EFFECTS OF PROGRAM-FEEDING STRATEGIES ON GROWTH-PERFORMANCE AND CARCASS CHARACTERISTICS OF FEEDLOT CATTLE

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Abstract: Ninety-six crossbred yearling steers were used in a 124-d finishing trial to compare 3 program feeding strategies with conventional ad libitum feeding on growth-performance, carcass characteristics, and NE value of the diet. Feed intake of program-fed steers was restricted to permit 1.5 kg/d weight gain for the initial 28, 56, or 84 d of the finishing period. Thereafter, steers were allowed ad libitum feed access. Steers were fed an 85% concentrate steam-flaked corn-based finishing diet twice daily. Overall ADG was 1.57, 1.50, 1.68, and 1.60 kg/d for ad libitum and 28-, 56-, and 84-d feed restriction, respectively. The ADG of ad libitum vs restricted-fed steers did not differ ($P > .10$). Although, there was a quadratic effect ($P < .05$) of duration of feed restriction on ADG. Overall DMI/ADG was not affected by treatments, averaging 5.36, 5.56, 5.29, and 5.34, respectively. Dietary NE was also not affected by treatments, averaging 103, 100, 103, and 102% of expected, respectively. Carcass marbling score was greater ($P < .10$) for ad libitum than for restricted-fed steers, averaging 4.28, 3.92, 4.00, and 3.88, respectively.

Introduction

Program feeding to achieve ADG of 90 to 95% of ad libitum-fed feedlot cattle has improved the efficiency of growth-performance (Zinn, 1987; Hicks et al., 1990; Loerch, 1990; Sip and Pritchard, 1991; Bartle and Preston, 1992). Presumably, this benefit is due, in part, to reduced day-to-day fluctuations in feed intake, and the associated reductions in acute and chronic digestive disturbances. However, a limitation of program feeding is that it restricts cattle from achieving their optimal growth-rate potential. Because DM intake of feedlot cattle is most volatile during the initial 100 kg of gain, it may be beneficial to program feed during the initial growing period and return cattle to ad libitum feed access during the finishing period. This study was conducted to compare the effects of conventional ad libitum feeding vs program-restricted feeding for the initial 28, 56, or 84 d following the receiving period, on growth-performance and carcass characteristics.

Experimental Procedures

Ninety-six crossbred yearling steers (323 kg) were used in a 124-d feeding trial to compare three program feeding strategies with conventional ad libitum feeding on growth-performance, carcass characteristics, and NE value of the diet. Feed intake of program-fed steers was restricted to permit 1.5 kg/d weight gain for the initial 28, 56, or 84 d of the finishing period. Steers were blocked by weight and randomly allotted to 16 pens (six steers/pen) equipped with automatic waterers and fence-line feed bunks. The trial was initiated January 24, 1996. Feed intake of the program-fed steers was determined according to the following equation:

$$FI = ((.0557BWT^{.75}(1.5^{1.097}))/NE_g) + (.077BWT_{.75}/NE_m),$$

where FI is daily DM intake in Kg, 1.5 is the expected ADG in kg, BWT is the average full weight reduced 4% to account for digestive tract fill, and NE_m and NE_g are expressed in Mcal/kg. Feed intake was adjusted at weekly increments according to projected changes in live weight. Composition of the diet is shown in Table 1. Steers were fed twice daily. Upon initiation of study and at d 56, steers were implanted with Synovex-S (Syntex, Des Moines, IA). Diets were prepared at weekly intervals and stored in plywood boxes located in front of each pen. Energy retention (ER, megacalories) was derived from measures of BWT and ADG according to the following equation:

$$\text{Steers EG} = (.0557\ BWT^{.75})\ ADG^{1.097}$$

(NRC, 1984). Net energy content of the diet for maintenance and gain were calculated assuming a constant fasting heat production (MQ) of $.077BWT^{.75}$ Mcal/d. From estimates of ER and MQ, the NEm and NEg values of the diets were obtained by process of iteration (Zinn and Plascencia, 1996) to fit the relationship: NEg = (.877NEm) - .41. This trial was analyzed as a randomized complete block design experiment (Hicks, 1973).

Implications

There may be little growth-performance advantage to restricting average daily weight gain during the initial twenty-eight, fifty-six, or eighty-four days of a one hundred twenty-four day feeding period.

Table 1. Composition of diet fed to steers (DM basis)

Item	Basal diet
Ingredient composition, %	
Alfalfa hay	5.00
Sudangrass hay	10.00
Steam-flaked corn	65.55
Cottonseed meal	4.50
Limestone	1.85
Urea	1.40
Magnesium oxide	.20
Trace mineralized salt	.50
Vitamin A, IU/kg	2,200
Laidlomycin, g/1000 kg	12.5
Yellow grease	5.00
Cane molasses	6.00
Nutrient composition[a]	
NEm, Mcal/kg	2.24
NEg, Mcal/kg	1.56
CP, %	14.0
Lipid, %	8.1
NDF, %	18.3
Calcium, %	.80
Phosphorus, %	.33
Magnesium, %	.34
Potassium, %	.85
Sulfur, %	.14

[a]Based on tabular values (NRC, 1984) with the exception of yellow grease (Zinn, 1988).

Table 2. Influence of program feeding on growth-performance of feedlot steers

		Program feeding			
Item	Ad libitum	28-d	56-d	84-d	SD
Days on test	124	124	124	124	
Pen replicates	4	4	4	4	
Live weight, kg[a]					
Initial	323.2	323.1	322.7	323.2	.7
28-days[b]	368.9	362.9	365.4	367.0	3.6
56-days	414.4	410.3	412.5	409.2	5.1
84-days[c]	457.2	450.4	463.4	456.2	6.1
124-days[d]	518.6	508.6	530.1	521.5	10.8
Weight gain, kg/d					
1-28 days	1.63	1.42	1.53	1.56	.13
28-56 days[e]	1.63	1.69	1.68	1.51	.15
56-84 days[bfg]	1.53	1.43	1.82	1.68	.11
84-124 days	1.52	1.45	1.67	1.65	.20
1-124 days[c]	1.57	1.50	1.68	1.60	.09
DM intake, kg/d					
1-28 days[h]	7.48	7.12	7.22	7.07	.18
28-56 days	8.48	8.35	8.52	8.39	.49
56-84 days[c]	8.55	8.74	9.67	8.76	.52
84-124 days[e]	8.90	8.81	9.77	9.56	.58
1-124 days[d]	8.42	8.32	8.88	8.56	.35
DM intake/gain					
1-28 days[e]	4.63	5.02	4.73	4.54	.37
28-56 days[f]	5.22	4.96	5.07	5.58	.31
56-84 days[i]	5.60	6.10	5.34	5.23	.34
84-124 days	5.95	6.16	5.83	5.82	.56
1-124 days	5.36	5.56	5.29	5.34	.19

[a]Initial and final live weights reduced 4% to account for fill.
[b]Ad libitum vs program, P < .10.
[c]Program quadratic effect, P < .05.
[d]Program quadratic effect, P < .10.
[e]Program linear effect, P < .10.
[f]Program linear effect, P < .05.
[g]Program quadratic effect, P < .01.
[h]Ad libitum vs program, P < .01.
[i]Program linear effect, P < .01.

Table 3. Influence of program feeding on dietary net energy

		Program feeding			
Item	Ad libitum	28-d	56-d	84-d	SD
Days on test	124	124	124	124	
Pen replicates	4	4	4	4	
Diet net energy, Mcal/kg					
Maintenance	2.30	2.24	2.30	2.29	.06
Gain	1.60	1.55	1.61	1.60	.05
Observed/expected diet NE					
Maintenance	1.03	1.00	1.03	1.02	.03
Gain	1.03	.99	1.03	1.03	.03

Table 4. Influence of program feeding on carcass characteristics of feedlot steers

		Program feeding			
Item	Ad libitum	28-d	56-d	84-d	SD
Carcass weight, kg[ab]	325.9	319.8	333.1	329.4	7.1
Dressing percentage	62.8	62.9	62.8	63.2	.6
Ribeye area, cm^2	78.7	77.6	80.6	80.7	3.4
Fat thickness, cm	1.05	1.01	1.16	1.11	.17
KPH, %[c]	2.10	2.11	2.16	2.12	.08
Quality grade[de]	4.28	3.92	4.00	3.88	.32
Retail yield, %	50.3	50.4	50.1	50.4	.6
Abscessed livers, %	12.5	4.2	8.3	4.2	11.2

[a]Program linear effect, $P < .10$.
[b]Program quadratic effect, $P < .10$.
[c]Kidney, pelvic, and heart fat as a percentage of carcass weight.
[d]Ad libitum vs program, $P < .10$.
[e]Coded: Minimum slight = 3, minimum small = 4. etc.