out the experiment, it further increased the gains and slightly lowered the feed requirements.

The gains were very satisfactory in both lots receiving the antibiotic.

The mixed plant and animal protein supplement without an antibiotic as fed in Lot 4 produced more rapid daily gains than did the plant protein supplement alone, soybean meal, as fed in Lot 1.

When the antibiotic was added to the mixed protein supplement in Lot 5, until the pigs reached 100 pounds, the rate of gain was unchanged but the feed requirements were slightly lowered. When the antibiotic was fed in the supplement throughout the experiment, the rate of gain was markedly increased and the feed requirements decreased.

It is evident from these results that aureomycin added to the ration, either for a limited time or for the duration of the feeding period, increased the rate of gain, and this was therefore its chief effect; the effect of the antibiotic was most marked when it was fed throughout the experiment.

The effect of the antibiotic was more apparent in the all-plant protein-fed pigs and not so effective where a mixed protein supplement was fed.

**EXPERIMENT IV—Winter, 1952**

The Effect of Antibiotics (Aureomycin-B<sub>2</sub> Supplement) and Vitamin B<sub>2</sub> Supplement on Weaning Pigs in the Dry Lot.

C. E. Aubel

This experiment was conducted this past winter with fall pigs in the dry lot. Its object was to get information on the effect of feeding a vitamin B<sub>2</sub> supplement along with antibiotics.

Three lots of pigs were fed. Lot 1 received a mixed animal and plant protein supplement of 4 parts tankage, 4 parts soybean meal, 1 part linseed meal, and 1 part alfalfa meal. Lot 2 received a similar protein supplement, but to which aureomycin had been added as Aurobac at the rate of 3 pounds to 100. Lot 3 received the same as Lot 2 except that a vitamin B<sub>2</sub> supplement, containing riboflavin, nicotinic, pantothenic acid, choline chloride, and folic acid, Lederle's No. 49 was added at the rate of 3 pounds per 500 of the supplement.

All lots were self-fed shelled corn as well as the protein supplement, and some very poor loose alfalfa hay was offered but was consumed very sparingly.

The following table gives the results of this experiment:

**EXPERIMENT IV—Winter, 1951-52**

The Effect of Antibiotics (Aureomycin-B<sub>2</sub> Supplement) and Vitamin B<sub>2</sub> Supplement on Weaning Pigs in the Dry Lot.

*(November 27, 1951, to February 28, 1952—97 days)*

<table>
<thead>
<tr>
<th>Ration fed</th>
<th>Protein mixed supl.</th>
<th>Protein mixed supl. plus Aurobac-B&lt;sub&gt;2&lt;/sub&gt;</th>
<th>Protein mixed supl. plus Aurobac-B&lt;sub&gt;2&lt;/sub&gt; and B&lt;sub&gt;2&lt;/sub&gt; suppl.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lot number</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>No. pigs in lot</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Av. initial wt. per pig</td>
<td>42.55</td>
<td>42.50</td>
<td>42.60</td>
</tr>
<tr>
<td>Av. final wt. per pig</td>
<td>196.90</td>
<td>210.30</td>
<td>214.80</td>
</tr>
</tbody>
</table>

| Av. total gain per pig | 154.55 | 167.30 | 172.20 |
| Av. daily gain per pig | 1.59   | 1.72   | 1.77   |

**Av. daily ration per pig:**

- Corn: 5.20, 5.34, 5.25
- Alfalfa hay: .03, .04, .04
- Mixed protein suppl.: .85, .82, .87

**Feed consumed per 100 lbs. gain:**

- Corn: 326.45, 308.99, 295.87
- Alfalfa hay: .22, .23, .27
- Mixed protein suppl.: .53.33, 47.87, 56.16
- Mineral mix: .06, .05, .04

**Feed cost per 100 lbs. gain:**

$13.24, $12.34, $13.14

Feed prices charged: Shelled corn, $1.86 per bushel; alfalfa hay, $50.00 per ton; mixed protein supplement, $30.0 per ton; in Lot 1; mineral mixture, 3c per pound; mixed protein supplement, Lot 2, with Aurobac, $112.20 per ton; mixed protein supplement, Lot 3, with Aurobac and B<sub>2</sub> supplement, $120.24 per ton; Aurobac, 5c per pound; Vitamin B<sub>2</sub> supplement, C-49 Lederle, 57c per pound.

**Observations**

When aureomycin was added to the diet as in Lot 2, the rate of gain was materially increased, and the feed requirements per 100 pounds gain were decreased.

When the vitamin B<sub>2</sub> supplement was added to the aureomycin diet, the result was to increase the daily gains further and decrease the feed requirements.

From the results of this experiment, it is evident that the addition of an antibiotic and vitamin B<sub>2</sub> supplement improved the efficiency of the ration when the protein supplement was one of mixed plant and animal proteins.

**Project 236: The Relation of Physical Balance and Energy Value in Sheep Rations**

A Comparison of Different Roughages Combined with Two Levels of Concentrate Allowance for Wintering Ewe Lambs.

T. Donald Bell, R. F. Cox, D. Richardson, D. B. Parrish, and J. S. Hughes

**Introduction**

Many experimental trials with fattening lambs at the Kansas Agricultural Experiment Station have indicated that rations including approximately 55 percent roughage and 45 percent concentrates produce more economical gains in relation to nutrients consumed than rations containing either a higher or lower proportion of concentrates. Because of the variability of the chemical and nutritive composition of many of the roughages, this physical balance relationship of the ration may be more accurately described by the ratio of crude fiber to total digestible nutrients, and the ratio found to be most economical in lamb fattening rations has been approximately 1 part crude fiber to 4 parts T.D.N.*

Ewe lambs, being raised for breeding replacements, are commonly wintered on rations composed largely of roughages, with few if any additional concentrates. If lambs respond most economically to

* T.D.N. refers to Total Digestible Nutrients.
DIFFERENT ROUGHAGES WITH VARYING CONCENTRATE ALLOWANCES FOR WINTERING EWES LAMBS.

<table>
<thead>
<tr>
<th>Lot number</th>
<th>Ratio</th>
<th>Crude fiber</th>
<th>No. days on feed</th>
<th>Initial wt. per lamb</th>
<th>Total gain per lamb</th>
<th>Daily gain per lamb</th>
<th>Feed per lamb daily</th>
<th>Feed cost per cwt. gain</th>
<th>T.D.N. per lamb daily</th>
<th>Gain per 100 lbs. T.D.N.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.7</td>
<td>1.5</td>
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Experimental Procedure

In the winter of 1951-52 a test was made of the response of ewe lambs to rations containing different proportions of roughages and concentrates as well as of the response to rations made up of some of the common roughages found in Kansas. The ewe lambs, which were of three breeding types, were secured from Southern Utah; they will be used in the subsequent breeding studies. The lambs were divided into six lots with uniform distribution of the roughages in the various lots. The roughages compared were long alfalfa hay, ground Atlas stover, and Atlas silage in combination with prairie hay. Cottonseed meal was added to supply protein to all of the rations, and milo grain was also given in those three lots where a higher ratio of crude fiber to T.D.N. was desired. Originally, the experiments were planned for two lots of lambs to receive each of the three roughages or a combination of roughages. One of the two lots was fed a ration with a T.D.N. ratio of 1:1, and the other lot a crude fiber-T.D.N. ratio of 1:3. Because of limited digestive capacities and the lack of palatability of some of the roughages used, these ratios could not be maintained. The accompanying table gives the rations fed in the various lots, the crude fiber-T.D.N. ratios, and the response of the lambs to the various rations. Feed prices used to determine the feed costs in lines 12 and 13 were:

- Alfalfa hay $30.00 per ton
- Prairie hay 15.00 per ton
- Ground sorghum stover 7.50 per ton
- Atlas silage 7.50 per ton
- Milo grain 2.50 per cwt.
- Cottonseed meal 5.50 per cwt.

Observations

1. The replacement of roughage with concentrates increased the rate of gain of the lambs as well as the gain per 100 pounds of T.D.N. (Compare lots 1 with 2; 3 with 4; 5 with 6.) None of the levels of concentrate feeding reached a crude fiber-T.D.N. ratio of 1:4, which was found to be optimum in lamb fattening trials, but best response was shown on the three roughage rations when the ratio approached this value.

2. The alfalfa hay was of poor quality and gave the poorest and least economical gains of any of the roughages when it was fed with the lower level of concentrates, while Atlas stover produced the largest and most economical gains on the rations of lower concentration.

3. Rates of gains, and pounds produced per 100 pounds of T.D.N., were similar in all three lots of lambs receiving the different roughages and fed with the higher level of concentrates. Based on current feeding prices, however, the feed cost per hundredweight of gain was lowest when sorghum stover was fed, next lowest with sorghum silage and prairie hay as the roughage, and highest when alfalfa was the roughage fed.

4. There is insufficient experimental evidence to indicate how much a ewe lamb should gain in weight or condition during the winter period, but it probably should be well grown and thrifty by spring if she is to respond best to breeding in June or July for fall and early winter lambs. It would appear from these tests that a ration of...
Project 236: The Relationship of Physical Balance and Energy Value in Sheep Rations

1951 Trials with Wether Feeding Lambs

by T. Donald Bell, Rufus F. Cox, J. S. Hughes

Lamb fattening rations varying in physical nature but virtually alike chemically have been studied at the Kansas Agricultural Experiment Station for a number of years. Previous tests have demonstrated that the rate of gains and the efficiency of feed utilization by fattening lambs are associated closely with the physical balance of the ration and bulkiness of the ration.

Objects of the 1951 trials:
1. To test the relative efficiency of rations which vary in the amount and character or condition of the crude fiber consumed by fattening lambs.
2. To investigate the value of bicarbonate of soda in controlling digestive disorders in lambs consuming rations which are highly concentrated or which have had the roughage portion of the ration reduced by grinding and pelleting.

Plan of Feeding
Lot 2—corn and alfalfa hay—highly concentrated (CF:TDN ratio of 1:5:1).
Lot 3—corn and alfalfa hay, plus bicarbonate of soda (CF:TDN ratio of 1:5:1).
Lot 4—corn and pelleted alfalfa (CF:TDN ratio 1:4).
Lot 5—corn and pelleted alfalfa (CF:TDN ratio 1:5:1).
Lot 6—corn and pelleted alfalfa, plus bicarbonate of soda (CF:TDN ratio 1:5:1).

Summary
Results of the test are summarized in the accompanying table and indicate:
1. Gains were just as large with a ration of medium concentration as with those highly concentrated when chopped alfalfa hay was fed with corn. When pelleted alfalfa was fed, a ration of medium concentration produced significantly larger gains than those produced by concentrated rations.
2. Digestive disturbances were frequent in the lots receiving pelleted alfalfa and higher levels of concentrates.
3. Sodium bicarbonate was ineffective in controlling digestive disturbances in those lots receiving the more highly concentrated rations.
4. The rumen content of the lambs receiving the chopped hay was slightly more alkaline than that from lambs receiving the pelleted alfalfa.