EFFECTS OF LIMIT FEEDING ON FEEDLOT PERFORMANCE AND CARCASS CHARACTERISTICS

W. J. Hill[1], D. S. Secrist[1], F. N. Owens[2], and D. R. Gill[2]

Story in Brief

Brangus x English crossbred, fall-born steers (n=144) from a single ranch were allotted randomly at weaning (June 1994) to either 1) enter the feedlot in July, 2) graze native range and enter the feedlot in September, or 3) November. Diets consisting of 82% corn (either whole, rolled coarse, or rolled fine), 8% cottonseed hull and 10% supplement pellets. Cattle were fed either ad libitum or limited to 83% of ad libitum intake until they had gained about 300 lb (Period 1) after which they were all given ad libitum access to feed (Period 2). Cattle were fed to an average of .5 inches of backfat and slaughtered in groups by feedlot entry date. The corn form by feeding management interaction was not significant. Daily dry matter intake during Period 2 was not different but due to intake restriction during Period 1, total trial dry matter intake was less for limit fed cattle (16.9 vs 18.3 lb). Limit feeding resulted in lower average daily gains during Period 1 but slightly higher daily gains during Period 2 leading to a tendency for reduced daily gains for the total trial . Although feed/gain was not different during Period 1, feed/gain during Period 2 was 12.4% superior for cattle that previously had been limit fed which led to a trend for an improvement (3.2%) for the total trial based on carcass adjusted final live weight (63.5% dress). Although carcass weight was decreased by limit feeding (699 vs 720 lb) reflecting lower ADG, no other carcass characteristics were affected by limit feeding. Limit feeding resulted in decreased feed costs but, due to lighter selling weights, had no effect on net returns. The value of limit feeding was greater when corn price was $4.00 than $3.00.

(Key Words: Limit Feeding, Steers, Feedlot.)

Introduction

For the beef industry to successfully compete for feed grains with lower profit margins, new methods to increase efficiency of beef production must be tested and adopted. Restricting dry matter intake at specific times during the feeding period may improve feed efficiency of feedlot cattle. Various schemes for restricting intake sufficiently but not drastically have been devised and generally have improved feed efficiency. This indicates that striving for

[1] Graduate Assistant [2] Regents Professor

maximum dry matter intake will not always provide maximum economic return. Specific controlled intake programs may improve feedlot efficiency with this simple change in feeding management. However, effects of grain processing on benefit from intake restriction have not been examined. The objective of this experiment was to examine the effects of restricted feeding on feedlot performance and economics for cattle fed corn subjected to different processing methods.

Materials and Methods

Animals and Diets Predominately black, Brangus x English crossbred, fall born steers (n=144) were received in July, September and November of 1994 at the feedlot research facilities at Stillwater, OK. The calves all originated from a single ranch in northeastern Oklahoma. At weaning (June 1994) the calves were stratified by weight and assigned randomly as blocks of equal weight to either: 1) enter the feedlot in July, 2) graze native range until entering the feedlot in September, or 3) graze native range until entering the feedlot in November. Upon arrival at the feedlot, steers in each block (n=48) were weighed, vaccinated with a modified live virus 4-way respiratory and 7-way clostridial vaccine. After weighing, steers were stratified by weight and allotted randomly to treatment and pen ensuring an equal weight distribution in each pen within block. The treatments were arranged in a 3 by 2 factorial with date entering the feedlot serving as the block. Diets containing corn processed by one of three methods (finely rolled, coarsely rolled or whole corn) were fed either for ad libitum consumption or at a restricted rate. Limit fed pens received an average of 83% of the intake of ad libitum fed pens within each particle size and block until they had gained approximately 300 lb live weight (Period 1). This was approximately half of the feeding period. For the second half of the trial (Period 2), all cattle had ad libitum access to their diet.

The steers were housed (8 steers/pen) in 18 partially covered pens (6 pens/block and 3 pens/treatment combination) with slatted floors and covered cement fenceline feedbunks. Table 1 provides information on days fed and implant information. All calves were implanted twice (Synovex-S® then Revalor-S®) so that they received their final implant at least 70 days prior to slaughter. The cattle were dewormed with a feed-borne anthelmintic (Safeguard®) after feed intakes had stabilized.

Isocaloric and isonitrogenous dry corn based diets (Table 2) were fed once per day at approximately 3:00 PM. Diet ingredients (corn, cottonseed hulls and protein supplement) were analyzed for dry matter, crude protein and starch. The diets differed only in the extent to which corn had been processed.

Steers were weighed following transport to the feedlot (5 hours) and at 28 d intervals thereafter. The carcass-adjusted final weight was calculated by

dividing hot carcass weight by 63.5%. A 4% pencil-shrink was applied to all live weights (except for initial weights obtained immediately after transport) prior to calculating gains. All animals were slaughtered at Excel Corporation, Dodge City, KS. Carcass data were collected following a 48 hr chill.

Economic Analysis Economic calculations were computed using various costs to partially allow for extrapolation to different marketing options (live or carcass basis) and variable feed costs. These computations may prove useful considering high prices for corn and value based marketing systems. Carcass value was calculated using a base choice carcass price of $93.00/cwt. Discounts included those for quality grade ($6/cwt for select and $31/cwt for standard), for carcass weight ($20/cwt for carcasses over 900 lb or under 550 lb), and yield grade ($20/cwt for yield grade 4 carcasses). The only premium considered was $8/cwt for carcasses graded prime. Live value was determined at $63.00/cwt for all cattle. and was calculated using a shrunk (4%) live weight. Purchase cost was $68/cwt for cattle based on weight on arrival at the feedlot. Feed costs were assessed at two corn prices ($4.00 and $3.00/bushel) with supplement priced at $194/ton and cottonseed hulls at $76/ton. Total production cost was the sum of the purchase and feed costs excluding management, labor, and interest costs, because all cattle were fed the same number of days and required no additional labor. The objective of the economic analysis is to illustrate the relative value of these two feeding systems. Net return was calculated by subtracting value (either carcass or live) from either high ($4.00 corn) or low ($3.00 corn) total cost.

Results and Discussion

None of the corn processing by limit feeding interactions was significant. Consequently, only the main effect of feeding management will be discussed. Effects of corn processing on performance, carcass characteristics, and ruminal metabolism are reported elsewhere in this publication. Average daily gain (ADG) was decreased ($P<.01$) 20% by restricting feed intake during Period 1 (Table 3). However, when these limit fed steers were given ad libitum access to feed during Period 2, they compensated, having 10% greater ($P<.07$) ADG. For the total trial, however, ADG tended to be less (3.1%) for steers that had been limit fed due to incomplete compensation during Period 2. This depression in gain was more severe (5%; $P<.09$) when final weight was calculated from carcass weight divided by 63.5% (average dressing percentage) than from shrunk live weight (3%; $P<.22$) due to a slightly lower dressing percentage for the cattle that had been limit fed.

Feed intake by design was 17% lower ($P<.001$) for limit fed steers during Period 1, but did not differ ($P=.88$) during Period 2. Over the total trial, feed intake was 8% lower ($P<.01$) for limit fed steers. Feed:gain was slightly (1.7%)

depressed (P=.74) for limit fed steers during Period 1, but was improved (P<.05) by 14% during Period 2. Over the total trial, feed:gain was not significantly different, but cattle that had been limit-fed tended to be more efficient. The magnitude of the numerical improvement in feed:gain from limit feeding depended on which final weight was used in the calculation, being 5.3% based on live weight vs 3.2% based on carcass weight.

Feeding management system had no effect (P>.20) on any of the measured carcass traits (Table 4). Even though marbling scores were similar, there was a trend for different distributions of quality grades. Only among the steers fed ad libitum did any of the carcasses grade prime; limit fed cattle had slightly more standard carcasses. Additionally, only with ad libitum feeding did any overweight carcasses occur.

Economic data are presented in Table 5. Both carcass value and live value was greater for steers fed ad libitum due to heavier live and carcass weights, with the difference being greater on a carcass than on a live basis. The prime carcass benefit was largely canceled by the yield grade 4 carcass. Due to this difference, selling on a live weight rather than a carcass basis was slightly more beneficial for steers that had been limit fed. Feed cost was less (8%; P<.05) for limit fed cattle due to lower feed intake; the dollar advantage from limit feeding is greater when corn has a higher price. Total costs mirrored feed costs since purchase cost was the same and the feed intake was only variable factor. Net returns did not differ statistically; however, these numerical differences may be economically significant. Using carcass values with a low corn price favored steers fed ad libitum by almost $5.00/steer. However, when net returns are calculated from live weights and values, limit fed steers were more profitable under both corn prices with the greater benefit ($8/steer) being realized when corn was more expensive. Certainly, as rations costs increase limit feeding becomes more valuable. The difference in carcass weight could have been reduced by feeding the limit fed steers longer which might have reduced the number of carcasses grading standard among the limit fed steers. Values for determining carcass value were rough averages; seasonal variations on the discounts potentially could change the interpretation slightly. However, since the carcass characteristics were quite similar, any change in the pricing structure should affect both groups similarly.

In conclusion, limit feeding is a simple management practice that may improve the efficiency and profitability of cattle feeding. Even without limit feeding, feedlots that adopt a "slick bunk" policy for feeding cattle may achieve some of the benefits associated with limit feeding such as reducing feed waste, providing fresher feed, increasing the regularity of eating, and reducing the incidence of engorgement by individual cattle.

Table 1. Management summary.

Starting month	July	September	November
Date on feed	July 14,1994	Sept. 15, 1994	Nov. 15, 1994
Day of Synovex implant	42	0	0
Day of Revalor implant	131	93	82
Slaughter date	Feb. 7, 1995	March 7, 1995	May 9, 1995
Days on feed	208	173	175
Days after Revalor implant	77	80	93
Limit feeding gain	298	310	301
Limit feeding days	105	93	83
Total 1st period gain	368	355	371

Table 2. Diet and calculated nutrient composition (% of DM) .

Ingredient	% of diet dry matter
Dry corn	82.05
Cottonseed hulls	8.00
Soybean meal	4.00
Cottonseed meal	4.00
Limestone	1.00
Urea	.60
Salt	.30
Manganous oxide	.004
Copper sulfate	.001
Zinc sulfate	.002
Vitamin A-30	.01
Rumensin-80	.017
Tylan-40	.013
Nutrient content, dry matter basis[a]	
NEm, Mcal/cwt	95.0
NEg, Mcal/cwt	60.0
Crude protein, %[b]	13.4
Potassium, %[c]	.57
Calcium, %[c]	.44
Phosphorus, %[c]	.32
Magnesium, %	.16
Cobalt, ppm	.01
Copper, ppm	8.5
Iron, ppm	51.5
Manganese, ppm	44.0
Zinc, ppm	34.9

[a] Using nutrient content of feedstuffs according to NRC (1984).
[b] Based on Kjeldahl analysis of individual feeds.
[c] Analyzed by Servi-Tech Laboratories, Dodge City, KS.

Table 3. Summary of feedlot performance data for limit and ad libitum fed cattle.

Item	Ad Lib	Limit	Sem	P<
Average days on feed	185	185		
Weight, lb				
Initial	542	539	2.19	
Carcass adjusted live	1136	1103	10.91	.05
Shrunk live	1139	1117	9.55	.13
Carcass wt	721	700	6.9	.05
Feed intake, lb/day				
Period 1	16.9	14.0	.41	.01
Period 2	19.9	19.8	.47	.88
Total trial	18.4	16.9	.38	.02
Period 1 gain, lb	365	303	7.88	.01
Average daily gain, lb				
Period 1	3.53	2.92	.09	.01
Period 2	2.82	3.12	.11	.07
Total, carcass basis	3.19	3.04	.06	.09
Total, live basis	3.21	3.11	.05	.22
Feed: Gain				
Period 1	4.75	4.83	.16	.74
Period 2	7.00	6.13	.23	.02
Total, carcass basis	5.64	5.46	.13	.32
Total, live basis	5.62	5.32	.13	.13

Table 4. Carcass characteristics of limit fed and ad libitum fed steers.

Item	Ad Lib	Limit	Sem	P<
Dressing %	63.4	62.8	.35	.20
Ribeye area, square inches	11.9	11.7	.18	.46
Ribeye area / carcass cwt	1.65	1.68	.02	.32
KPH, %	1.90	1.80	.056	.24
Backfat, inches	.54	.52	.02	.65
Yield grade	3.1	3.0	.06	.40
Percent yield grade 4	8.33	9.72	2.69	.72
Marbling score[a]	313	320	9.61	.63
Percent prime	4.16	0.0	1.96	.16
Percent choice	43	49	3.46	.23
Percent select	51.4	48	5.54	.67
Percent standard	1.39	2.78	2.12	.65
Percent overweight carcasses	1.38	0	.98	.34

[a] Slight amount of marbling = 200-299; small = 300-400.

Table 5. Economic data by feeding management system.

Item	Ad Lib	Limit	Sem	P<
Steers, number	72	72		
Final value, $/steer				
Carcass[a]	633	611	9.58	.13
Live[b]	717	703	6.0	.13
Costs, $/steer				
Purchase	369	366	1.49	.30
Feed expensive[c]	238	218	5.43	.03
Feed economical[d]	190	174	4.34	.03
Total expensive feed[c]	606	585	6.04	.03
Total economical feed[d]	559	541	4.98	.03
Net return, $/steer				
Carcass basis, expensive feed[ac]	26.74	26.46	9.66	.98
Carcass basis, economical feed[ad]	74.53	70.35	9.52	.76
Live basis, expensive feed[bc]	111	119	6.77	.43
Live basis, economical feed[bd]	159	163	6.25	.67
Cost of gain, expensive feed, $/lb[c]	.40	.39	.008	.52
Cost of gain , economical feed, $/lb[c]	.32	.31	.006	.52

[a] Value calculated based on carcass premiums and discounts.
[b] Value calculated based on a common price ($63/cwt) and live weight.
[c] Calculated using a corn price of $4.00/bushel.
[d] Calculated using a corn price of $3.00/bushel.