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A programmed gain phase in the feeding period reduced total feed consumed but did not improve performance. Economics favored ad libitum feeding due to differences in carcass weight.

Summary

One hundred sixty crossbred steer calves were used to evaluate the efficacy of including a programmed gain phase in the feeding program and to evaluate effects of rate and duration of programmed gain on finishing performance. Including a multiple phase programmed gain period with two rates of gain resulted in performance similar to a single period of programmed gain. Increasing length of the programmed gain period resulted in higher gains and dry matter intakes after steers were switched to ad libitum feeding. Cumulative daily gain and dry matter intake were decreased by the programmed feeding strategies. Net return per animal was lower and cost of gain higher when a period of programmed gain was part of the feeding program.

Introduction

Limit feeding of high concentrate diets as part of a finishing system has been researched for many years. In most cases, previous research has focused primarily on maintaining some degree of intake restriction throughout feeding. Improvements in feed efficiency have been demonstrated as a result of feed restriction. However, daily gain, carcass weight and carcass fatness tend to decrease with feed restriction. Consequently, time required to reach similar final weights increases.

Recent studies restricted energy intake so animals were "programmed" to gain at a certain rate for a given period of time. The underlying theory to this practice: some compensatory growth will occur when animals are given full access to feed, resulting in similar cumulative daily gains. The reduced feed consumption accompanying the programmed gain period, coupled with compensatory growth, serves to enhance efficiency in programmed gain animals. Also, it has been suggested that the possibility exists for promoting multiple periods of compensatory growth by including multiple periods of programmed gain in the finishing program. However, little is known about the optimum rate or duration of programmed gain.

The objectives of this research were to evaluate both rate and duration of programmed gain in finishing calves while assessing the efficacy of including a programmed gain strategy in the feeding program.

Procedure

One hundred sixty steer calves (656 lb) were blocked by weight into five weight blocks and randomly assigned within block to one of four pens (eight steers/pen). Each pen was randomly assigned to one of four treatments based on rate and duration of programmed

Table 1. Composition of finishing diet.

Ingredient	Percent ediet DM
Wet corn gluten feed	35.000
Dry-rolled corn	32.100
High-moisture corn	21.400
Alfalfa hay	7.500
Supplement	4.000
Ground milo	.392
Limestone	1.454
Feathermeal	1.100
Bloodmeal	.600
Salt	.300
Tallow	.080
Trace mineral	.030
Rumensin	.016
Vitamin premix	.015
Tylan	.013

gain. Treatment 1 was an ad libitum control in which steers were offered ad libitum access to feed throughout the trial. Treatment 2 consisted of one duration (70 days) and one rate (2.8 lb/day) of programmed gain. Steers receiving Treatment 3 were programmed to gain 2.5 and 3.0 lb/day for 35 days each. Steers in Treatment 4 were programmed to gain 2.5 and 3.0 lb/day for 50 days each. Intake required to achieve the programmed rate of gain was calculated using the net energy equations contained in the NRC (1996) computer model. Intakes of calves in programmed gain treatments were adjusted every 14 days.

Adaptation diets contained 45, 35, 25, 17.5 and 12.5 percent alfalfa hay (DM basis) and were fed for four, five, five, seven and seven days, respectively. The final diet (Table 1) was formulated to meet the metabolizable protein requirement of the ad libitum control group at the midpoint of the initial 70 days in the feeding period. The final diet contained 16.2 percent CP (DM basis), 10.4 percent DIP (percent of DM), 5.8 percent UIP (percent of DM), .70 percent Ca, .35 percent P, .65 percent K and included 25 g/ton Rumensin® and 10 g/ton Tylan®. Steers were implanted with Synovex®-S at the beginning of the trial and re-implanted with Revalor®-S on day 70. The experiment was initiated on December 9, 1997. Steers in all treatments were weighed the day prior to slaughter at a commercial packing plant. Based on projected performance from interim weights, steers were slaughtered at equal treatment mean live weights. Following a 24-hour chill, yield grade, marbling score and twelfth rib fat thickness were recorded. The mean dressing percentage (63.8 percent) was used to calculate carcass adjusted performance. In an effort to account for differences in gut fill, interim weights of steers consuming feed ad libitum were shrunk 4 percent to be used in performance calculations.

Table 2. Effect of programmed gain on interim performance.

	Treatment				
	1	2	3	4	SEM
Treatment description					
ADG, lb	Maximum	2.8	2.5/3.0	2.5/3.0	
Duration, days	154	70	35/35	50/50	
Period 1[a]					
ADG, lb	3.53[e]	2.97[f]	2.87[fg]	2.66[g]	.09
DMI, lb/d	19.63[e]	15.65[f]	14.86[g]	14.86[g]	.12
Feed:gain	5.58	5.27	5.21	5.61	.15
Period 2[b]					
ADG, lb	4.12[e]	3.09[fg]	3.26[f]	2.72[g]	.15
DMI, lb/d	22.36[e]	16.30[f]	16.71[f]	17.71[g]	.23
Feed:gain	5.44[e]	5.29[e]	5.22[e]	6.50[f]	.22
Performance during programmed gain period[c]					
ADG, lb	3.83[e]	3.03[f]	3.07[f]	2.69[g]	.06
DMI, lb/d	21.02[e]	15.96[fg]	15.77[g]	16.33[f]	.17
Feed:gain	5.47[e]	5.27[ef]	5.16[f]	6.06[g]	.09
Period 3[d]					
ADG, lb	2.94[e]	3.15[e]	3.05[e]	3.50[f]	.10
DMI, lb/d	23.00[e]	23.60[e]	23.43[e]	24.97[f]	.40
Feed:gain	7.86	7.50	7.69	7.16	.19

[a]Day 1-35 for Treatments 1, 2 and 3; Day 1-50 for Treatment 4.
[b]Day 35-70 for Treatments 1, 2 and 3; Day 50-100 for Treatment 4.
[c]Day 1-70 for Treatments 1, 2 and 3; Day 1-100 for Treatment 4.
[d]Day 71-154 for Treatment 1; Day 71-161 for Treatments 2 and 3; Day 101-161 for Treatment 4.
[efg]Means within a row with unlike superscripts differ (P<.05).

Results

Effects of programmed gain on interim performance are shown in Table 2. As expected, steers fed ad libitum during Period 1 gained faster (P<.05) and consumed more feed (P<.05) than the other treatments. Both treatments in which steers were programmed to gain 2.5 lb/day resulted in faster gains than predicted during Period 1. Steers programmed to gain 2.5 lb/day during the initial 35 days of the feeding period (Treatment 3) gained 2.87 lb/day. Steers programmed to gain 2.5 lb/day for the first 50 days on feed (Treatment 4) gained 2.66 lb/day. There were no statistical differences in feed conversion among treatments during Period 1. Steers fed ad libitum gained faster (P<.05) and consumed more feed (P<.05) than all other treatments during Period 2 (Table 2). During Period 2, Treatment 3 resulted in 8.6 percent faster gains than predicted while Treatment 4 resulted in gains 9.3 percent slower than predicted. The slower than predicted daily gain and reduced (P<.05) feed efficiency observed in steers in Treatment 4 are likely due to the inclement weather experienced during the latter stages of Period 2. The length of restriction for Treatment 4 was 50 days, while the duration for Treatment 3 was only 35 days. The additional 15 days of limit feeding for steers in Treatment 4 were accompanied by severely muddy pen conditions and a severe snowstorm.

Daily gain and feed consumption were greater (P<.05) for steers fed ad libitum during the overall programmed gain period (Table 2). Treatment 2 resulted in 8.2 percent faster daily gain than predicted for the 70 day period. Treatments 2 and 3, in which the programmed gain period was 70 days, resulted in increased (P<.05) daily gain and improved feed conversion (P<.05) versus Treatment 4 where the programmed gain period was 100 days. Performance of Treatments 2 and 3 was similar during the programmed

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Table 3. Effect of programmed gain on cumulative performance.

	Treatment				
	1	2	3	4	SEM
Pens	5	5	5	5	——
Animals	39	40	40	40	——
Initial Wt., lb	655.6	655.4	655.0	656.2	.7
Final Wt., lb[a]	1167.2	1151.0	1144.4	1139.2	10.4
Day 1-Slaughter[a]					
ADG, lb	3.34[d]	3.10[e]	3.06[e]	3.02[e]	.06
DMI, lb/d	22.10[d]	20.13[e]	19.95[ef]	19.34[f]	.25
Feed:gain	6.62	6.50	6.53	6.41	.11
Total feed, lb/hd	3204.0[d]	3240.9[e]	3211.3[ef]	3113.8[f]	38.7
Days on feed	154	161	161	161	——
Net profit, $/hd[b]	16.31	10.12	7.33	7.65	——
Cost of gain, $/cwt	47.59	48.12	48.43	48.04	——
Carcass adjusted performance					
ADG, lb	3.31[d]	3.08[e]	3.10[e]	2.95[e]	.05
Feed:gain	6.67	6.53	6.44	6.57	.09
Carcass characteristics					
Hot carcass wt, lb	743.7	734.9	736.4	721.4	5.5
Dressing %	63.7	63.8	64.3	63.3	.3
Marbling score[c]	475.4	460.0	476.4	457.8	8.1
Yield grade	2.08[d]	1.77[e]	2.03[d]	1.85[de]	.08
Fat thickness, in.	.37	.38	.41	.37	.01

[a]Final live weight adjusted for 4% shrink.
[b]Purchase price = $85.00/cwt; Sales price = $70.00/cwt; Yardage $.30/d; Feed cost $100.00/ton; Feed and cattle interest 10%.
[c]Marbling score: Slight = 400; Small = 500.
[def]Means within a row with unlike superscripts differ (P<.05).

gain period, indicating little compensatory growth as a result of changing the severity of energy restriction without altering the duration.

After all steers were switched to ad libitum feeding from their respective programmed gain treatment, Treatment 4 resulted in higher (P<.05) daily gain and feed consumption. The interim results suggest that with the longest restriction, some compensatory growth was occurring. These steers were restricted longer and consequently spent less time at a heavier body weight. The increased growth rate of cattle in Treatment 4 was most likely a function of a lower maintenance requirement, making more energy available for gain.

Cumulative live weight performance for the entire feeding period is shown in Table 3. Steers fed ad libitum throughout the trial gained faster (P<.05) and consumed more feed (P<.05) than steers in all other treatments. Daily gains among steers in programmed gain treatments were similar for the entire trial. Feed conversion among all treatments was similar, though numerically lower for programmed gain treatments. These results disagree with previous findings when including a programmed gain period resulted in improved efficiency versus steers fed ad libitum. However, our diets contained 35 percent wet corn gluten feed which may have prevented subacute acidosis from occurring in steers fed ad libitum. Based on projections from interim performance, programmed gain treatments required an additional seven days on feed to reach slaughter weight. Total pounds of feed consumed per animal was lower (P<.05) in steers undergoing a period of programmed gain compared to those having ad libitum access to feed throughout the trial. Total pounds of feed consumed per animal was lower (P<.05) for Treatment 4 than for Treatment 2. Carcass adjusted performance was similar to live weight performance. In general, carcass characteristics (Table 3) were unaffected by treatment. Though not statistically different, steers undergoing a 100 day programmed gain period gave up 22 pounds of carcass weight compared to steers fed ad libitum throughout the experiment. Even though steers in Treatment 4 had higher daily gains after being switched to ad libitum feeding, they were unable to completely make up the difference in weight. Dressing percentage, marbling score and fat thickness were similar among treatments. It is unclear why steers in Treatment 2 had a lower (P<.05) yield grade than steers in Treatments 1 and 3. Net profit ($/head) and cost of gain ($/cwt) favored ad libitum feeding for the entire feeding period. Clearly, the programmed gain strategies were successful in terms of reducing the total amount of feed required for animals to reach market readiness. However, if a programmed gain period is to be included in the feeding period, weight cannot be sacrificed in exchange for reduced feed costs at the feed prices used.

Daily gain and feed conversion were not enhanced by including a programmed gain period in the feeding program. These data suggest programmed gain strategies do not reduce carcass merit. The amount of feed needed to reach market readiness is reduced by including a programmed gain phase. However, economics did not favor including a programmed gain period, because the feed cost savings did not offset the loss of weight gain. Feed cost alone would need to reach $160/ton before the loss of gain would be offset by feed cost savings.

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