3. Alfalfa straw and alfalfa hay both proved much superior to Axtell roughage in the efficiency and rate of gains produced. See lots 1, 9 and 10.
4. Axtell roughage had approximately 70 percent the value of alfalfa hay or alfalfa straw in these tests, agreeing closely with tests of last year.

CHEMICAL ANALYSIS OF FEEDS USED

FEED	Protein	Ether Extract	Crude Fiber	Moisture	Ash	Nit.-Free Extract
Axtell Grain	11.38	3.95	1.61	10.09	1.59	71.38
Westland Milo	8.81	3.29	1.73	11.00	1.64	73.56
Immature Westland Milo	10.69	2.75	2.56	10.45	1.74	71.81
Axtell Roughage	3.06	1.34	22.97	7.36	9.85	55.42
Alfalfa Straw	11.25	1.30	41.27	7.18	6.57	32.43
Alfalfa Hay	13.56	1.27	36.96	8.10	9.42	30.69

Table II

5. Feeding of highly concentrated rations reaching 2.4 pounds of corn per lamb daily at intervals, in this year's experiments failed to produce enterotoxemia or any other form of serious digestive disturbance. Because of this, the tests of the value of bicarbonate of soda for reducing digestive disorders were inconclusive.
6. There was evidence that soda feeding resulted in decreasing total feed consumption and gains in this year's tests. This is directly opposed to last year's results and indicates the need for more experimental work on this subject.
7. No difference in response was noted where soda was fed to lambs mixed dry with the feed compared with supplying it in the drinking water.
8. Moderately heavy losses from urinary calculi resulted in the experimental lambs fed highly concentrated rations, lending support to the belief that forcing lambs for rapid gains predisposes them to losses from apparently unrelated maladies.
9. The level of soda feeding in these tests was approximately 1/5 ounce per lamb daily. Expressed otherwise this averaged about 1.3 pounds per 100 lambs daily, or slightly less than 1 percent of the concentrates or ½ percent of the total feed.

Project 236: The Relationship of Physical Balance and Energy Value in Sheep Rations.

Kansas Agricultural Experiment Station—Manhattan, Kansas
1947-48

THE RELATIONSHIP OF PHYSICAL BALANCE OF THE RATION TO ENERGY VALUE AND TISSUE FORMATION IN FAT LAMBS

Rufus F. Cox, D. L. Mackintosh, Ed F. Smith, J. S. Hughes

Many tests have been completed at this station bearing on some phase of physical balance in sheep rations. Differences in gains consistently have favored a medium proportion of concentrates to roughage over either more concentrated or more bulky rations. It was deemed advisable to determine whether this difference in gains would be expressed in the distribution of fat throughout the carcass.

Sixty Wyoming lambs of the long-wool crossbred type used for this study, were divided into six lots. Lots 1, 2 and 3 were fed corn and alfalfa hay in amounts such that the ratios of crude fiber to digestible nutrients were 1 to 3; 1 to 4; and 1 to 5 respectively. Lots

4, 5 and 6 received oat groast (hulled oats) and alfalfa with the crude fiber: digestible nutrient ratios corresponding to those of lots 1, 2 and 3 respectively.

At the end of the feeding period all the lambs were slaughtered, carcasses graded and physical and chemical studies made on certain tissues. The hotel rack which is considered the most representative cut of the lamb carcass, was taken from the carcasses of three representative lambs from each lot. Manual separation of fat, muscle and bone was made on these cuts and a chemical analysis of the rib-eye muscle made to determine the amount of fat present.

The tables and summary on the following pages give detailed results of these tests.

Kansas Agricultural Experiment Station—Manhattan, Kansas

Crude Fiber: Total Digestible Nutrient Ratios in Lamb Fattening Rations

Rufus F. Cox, D. L. Mackintosh, Ed F. Smith, J. S. Hughes

Table—March 17. 1948 to May 31, 1948—75 Days

Lot Number	1	2	3	4	5	6
Ration Fed	Corn Alfalfa Hay	Corn Alfalfa Hay	Corn Alfalfa Hay	Oats Groats Alfalfa Hay	Oats Groats Alfalfa Hay	Oats Groats Aflalfa Hay
Ratio (Crude fiber to T. D. N.	1 to 3	1 to 4	1 to 5	1 to 3	1 to 4	1 to 5
No. Lambs per lot	10	9	10	10	10	10
Number days on feed	75	75	75	75	75	75
Initial weight per lamb	75.50	77.51	75.60	76.00	77.80	75.70
Final weight per lamb	96.10	100.22	95.30	96.60	95.50	94.10
Total gain per lamb	20.60	22.71	19.70	20.60	17.70	18.40
Daily gain per lamb	.27	.30	.26	.27	.24	.25
Feed per lamb daily:						
Grain	1.04	1.29	1.44	.86	1.09	1.23
Hay	1.70	1.20	.93	2.01	1.41	1.09
Feed per cwt. gain:						
Grain	380.10	426.51	546.90	313.30	460.51	502.93
Hay	620.97	398.06	352.64	732.57	598.81	444.78
Dry matter per lamb daily	2.51	2.27	2.16	2.65	2.31	2.15
T. D. N. per lamb daily	1.76	1.71	1.70	1.85	1.76	1.72
Gain per 100 lbs. T. D. N.	15.34	17.54	15.29	14.59	13.64	14.53
Carcass grades:						
Choice	1					
Good	4	7	6	3	8	5
Commercial	4	2	2	7	1	5
Utility	1		2		1	
Coordinated carcass grade	25	28	24	23	27	25
Dressing percent	49.3	50.0	49.6	48.1	49.8	50.4

Kansas Agricultural Experiment Station—Manhattan, Kansas

PHYSICAL AND CHEMICAL ANALYSES OF HOTEL RACK OF LAMB CARCASSES

Rufus F. Cox, D. L. Mackintosh, Ed F. Smith, J. S. Hughes

Table—(All weights are averages for the lots expressed in grams.)

Lot No.	Total Weight Rack	Weight Eye Muscle	Percent Eye Muscle	Weight Outside Fat	Percent Outside Fat	Weight Total Fat	Percent Total Fat	Percent Rib-Eye Muscle Fat	Weight Bone	Percent Bone	Weight Total Lean	Percent Total Lean	Weight Misc.
I	2378.67	330.67	13.9	517	21.76	811.33	34.12	6.0	411.67	17.36	776.33	32.63	12
II	2291	338	14.78	495.33	21.17	752.33	32.75	5.0	390.33	17.02	778.33	34.03	9.33
III	2425.33	344.67	14.23	478	19.73	745.67	30.57	5.5	422	17.51	876.67	36.16	9.67
IV	2131	326.67	15.16	395.67	17.99	592	27.76	5.0	406.33	19.04	774.67	36.37	7.67
V	2199.67	313.67	14.27	484.67	21.84	717.67	32.44	5.2	420	19.15	728.33	33.21	10.33
VI	2461.67	382	15.54	525.33	21.13	785.33	31.72	4.9	448	18.24	824.33	33.59	11

OBSERVATIONS

1. Lambs fed corn and alfalfa in medium concentration (crude fiber: digestible nutrient ratio of 1:4) gained more than lambs fed either more concentrated or more bulky combinations of the same feeds.
2. Lambs fed the ration of medium concentration also made more efficient gains, as measured by the gain per 100 pounds of digestible nutrients consumed, than lambs on more, or on less concentrated rations.
3. The carcass grading of the lambs, while revealing no great differences, was somewhat higher for those fed the rations of medium concentration.
4. No consistent differences in dressing percentages was indicated in these different levels of feeding.
5. The differences shown in tissue deposition did not appear to justify definite conclusions.
6. The mechanical separation of lean and fat of the hotel racks and the chemical analyses of the rib-eye muscles gave no evidence that the lambs fed the more concentrated rations were any better finished than those fed the more bulky rations.

Project 236: Relationship of Physical Balance and Energy Value in Sheep Rations.

Rufus F. Cox - J. S. Hughes

1948-49 Progress Report

INTRODUCTION

It has been demonstrated that the rate of gains and the efficiency of feed utilization by fattening lambs are associated closely with the physical nature of the ration. The manner in which physical balance affects feed utilization however is not known.

The objects of the experiments now in progress are:

1. To study additional factors associated with the physical balance of the ration, and,
2. To make further tests of the efficiency of bicarbonate of soda in reducing losses arising from the feeding of rations which are improperly balanced physically.

EXPERIMENTAL PROCEDURE

Lot 1 - Corn and alfalfa hay - medium concentration. (Crude Fiber: Total Digestible Nutrient Ration - CF:TDN - 1:4)

Lot 2 - Corn and alfalfa hay - highly concentrated. (CF:TDN Ratio 1:55.)

Lot 3 - Corn and alfalfa hay plus Bicarbonate of Soda (CF:TDN Ratio 1:55.)

Lot 4 - Corn and alfalfa hay (Lambs vaccinated against enterotoxemia) (CF:TDN Ratio 1:55)

Lot 5 - Corn and Pelleted alfalfa (CF:TDN Ratio 1:55.)

Lot 6 - Corn and Pelleted alfalfa plus Bicarbonate of Soda (CF:TDN Ratio 1:55.)

Results are being measured by weight gains and by observations of response to feeding. Clinical studies will be made of any cases of digestive disturbances which may occur.

Certain other determinations also are being made such as the pH of the blood, urine and rumen contents and the CO_2 content of the blood as affected by the physical nature of the ration.

This experiment has not progressed sufficiently to justify any con-