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GROWTH AND DEVELOPMENT OF REPLACEMENT HEIFERS
WINTERED WITH RHYTHMIC CHANGES IN FEEDING

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Palsson (1955) and Wilson and Osbourn (1960), have presented extensive reviews on compensatory growth of beef cattle. Winchester and Ellis (1957) and Winchester et al. (1957) have described growth characteristics of cattle following protein and energy restriction. Wallace et al. (1962) found that weaner calves using the sagebrush-bunchgrass range typical of southeastern Oregon could gain up to 0.73 kg. per day during the period from fall weaning to range turnout time in April without an adverse effect on summer gain from range typical of southeastern Oregon.

Lawrence and Pierce (1964) fed growing cattle to gain from 0 to 0.73 kg. per day during the winter and reported that even with a high compensatory growth rate during 5 summer months on pasture it was not sufficient for these animals to completely recover from the minimal winter gains. They further reported that even though skeletal growth continued, body measurements showed that animals on the low plane of nutrition had not caught up with the others by the end of the summer grazing period.

Latvietis' (1961) work suggests that young animals might be fed in a broken or rhythmic feeding schedule, altering the feed from high to low at short intervals and thereby increase rate of growth, development, and feed efficiency. He reported a 16% decrease in feed requirement and 17% more gain from feeding 8 month old heifers on a cycle varying the feed from 80 to 120% each 20 days. He further reported these heifers reached sexual maturity sooner, and that first estrus occurred in them 20-30 days earlier than in the controls.

The purpose of the present study was to determine if a pattern of short and long feeding could be established that would affect growth, development and feed efficiency of replacement heifer calves.

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EXPERIMENTAL PROCEDURE

Two trials were conducted during a 2-year period. In the fall of 1963, 24 weaner heifers with an average weight and age of 195 kg. and 7 months, respectively, were stratified by weight and allotted to one of 3 treatments. The treatments were: (1) normal feed, in which each animal received hay ad libitum, 0.9 kg. of barley and 0.45 kg. of cottonseed meal per day, (2) alternate feed, in which each animal received 75% and 100% of the total feed as those of treatment 1, alternating from short to full feed weekly, and (3) the same as treatment 2 except alternating from short to full feed every 2 weeks.

The second trial the following year utilized 39 weaner heifers, averaging 175 kg. and 7 months in age, which were allotted to 3 treatments. The treatments were: (1) normal feed, in which each animal received hay ad libitum, 0.9 kg. of barley and 0.45 kg. of cottonseed meal daily, (2) alternate short feed, in which each animal received in 2-week cycles, 75% and 100% of the total feed of those in treatment 1, and (3) alternate normal feed, in which each animal received the same total feed as in treatment 1, except that the feed was offered in 2-week cycles at 75% and 125%.

Both trials ran for a total of 21 weeks with the animals on their respective treatments for 18 weeks and on the normal feed for the last 3 weeks. Body weights were taken weekly in the first trial and every 2 weeks in the second trial. All weights were taken after an overnight restriction from feed and water. In the first trial, feed rates for each animal on treatments 2 and 3 were based on the intake of a corresponding normal fed animal it was paired with on treatment 1. In trial 2 the rate of feeding for treatments 2 and 3 were based on the average of all animals on treatment 1. In both trials the animals were individually fed in a barn where they were tied to feed bunks from 7 a.m. to 4 p.m. daily. Water was available in the barn and salt, bonemeal, and water were available in the lots where the heifers ran while not tied. Body measurements were taken with the method used by Lawrence and Pierce (1964) on all animals in the second trial at the beginning and at the end of the trial. These measurements were height at withers, body depth, body width, body length, and length of leg.

RESULTS AND DISCUSSION

The animals on the normal feed regime gained at a relatively constant rate throughout each of the trials, whereas those on alternate feeding made gains corresponding to their feeding pattern (Table 1). In trial 1 the heifers on normal feed gained significantly more than those on either a one or a two week short feeding cycle. Differences in gains from treatment 2 and 3 were not significant.

Those on weekly alternate feed (Trial 1) lost weight during the short feed period and gained on full feed while those on a 2-week alternating pattern lost weight during the first week and gained during the second week of short feed and continued to gain during full feed (Figure 1).

Table 1. Average daily gain, feed intake, and feed utilization by treatments 1/

Measure of performance	Treatment		
	1	2	3
<u>Trial 1</u>			
Hay intake, kg./day	4.4	3.9	3.8
Cottonseed meal intake, kg./day	.45	.34	.34
Barley intake, kg./day	.91	.68 ^b	.68
Daily gain, kg./day	.54 ^a	.40 ^b	.38 ^b
Feed/kg. gain, kg.	10.7 ^e	12.3 ^f	13.1 ^f
<u>Trial 2</u>			
Hay intake, kg./day	4.1	3.4	3.5
Cottonseed meal intake, kg./day	.45	.40	.45
Barley intake, kg./day	.91	.80	.91
Daily gain, kg./day	.44 ^c	.34 ^d	.40 ^c
Feed/kg. gain, kg.	12.5 ^g	13.6 ^g	12.3 ^g

1/ Values with the same superscript are not significantly different ($P < .05$)

In trial 2, where the 1-week cycle was eliminated and all animals were on a 2-week cycle, the animals on both treatment 2 and 3 gained during both the short and full fed cycle. However, those on treatment 3 (alternate normal feed) gained significantly more than those on the alternate short feed of treatment 2. The normal fed animals in trial 2 gained significantly more than those on alternate short feed but not differently from the alternate full fed animals.

Feed consumption and feed efficiency data are presented in Table 1. The hay fed was a native flood meadow hay containing 8.5% crude protein. This is an extremely bulky roughage which probably contributes more to low levels of animal production than any other single factor. Animals of the size used in this trial cannot consume more than 4 or 5 kg. of this kind of hay daily. This made it such that it was not possible for the animals to make up for their short feed period during their period on full feed. This is especially evident from the hay intake data in trial 2 where the animals on the alternate full feed of treatment 3 consumed only 0.04 kg. more hay than those on the alternate short feed.

The animals on the normal feed in the first trial were significantly more efficient in feed utilization than those on either of the alternate feed patterns. However, there were no significant differences in feed efficiency of any treatments in the second trial.

The heifers from both trials were exposed to the bull at an average age of 15 months. Conception rate or date was not affected by any of the treatments. However, this was not a measure of sexual maturity

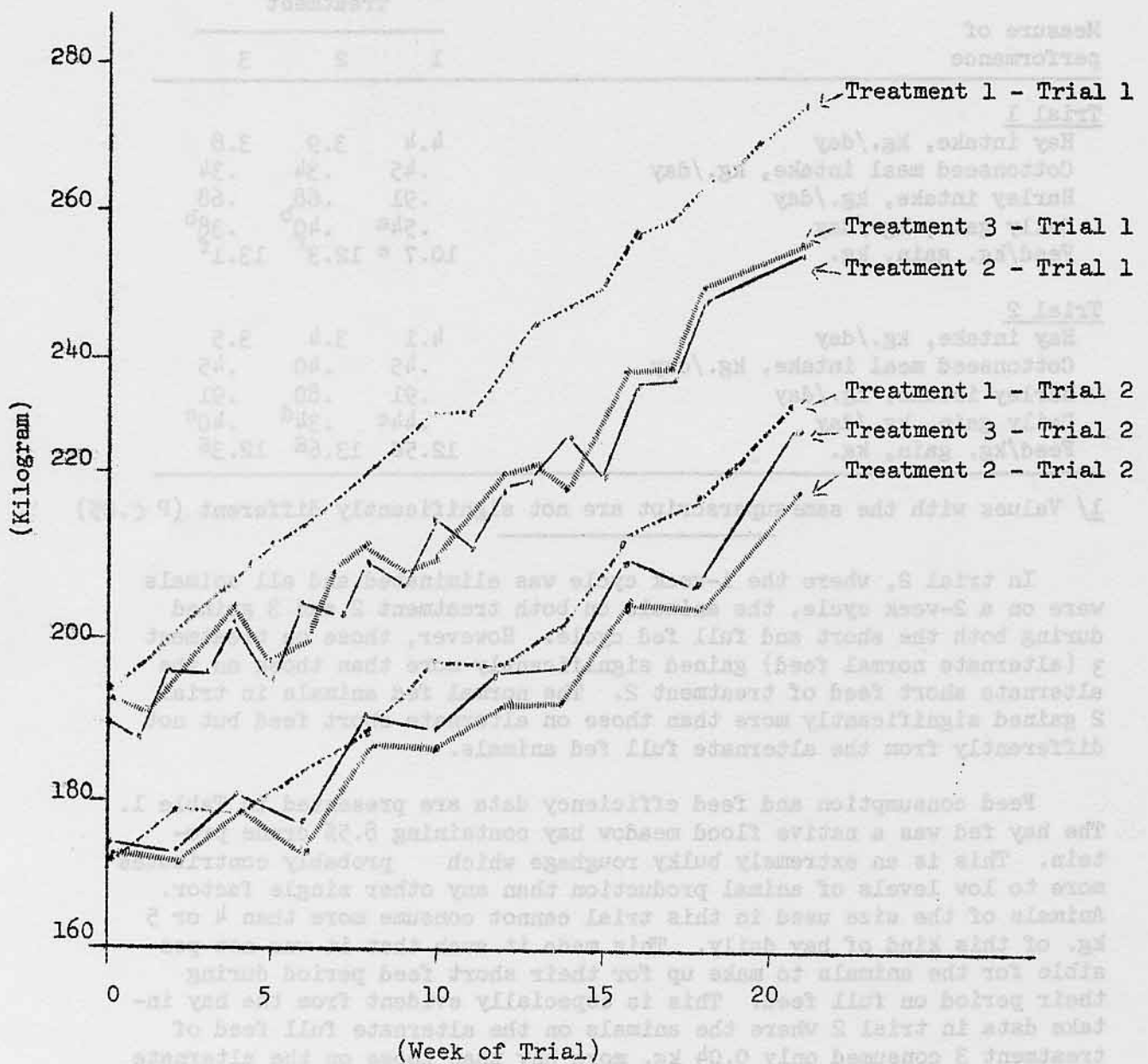


Figure 1. Average accumulative body weight change for heifers on each treatment of trials 1 and 2

since all animals were well past the age when first estrus should occur in normal animals. Body measures of growth during the trial period are presented in Table 2. Body measurements followed the same pattern as gains indicating no particular advantage from the alternate feed patterns in promoting skeletal growth.

Table 2. Growth measurements representing growth during trial for each treatment in trial 2.

Measurement <u>1/</u>	Treatment		
	1	2	3
Height at withers, cm.	7.8	6.4	7.8
Body depth, cm.	5.4	4.4	5.2
Body width, cm.	3.0	2.7	2.8
Body length, cm.	14.5	13.0	14.3
Length of foreleg, cm.	2.4	2.0	2.6

1/ These data represent average differences between initial and final measurements. Body depth was measured at the heart girth, width was measured over the withers and length from point of shoulder to pin bone.

The lack of response from the different levels and patterns of feed is not in agreement with that reported by Latvietis (1961). The type of roughage used in these trials or the level of nutrition may have been the reason. Response may have been different if a higher energy level or a less bulky roughage had been fed.

SUMMARY

Two studies were conducted to determine the influence of rhythmic changes in feeding on growth, development, and feed efficiency of heifer calves. In the first study 24 calves were allotted to 3 treatments: (1) normal feed, native hay ad libitum, 0.9 kg. of barley and 0.45 kg. of cottonseed meal per day; (2) alternate feed, 75% and 100% of total feed allotted to animals in treatment 1, alternating from short to full feed weekly; and (3) the same as treatment 2 except alternating every 2 weeks. In the second study 39 calves were allotted to 3 treatments: (1) normal feed; (2) alternate short feed, 75% and 100% in 2 week cycles; and (3) alternate normal feed, 75% and 125% in 2 week cycles.

Heifers in trial 1 on normal feed gained at a constant rate while those on weekly alternate feed lost weight during the period of short feed and gained weight on full feed; those on biweekly alternate feed lost during the first week on short feed and gained during the second week of short feed and while on full feed.

Heifers in trial 2 followed the same pattern as heifers in trial 1 with those on the alternate regime losing the first week on short feed and gaining the second week on short feed and while they were on full or long feed. Daily gains and feed per kg. gain for trials 1 and 2 for each treatment, respectively were: (1) 0.54, 10.7, 0.44, and 12.5 kg., (2) 0.40, 12.3, 0.34, and 13.6 kg., and (3) 0.38, 13.14, 0.40, and 12.3 kg.

Normal fed animals gained significantly more than animals on other treatments. Feed utilization was significantly higher in the normal fed animals than in the alternate fed animals on short feed in the first trial. In trial 2 feed utilization was significantly higher in the normal fed than in the alternate short fed but not higher than the alternate full fed animals.

Body measurements indicated that the alternate short fed animals made significantly less growth than those on normal and alternate full feed.

LITERATURE CITED

- Latvietis, J. J. 1961. Influence of rhythmic changes in feeding on the growth, development, and feed utilization of young Latvian red cattle. Inst. Zivot Vet. 12:77-86. Russian: English summary
- Lawrence, T.L.V. and J. Pearce. 1964. Some effects of wintering yearling beef cattle on different planes of nutrition I. Liveweight gains, food consumption, and body measurement changes during the winter period and the subsequent grazing period. Jr. Agr. Science. 63:5
- Palsson, H. 1955. Progress in the physiology of farm animals, II, ch 10, Butterworth Scientific Publication, London
- Wallace, Joe D., R. J. Raleigh, Farris Hubbert, Jr., and W. A. Sawyer 1962. Winter feeding and management of range calves. Ore. Agr. Exp. Sta. St. Bull. 584
- Wilson, P. N. and D. F. Osborun. 1960. Compensatory growth after under-nutrition in mammals and birds. Biol. Rev. 35:324
- Winchester, C. F. and N. R. Ellis. 1957. Delayed growth of beef cattle. U.S.D.A. Tech. Bull. No. 1159
- Winchester, C. F., R. L. Hines, and V. C. Scarborough. 1957. Some effects on beef cattle of protein and energy restriction. J. Animal Science 16:426