointed out that the pellets used in this experiment contained either 60 percent roughage and 40 percent concentrate or 50 percent roughage and 50 percent concentrate. Chopped alfalfa hay was added to the pellets to make a ration containing either 65 percent roughage and 35 percent concentrate or 55 percent roughage and 45 percent concentrate. In addition, the source of roughage in the pellets was either dehydrated or sumcured alfalfa hay. In the following discussions, rations consisting of pellets made with 60 percent sumcured alfalfa hay and 40 percent com plus enough chopped alfalfa hay to make a ration having a 66-35 roughage to concentrate ratio, will be spoken of as 65-35 sumcured pellets. Reference to the other rations will be made in a like manner.

Results of the feeding trial are given in Table 2. The lambs made more rapid gains when fed pelleted rations than when fed similar non-pelleted rations in all cases but one. This exception was with the 55-45 dehydrated pellets. The rate of gain from this ration was essentially the same as that from the 55-45 non-pelleted ration. The increased rates of gain apparently resulted from more efficient feed utilisation since the total amount of feed consumed was less with the pelleted rations than with the non-pelleted

Lot muber	-	60	50	4	8	. 6
	* 60% sun.	50% sun.	65% choppeda	55% chopped	* 60% dehy.	* 50% dehy.
Ration	s alf. hay	alf. hay :	alf. hay :	alf. hay	: alf. hay	s alf. hay
	a 40% corn	1 50% corn :	35% ground:	45% ground	1 40% corn	* 50% corn
	s Pelleta*	Pellets* :	corn :	corn	: Pellets*	: Pellets"
fo. lambs per lot	21	22	21	20	21	22
Days on feed	88	88	88	88	88	88
lvg. initial wt. per lamb	77.0	75.4	75.3	75.3	75.5	75.1
lyg. final wt. per lamb	117.5	115.0	108.8	106.1	110.6	106.2
Avg. total gain per lamb	40.5	59•6	33.4	51.0	35.1	51.1
be. feed deily gain per lamb	•459	• 450	•380	• 352	• 399	. 353
Pellet	5.15	2°92			2.94	2.62
Chopped hay Ground corn	•418	.408	2.20	1.33	•408	• 408
bs. feed per out. of gain						
Pellet	684.7	647.9			735.5	740.7
Chopped hay Ground corn	87.6	90°6	577.9 304.6	483.7 377.7	102.1	115.4
feed cost per out. gain	\$16.44 \$8.66	\$16.43 \$6.61	\$16.25 \$5.45	\$16.89 \$5.24	\$19.31 \$6.78	\$20.24
to. lambs died	-		ar an A	1		
laroass grades Prime				63	1	
Choice	10	17	12	6	10	11
Good	11	4	67	6	p	10

\* Each lamb received, in addition, .4 pound of chopped alfalfa hay daily.

rations. The cost of gain with pellets containing dehydrated alfalfa hay was considerably more than that with pellets containing sumcured alfalfa hay or the non-pelleted rations. This can be partially attributed to the high cost of dehydration.

Pellets containing sumcured alfalfa hay gave significantly better results than pellets containing dehydrated alfalfa hay. Not only did the lambs gain more rapidly on the pellets made with sumcured hay, but the feed efficiency was greater and the cost per hundred pounds of gain less.

Slightly faster gains were obtained from 65-35 summered pellets than from 55-45 summered pellets. The same was true with the pellets containing dehydrated alfalfa hay. Another fastor of interest is that the 55-45 sumcured pellets produced faster gains than either of the rations containing dehydrated alfalfa. This tends to indicate that while a 65-45 roughage to concentrate ratio may be desirable, a more important factor in obtaining good results from pellets is the utilisation of summured alfalfa hay as the source of roughage. Feed efficiency and cost per hundred pounds of gain were varied and inconsistent between the pellets containing different ratios of roughage to concentrate.

In the non-pelleted rations, the 65-35 roughage to concentrate ration produced a slightly factor rate of gain and a lower cost per hundred pounds of gain than the 55-45 ration.

It is thought that the addition of a small amount of roughage to the pelleted ration, as was done in this trial, lends to more efficient utilization of the pellets.

The feed prices and processing charges used in determining the feed cost were as follows: Chopped alfalfa hay, \$25.00 per ton; ground corn, \$1.50 per bushel; dehydrated alfalfa hay, \$37.00 per ton; grinding hay for the pellets, \$5.00 per ton, and mixing and pelleting, \$5.00 per ton. On the basis of these figures, the 60-40 summured pellets cost \$44.44 per ton, the 50-50 summured pellets cost \$46.80 per ton, the 60-40 dehydrated pellets cost \$48.62 per ton and the 50-50 dehydrated pellets cost \$50.28 per ton.

One lamb died during the next to last week of the trial due to enterotoxemia.

#### Metabolism Study

The average values for the metabolism study are found in Tables 3 and 4. <u>Digestion Trial</u>. With the rations containing 65 percent roughage and 35 percent concentrate, the lambs receiving sumcured pellets had a higher total digestible mutrient value than the lambs on the non-pelleted ration. The non-pelleted ration, however, gave a higher total digestible mutrient value than the pelleted ration with dehydrated alfalfa hay. In the 55-45 rations, the same relationship existed. The better results obtained from sumcured pellets are in agreement with results of the feeding trial. The 55-45 rations produced considerably higher total digestible mutrient values than the 65-55 rations.

There was little difference in the digestion coefficients for orade fiber in any of the pelleted rations. The fiber digestion coefficients for both of the non-pelleted rations were essentially the same and were considerably higher than these of the pelleted rations. The digestion coefficient values for crude fiber in this trial were considerably higher in the pelleted rations than these reported previously for similar trials (Hays, 3), (John, 4). The small amount of chopped alfalfa hay added to the pellete is thought to have aided in the digestion of crude fiber. Pellets alone, due to their compactness, would probably tend to more more rapidly

Table 5. Digestibility study with lambs.\*

No. of			1	Digestion Coef	ficient	8	
Lambs	8	ation	s Protein	s E. Extract :	Fiber s	N.F.e.E.	T.D.H.
			98	R	R	20	DR.
***	65-35	DP1	66.71	67.75	56.79	78 <b>•</b> 94	17.98
60	65-35	Sp2	72.98	61.82	38.17	81.94	63.72
60	65-35	ARACS	69.34	61.49	44.76	79 <b>.</b> 86	62.06
0	55-45	DP4	65.18	81.72	55.82	80.76	64.61
8	55.45	Sp5	71.89	72.75	\$6•23	83.98	67.08
60	55-45	AH&C <sup>6</sup>	72.65	70.98	44.92	83.10	66.78

. Individual lamb results are shown in Appendix Tables 5-10.

\*\* One lamb was removed due to illness.

Represents pellets containing 60 percent dehydrated alfalfa hay and 40 percent corn plus enough chopped alfalfa hay to make a 65-35 ratio.

Represents pellets containing 60 percent sumoured alfalfa hay and 40 percent corn plus enough chopped alfalfa hay to make a 65-35 ratio.

Represents a non-pelleted ration consisting of 65 porcent chopped alfalfs hay and 35 percent ground yellow corn.

Represents pellets containing 50 percent dehydrated alfalfa hay and 50 percent corn plus enough chopped alfalfa hay to make a 55-45 ratio.

Represents pellets containing 50 percent sumeured alfalfa hay and 50 percent corn plus enough chopped alfalfa hay to make a 55-45 ratio.

Represents a non-pelleted ration consisting of 55 percent chopped alfalfa hay and 45 percent ground yellow corn. Table 4. Average results of mitrogen balance shudy with lambs.

: Total: Grams: % M flotal M :% M in : Grams sml. of: M in : in faces : feces : M : urine: urine:urine:and urine:retained	1 10032 84.78 54.50 136.73 87.79 18.89	. 14928 89.99 58.42 132.00 85.53 22.27	i 13146 88.45 63.44 131.18 94.09 8.23	: 10295 73,96 47,55 115,61 82,38 27,40	i 11521 78.35 51.59 121.22 79.82 30.65	1 10640 87.11 54.16 131.11 81.52 29.70
fams: % N in : in bces: feccs	1.91 55.29	1.76 27.11	L.75 30.65	1.15 34.82	2.87 28.23	1.00 27.36
a dry : N	2106 51	1775 41	1849 41	2096 54	1712 45	1701 44
: Grams : N : consumed	155.53	158.02	159.41	155.52	151.86	160.82
Ration	65-35 DP <sup>1</sup>	65-35 SP2	65-35 AR&CS	55-45 DP <sup>4</sup>	55-45 SP <sup>5</sup>	55-45 AH&C6
No. of:	244	60	8	60	60	60

Individual lamb results are shown in Appendix Table 11.

\*\* One lamb was removed due to illness.

Represents pellets containing 60 percent dehydrated alfalfa hay and 40 percent corn plus enough chopped alfalfa hay to make a 65-35 ratio.

Represents pollets containing 50 percent auroured alfalfs hay and 40 percent corn plus enough chopped alfalfa hay to make a 65-35 ratio.

Represents a non-pelleted ration consisting of 65 percent chopped alfalfa hay and 35 percent ground vallow corn.

Represents pellets containing 50 percent dehydrated alfalfa hay and 50 percent sorn plus enough chopped alfalfa hay to make a 55-45 ratio.

Represents pellets containing 50 percent surcured alfalfs hay and 50 percent corn plus enough chopped alfalfa hay to make a 55-45 ratio.

Represents a non-pelleted ration consisting of 55 percent chopped alfalfa hay and 45 percent ground vellow corn. through the digestive tract than pellets accompanied by roughage. Not only would the roughage delay the passage of the pellets through the digestive tract, but it would also add bulk to the ration. This would help to avoid the formation of a doughlike mass in the digestive tract which would not be readily attacked by the digestive juices (Maynard and Locsli, 8).

The summured pellets produced considerably higher digestion coefficients for orude protein than did the pellets containing dehydrated alfalfa hay. The 65-35 summured pellets gave a slightly higher value for protein than did the 65-35 non-pelleted ration, however, the values for 55-45 summured pellets and the 55-45 non-pelleted ration were essentially the same.

The 55-45 rations gave much higher digestion coefficients for ether extract than did the 65-35 rations. Pellets containing dehydrated alfalfa hay had considerably higher values than either the sumcured pellets or the non-pelleted rations.

Sunoured pellets produced slightly higher digestion coefficients for nitrogen-free extract than did the non-pelleted rations. The non-pelleted rations gave higher values than did the dehydrated pellets. The rations containing 55 percent roughage produced somewhat higher digestion coefficients for nitrogen-free extract than did the rations containing 65 percent roughage.

<u>Mitrogen Balance</u>. The differences in nitrogen retention in the rations containing 55 percent roughage and 45 percent concentrate were slight. The 65-35 ration consisting of chopped alfalfa hay and corn, however, produced a much lower nitrogen retention than did the 65-35 pelleted rations. This difference was largely due to the failure of two of the lambs to eat properly, during which time they exhibited a negative nitrogen balance. The average percent nitrogen retained for the 55-45 rations was considerably higher than for the 65-35 rations.

# GENERAL DISCUSSION

In this experiment it was found that lambs being fattened on pelleted rations consisting of summured alfalfa hay and corn gained more rapidly and had better feed efficiency than lambs being fed pelleted rations consisting of dehydrated alfalfa hay and ground corn or non-pelleted rations consisting of dehydrated alfalfa hay and ground corn. The better results obtained from the pelleted rations containing summured alfalfa hay are in agreement with other work previously reported (Hays, 5). Many of the experiments found in the literature report the use of molasses in the pellets along with the other ingredients. Even with this factor to consider, it is generally agreed that pelleted rations produce more rapid and efficient gains in lambs than similar rations in non-pelleted form. These results further confirm this observation, but only when summured alfalfa hay was used as the source of roughage in the pellets.

Results from this experiment showed that the rate of gain and feed efficiency in the sumcured pellets having different ratios of roughage to concentrate were essentially the same. Also, the cost per hundred pounds of gain was the same. This lack of variability between the different ratios of roughage to concentrate is not in agreement with the work conducted by Hays (3), who reported that his results definitely confirmed a greater feed efficiency of pelleted rations containing a 55-35 ratio.

Jordan, et al. (5), reported that lambs on all-pelleted rations developed an apparent oraving for roughage and began chewing on feed bunks and fence posts. The lambs in this experiment received approximately .4 pound of ohopped alfalfa hay along with the pellets. No signs of a graving for

roughage were noted. It is also thought that the addition of this small amount of roughage to the ration helps to effect a more complete breakdown of the orude fiber in the ration. The digestion coefficients for the orude fiber are considerably higher in this experiment than in the trial conducted by John (4) in which no additional roughage was added to the pellets.

Results from this trial comparing the rate of gain and feed efficiency between pelleted rations containing dehydrated alfalfa hay as the source of roughage and non-pelleted rations are in agreement with the work reported by Cate, et al. (2), in which they found that there was little or no advantage to be gained from pelleting rations consisting of alfalfa meal and corn. The pellets containing dehydrated alfalfa not only failed to produce an appreciable increase in rate and efficiency of gain over non-pelleted rations, but the cost of the dehydrated pellets raised the cost per hundred pounds of gain considerably above that for non-pelleted rations.

Only one other worker, Hays (3), used pelleted rations containing either suncured alfalfa hay or dehydrated alfalfa hay, so only one comparison can be drawn between the relative merits of pellets containing these two sources of roughage. The actual values for the total digestible mutrients and the various digestion coefficients varied somewhat between this experiment and the work conducted by Hays (5). However, the results of the metabolism studies of the two trials are in fairly close agreement as far as relative differences between the different rations is concerned except in the case of the crude fiber digestion coefficients. Hays reported a much lower value for the 60-40 pelleted rations than for the 55-45 pelleted rations, but this is thought to be due to the fact that Hays did not add ehopped alfalfa hay to his 60-40 pellets.

Nitrogen retention was higher with the 55-45 rations, than with the

65-55 rations. There was little difference in the percent of nitrogen retained in the 55-45 rations.

In the 65-35 rations, the non-pelleted ration produced a much lower nitrogen balance than did either of the pelleted rations. This low value is largely attributed to the failure of two lambs to eat properly while on the non-pelleted ration.

The lambs used in the metabolism study were the heaviest of the group of lambs purchased for both the feeding trial and metabolism study. It is believed by some people that animals confined to orates for experimental purposes exhibit extreme states of unthriftiness and loss of weight during this confinement. A point of interest is that the lambs utilized in this metabolism study had an average weight exactly the same at the end of the trial as at the beginning although they did lose considerable muscle tone due to lack of exercise.

#### SUMMARY AND OBSERVATIONS

One hundred and twenty-six lambs were used in the feeding trial of this experiment. They were assigned to lots according to weight in order to insure a uniform average size of lambs in each lot. There were six lots of twenty-one lambs each. Felleted and non-pelleted rations with two different ratios of roughage to concentrate were fed. In addition, dehydrated alfalfa hay was used for the source of roughage in one set of pellets while sunsured alfalfa hay was used in the other set.

It was found that the lambs made more rapid gains on the pelleted rations than on the non-pelleted rations in all cases but one. The increased rates of gain were apparently due to more efficient feed utilization rather than increased feed intake since the lambs on the non-pelleted rations

consumed more feed than those on the pelleted rations.

Pellets containing sumcured alfalfa hay as the source of roughage produced faster and more economical gains than pellets with dehydrated alfalfa hay as the source of roughage.

Where dehydrated alfalfa hay was the source of roughage, the 65-35 pelleted ration produced best results. When sumoured alfalfa hay was the source of roughage, there was no significant difference in economy and rate of gain between the pellets containing the two different ratios of roughage to concentrate.

The cost per hundred pounds of gain was approximately the same for the non-pelleted rations and the pelleted rations containing suncured alfalfa hay. The cost was considerably higher with pellets containing dehydrated alfalfa hay. This can be partially attributed to the high cost of dehydration.

Eight wether lambs were used in the netabolism study of this experiment. These lambs were fed the same rations that were used in the feedlot trial. Each lamb was on each ration for one week with a three-day adjustment period in between. There was little difference in the total digestible mutrient value for any of the rations containing the same ratio of roughage to concentrate. The rations containing 55 percent roughage and 45 percent concentrate produced somewhat higher total digestible nutrient values than did the 65-35 rations. Digestion coefficients for crude fiber were significantly higher in the non-pelleted rations. Digestion coefficients for ether extract were higher in the rations containing 55 percent roughage and 45 percent concentrate, with the pelleted rations containing dehydrated alfalfa hay having considerably the highest value.

The pelleted rations containing suncured alfalfa hay and the non-pelleted

rations gave orude protein digestion coefficients that were essentially the same. The crude protein digestion coefficients for the pelleted rations containing dehydrated alfalfa hay were somewhat lower than those in the other rations. There was no significant difference in the digestion coefficients of nitrogen-free extract in any of the rations, however, the 55-45 rations held a slight edge over the 65-35 rations in this value.

There was little difference in the average amount of nitrogen retained among the 55-45 rations. Mitrogen retention from the 65-55 rations was much the lowest in the non-pelleted ration. It is thought that this low value resulted largely from the failure of two of the lambs to eat properly. The overall average for nitrogen retention was significantly higher in the rations containing 55 percent roughage and 45 percent concentrate.

The following observations were made from this experiment: Lambs gained as fast or faster on pelleted rations than on similar rations in non-pelleted form.

Pellets containing sumsured alfalfa hay produced more rapid and economical gains than pellets containing dehydrated alfalfa hay.

Pelleted rations containing sumcured alfalfa hay as the source of roughage produced higher total digestible mutrient values than non-pelleted rations or pelleted rations containing dehydrated alfalfa hay. This difference was slight in the case of the non-pelleted rations.

Rations containing 55 percent roughage and 45 percent concentrate produced higher total digestible nutrient values than rations having a 65-35 roughage to concentrate ratio.

Digestion coefficients of crude fiber were higher in non-pelleted rations than in pelleted rations.

Digestion coefficients for crude protein were lower in the pelleted

rations containing dehydrated alfalfa hay than in pelleted rations containing suncured alfalfa hay or the non-pelleted rations.

Rations containing 55 percent roughage and 45 percent concentrate produced higher digestion coefficients for other extract than rations containing 65 percent roughage and 35 percent concentrate.

Pelleted rations containing dehydrated alfalfa hay produced higher digestion coefficients for ether extract than pelleted rations containing suncured alfalfa hay or the non-pelleted rations.

## ACKNOWLEDGMENTS

The author wishes to express his deepest approxiation to Dr. Draytford Richardson, major instructor, for his assistance and guidance in conducting the experiment and preparing the manuscript, and to Carl Mensies and Ted Nelson for their help with the feeding trial.

The author is especially grateful to his wife, Anne Striegel, not only for inspiration, but also for her assistance in the preparation of data and typing of the manuscript.

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Tal		Total grams fed	Pro-	Grame : crude : protein;	Ether	s Grams ; s ether ; s extracts	z2.25	: X : :Crude: :fiber:	Grams crude fiber	N.F.E.	s Grams s E N.F.E.s	Total nutrients digested	T. Z.
21	Pellets Alf. hay Total Feees Am't di Dig. co	4848 712 5560 1882 gested	15.38 15.50 15.37 ent	745.62 110.56 855.98 289.26 566.72 66.20	3.65 1.66 3.18	175.98 11.81 187.79 59.84 127.95 68.15	287.88	18-12 29-30 36-05	878.45 206.61 2087.05 678.46 408.60 37.58	48.29 38.32 29.31	2341.09 272.85 2615.92 561.61 2062.51 78.89	3325°51	59°81
	Pellets Alf. hay Total Feces Am't di Dig. co	5600 840 6440 2239 gested	15.58 15.50 15.14 ent	861.28 130.20 991.48 538.98 652.50 65.81	5.63 1.66 5.22	203.28 13.94 217.22 72.09 145.15 66.81	326.54	18.12 29.30 36.96	1014.72 246.12 1260.84 827.55 455.51 84.56	48.29 58.32 28.55	2704.24 521.88 521.88 5026.12 639.25 2586.89 78.87	3799 <b>。</b> 24	58 <b>.</b> 99
R	Pellets Alf. hay Total Feces Am't di Dig. co	5600 840 6440 1897 gested effici	15.38 15.80 14.66 ant	861.28 150.20 991.48 278.10 715.38 71.95	3.63 1.66 3.11	203.28 15.94 217.22 58.99 168.23 72.84	356.01	18.12 29.30 37.55	1014.72 246.12 1260.84 711.94 548.90 45.53	48°29 38°32 30°38	2704.24 521.88 526.12 576.30 2449.82 78.49	4088.11	60.56
105	Pellets Alf. hay Total Feces Am't di Dig. co	5600 840 6440 2174 gested gested	15.38 15.50 15.99 ant	861.28 130.20 991.48 547.62 643.86 64.3386	5.65 1.66 5.35	205.28 15.94 217.22 72.82 144.40 66.47	324° 90	18.12 29.30 57.70	1014.72 246.12 1260.84 819.59 441.25 34.99	48°29 38°32 29°10	2704.24 321.88 321.88 3026.12 632.65 2393.49 79.09	3805 <b>.</b> 50	59° 06

Tab1	e 5. (cono	I.)											
Lamb		Total grams: fed s	Pro-s	Grama : orude : protein:	g Ether extract	a Greens : s ether : s extracts	x2. 25	s Crudes s Crudes	Grams : orude : fiber :	N.F.E.	Grams a W.F.E.	Total mutrients digested	T.D.N.
40	Pellets Alf. hay Total Feces Am't di	5600 840 6440 2366 gested efficie	15.38 15.50 14.91	861,28 130,20 991,48 352,77 638,71 64,41	3.65 1.66 3.20	205.28 15.94 217.22 75.71 141.61 85.14	<b>318</b> • 39	18.12 29.30 37.69	1014.72 246.12 1260.84 891.74 369.10 29.27	48°29 38°32 30°14	2704.24 321.88 321.88 713.11 2313.01 76.43	3639.21	56. 50
120	Pelleta Alf. hay Total Feces Am't di Dig. co	5000 840 6440 1972 gested efficie	15.38 15.50 15.45 nt	861.28 130.28 991.48 304.67 686.81 69.27	5.63 1.66 2.97	205+28 15+94 217+22 58+56 158+66 73+04	356 <b>.</b> 98	18.12 29.30 37.19	1014.72 246.12 246.84 735.84 527.46 41.83	46. 29 38. 32 29. 94	2704.24 321.68 3226.12 590.41 2435.71 80.48	4006.96	62°21
149	Pellets Alf. hay Total Feces Am't di Dig. co	5600 840 6440 2226 gested efficted	15.38 15.50 15.90 mt	861.28 130.28 991.48 353.93 637.55 64.30	3.63 1.66 3.72	205.28 15.94 217.22 82.80 134.42 61.88	302.44	18.12 29.50 56.20	1014.72 246.12 1260.84 805.81 455.03 36.08	48.29 38.32 30.08	2704.24 321.88 321.88 3026.12 669.58 659.54 23556.54 77.87	3761.56	58 <b>°</b> 25
Tota Dig.	1 fed 44 1 digested coefficie	., 200 nt		6804.86 4539.53 66.71		1491.11 1010.50 2 67.75	2273.17		8652.10 3183.65 36.79		20770.64 16397.77 78.94	26394.12	£9°71

Land		Totals	Pro-s	Grams : crude :	Ether	s Grams	t x2.25	: % :	Grems :	RI	Greens al	Total	BR C
	8 8	fed :	teins	protein:	extract	s extract	-	sibers	Liber	NeFeEs	S NeFeres	ulgested.	eNale 1
12	Pellets	5600	15.38	861.28	2.81	157.36		15.15	848.40	53.65	3004.40		
ł	Alf. hay	840	15.50	130.20	1.66	13.94		29.30	246.12	38.32	321.88		
	Total	6440		991.48		171.30			1094.52		3326°28		
	Feces	1807	14.85	268.53	2.87	51.86		56.90	666.78	35.29	601-55		
	Am't di	gested		723.15		119.44	268.74		427°74		2724.73	4144.36	64.35
	Dig. co	efficie	ent	72.93		69.72			39°08		81.91		
24	Pellets	5600	15.38	861.28	2.81	157.36		15.15	848.40	53.65	3004.40		
	Alf. bav	840	15.50	150.20	1.66	15.94		29.30	246.12	38 • 32	321.88		
	Total	6440		991.48		171.30			1094.52		3326.28		
	Feces	1871	13.26	248.09	5.42	63.98		38.33	717.15	32.45	607.13		
	Am't di	rested		743.39		107.32	241.47		577°37		2719.15	4081.38	63.37
	Dig. co	officie	int	74.97		62.65			34.47		81.74		
5626	Pellets	5600	15.38	861.28	2.81	157.36		16.15	848.40	53.65	3004+40		
	Alf. hay	840	15.50	130.20	1.66	13°94		29°30	246.12	38.32	321.88		
	Total	6440		991.48		171.30			1094.52		3326.28		
	Foces	1738	14.56	253.05	5.33	57 + 87		36°13	628.80	32.52	565.13		
	Am'to di	gested		738.43		115.43	255.21		465.72		2761.09	4220.45	65.53
	Dig. co	efficie	nt	74.47		66.21			42.55		83°00		
12	Pellets	4368	15.38	671.79	2.81	122.74		15.15	661.75	53.65	2343.43		
	Alf. hav	642	15.50	99°51	1.66	10.65		29.30	188.10	38•32	246.01		
	Total	5010		761.30		133.39			849.85		2589.44		
	Feces	1295	13.84	178.95	5.65	47.19		37.56	485.65	51.86	411.94		
	Am't di	rested		582.35		86.20	193.95		364.20		2177.50	3318°00	66.22
	Dig. co	offloie	int	76.49		64.62			42.85		84.09		

Table 6. Directibility study with lambs using a pelleted ration consisting of 60 percent sumeured

Iamb		grams;	Pro-s	Grams : erude : protein;	Ether	: Grams : ; ether : ; extracts	x2.25	: X : sCrude:	Grams ; erude ; fiber ;	N.F.E.	s Grams B.F.E.	Total mutrients digested	T.D.N
102	Pellets Alf. hay Totel Feces Am't di Dig. oc	5600 840 840 8440 1841 1841 1841 igested	15.58 15.50 15.57 mt	861.28 150.20 991.48 286.64 704.84 71.08	2.81 1.66 4.11	157.56 15.94 171.50 75.66 95.64 55.83	215,19	15.15 29.30 36.11	848.40 246.12 1094.52 664.78 429.74 39.26	53.65 38.52 31.76	5004.40 521.88 5326.28 584.70 2741.58 82.42	4091.35	65.53
49	Pellets Alf. hay Total Feces Am't di Dig. co	5600 840 6440 1700 Igested	15.38 15.80 13.78 mt	861.28 150.20 991.48 234.26 757.22 76.57	2.81 1.66 5.31	157.36 13.94 171.30 56.27 115.03 67.15	258•81	15.15 29.30 37.79	848.40 246.12 246.12 1094.52 642.45 452.09 41.30	55.65 38.52 52.55	3004.40 321.88 5326.28 549.95 2676.53 82.95	4144.45	64.35
120	Pellets Alf. hay Total Peces Am't di Dig. co	5600 840 6440 1966 Igested	15.58 15.50 14.96 mt	861.28 130.20 991.48 294.11 697.57 70.55	2.81 1.66 3.73	157.36 15.94 171.30 73.35 97.97 57.19	220.45	15.15 29.30 37.17	848.40 246.12 246.12 1094.52 750.76 365.76 353.25	53.65 38.52 31.48	3004.40 321.88 3326.28 618.89 2707.39 81.39	3988 <b>.</b> 95	61.94
149	Pellets Alf. hay Total Feces Am't di Dig. co	5600 840 6440 2019 2019	15.38 15.50 16.10 mt	861.28 861.28 991.48 325.05 666.43 67.21	2.81 1.66 4.09	157.36 15.94 171.50 82.57 88.73 51.79	199,64	15.15 29.50 35.94	848.40 246.12 246.12 1094.52 725.62 368.90 358.90 35.70	53.65 38.52 31.32	5004.40 521.88 5326.28 632.35 652.35 80.98	3828° 90	61.00
rota Dig.	1 fed 50 1 digested coefficie	,090 ant		7701.66 5613.18 72.88		1532.49 825.76 61.82	1853.46		8511.49 3249.52 38.17		25873.40 21201.70 81.94	31917.86	63 <b>°</b> 72

Table 6. (cenel.)

11		otals	R	Grams :	a Kan	Grams :	20.02	a Martin	Grams :	8	Grame .	Total mitri ante	8
r fed	fed	an an	tedne	proteinse	atraot:	extracts	0.909Y	s fibers	fiber a	N.F.E.s	H.F.E.s	digested	T.D.N.
y 4130	4130		15.50	640.15	1.66	68.55		29.30	1210.09	58.32	1582.61		
6356	3356		70077	16-168	0000	154.47		1.494	1257.72		3192.23		
1925	1925		14.71	282.87	5.53	67.88		58°70	744.20	31.05	596°70		
digeste	Pris.		t	609•04 68•28		86.59 56.05	194.82		513.52 40.82		2595.55	3912°91	61.56
w 4130	61.30		15.50	640.15	1.66	68.55		29.30	1210.09	38.32	1582.61		
2226	2226		11.51	251.76	3.86	85.92		2.14	47.65	72.51	1609.62		
6356	6356			891.91		154.47			1257.72		<b>5192.2</b> 5		
1812	1812		15.84	250.78	5.67	66.50		57.91	686.92	51.62	571.14		
digeste	este	de la		641.13		87.97	197.93		570.80		2621.09	4030.95	65.41
co effic	ff10	40	at	71.88		56°94			45.38		82.10		
y 4150	4130	-	15.50	640.15	1.66	68°55		29.30	1210.09	58°52	1582.51		
2226	2226		11.51	251.76	3.86	85.92		2.14	47.63	72.31	1609.62		
6356	6356	-		891°91		154.47			1257.72		CZ •ZATC		
1985	1985		14.45	286.83	5°20	63+52		56.44	725.53	34.59	686.61		
digeste	este	-		605.08		90°95	204.65		534.59		2505.62	3849°72	60.56
coeffic	ff1e	10	nt	67.84		58°87			42.48		78.49		
y 4150	4150	0	15,50	640.15	1.66	68°55		29.30	1210-09	38.52	1582.51		
2220	2220	-	11.51	251.76	5°86	85.92		2.14	47.65	72.51	1609.62		
6556	5556	-		891.91		154.47			1257.72		3192°25		
1682	1682		14.21	239.01	2.49	41.88		56.88	620°32	34.16	574°57		
digeste	este	-1		652.90		112.59	253.32		637.40		2617.66	4161.28	65°47
nnnPP1 n	PP1 at	0	nt	73-20		72.88			50°67		82.00		

Table 7. Digestibility study with lambs using a non-pelleted ration consisting of 65 percent chopped

ul : ints: % ied :T.D.]	44 61.60	78 63.21	08 58 <b>.</b> 71	31 61.21	52 62°06
a Tota a mutrie adigest	<b>3915</b> .	4020.	3046.	5893.	30830 •
Grams N.F.E.	1582.51 1609.62 3192.25 700.75 2491.50 78.04	1582.61 1609.62 3192.23 647.55 2544.68 79.71	1582.61 1513.14 2604.52 571.68 2032.84 78.05	1582.61 1609.62 3192.23 675.93 2616.30 78.82	4950 <b>.15</b>
E % E	38.32 72.51 36.27	58-52 72-51 55-27	38.32 72.51 53.51	38,32 72,31 35,26	61 14
Grams orude f1ber	1210.09 47.65 47.65 1257.72 667.50 590.22 590.22	1210.09 47.65 1257.72 670.14 587.58 46.71	987.41 58.86 58.86 58.86 632.75 594.61 58.44	1210.09 47.63 1257.72 685.52 572.40 45.51	9830.51 4400.85
: % :	29.30 2.14 54.55	29.50 2.14 36.50	29•30 2•14 37•03	29.50 2.14 35.75	
x2.25	225.42	250 <b>.</b> 89	146.01	198.33	1670.40
Greens : ether : extracts	68.55 85.92 154.47 54.28 100.19 64.86	68.55 85.92 85.92 154.47 42.96 42.96 111.51 72.18	55.94 70.09 126.03 61.58 64.45 51.13	68.55 85.92 64.47 66.32 88.15 88.15 87.06	07.32 42.40
Ether : Ether : oxtraots	1.66 3.86 2.81 2.81	1.66 5.86 2.54 1	1.66 3.86 3.61 3.61	1.66 5.86 3.46 3.46	12
Grams : crude : protein:	640.15 251.76 891.91 285.61 68.30 68.20	640.15 251.76 891.91 254.28 637.65 71.49	522.55 205.58 727.75 727.75 254.02 254.02 473.71 85.09	640.15 251.76 891.91 285.65 606.28 67.97	971.10 834.07
Pro-1 teins	15.50 11.51 14.68 nt	15.50 11.31 13.85 t	15.60 11.51 14.89 bt	11.51 11.51 14.90 at	6 4
Total, grams, fed :	4130 2226 6356 1932 gested	4130 2226 6356 1836 1836 gested fficien	3370 1816 5186 1706 gested	4130 2226 6356 1917 59sted	678
	Alf. hay Corn Total Feces Am't di	Alf. hay Corn Total Feces Am't di	Alf. hay Corn Total Feces Am't di Dig. co	Alf. hay Corn Total Fecea Am't dig Dig. coe	fed 49, digested
Lamb	103	49	120	149	Total

Lamb		Total,	Pro-:	Grams : erude :	Ether	Grams :	x2.25	s % s	Grams a crude :	a Rada	Grams si	Total nutrients	TeDelle
	8 8	DOI	10191	Sureaoud	ACTROP	A DETONA		2 7 7 7 0 7 8	-				
21	Pellets	5040	13.56	683.42	4.39	221.25		15.51	781.70	53.42	2692.36		
	Alf. hay	280	18.00	100.80	1°78	9.96		25.59	143.30	58°84	217.50		
	Total	5600	9 IL 100	19 020	00 0	12.102		35.46	588.99	53-94	563.74		
	Feces Am't d1	TOOT	10 °CT	525.61	0000	183.21	412.22	-	356.01		2346.12	3619.96	64.64
	Dig. co	effloi.	ant	67°02		79.23			56.32		80.62		
77	Pellets	6664	13.56	903°63	4.59	292.54		15.51	1033.58	53•42	3559•90		
	Alf. hay	728	18.00	131.04	1.78	12.95		25.59	186.29	38•84	282.75		
	Total	7392		1034.67		305.49			LO.ATZT		00-27-00		
	Feces	2303	15.86	365.25	2.60	59•87		36.65	844.04	STers	DE STL	10 0001	00 00
	Am't di	gested		669.42		245.62			375.83		02-5270	41660GG	00+00
	Dig. co	offloit	ant	64.69		80.40			00° 00		ne •To		
5626	Pellets	6664	13.56	903.63	4.39	292.54		15.51	1033.58	53.42	\$559°90		
	Alf. hav	728	18,00	131.04	1.78	12.95		25.59	186.29	38.84	282.75		
	Total	7392		1034.67		305.49			1219.87	-	3842.65		
	Feder	2393	15.18	363.25	2.44	58.38		56°98	884.93	31.42	715.88		00 00
	Am't di	gested		671.42		247.11	555°99		334.94		11.0270	ST*RDON	00e40
	Dig. co	offici	ent	64°83		80°88			21.40		10.010		
F	Palleta	5040	13.56	685°42	4.39	221.25		16.51	781.70	53.42	2692.36		
!	Alf. hav	560	18-00	100.80	1.78	9.96		26.59	143.30	38.84	217.50		
	Total	5600		784.22		251.21			925°00		2909.86		
	Feces	1603	15.55	249.26	1.98	51.75		53°94	544.06	54.11	546.78		
	Am't di	gested		534.96		199.48	448.85		\$80° 82		2363.08	5727.82	50.00
	Dig. co	offici	ent	68.21		86°27			41.18		81.20		

Table 8. Digestibility study with lambs using a pelleted ration consisting of 50 percent dehydrated

otal : rients: %	32.65 85.37	78.37 64.64	22,58 66,45	12.42 62.59	95 <b>.</b> 17 64.61
s Tc Grams : muta W.F.E.s.dige	1559-90 282-75 282-65 777-30 1065-35 48 19-77	1659-90 282.75 282.75 814.88 814.88 814.88 814.88 027.77 78.79 78.79	1559-90 282-75 282-65 648-06 618-06 5194-59 83-13	35559-90 2822-75 2842-65 769-95 3072-70 46 79-96	8875.62 5320.75 558 80.76
N.F.E.	53.42 38.84 35.64 35.64 3	55.42 58.84 56.46 56.46	55.42 3 58.84 51.69	55.42 58.84 52.89 52.89	ରି ର
Grams : erude : fiber :	1055.58 186.29 1219.87 757.85 482.04 59.51	1033.58 186.29 1219.87 703.80 516.07 42.30	1055.58 186.29 1219.87 759.50 460.57 57.75	1055.58 186.29 1219.87 821.22 598.65 328.65	9169.22 3285.06 35.85
: % : :Crude: :fiber:	15.51 25.59 35.85	15.51 25.59 31.49	15.51 25.59 37.13	16.51 25.59 35.08	
x2.25	603.45	588° 30	556 <b>.</b> 62	502.45	4220.64
Grams : ether : extracts	292.54 12.95 305.49 37.29 268.20 87.79	292.54 12.95 305.49 44.02 261.47 85.59	292.54 12.95 305.49 58.07 247.42 80.99	292.64 12.95 305.49 82.16 223.55 73.10	2295.56 1875.84
Ether : Ether :	4.59 1.78 1.71	4.59 1.78 1.97	4.39 1.78 2.84	4.59 1.78 3.51	
Grams : crude : protein:	903.65 131.04 131.04 65.88 65.89 65.89	903.65 151.04 034.67 588.44 646.25 62.45	905.65 131.04 034.67 535.94 700.73 67.72	903.65 131.04 134.67 596.09 638.59 61.71	7776.46 5068.74
Pro-s	13.56 18.00 16.18	13.56 18.00 17.38	13.56 18.00 16.33	13.56 18.00 16.92 ant	
fotal sgrams	6664 728 7392 2181 1gested oefiicie	6664 728 7392 2255 1gested	6664 728 7392 2045 1gested eefflei	6664 728 7592 2341 1gested oeffici	6, 552 d
	Pellets Alf. hay Total Foces Am't d Dig. c	Pellets Alf. hay Total Feces Am't d Dig. c	Pellets Alf. hay Total Peces Am't d Dig. c	Pellets Alf. hay Total Feces Am't d Am't d	fed f
: dime.	103	6	120	149	Total Total

Table 8. (conel.)

Lamb		Total: grams: fed :	Pro-1	Grams : crude : protein:	Sther : extracts	Grams : ether : extracts	x2.25	: % : : Crude: fiber:	Grams crude fiber	M.F.E.E	Grams 1 M.F.E.1	Total mutri ents digested	T.D.N.
12	Pellets Alf. hay Total Feces Am't di, Dig. co	5814 638 6452 1776 1776 gested efficie	14.13 18.00 14.47 nt	821.61 114.84 956.55 256.98 679.37 72.55	3.07 1.078 4.05	178.48 11.55 189.85 71.57 118.26 62.29	266.08	13.10 25.59 36.32	761.65 163.26 924.89 645.04 279.85 30.25	57.57 58.84 54.75	3335.49 247.79 5583.28 616.80 2966.48 82.78	4191.78	64° 96
44	Pellets Alf. hay Total Feces Am't di Dig. co	6664 728 7592 1849 gested efficie	14.15 18.00 15.45 mt	941.62 131.04 1072.66 285.30 787.36 73.40	3.07 1.78 3.30	204.58 12.95 217.55 61.01 156.52 71.95	352.17	25.59 26.15 36.15	872.98 186.29 1059.27 668.41 568.41 36.89	57.37 38.84 33.69	3825.15 282.75 4105.88 622.92 5482.95 84.82	5012.35	67.80
5626	Pellets Alf. hay Total Feces Am't di Dig. co	6664 728 7392 1806 gested efficie	14.15 18.00 16.21 mt	941.62 131.04 1072.66 301.50 771.16	3.07 1.78 3.07	204.58 12.95 217.53 55.44 162.09 74.51	364.70	13.10 25.59 35.04	872.98 186.29 1059.27 652.82 426.45 40.25	57.37 38.84 33.89	2823.15 282.75 282.75 4105.88 612.05 5493.85 85.09	5056.14	68.40
Ę	Pellets Alf. hay Total Feces Am't di Dig. co	4590 510 5100 1209 gested	14.15 18.00 14.73 mt	648.56 91.80 740.36 178.08 562.28 75.94	3.07 1.78 3.00	140.91 9.07 149.98 36.27 115.71 75.81	255.84	15,10 25,59 35,86	601.29 150.50 731.79 433.54 298.25 40.75	57.57 58.84 55.60	2635.28 196.08 2831.36 406.22 2425.14 85.65	3541.51	69 <b>.</b> 44

bs using a pelleted ration consisting of 50 percent suncured 144.000 Di martilia 144 makin 0

i     i     red i     cont     low result     struct	- q		60 80 R-4 80	otal:	Pro-s	Grama :	Ether	s Grams	: x2.25	: % :	Grama	8 0 %	a Grama	a Total :	R C
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$			-	A DOT	STTPAN	NTANATA	OPTOVO	000 70 00 20	-						
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	2	Pellets	-	070	14.15	712.15	3.07	154.72		13.10	660.24	53.65	2891.44		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Alf. ha.		560	18.00	100.80	1.78	9.96		25.59	143.30	38.84	217.50		
		Total.		900		812.95		164.68			805•54		3108.94		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		Feces	-	396	15.55	217.07	2.65	36.71		36.29	506.60	53.78	471-56		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		Am't	dige	sted		595.88		127.97	287,93		296.94		2637.58	3818°13	68.18
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		Dig.	coel	fiole	int	75.29		01°17			36°95		84.83		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$	-	Pellets	9	664	14.15	941.62	3.07	204.58		13.10	872.98	57.37	3823.13		• •
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Alf. ha	2	728	18.00	131.04	1.78	12.95		25+59	186.29	38.84	282.75		
Teene     2054     16.50     53.400     77.51     57.45     613.78     53.455     613.05     541.56     683.35     66.0       Dig     Dig     oos(T140mt     05.0     10.002     360.04     357.45     681.35     4811.54     66.0       Dig     constratemt     05.0     14.15     73.45     36.0     34.55     587.45     581.34     66.0       Alft Freed     50.0     114.87     23.60     154.45     56.0     58.45     217.50     58.94     46.0       Alft Freed     500     114.67     23.60     15.70     154.65     35.97     56.70     58.94     217.50     66.6       Mart     digetted     90.0     112.87     276.10     58.70     50.72     5773.65     56.70     5773.65     56.70     5773.72     5773.65     56.6     5773.72     5773.65     56.6     5773.72     5773.65     56.6     5773.72     5753.75     55.75     57.75     57.75     57.74     57.74     55.75     57.74		Total		392	-	1072.66		217.55		-	059.27		4105.88		
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		Feces	eu	054	16-30	334.80	2.80	57.51		35.68	691.78	33.59	689-93		
$ \begin{array}{c ccccccccccccccccccccccccccccccccccc$		Am't	dige	ated		737.86		160.02	300.04		367.49		3415.95	4881.54	66.03
D     Palleta     5040     14.13     712.15     5.07     154.72     15.10     660.24     55.65     291.44       Total     Notal     100.4     14.67     21.53     20.55     15.40     501.44       Total     Notal     100.4     14.67     21.5.0     14.67     505.0     51.64     505.45     51.64     51.75     51.7		D1.6.	00 er	ficie	mt	68.78		73.56			34.69		83.19		
Alf.     Iny     500     10.00     1.78     9-96     25.55     31.5.00     21.55     0       Teelal     500     31.24     500     31.46     505.45     55.70     555.25     575.00     555.25     555.25     555.25     555.25     555.25     555.25     555.25     555.25     555.25     555.25     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26     555.26	8	Pellets	63	040	14.13	712.15	5.07	154.72		13.10	660.24	53.65	2891.44		
Total     16800     112-95     144-68     25.87     2005-65     2100-854     2100-854       Peees     1804     14.87     222.872     2.79     41.965     2.875     95.92     3100-854     35.87     95.92     375.165     66.6       Mark digented     656.40     72.8.77     95.87     000-405     57.70     577.202     3751.459     66.6       Mark digented     666.41     73.87     90.406     1.78.22     25.61     95.20     95.72     95.41     95.77     257.202     3751.459     66.6<		Alf. ha		560	18.00	100.80	1.78	9-96		25.59	143.30	38°84	217.50		
Peese     1504     14.67     23.64     0.4.66     53.67     0.65.07     55.70     55.71     50     66.60     55.71     55.71     50     55.71     50     66.60     55.71<		Total		009		812.95		164.68			805.54		3108.94		
Am <sup>4</sup> t digented     599.53     122.72     276.12     294.14     2675.02     3753.69     69.6       Dig.     confrictent     73.65     74.55     36.60     73.73     3753.65     69.6       Pig.     confrictent     73.65     36.60     73.57     355.45     355.65 <td></td> <td>Fees</td> <td>-</td> <td>504</td> <td>14.87</td> <td>223.64</td> <td>2.79</td> <td>41.96</td> <td></td> <td>55°87</td> <td>509.40</td> <td>36.70</td> <td>556.92</td> <td></td> <td></td>		Fees	-	504	14.87	223.64	2.79	41.96		55°87	509.40	36.70	556.92		
Dig. constrictant     72.45     74.52     36.60     83.72     83.72       19     Pallets     6664     14.15     941.62     3.07     204.63     15.10     97.24     952.15     952.15       147. hwy     7392     13.04     1.77     2.3.07     204.63     15.10     97.24     952.15     35.3.7     956.51     15.50     958.4     206.83     35.40     958.4     206.83     558.4     206.83     558.51     1058.55     15.05		Amet	dige	sted		589.51		122.72	276.12		294.14		2572.02	3731.59	66.63
10     Pallets     6664     14.15     941.62     5.07     204.68     13.10     67.2     55.51     5		Dig.	0001	ficie	mt	72.49		74.52			36.60		82.°72		
Alf. hay 728 18.00 131.04 1.78 12.95 25.69 106.29 38.84 282.75 70041 7392 1072.66 27.65 2.84 406.89 Peece 2047 18.92 34.51 2.89 85.45 35.97 665.36 44.00 695.96 Am't digeted 735.31 185.48 356.80 35.97 665.36 44.00 695.96 Mai't digeted 735.31 185.48 356.80 35.97 655.80 80.99 4866.92 65.8 Dife. eccfrictert 66.64 72.90 286.80 74.55 2056.66, 53.8 Field digeted 52,320 7893.25 1139.87 251.97 29.8 Field digeted 5458.65 1139.87 251.97 29.8 Field digeted 73.95 1139.87 251.970 2400.56 35100.78 67.4 Field digeted 77.85 77.75	8	Pellets	•	1664	14.15	941.62	5.07	204.58		15.10	872.98	57.37	3823.15		
Totul     7392     1072.66     27.45     1072.65     217.455     105.65     35.07     4106.86     805.86     805.87     805.87     805.86 </td <td></td> <td>Alf. ha</td> <td></td> <td>728</td> <td>18.00</td> <td>131.04</td> <td>1.78</td> <td>12.95</td> <td></td> <td>25.59</td> <td>186.29</td> <td>58.84</td> <td>282.75</td> <td></td> <td></td>		Alf. ha		728	18.00	131.04	1.78	12.95		25.59	186.29	58.84	282.75		
Feee     2047     16.92     346.35     2.88     55.45     33.97     655.46     34.00     695.49     44.00     695.46     45.00     465.45     54.30     4656.45     55.34		Total		1392		1072.66		217.55		-1	059.27		4105.88		
Am <sup>+</sup> t digested     736.31     188.83     556.80     555.81     5403.90     4805.92     55.8       Dig. scortrinutur     66.64     72.90     55.45     34.85     83.04     4865.92     55.8       Dig. scortrinutur     66.64     72.90     54.85     83.04     5956.52     55.8       rial fod 57.320     7893.25     1839.29     780.06     29056.64     57.04     57.04       rial fod 57.320     780.02     1139.87     7137.03     7400.56     51100.77     67.44       rial figered     5455.65     1139.87     2313.70     777.133     24405.46     51100.77     67.44       .5.     006/fiftedut     77.53     173.73     54.50     55.90     57.44		Peces		2047	16.92	346.35	2.688	58°35		33°97	695.36	34.00	695.98		
tral fed 52,320 7595.25 1839.29 7500.84 22056.04 7.50 trail digested 5459.53 1139.67 2519.70 2717.89 24405.66 55100.76 67.5 Le coefficient 71.69 72.75 36.23 83.89		Am't Dig.	dig	ficie	nt	756.51		158.58	356.80		363.91		3409°90	4866.92	65.84
val fed 52,320 7893.25 1899.29 780.04 22.2055.04 67.0 111 digeved 2559.55 1139.87 2519.70 2717.59 24405.65 35100.78 67.0 18. ooefficternt 7.28													-		
g. coefficient 71.89 72.75 36.23 83.98	tal	fed .	52.	250		7593 <b>.</b> 25 5459 <b>.</b> 53		1559.29	2519.70		717.89		29056°04	35100.78	67.08
	- 20	coeffic	fi ent	.87		71.89		72.75			56.23		82.98		

Table 9. (concl.)

	1	Total:	N.	Grems :	201	Grams		1 2 1	Grems :			Total	1
Tank	8 8 80	fed :	Pro-s	proteins	Ether	ether :	x2.25	: fibers	fiber	N.F.E.	Greens :	nutri ente digested	T.D.N.
5	Alf. hay Corn Total Feese	5080 5600 1305	16-11	554.40 285.01 859.41 210.25	1.78 5.86 5.67	54.82 97.27 152.09 47.89		25.59 2.14 35.49	788.17 55.92 842.09 457.04	58.84 72.51 53.98	1196.27 1822.21 3018.48		
	Am't di	gested	nt	629 <b>.</b> 18 74.95		104.20	234.45		405.05		2575.05 85.30	3843°73	68.63
EL.	Alf. hay Corn Total Feces Am't di	4060 5332 7592 1745 Sested	18.00 11.51 15.48 nt	750.80 376.84 1107.64 270.12 857.52 75.61	1.78 3.86 3.13	72.26 128.61 2200.87 54.61 146.26 72.81	529.08	25.59 2.14 33.50	1058.95 71.30 1110.25 584.57 525.68 47.54	38.84 72.31 35.49	1576.90 2409.56 3986.26 619.30 3566.96 84.46	5059°24	68°44
9626	Alf. hay Corn Total Feees Am't di	4060 3332 7392 1851 1851 50sted	18.00 11.31 16.68 at	730.80 376.84 1107.64 308.74 738.90 72.12	1.078 3.86 2.22	72.26 128.61 200.87 41.09 159.78 79.54	369 <b>.</b> 50	25,59 2,14 29,01	1058.95 71.50 1110.25 536.97 573.28 51.63	38.84 72.51 58.61	1576.90 2409.36 5986.26 714.67 3271.59 82.07	5003.27	67°68
Ę	Alf. hay Corn Total Feces Am't di	5780 5100 6880 1712 gested	18.00 11.51 15.37	680.40 580.61 1031.01 265.15 767.88	1.78 3.86 3.54	67.28 67.28 119.66 186.94 60.60 126.54 126.54	284.26	25.59 2.14 54.70	967.30 967.30 66.34 594.06 439.58 439.58	38.84 72.51 54.44	1468.15 2241.61 3709.76 589.61 3120.15 84.10	4611.87	67.03
	and a deal	0444400	211	110011		~~~~			in the second		10000		

annel ettine of 66 new work an F.Lau. Tahle 10. Dissetthilth

Lamb		: Total : grams	it Pro-	s Grams : s orude : protein:	Ether	: Grems : ether : extract	x2.25	: % : : Crude: : fiber:	Grams orude fiber	N.F.E.	s Grams s N.F.E.	r Total	s % sToDeMe
105	Alf. ha Corn Total Feces Am't Dig.	y 3165 2591 5756 1645 digested	18.00 11.31 15.40 ent	569.70 295.04 862.74 255.55 609.41 70.65	1.78 3.86 2.80	56.53 100.01 156.54 46.06 110.28 70.53	248.13	25.59 2.14 32.09	809.92 55.44 865.36 527.88 527.48 337.48 38.99	38.84 72.31 39.52	1229.28 1873.55 3102.85 550.10 2452.73 79.04	3647.75	63.37
49	Alf. ha Corn Total Feces Am't	y 4060 3332 7392 1876 14gested	18.00 11.31 16.08 ent	730.80 576.84 1107.64 301.66 805.98 72.76	1.78 3.86 3.45	72.26 128.61 200.87 64.54 136.55 67.96	307.19	25.59 2.14 53.45	1058.95 71.50 1110.25 627.14 485.11 45.51	38.84 72.31 35.38	1576.90 2409.56 5986.26 663.72 3322.54 83.34	4918°82	86.54
130	Alf. ha Corn Total Feces Am't d	y 3220 2656 5856 1807 11607 11gested	18.00 11.51 16.24 ent	579.60 298.13 877.75 244.75 655.00 72.11	1.78 5.86 5.14	57.31 101.74 159.05 47.51 111.74 70.25	251.41	25,59 2,14 33,82	823.99 56.41 880.40 509.66 570.74 42.11	38.84 72.31 34.37	1250.64 1906.09 3156.75 517.95 517.95 2638.78 83.59	8893 <b>.</b> 93	66.49
149	Alf. ha. Corn Total Feces Am't d Dig. e	r 4060 3332 7592 1973 Mgested	18.00 11.51 17.66 ent	730.80 376.84 1107.64 348.45 759.21 68.54	1.78 5.86 3.10	72,26 128,61 200,87 61,16 139,71 69,55	514.34	25,59 2,14 31,60	1038.95 71.50 1110.25 623.46 486.79 43.84	38.84 72.31 35.00	1576.90 2409.56 5906.26 690.55 5295.71 82.67	4856 <b>•0</b> 5	65,69
Total Total Dig.	l fed l digeste coeffici	55, 660 od ent		8041.45 5841.08 72.63		1457.90 1054.84 2 70.98	528° 59		8062.49 3621.71 44.92		28932.84 24045.51 83.10	35834 <b>.</b> 69	66.78

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Table	

Lamb	s Grams s M sonsume	difeces:	Grems: N in : feces:	feces:	Total	Grams: N in ; urine;	% I : in : urine:	Total N : in feces: and urine:	feces feces and urine	s Grams t t M t trebaineds	% M retained by lamb	
					Dehydra	ted Pel	lets (6	( <u>5-35</u> )*				
21	156.95	1882	46.28	35°79	6050	75.56	55.17	121.84	88.96	15.12	11.04	
11	158.63	2239	54.23	34.18	9420	85.06	55.61	159.29	87.79	19.37	12.21	
5	158.63	1897	44.49	28.04	4420	86.54	54.55	151.03	82.59	27.62	17.41	
103	158.63	2174	55.61	35.05	10050	80.40	50.68	136.01	85.73	22.64	14.27	
49	158.63	2366	56.44	35.57	37790	95.71	59.07	150.15	94.64	8.50	5. 36	
120	158.63	1972	48.74	50.72	6470	85.46	52.61	152.20	83.33	26.44	16.67	
149	158.63	2226	56.62	35.69	38030	88.60	55.85	145.22	91.64	13.42	8.46	
Total Average	1068.75	14756	362.41	35.29	12230	593° 38	54.50	955.74	87°79	155.11	12.21	
					Suncu	red Pel.	lets (6	5-35)*				
21	158.63	1807	42.93	27.06	9010	85.77	54.06	128.70	81.12	29.95	18.88	
77	158.65	1871	39°63	25.02	12810	86.46	54.50	126.15	79.52	52.49	20.48	
5626	158.63	1738	40.48	25.51	25720	105.45	66.47	145.93	91.98	12.72	8.02	
Ę	121.80	1295	28.49	23.49	2935	81.24	69.69	109.86	90.18	11.96	9.82	
103	158.63	1841	45.86	28.91	11450	90.11	56.80	135.97	85°71	22.67	14.29	
49	158.65	1700	37.48	23.62	13310	104.61	65.94	142.09	89.56	16.56	10.44	
120	158.65	1966	47.05	29.66	5300	83.15	52.41	130.20	82.07	28.44	17.95	•
149	158.63	2019	52.00	32.78	38890	85.16	53°68	137.16	86.46	21.49	15.54	
Total	1232.21	14205	554.11	-	19425	719.95		1056.06		176.28		
Average				27.11			58.42		86.53		14.47	

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Item 1     Chopped Alfailin Hay and Ground Som (G5-55)       TT     143.70     1825     64.55     54.55     54.17     12350     64.45     66.46     124.61     67.65     13.44       T1     143.70     1825     64.55     54.17     12350     64.46     56.46     124.61     67.65     13.46     9.46       T1     143.70     1805     182.61     64.65     55.41     12350     64.46     7.40     124.61     70.41     12	Lamb	s Grauns soonsume	t dry t difeces	Grams: M in : feces:	in:	Total: ml. : urine:	Grams: I in : urine:	A N :	Total N a in feces: and urine:	% M in feces	: Grams : : N : e:retained:	% N retained by lamb	
21 1     143.70 143.70     1825 182     64.85 64.86     51.96 54.86     53.96 54.86     5					Choppe	d Alfal	fa Hay	and Gro	und Corn	(65-35)			
Tilds, 70     1812     4.0.12     30.11     13390     04.46     50.0     124.01     110.61     12.00       73     142.07     1802     54.01     53.01     53.00     154.01     110.61     110.61     110.61     112.00       103     142.07     1802     54.01     53.01     53.01     55.01     55.01     124.01     10.0.11     124.01     120.00     54.01     53.01     54.01     55.01     134.01     124.01     126.01     54.01	21	142.70	1925	45.25	51.70	12250	84.05	58.88	129.28	90.58	15.44	9.42	
8528 143.70 1965 56.45 53.51 163.54 100.14 -11.64 -0.14   71 134.70 1885 46.87 53.75 183.54 100.145 177.68 -0.14   105 143.70 1885 46.87 53.47 85.61 85.61 85.61 85.61 85.61 85.75 95.85 125.45 97.62 135.55 9.46   106 143.70 185 40.68 83.40 87.60 135.47 10.242 -5.65 9.46   116 143.70 187.70 185.40 57.40 57.60 135.47 95.45 9.46   106 40.66 53.40 50.40 77.77 10.49.76 10.49.76 9.46   116.45 107.07 50.40 77.61 10.49.76 50.45 54.91   116.45 107.04 50.46 77.61 10.49.45 50.65 54.91   114.70 54.10 50.46 77.61 10.49.45 50.65 54.91   114.70 54.70 50.46 77.61 10.49.45 50.65 54.91   115.55 114.70 54.71 57.71 55.41 55.41   114.70 54.71	11	142.70	1812	40.12	28.11	13390	84.49	59.20	124.61	87.31	18.11	12.69	
1 143.070 1682 35.42 26.74 4310 61.05 155.45 97.40 12.19 97.40   10 143.070 1682 45.87 57.40 63.05 155.45 90.62 13.54 90.62 13.54   10 143.070 1836 46.96 53.41 95.05 153.45 90.65 9.45   10 144.070 1870 40.06 53.40 92.87 65.06 153.45 90.85 9.46   116.470 1870 46.70 53.40 92.87 67.06 153.45 90.85 9.46   116.51 1470 54.00 53.44 10.09.55 10.675 707.61 65.42 9.46   Arvenge 30.66 153.47 10.54 53.44 10.09.55 9.46 9.46   Arvenge 116.56 200 65.45 10.66 7.44 10.45 5.91   Arvenge 116.56 200 53.44 10.49.55 70.46 153.45 9.46   Arvenge 116.56 200 65.45 9.46 7.46 10.49.55 5.91   Arvenge 116.56 200 53.44 10.49.55 10.49.55 5.91	5626	142.70	1985	45.89	32.15	16260	108.45	75.99	154.54	108.14	-11.64	-8.14	
103     143.70     1832     4.6.87     13.4.70     8650     85.61     86.75     129.16     80.52     13.6.87     9.6.65     9.6.75     9.6.76	11	142.70	1682	58.24	26.79	4310	87.10	61.05	125.54	87.82	17.38	12.18	
40     145.77     135.67     135.45     135.46     135.46     135.46     135.46     137.45	105	142.70	1932	45.37	51.79	8650	83+81	58.73	129.18	90.52	13.53	9.48	
120     116.45     170     40.66     54.90     5315     79.05     119.77     30.268     -5.50     -2.682       Torbul     1115.35     142.70     1917     45.70     52.05     20667     77.71     10.49.05     9.25     9.26     -5.612       Torbul     1115.35     142.70     10.47     45.70     52.05     20667     77.71     10.49.05     94.09     55.91     5.91       Torbul     1115.35     147     10675     77.61     10.49.05     94.09     55.91     5.91       Torbul     115.55     2051     50.47     10.48.05     94.09     54.96     5.91       Torbul     115.55     2055     56.47     10.56     56.45     56.47     50.47     56.47     56.47     56.47     56.47     56.47     56.47     56.47     56.47     56.47     56.46     56.46     56.46     56.46     56.46     56.47     56.47     56.47     56.47     56.47     56.47     56.47     56.46     56.46     56	49	142.70	1856	40.68	28.50	27640	92.87	65.08	133.55	93.58	9.16	6.42	
140     142-70     167     45-70     52-03     20460     67-77     61.450     153-47     93-52     9.25     6.46       Total     1115-53     14705     54.10     50.450     67.47     61.45     1049.50     65.92     5.91       Arvenage     30.65     50.461     50.461     50.463     56.42     56.92     5.91       Arvenage     1156.57     50.461     50.461     50.461     56.44     56.92     5.91       Zi     1256.47     1561     41.57     53.47     95.46     56.41     50.46     5.91       Zi     1256.47     156.45     50.0     54.41     50.45     54.41     54.40     54.40       Zi     1256.47     10.049     77.45     56.01     120.46     54.41     54.40	120	116.43	1706	40.64	34.90	3615	79.09	67.92	119.73	102.82	-5.30	-2.82	
Total     1115.53     14795     541.69     106875     707.61     1048.50     65.92     5.91       Arounge     20.66     20.66     20.66     106875     707.61     65.44     94.09     65.92     5.91       Arounge     21     125.47     1061     41.97     54.91     5.91     5.91       21     125.47     1061     41.97     54.91     70.461     (55.45) <sup>0.0</sup> 54.91     5.97       21     125.47     1061     41.97     55.41     130.08     50.24     120.26     54.91     54.91       66.72     1056.45     2005     55.11     130.09     55.46     54.11     54.96     54.16       71     155.47     1005     55.46     55.47     135.48     54.96     54.16       71     155.47     1005     55.46     55.41     130.46     75.43     55.07     14.56       71     155.46     55.16     57.44     55.46     55.41     13.66     55.41     55.46     54.	149	142.70	1917	45.70	32°03	20460	87.77	61.50	135.47	93•52	9.24	6.48	
Isingle for the form of the for	Total	1115.33	14795	541.89	30.65	106575	707.61	63.44	1049.50	94•09	65.92	5.91	
21     155.47     1661     41.57     35.97     9940     71.86     67.27     115.25     90.24     12.26     9.76       77     165.64     2305     55.44     55.50     5300     72.14     45.67     130.48     76.67     54.96     21.15       6626     165.64     2305     55.00     5300     72.14     45.67     130.48     76.67     51.26     51.15     51.17     51.76     51.17     51.76     51.17     51.76     51.17     51.76						Dehydr	sted Pe.	Lets (	55-45)**				
TT     165.64     2305     55.44     55.60     73.64     45.67     130.65     76.67     54.96     21.15       T1     125.47     1035     56.12     55.10     19000     53.46     50.67     31.41     133.65     51.15     51.15       T1     125.47     1035     59.68     53.17     135.66     93.41     13.65     61.13.65     61.13.65     61.15 </td <td>21</td> <td>125.47</td> <td>1661</td> <td>41.37</td> <td>32.97</td> <td>0766</td> <td>71.86</td> <td>57.27</td> <td>115-25</td> <td>80.24</td> <td>12.24</td> <td>9-78</td> <td></td>	21	125.47	1661	41.37	32.97	0766	71.86	57.27	115-25	80.24	12.24	9-78	
6626     165.46     2395     55.10     18000     93.88     55.10     18700     93.88     63.11     152.00     91.81     135.54     63.19       10     125.64     1304     53.410     5370     53.85     50.610     13.854     77.17     17.89       105     155.64     134.06     53.410     5770     72.88     45.77     137.82     35.70     22.37       40     155.64     2770     72.88     45.77     137.82     35.71     27.82     16.69       120     155.64     2740     75.87     45.77     137.82     35.70     22.34       120     155.64     2740     75.46     124.46     36.77     137.42     35.71       130     155.64     274     57.77     45.77     137.42     36.70     23.45       140     155.64     2790     71.44     35.70     134.07     30.95     34.77     137.42       155.64     273.7     25.77     55.79     52.94     76.96	77	165.54	2303	58.44	35.30	8300	72.14	43.57	130.58	78.87	34.96	21.15	
Til     155,e4     103     53,e8     53,178     5370     55,e5     50,e8     12,e9     12,e9     12,e9       103     155,e4     2181     53,e8     5570     72,s8     55,57     23,8,70     23,17       40     155,e54     2281     55,e7     57,e3     55,77     13,e3     56,77     23,23     14,e9     23,17       40     155,e54     2284     57,e4     56,77     13,e3     45,77     13,e9     14,e9     23,47     19,e9     24,e7     14,e9     24,e7     16,e6     24,e7     15,e9     24,e7     10,e9     24,e7     14,e9     24,e7     13,e0     19,e0     24,e7     19,e0     24,e7     14,e0     12,e4,e1     15,e0     24,e7     13,e0     13,e0     13,e0     13,e0     15,e0     24,e1     14,e0     14,e0     24,e1     14,e0     15,e0     24,e0     24,e1     14,e0     24,e1     14,e0     15,e0     24,e0     24,e0     24,e0     24,e0     24,e0     25,e0     24,e0	5626	165.54	2395	58.12	35.10	19600	93.88	56.71	152.00	91.81	13.54	8.19	
103     165.46     2101     65.46     54.10     5770     72.58     45.72     125.64     77.68     56.70     22.17       130     165.64     22.81     55.45     77.46     75.45     75.46     76.76     10.76     10.76     24.77       130     165.64     23.84     53.45     77.46     45.34     40.66     24.77       140     165.64     23.41     53.45     77.46     45.34     40.66     24.77       149     165.64     23.41     53.47     134.60     75.45     40.65     24.77       149     165.64     23.47     53.27     52.0700     70.70     42.70     80.99     31.47     19.602       146     165.64     24.81     53.67     52.40     70.47     53.40     75.45     40.65     24.77       149     165.64     24.81     53.67     70.42     13.40     75.45     40.65     24.77       140     165.64     24.82     27.80     70.42     75.45	11	125.47	1603	39 <b>.</b> 88	31.78	3370	63.52	50.62	105.40	82.41	22.07	17.59	
40 165.45 2235 62.15 7.54 7740 75.77 137.42 85.51 27.62 15.69 220 165.64 2045 52.45 22.7 5290 71.46 45.16 124.89 75.45 24.97 149 165.64 2046 53.45 23.27 5290 70.70 42.70 134.07 80.98 75.40.65 24.97 149 165.64 2041 65.77 38.28 27090 70.70 42.70 134.07 80.98 219.85 19.02 140 1244.18 16762 455.22 54.82 82500 591.70 47.56 224.98 82.88 219.85 17.62 Average 1244.18 16762 455.22 54.82 82500 591.70 47.56	103	165.54	2181	56.46	54.10	5270	72.38	43.72	128.84	77.83	56.70	22.17	
120 165.64 2045 53.43 52.27 5390 71.46 43.16 124.69 75.43 40.65 24.57 149 165.64 2341 63.37 39.28 27030 70.70 42.70 134.07 80.98 31.47 19.02 104al 1244.19 16762 433.22 82360 591.70 42.76 924.93 219.55 19.56 Average 47.56 924.93 13.45 17.66	49	165.54	2235	62.15	57.54	3740	75.77	45.77	137.92	85.31	27.62	16.69	
148 105.54 2341 63.37 39.28 27090 70.70 42.70 134.07 80.98 31.47 19.02 Total 1244.18 16762 435.22 82360 591.70 47.55 924.93 82.58 219.25 Average	120	165.54	2045	53.43	\$2.27	5290	72.46	43.16	124.89	75.43	40.65	24.57	
Total 1244.18 16762 435.22 82500 591.70 924.95 824.95 12.58 19.25 Average 47.55 924.95 12.58 17.62	149	165.54	2341	63°37	38°28	27090	70.70	42.70	134.07	80.98	51.47	19.02	
Average 54.82 47.56 32.58 17.62	Total.	1244.18	16762	133.22		82360	691.70		924.93		219.25		
	Average				54.82			47.56		82.38		17.62	

Table 11. (concl.)

ZI     146.401     1776     41.11     77.465     117.465     10809     58.26.50     157.464     77365       77     177.462     10809     56.26.50     258.26.50     258.26.50     258.26.50     258.26.50     278.27       105     113.465     1209     28.26.50     258.46     778.65     248.27       105     113.465     1209     28.26.55     25.465     716.05     278.20     98.75       120     171.462     2047     55.41     52.420     98.95     24750       120     171.462     2047     55.41     52.420     98.27     92.27       1214.48     15805     54.20.66     54.20.56     28.2.2.5     92.27     92.27       1214.48     15805     54.20.66     58.2.2.5     26.2.2.5     26.2.2.5     92.27       131.7.452     135.655     54.2.3.65     58.2.2.5     26.2.5     26.2.5     92.2.5     92.2.5     92.2.5     92.2.5     92.2.5     92.2.5     92.2.5     92.2.5     92.2.5     92.2.5	1.11 27.44 775 5.64 28.55 1556 8.49 28.05 2432 8.49 28.05 2432 8.40 272 26.70 507 6.45 21.50 453 5.41 32.52 2473 5.41 32.52 2473 5.41 32.52 2473 5.41 32.52 2473 5.41 32.52 2473	Sumeured Pe 0 85,25 0 85,25 0 85,25 0 65,96 0 65,96 0 75,54 0 75,54 0 72,95 0 72,95 0 72,95 0 72,95 0 72,95 0 72,95 0 72,95 0 72,95 0 72,57 0 72,57 0 75,57 0 85,57 0 95,57 0 16,57 0 17,57 0 17,57	211ets ( 59.59 56.98 56.98 56.98 48.60 59.06 49.88 42.75 57.92 57.92	55-45)** 130.59 128.89 146.05	04 24		
21     149.61     1776     41.11     27     149.61     77%       77     77     120.61     177.62     120.61     120.61     120.61       713     171.62     1800     45.84     25.63     1550     276       713     130.67     1206     25.64     25.65     276     276       130.67     1306     55.47     27.60     25.64     26.65     276     697       120     171.62     2054     55.45     55.47     27.60     4950     4950       120     171.62     2047     55.41     57.80     4950     4950       120     171.62     2047     55.41     57.80     497     477       149     171.62     2047     55.41     57.80     9217     497       146.56     1576     55.41     52.50     9217     25.64     9690       146.50     157.52     25.60     4950     55.43     55.43     55.43     57.64     9660	1.11 27.44 773 6.26.50 1556 50.556 6.24 26.50 1556 50.527 6.42 25.50 1254 6.42 25.50 207 6.43 25.50 907 6.41 25.20 435 6.41 32.23 2479 6.41 32.23 2479 6.41 32.23 2479 6.41 32.23 2479 6.41 32.23 2479	0 89.25 0 85.25 0 85.25 0 97.79 64.86 75.37 75.34 72.95 0 72.95	59, 59 56, 98 56, 98 56, 98 49, 98 42, 75 57, 92 42, 50	130.39 128.89 146.03	04 04		
77     177.462     1860     56.26.50     1550       71     113.46     1800     56.26.50     260.50       105     113.46     1200     280.40     2702       105     113.46     1200     28.40     2702       105     171.452     1800     28.40     2700     2702       105     171.452     2047     55.41     27.40     497       120     171.452     2047     55.41     32.42     24700       120     171.452     2047     55.41     32.42     92470       Notring     153.450     156.41     35.42     92470       Notring     153.452     156.43     32.470     9217       Notring     153.450     156.43     32.470     92.470       Notring     153.450     55.41     52.40     900       Notring     156.46     156.43     35.41     24.40     90.430       Notring     156.50     150.55     55.42     92.420     90.430     92.420 <th>6.4.64 26.69 1556 9.24 28.210 2462 8.49 24.00 2010 2010 8.45 21.20 607 9.541 32.20 607 6.71 27.50 453 5.41 32.50 2473 5.41 32.50 2473 5.41 32.50 2473 5.41 32.50 2473 5.41 32.50 2473</th> <th>0 83.25 97.79 64.89 73.37 75.37 75.34 75.34 75.34 75.34 75.34 75.34 75.34</th> <th>48.50 56.98 59.06 49.88 42.75 57.92 42.50</th> <th>128.89 146.05</th> <th>000000</th> <th>19.42</th> <th>19.07</th>	6.4.64 26.69 1556 9.24 28.210 2462 8.49 24.00 2010 2010 8.45 21.20 607 9.541 32.20 607 6.71 27.50 453 5.41 32.50 2473 5.41 32.50 2473 5.41 32.50 2473 5.41 32.50 2473 5.41 32.50 2473	0 83.25 97.79 64.89 73.37 75.37 75.34 75.34 75.34 75.34 75.34 75.34 75.34	48.50 56.98 59.06 49.88 42.75 57.92 42.50	128.89 146.05	000000	19.42	19.07
5226 177.452 1860 46.24 23.405 24627 171 118.46 1209 28.45 24.05 2462 149 130.07 1396 53.478 25.40 507 120 130.07 1396 53.478 25.40 507 120 130.07 1396 55.41 52.82 2475 149 171.452 2047 55.41 52.82 2475 140 171.452 2047 55.41 52.82 2475 140 171.452 1365 542.96 2017 Average 137.42 1365 542.96 2017 21 134.50 1305 53.63 25.60 9600 21 137.22 1351 40.50 25.50 8300 6228 177.22 1351 40.50 25.50 8300 140 30 20 25.51 2300 111.12 196.50 172 2000 25.52 2300	6.24 28.10 2482 4.73 26.00 276 4.73 25.00 433 5.6 31.20 687 5.41 32.82 2473 5.41 32.82 2473 5.41 32.82 2473 5.41 32.82 2473 5.41 32.83 221 2.96 28.23 221	97.75 69.96 69.96 64.89 75.37 75.34 75.34 775.34 772.95	56.98 59.06 49.88 42.75 57.92 42.50	146.03	75.09	49.75	24.01
71     113.45     1209     25.45     24.05     27.65       103     130.07     1396     54.75     25.47     25.76     207       120     171.62     2054     55.41     25.43     25.05     55.47     27.60     697       120     171.62     2054     55.41     27.40     697     435       140     171.62     2047     55.41     57.80     435     2475       140     171.62     2047     55.41     57.80     9217     435       Average     1214.88     13695     542.56     9217     9217     44       Average     1314.50     13695     542.56     9217     9217     9217       Average     1354.50     13695     542.56     9217     924.85     924.75       Average     1354.50     13655     542.66     936.60     926.64     9666     177.22     145.55     24.85     936.67     936.62     177.22     175.5     95.60     936.62     936.62	8.49 24.05 276 4.75 26.70 507 5.67 21.50 697 5.41 52.50 487 5.41 52.28 2473 2.96 28.28 9217 2.96 28.28	0 69,96 64,89 0 75,37 0 75,34 0 72,95 0 626,83	59.06 49.88 42.75 57.92 42.50		85.08	25.50	14.09
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49     177.462     2054     55.46     55.46     55.46     55.45     45.46       120     130.07     1604     55.41     52.50     4805       140     171.462     2044     55.41     52.82     24705       150     171.462     2044     55.41     52.82     2770       Total     1214.48     13695     542.96     22170     27170       Average     1214.50     13695     542.96     22170     27045     25.42     92170       Average     1214.50     13695     542.86     542.64     9660     270       Average     177.222     1745     53.51     24.66     9600       21     1354.50     1305     35.46     9600     6206     1777.222     24.55     6200     9500       77     177.522     1745     53.51     25.56     9860     9500       77     177.222     1756     53.52     25.56     9860     9500       71     1364.50     1772	3,56 51,20 687 6.78 27,50 483 5,41 52,28 2473 5,41 52,28 2473 2,96 28,23 9217 2,96 28,23 9217	0 73.37 0 75.34 0 72.95 0 626.83	42.75 57.92 42.50	99.62	76.58	30.45	23.42
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5626 177.22 1851 49.59 27.86 8950 71 164.96 1712 42.10 25.52 3230	3.21 24.38 627	0 101.88	57.48	145.09	81.86	52.13	18-14
71 164.96 1712 42.10 25.52 3230	3.39 27.86 895	0 85.92	48.48	135-31	76.35	41.91	23.65
	2.10 25.52 3230	0 86.72	52.57	128.82	78.09	56.14	21.91
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120 140.43 1507 39.15 27.87 4830	3.15 27.87 4830	0 86.02	61.25	125.17	89.13	15.26	10-67
149 177°22 1973 55°74 31°45 37100	5.74 31.45 3710	80.89	51.28	146.63	82.73	30.59	17.27
Total 1286.60 15615 562.01 85120	2.01 8512(	696.93	2	048°94		237.66	
Average 27.36	27.36		54.16		81.52		18.48

\*\* Fellets contained 50 percent roughage and 40 percent concentrate. Enough chopped alfalfa hay was added to make a 55-45 ratio.

A STUDY OF METABOLISM AND RATE OF GAIN WITH LAMBS USING PELLETED AND NON-PELLETED RATIONS

by

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B. S., Kansas State College of Agriculture and Applied Science, 1954

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

This experiment was designed to study the feedlot performance, digestibility, and nitrogen retention from pelleted and non-pelleted rations having two different ratios of roughage to concentrate. In addition, the pellets contained either dehydrated or sunsured alfalfa hay as the source of roughage.

One hundred and thirty-four lambs were used, with the eight heaviest being selected for the metabolism study. The lambs used in the feeding trial were divided into six lots of 21 animals each.

The same rations were used in both the feeding trial and metabolism study. The experimental rations were as follows: (1) Pellets containing 60 percent dehydrated alfalfa hay and 40 percent corn plus enough chopped alfalfa hay to make a 65-35 ratio. (2) Pellets containing 60 percent sumcured alfalfa hay and 40 percent corn plus enough chopped alfalfa hay to make a 65-35 ratio. (3) Non-pelleted ration consisting of 65 percent chopped alfalfa hay and 35 percent ground yellow corn. (4) Pellets containing 50 percent dehydrated alfalfa hay and 50 percent corn plus enough chopped alfalfa hay to make a 56-45 ratio. (5) Pellets containing 50 percent suncured alfalfa hay and 60 percent corn plus enough chopped alfalfa hay to make a 55-45 ratio. (6) Non-pelleted ration consisting of 55 percent chopped alfalfa hay and 45 percent ground yellow corn.

It was found that lambs being fattened on pelleted rations containing suncured alfalfa hay gained more rapidly and had better feed efficiency than lambs on pellets containing dehydrated alfalfa hay or on non-pelleted rations. There was little difference in rate of gain, feed afficiency and cost per hundred pounds of gain between suncured pellets having different ratios of roughage to concentrate. In the dehydrated pellets and the non-pelleted rations, rate and economy of gain were best in the rations containing the higher level of roughage. The cost of gain was about the same for the suncured pellets and the non-pelleted rations. Cost of gain for the dehydrated pellets was considerably higher.

Total digestible mutrient values were higher in the 55-45 rations than in the 65-35 rations. Pellets containing dehydrated alfalfa hav gave the lewest total digestible mutrient values, sunsured pellets gave the highest, and the values for the non-pelleted rations fell between the two. Digestion coefficients for crude protein were lowest in the dehydrated pellets. There was little difference between the protein digestion coefficients for suncured pellets and the non-pelleted rations. The two different levels of roughage to concentrate produced no significant differences in orade protein digestion coefficients. Ether extract digestion coefficients were considerably higher in the dehydrated pellets than in the other two rations. Rations containing 55 percent roughage gave a higher value for ether extract than did the rations containing 65 percent roughage. There was little difference in the digestion coefficients for orude fiber in any of the pelleted rations. Fiber direction coefficients for both of the non-pelleted rations were essentially the same and were considerably higher than those for the pelleted rations. The 55-45 rations produced slightly higher digestion coefficients for nitrogen-free extract than did the 65-35 rations. There was little difference in the values for nitrogen-free extract within the rations containing the same ratio of roughage to concentrate.

The 55-45 rations produced higher average percents of nitrogen retention than did the 65-35 rations. There was little difference in nitrogen retention from the 55-45 rations, while in the 65-35 rations, the non-pelleted ration gave a much lower value than did the pelleted rations. It is thought that this low value was due to the failure of two of the lambs on the nonpelleted ration to eat properly.