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A.S. Series 73-34

Growing and Finishing Bulls, Heifers and Steers

P. J. Thiex and L. B. Embry

Growth rate of an animal depends upon energy consumed in excess of that for maintenance, and the requirements increase as the animal grows and fattens. Male and female cattle differ in rates of growth and fattening, but changes may be brought about by castration. There still is some concern as to the effects of market weight and energy content of rations on weight gain, feed efficiency and carcass characteristics of feedlot bulls, heifers and steers.

This experiment was conducted to study these factors. Bulls (calves and yearlings), heifers and steers were fed to one of two final weight groups. Rations with about 50% or 90% concentrates were used for each weight and sex group. This report is concerned with the feedlot performance data. Results of the study on carcass data are presented in another report (A.S. Series 73-37).

Procedures

The cattle for the experiment were from the experimental cow herd at the Pasture Research Center, Norbeck. Hereford cows were bred artificially to one Hereford bull over a period of about 6 weeks. Cleanup bulls were then used which were mostly half-sibs and progeny of the cow herd from the previous year.

The yearling bulls were used for cleanup bulls during the immediate past breeding season and were the larger calves from those of the previous year. Each ran in a pasture with 8 to 10 cows after the period of artificial insemination. They were fed no grain during the period of summer grazing.

The bull calves were from a group of 126, and 34 of the larger ones were selected for use as cleanup bulls the following breeding season. The remaining ones were shipped to Brookings for the feedlot experiment. During a preliminary period of about 3 months, they were fed a ration of alfalfa-bromegrass haylage or hay, protein supplement and a limited feed of grain. Upon initiation of the feedlot experiment, 84 were selected from the 92 head. They were allotted into 12 pens of 7 each. After the initial weighing and allotment, those in four of the pens were castrated for the steer group in the experiment.

The 56 heifers were a random assortment from 128 head from which no previous selection had been made. They were trucked to Brookings at about the same time as the bull calves and were fed in the same manner as the bulls during the preliminary period.

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Prepared for the Seventeenth Annual Cattle Feeders Day, November 2, 1973.

Experimental treatments were two final market weights for each of the sex groups. Weight group 1 was to be about 1350, 1100, 950 and 1050 lb., respectively, for yearling bulls, bull calves, heifers and steers. These weights were expected to produce slaughter cattle grading low to average Good. Weight group 2 was to be about 1500, 1250, 1100 and 1200 lb., respectively, for yearling bulls, bull calves, heifers and steers. These weights were expected to produce slaughter cattle grading low to average Choice.

Dietary treatments within each weight group were 50% or 90% concentrate rations on an air-dry basis. The rations consisted of alfalfa-bromegrass haylage and a concentrate-supplement mixture. Ingredient composition of each ration is shown in table 1.

Table 1. Ingredient Composition of Rations (Air-Dry)

Ingredient	50% concentrate diet %	90% concentrate diet %
Alfalfa-brome haylage	50.0	10.0
Rolled corn grain	49.0	87.0
Soybean meal (44%)	--	6.0
Limestone	--	1.0
Dicalcium phosphate	0.5	--
TM salt	0.5	0.5
Potassium chloride	--	0.5
Vitamin A (1500 I.U./lb. of ration)	5 g	5 g
Vitamin E (8 I.U./lb. of ration)	4 g	4 g
Aureomycin-10 (5 mg./lb. of ration)	22.7 g	22.7 g

The steers were implanted with 36 mg. of diethylstilbestrol (DES) at the beginning of the experiment and again after about 4 months for those in weight group 2. Heifers were fed 0.4 mg. daily of melengestrol acetate (MGA). Bulls did not receive any hormone additive or implant treatment.

Feeding was once daily in amounts that would be nearly consumed by the next feeding after the cattle were on full feed. They were raised to a full feed over a period of about 2 weeks. The 90% concentrate ration was calculated to contain 13% protein, 0.60% calcium and 0.35% phosphorus on an air-dry basis. Supplements were added to the 50% concentrate ration to furnish at least these amounts of nutrients. Alfalfa-brome haylage (average of about 58% dry matter) and concentrates were fed separately but in ratios to give the 50 or 90% levels of concentrates on an air-dry basis. Hay was fed on a few days when trouble was encountered from freezing of haylage in the silo. Total amount was small and the quantities were converted to a haylage equivalent for daily forage consumed shown in the tables.

The cattle were marketed as the group (sex and concentrate level) reached the approximate desired weight. Carcass data were obtained and sides were brought to the meat laboratory for studies of carcass quality and composition (see A.S. Series 73-37). Some losses occurred during the experiment. Data presented are for the cattle completing the experiment.

### Results

Sex groups were not considered to be directly comparable in the experiment. Differences existed as to selection from the source groups, and there was a lack of uniformity in a terminal point for the experimental periods between groups. Therefore, results are presented and discussed within sex groups as to the effects of market weight and concentrate level of the rations. However, comments as to similarity or difference in response by sex groups to the treatments are made where deemed appropriate. Percentage difference in weight gain and feed efficiency and haylage replacement values of the concentrates as affected by market weight and concentrate level of ration are presented in table 6.

### Yearling Bulls

Results of the feedlot performance from the yearling bulls are presented in table 2. Those in weight group 1 and fed the 90% concentrate ration were marketed at 1335 lb. and they were fed for 104 days (3.56 lb. daily). There was a pronounced reduction in weight gain for those fed the 50% concentrate diet (21.3%). This group was fed for 145 days but they had a higher final weight. On basis of their daily gain, 132 days would have been needed for the same amount of gain as for the 90% concentrate group.

Table 2. Market Weight and Concentrate Level of Ration  
for Finishing Yearling Bulls

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	7	7	7	7
Days fed	145	104	217	168
Avg. init. shrunk wt., lb.	964	965	965	968
Avg. final shrunk wt., lb.	1371	1335	1542	1530
Avg. daily gain, lb.	2.80	3.56	2.66	3.35
Avg. daily ration, lb.				
Concentrates	17.68	25.27	17.27	26.19
Haylage	22.76	4.05	24.04	4.04
Total	40.44	29.32	41.31	30.23
Feed/100 lb. gain, lb.				
Concentrates	631	709	649	782
Haylage	813	114	904	120
Total	1444	823	1553	902

Total feed intake and feed requirements were higher for the bulls fed the 50% concentrate rations but with less concentrates. On basis of feed efficiency, 100 lb. of the extra corn consumed by the yearling bulls fed the ration with 90% concentrates reduced the amount of haylage by 896 lb. in comparison to the 50% concentrate ration.

Yearling bulls in weight group 2 fed the 90% concentrate ration were marketed at 1530 lb. and were fed for 168 days. In this comparison, those fed the 50% concentrate ration gained 0.69 lb. less (20.6%) daily. Feed intake and total feed requirements were also greater for the 90% concentrate group. In this instance, each 100 lb. of corn consumed in excess of the 50% concentrate group resulted in a reduction of 589 lb. of haylage.

The reduction in going from weight group 1 to weight group 2 was similar for the 50% concentrate (5.0%) and the 90% concentrate (5.9%) groups. Also, the increase in total feed requirements at the higher final weight was similar for the 50% (7.5%) and 90% (9.6%) concentrate groups.

These data indicate a substantial advantage in weight gain for the higher level of concentrates and a good replacement value of concentrates for haylage with each weight group. However, differences between concentrate levels on basis of weight gain and feed efficiency between weight groups were small. Number of animals were small and more data are needed to properly evaluate the effects of concentrate levels at various market weights for feedlot yearling bulls.

Bull Calves

Results of the experiment with bull calves are presented in table 3. Those in weight group 1 fed the 90% concentrate ration were marketed at 1100 lb. after 227 days, and they had an average daily gain of 2.94 lb. When fed the 50% concentrate ration, there was a reduction in rate of gain of 0.35 lb. (11.9%). Feed intake and feed requirements were higher for the lower energy ration. On basis of feed efficiency, 100 lb. of the extra corn in the higher energy rations resulted in a reduction of 616 lb. of haylage.

Table 3. Market Weight and Concentrate Level of Ration for Growing and Finishing Bulls

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	14	14	14	13
Days fed	259	227	357	311
Avg. init. shrunk wt., lb.	434	432	433	433
Avg. final shrunk wt., lb.	1107	1100	1242	1281
Avg. daily gain, lb.	2.59	2.94	2.26	2.72
Avg. daily ration, lb.				
Concentrates	12.60	16.99	13.28	18.01
Haylage	17.48	2.86	19.11	3.36
Total	30.08	19.85	32.39	21.37
Feed/100 lb. gain, lb.				
Concentrates	485	579	586	662
Haylage	676	97	847	124
Total	1161	676	1433	786

When fed the longer period of time for weight group 2, daily gain was 2.72 lb. Weight gain was reduced by 0.46 lb. daily (16.9%) for the 50% concentrate ration in comparison to 90% concentrates. On basis of feed efficiency, 100 lb. of the greater amount of concentrates consumed by the 90% concentrate groups resulted in 951 lb. less haylage.

Weight gains were reduced more from weight group 1 to weight group 2 by the 50% concentrate ration (12.7%) than by the 90% concentrate (7.5%). Respective increases in feed requirements were 23.4 and 16.3% for the 50% and 90% concentrate rations.

As with the yearling bulls, these data show a decided advantage for the 90% concentrate ration on basis of weight gain and concentrate replacement value for haylage. The advantage for the higher level of concentrates became more pronounced as the bull calves were fed to the heavier weight. However, the effect may have been partly from weather. Bull calves fed the 50% concentrate ration to the heavier weights were fed for a longer time and a greater part of the period was during more severe weather conditions.

Heifers

Results of the experiment with heifer calves are presented in table 4. Heifers in weight group 1 fed the 90% concentrate ration were marketed at 970 lb. and had made an average daily gain of 2.48 lb. For the group offered the ration with 50% concentrates, there was a 14.1% reduction in rate of gain. On basis of feed efficiency, 100 lb. of the greater amount of corn consumed by the 90% concentrate group resulted in a reduction of 376 lb. of haylage.

Table 4. Market Weight and Concentrate Level of Ration for Heifers

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	14	14	14	14
Days fed	238	210	301	273
Avg. init. shrunk wt., lb.	444	449	443	442
Avg. final shrunk wt., lb.	952	970	1109	1102
Avg. daily gain, lb.	2.13	2.48	2.21	2.41
Avg. daily ration, lb.				
Concentrates	11.56	17.93	12.34	16.48
Haylage	16.91	2.92	17.73	2.86
Total	28.47	20.85	30.07	19.34
Feed/100 lb. gain, lb.				
Concentrates	543	723	557	685
Haylage	794	118	804	119
Total	1337	841	1361	802

In weight group 2, the reduction in weight gain for the 50% concentrate ration in comparison to the 90% concentrate was 8.3%. In this instance, the replacement value for 100 lb. of the greater amount of concentrates from the 90% concentrate ration was 544 lb. of haylage.

These data show a greater response to the higher concentrate ration by heifers when marketed at the lighter weight. There were only small changes in weight gain and feed efficiency by feeding to the heavier weights. These results differ somewhat from those obtained with bull calves. There were substantial reductions in weight gain and increases in feed requirements for bull calves when fed to the heavier weights, being more pronounced with the lower level of concentrates.

### Steers

Results of the experiment with steer calves are presented in table 5. In weight group 1, steers fed the 90% concentrate ration gained only 6.1% more than those fed the 50% level of concentrates. This was the lowest response obtained from the higher level of concentrates and 100 lb. concentrates reduced haylage by 488 lb.

Table 5. Market Weight and Concentrate Level of Ration for Steers

	Weight group 1		Weight group 2	
	50%	90%	50%	90%
No. animals	6	6	7	7
Days fed	245	217	350	280
Avg. init. shrunk wt., lb.	452	430	438	435
Avg. final shrunk wt., lb.	1094	1035	1159	1204
Avg. daily gain, lb.	2.62	2.79	2.06	2.75
Avg. daily ration, lb.				
Concentrates	12.79	16.89	13.45	18.28
Haylage	17.79	2.86	19.37	3.10
Total	30.58	19.75	32.82	21.38
Feed/100 lb. gain, lb.				
Concentrates	488	606	653	666
Haylage	679	102	940	112
Total	1167	708	1593	778

Rate of gain was about the same for weight group 2 as for weight group 1 when fed the higher concentrate ration. However, there was a marked reduction for steers in weight group 2 when fed to the heavier weight. This is not believed to be a true effect of treatment. This pen of steers showed a somewhat lower performance than those in weight group 1 during the period of time when weather conditions and rations were the same for the two groups.

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These data show essentially no difference in weight gain for weight group 1 over weight group 2 when fed the 90% concentrate ration. However, there was an improvement in feed efficiency (9.9%) for those marketed at the lighter weight. Numbers were small and other studies should be conducted to obtain more reliable data.

### Summary

This experiment with feedlot bulls (yearlings and calves), heifers and steers showed an advantage in weight gains for a ration with about 90% concentrates over one with about 50% concentrates when market weights in the above order of sex groups were about 1350, 1100, 950 and 1050 lb. and at the heavier weights of about 1530, 1250, 1100 and 1200 lb.

Yearling bulls showed the most advantage for the higher level of concentrates with only small differences between weight groups. These results would indicate a need for high energy rations for large cattle capable of making rapid gains to rather heavy weights without excessive fattening. Rate of gain decreased and feed requirements increased when fed to the heavier weights. However, these changes were similar for the two levels of concentrates.

Bull calves also showed a pronounced advantage for the higher level of concentrates. The advantage was some greater when fed to the heavier weights. While there was a decrease in rate of gain and an increase in feed requirements when fed to the heavier weights, the changes were greater with the lower level of concentrates. These results also indicate a need for high energy rations for cattle capable of making high rates of gain. It would further appear that such rations become more important as the cattle approach a high degree of finish. However, a weather factor in the experiment cannot be discounted. Those in weight group 2 fed the 50% concentrate ration were fed the longest time and a greater amount of the total time was under more severe weather conditions.

Heifer calves showed even more advantage for the higher level of concentrates than did bull calves when marketed at the lighter weight. Interesting results with the heifers were the small changes in weight gains and feed requirements when fed to the heavier weights. They appeared to differ from bulls and steers in changes in weight gain and feed efficiency with increasing weight and finish.

Steers in weight group 1 fed the 90% concentrate ration showed the least response to the higher level of concentrates. Performance by the pen fed 50% concentrates in weight group 2 was not believed to be typical for the ration and comparisons with other treatments could give some distorted values. There was only a small change in weight gain for the 90% concentrate group when fed to the heavier weights. They did consume more feed and higher feed requirements than when marketed at the lighter weights.

Table 6. Performance of Feedlot Bulls, Heifers and Steers as Affected by Concentrate Level of Rations and Market Weight

	Bulls Yearlings	Bulls Calves	Heifers Calves	Steers Calves
<u>Advantage for 90% Over 50% Concentrates</u>				
Average daily gain, %				
Wt. group 1	21.3	11.9	14.1	6.1
Wt. group 2	20.6	16.9	8.3	---
<u>Concentrate Replacement Value as Haylage, Lb.</u>				
Wt. group 1	896	616	376	488
Wt. group 2	589	951	544	---
<u>Advantage of Weight Group 1 Over Weight Group 2</u>				
Average daily gain, %				
50% conc.	5.0	12.7	3.6	---
90% conc.	5.9	7.5	-2.9	-1.4
Feed efficiency, %				
50% conc.	-7.5	-23.4	-1.8	---
90% conc.	-9.6	-16.3	-4.6	-9.9