

Effect of Feeding for Rapid vs. Moderate Rates of Gain on Feed Efficiency and Carcass Composition Of Steer Calves

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Consumer surveys indicate a preference for smaller and leaner beef cuts than were popular in the past. Beef is included in the diet more for its taste appeal and as a source of protein than for its energy value. Hence, feeding regimes should be established that will result in the greatest amount of protein tissue, and the least amount of unwanted fat tissue, at cheapest cost — while still retaining flavor, tenderness, juiciness, and other desirable qualities.

Few studies have been conducted to determine the effect of different rates of gain of fattening calves on the quality of beef and the efficiency of feed conversion. To investigate the problem, a series of tests was initiated in the fall of 1956. Steer calves were individually fed so as to gain at different rates until each had attained a total gain of 400 pounds. The effects of these treatments were evaluated in terms of efficiency of feed conversion, and the physical and chemical composition of the carcass produced.* The results reported here cover the second trial which was started in the fall of 1957.

Procedure

Twenty-four weanling Hereford steer calves from the Fort Reno Experiment Station herd were selected for this study in October, 1957. One-half of the calves were sired by a pair of half-brother bulls (6 calves by each) and the other half by another pair of half-brothers (8 calves by one, 4 by the other) closely related to the first pair. The calves were allotted to treatment on the basis of age, weight, sire, dam productivity, and feeder grade.

They were individually-fed in stanchioned stalls, twice daily, during the trial. All calves remained on test until they made a total of 400 pounds of feedlot gain. Previous feeding trials have shown that full-fed calves of this age require such a gain from weaning to market to reach choice slaughter grade. The four treatments used (6 calves per treatment) were as follows:

- Lot 1—Fed to gain rapidly (full-fed).
- Lot 2—Fed to gain 200 pounds rapidly, then gain 200 pounds moderately .
- Lot 3—Reverse of Lot 2, fed to gain moderately at first, then rapidly.
- Lot 4—Fed to gain moderately throughout (approximately one-half of full-feed).

*Results of the 1956-57 trial are reported in Oklahoma Agricultural Experiment Station Miscellaneous Publication MP-51. A third trial is now in progress.

All calves received rolled milo, cottonseed meal, dehydrated alfalfa meal pellets, and cottonseed hulls, with minerals free-choice. Those fed to gain rapidly (full-fed) received about 2 pounds of milo per cwt. daily, or all the grain they would consume; calves on the moderate level were fed approximately one-half of this or 1 pound of milo per cwt. per day. Cottonseed hulls were increased somewhat for calves receiving only a moderate grain intake.

Shrunk weights were taken to determine feedlot gain. When each calf had gained 400 pounds, it was slaughtered at the meats laboratory. Detailed chemical and physical tests were conducted to determine the yield of wholesale cuts, their composition, and desirability.

Results

A summary of average daily gains, feed consumption, and feed efficiency is shown in Table 1. Live grade and carcass data including

TABLE 1. Average feedlot performance and nutrient intake of individually-fed steer calves at different rates (1957-58 trial).

	High Lot 1	High-Moderate Lot 2	Moderate-High Lot 3	Moderate Lot 4
No. of steers on treatment ¹	5	5	5	5
Total days on feed	205	261	222	281
Ave. weights (lb.)				
Initial	504	477	475	515
Final	899	860	875	915
Ave. daily gain				
Phase I	1.99	1.96	1.66	1.60
Phase II	1.88	1.16	2.01	1.30
Total period	1.94	1.47	1.81	1.43
Ave. daily gain minus fill (lb.) ²	1.65	1.24	1.52	1.19
Ave. daily ration (lb.)				
Rolled milo	12.6	8.4	10.2	7.0
Cottonseed meal	1.3	1.3	1.4	1.5
Dehydrated alfalfa pellets	1.0	1.0	1.0	1.0
Cottonseed hulls	3.9	6.6	5.7	8.0
2-1 mineral mix	ad. lib.	ad. lib.	ad. lib.	ad. lib.
Feed required per lb. gain (lb.) ³				
Concentrates	7.8	7.3	7.0	6.7
Roughages	2.0	4.5	3.1	5.6
TDN required per lb. gain (lb.) ³	6.8	7.5	6.7	7.5
Feed cost per lb. gain (¢) ³	18.7	20.0	18.1	19.7

¹One steer died in Lot 1 due to bloat; another removed because of a throat injury in Lot 4; one steer removed from each of Lots 2 and 3 because of poor performance.

²Contents of rumen, reticulum, omasum, and abomasum determined at time of slaughter and deducted from live animal weight.

³Based on average live gain, with no consideration for differences in "fill" at slaughter.

grade, yield, rib eye area, marbling, yield of wholesale cuts, chemical and physical composition of 9-10-11th rib cuts, and tenderness are given in Table 2.

Lot 1 steers, fed to gain rapidly throughout, made average daily gains of 1.94 pounds, while those fed moderately (Lot 4) gained only 1.43 pounds per day. This was to be expected because of the difference in the energy content of the rations.

It is interesting to note that Lot 3 steers, fed moderately and then rapidly, made nearly as rapid gains for the entire period as those fed to gain rapidly throughout. Similarly, steers fed at a high level and then moderately (Lot 2) performed little better than those fed moderately throughout. The poor gains made by Lot 2 in the last half of the trial may have been due to their increased maintenance requirements, although the grain allowance was adjusted on the basis of body weight.

TABLE 2. Live animal and carcass grade, and composition of carcasses of steers fattened at different rates of gain (1957-58 trial).

	High Lot 1	High-Moderate Lot 2	Moderate-High Lot 3	Moderate Lot 4
Final grade score on-foot ¹	14.8	17.1	15.4	15.6
Carcass grade score ¹	14.5	15.6	15.5	16.7
Dressing percent	60.9	60.3	60.7	60.8
Area of muscle (sq. in.)	10.2	9.3	9.7	10.3
Marbling score ²	16.9	16.5	20.0	19.4
Wholesale cuts (%)				
Round	17.3	18.2	17.8	18.8
Rump	5.7	5.7	5.7	5.7
Rib	7.7	8.4	7.8	8.3
Loin	15.1	15.0	15.0	14.5
Chuck	26.0	25.1	25.6	26.3
Others ³	28.2	27.6	28.0	26.4
Composition of 9-10-11th rib cut (%) ⁴				
Fat	32.4	27.8	30.5	26.2
Muscle	56.3	58.8	57.6	61.7
Bone	13.3	14.8	13.7	13.9
Chemical composition of eye muscle (%)				
Water	71.33	72.21	71.58	72.78
Fat	4.19	4.01	3.99	2.90
Protein	21.94	21.45	21.88	21.71
Ash	1.14	1.09	1.13	1.13
Tenderness of loin steak				
Shear test (lb.) ⁵	14.3	13.5	15.9	16.0

¹Ave. Choice=10, Low Choice=12, High Good=14, Ave. Good=16, and Low Good=18.

²Ave. opinion of 5 judges; lowest value=best marbling.

³Includes yield of flank, kidney knob, plate, brisket, and shank.

⁴Calculated from physical separation of 9-10-11th rib cut.

⁵Average of 9 shears per steak, least lb.=most tender.

Lot 3 steers may have out-gained Lot 1 steers in the second phase for the same reason.

Results of a pilot study the previous year had shown that calves on a high-roughage diet tended to have more "fill" than calves fed more concentrates. When stomach contents were removed from the data reported here, essentially no difference in average daily gain relationships were noted.

Although there were wide differences in the amount of grain fed per day, the amount required per pound of gain was remarkably similar for the four treatments. This was due primarily to the extra time required for the moderately-fed calves to gain the desired amount. In addition, more roughage was required for calves fed at the moderate level.

When Morrison's digestible nutrient values were applied to the feed required per pound of gain, the least T.D.N. values were noted for the high and moderate-high treatments. The calves finishing on the moderate treatment required the same amount of T.D.N. per pound of gain, whether they were started on high or on moderate level of feeding. On the basis of either pounds of feed, or T. D. N. per pound of gain, the moderate-high level was slightly more efficient, followed by Lots 1, 2, and 4 in that order.

Feed cost per pound of gain was least for Lot 3 calves on the moderate-high regime, and greatest for the reverse of this treatment (Lot 2). Lot 1 calves, full-fed for 400 pounds of feedlot gain, were more economical than Lot 4 steers due to greater gains and shorter time on feed.

From the carcass grades and slaughter data shown in Table 2, it is apparent that differences between treatments were rather small. The steers full-fed all the way graded "high good," while those fed moderately for the entire trial graded "average good," and the other two lots were intermediate.

There were no definite trends in dressing percent, eye muscle area, or marbling score. The high-moderate group (Lot 2) had the smallest loin eye and lowest dressing percent, while the high and moderate lots (1 and 4) were highest in these measurements. In marbling score, however, Lots 1 and 2 showed decidedly more marbling than Lots 3 and 4.

Steers fattened on the moderate level had a higher percentage of round and rib and a lower percentage of the cheaper wholesale cuts than steers from Lots 1 and 3, but the differences were not great. Rump, loin, and chuck percentages showed no definite trends.

Carcass composition data, as determined by physical separation of the 9-10-11th rib cut, indicate that carcasses from the slower-growing cattle were higher in lean and contained less fat. This would also be expected. Steers fed to gain rapidly (Lot 1) were highest in fat content and those fed moderately (Lot 4) were lowest in percent fat; other treatments tended to reflect the level of grain fed during the last one-half of the trial.

When feed efficiency (using T.D.N. values in Table 1) was expressed as pounds of T.D.N. required per pound of lean meat, the moderate-high group was most efficient (11.6 pounds), the high and moderate groups were next (12.1 pounds), and the high-moderate group was least efficient (12.8 pounds). Again, the differences were small. However, since the highest priced cuts of the beef carcass (round, loin, and rib) contain a higher percentage of lean meat than some of the cheaper cuts, the value of the carcass from moderately-fed steers may have been worth more than from the full-fed calves.

Chemical composition of lean tissue from the 9-10-11 rib cut showed a slightly higher moisture and lower fat content for calves fed moderately. This difference was not reflected by an increase in protein. In this experiment, changing feed patterns had little effect on composition of lean tissue.

Tenderness tests (Warner-Bratzler shear values) on loin steaks revealed little differences among treatments, although Lot 4 (moderately-fed) calves had the least tender steaks, according to this technique. The moderate-high group (Lot 3) was also less tender than Lot 1 (high), or Lot 2 (high-moderate). These values correlate fairly well with marbling score data, but not with fat content of eye muscle in the case of Lots 2 and 3. Preliminary results with taste panel data do not correlate with any of the above measurements with respect to tenderness.

Summary

The results from the second in a series of three fattening trials to determine the effect of different rates of gain on feed efficiency and carcass composition are reported. Twenty-four steer calves were individually-fed to make a total feedlot gain of 400 pounds. Groups of 6 calves each were fed to gain at the following rates: High throughout; high for 200-pound gain, then moderately for the remainder; moderately and then high; and moderately throughout. Approximately 2 pounds of milo per cwt. daily was fed to the high groups, and those moderately-fed received about 1 pound of milo per cwt. daily, with a higher roughage intake for the moderately fed group.

Results of the second trial indicate that steer calves fed to gain rapidly for 400 pounds produced a slightly higher grading carcass with a higher percentage of fat, on less total feed and in shorter time, than those fed moderately. Such treatment, however, resulted in a lower percentage of round, rib and chuck, and less lean tissue in the carcass. Also, the high level group showed no consistent advantage in tenderness, indicating that quality differences may not have been large.

Carcass desirability of the moderately-fed group was encouraging for this type of feeding regime. Changing from high to moderate, or the reverse, generally gave results intermediate to feeding either high or moderate throughout, with a tendency to be closer to the group fed on the same level for the last one-half of the trial. The high-moderate treatment appears to be the least desirable of the four methods studied.