Effects of Limit-Fed Growing Programs on Finishing Performance and Carcass Traits of Steers in a Commercial Feedlot

J. Rakestraw[1], K. S. Lusby[2], and A. J. Edwards[3]
[1]*XIT Feeders, Dalhart, Texas*
[2]*Professor, Animal Science Department, Oklahoma State University*
[3]*Professor, College of Veterinary Medicine, Kansas State University*

Introduction

Growing programs have long been used to increase the age and weight of calves at slaughter. Growing programs are also useful when calves are available at attractive prices but grazing programs are unavailable. However, traditional growing programs have utilized a full feed of lower energy rations. While these rations provide the desired lower rate of gain during the growing period, the poor feed efficiency realized with full feed and reduced gain has limited the feasibility of such programs. While it has been known that providing the energy necessary for a reduced level of gain with a reduced amount of high concentrate ration should be more economically and energetically efficient than the use of full-fed high roughage rations, the potential management problems associated with limit feeding have limited adoption of the practice. With the advent of microcomputers, it is now possible to accurately predict the amount of a given ration needed to achieve a target weight gain. Further, feed additives such as monensin reduce the danger of overeating and acidosis associated with high energy rations and minimize some potential problems associated with feeding a limited amount of high concentration ration. The Objectives of this research were: (1) to determine the effect of limit feeding rations containing two energy levels on performance of weaned calves during the growing phase and, (2) on subsequent finishing performance and carcass traits.

Methods and Materials

Seven hundred and sixty two spring-born (March-April) Limousin x Hereford-Angus calves from one ranch near Gordon, Nebraska were weaned and shipped to XIT Feeders, a division of Continental Grain Co. near Dalhart in the northwestern Texas panhandle. Calves arrived at the feedlot on November 2 and 3, 1989. On arrival, steers were randomly allotted to 8 pens and assigned by pen to one of 3 treatment groups (Table 1). Treatments were (1) limit feeding a ration containing 61 Mcal NEg/CWT of DM to gain 2.20 lb/day; (2) limit feeding a ration containing 66 Mcal NEg/CWT to gain 2.20 lb/day; or (3) *ad libitum* a ration containing 61 Mcal NEg/CWT until weight reached 750 lbs. Approximately 95 calves were assigned to each pen and provided 12 inches of bunk space per calf. All pens were switched to full feeding of a ration containing 66 Mcal NEg/CWT when calves averaged 750 lbs. The first pen was slaughtered when visual conditions indicated that the majority of that pen would attain choice grade. All other pens were then slaughtered so that all pens had equal days to slaughter from the end of the growing period.

TABLE 1 Rations fed during limit feeding period.

		Percent in Ration, as fed		
Ingredient	% DM	Treatment 1	Treatment 2	Treatment 3
Corn silage	35.0	40.5	16.5	16.0
Flaked corn	79.0	40.3	62.4	54.0
Wheats midds	88.0	9.0	10.0	12.0
Supp, grower	93.0	5.7	6.6[a]	
Supp, finisher				2.5[b]
Fat	99.0	1.5	2.5	1.5
Cane molasses	73.0	3.0	2.0	4.0
Alf. Hay		0	0	10.0
Dry matter, %		62.9	73.9	74.3
Rumensin, g/ton		21.3	24.6	14.3
Tylan, g/ton		7.6	8.8	4.7
Nutrients, DM basis:				
NEm, Mcal/cwt		93.0	99.4	93.5
NEg, Mcal/cwt		61.0	66.0	60.5
Crude protein, %		15.0	15.0	13.3
Concentrate, %		78	92	83
Crude fiber, %		8.6	5.7	8.6
Potassium, %		0.93	0.7	1.10
Calcium, %		0.73	0.65	.67
Phosphorus, %		0.38	0.39	.37
Magnesium, %		0.22	0.21	.23

[a]Grower supp(%): 65 CP, 32.5 NPN, 6.1 Ca., .6 P, 1.1 K.
[b]Finisher Supp (%): 78.5 CP; 63.5 NPN; 11.8 Ca.; .5 P; 1.7 K.

On arrival, calves were implanted with Synovex S, vaccinated with Bovishield 4 (Norden) and injected with Ivomec (MSD Agvet). Cattle were revaccinated with Bovishield 4 on day 10 after arrival. At 90 days post arrival, cattle were reimplanted with Synovex S (Syntex), revaccinated with Bovishield 4 and injected with 7-way Clostridial vaccine (Affiliated Labs).

All calves were fed warm-up rations *ad libitum* from arrival until November 23 by which time all pens demon-

strated stable consumption. At that time all calves were weighed full by pen. Three pens each were weighed full and switched to limit-feeding (Treatments 1 and 2) and two pens served as controls (Treatment 3). The amount of each ration for limit-fed pens was calculated with a microcomputer program (Progfeed) which predicted daily feed based on weight and rate of gain of the steers (NRC 1984), NEm and NEg content of the ration. Daily feed allowance was increased at 14-day intervals as the calves gained weight. During days when calves encountered cold stress, the amount of limit-fed rations was increased by 10%. Limit-fed pens were fed once daily at 8 AM and full-fed pens were fed 3 times per day. A check weight was taken on December 22, approximately 30 days into the growing period.

All pens were switched to full feeding of the finishing raton (Table 2) when pens weighed approximately 750 lbs. Pens were reweighed full at this time. At the end of the growing period, two feeder calf order buyers and one packer buyer scored all pens for body condition (scale of 1 = very thin to 9 = very fat). All calves were slaughtered at a commercial packing facility and carcass data obtained from USDA graders. All weights from the time of arrival at the feedlot to slaughter were adjusted to a 4% shrunk basis.

TABLE 2 Final finish ration for all pens.

Ingredient	% DM	Percent in ration, as fed
Corn silage	34.5	19.0
Flaked corn	79.0	32.5
Flaked milo	79.0	30.0
Wheats midds	88.0	10.0
Supp, finisher[a]	95.5	3.2
Fat	99.0	3.3
Beet molasses	73.0	2.0
Dry matter, %		72.5
Rumensin, g/ton		19.5
Tylan, g/ton		6.2
Nutrients, DM basis:	%	
NEm, Mcal/cwt	99.7	
NEg, Mcal/cwt	66.5	
Crude protein, %	13.2	
Concentrate, %	92	
Crude fiber, %	5.9	
Potassium, %	0.7	
Calcium, %	0.65	
Phosphorus, %	0.36	
Magnesium, %	0.22	

[a]Finisher supp (%): 72 CP; 63 NPN; 13 Ca; .5 P; 1.1 K.

Records were kept for pen weights, feed intake, calves removed as bullers, calves treated for sickness and death loss. Feed costs were calculated based on ration ingredient costs plus markup for feedlot overhead.

Data were analyzed using the least squares procedure of SAS (1985). Pens were the experimental units.

Results and Discussion

Steers weighed about 536 lbs with a 3% pencil shrink in Nebraska. Transit shrink to the feedlot was about 3.5% from pay weight. Gains were minimal during the receiving and warm-up period (Table 3). During this period all pens were managed alike and calves on all treatments regained their original purchase weight. About 25% of calves were treated for respiratory disease. One calf each died from respiratory disease and bloat.

TABLE 3 Performance of steers during warm-up period.

	Limit-fed		Full-fed
	Treatment 1	Treatment 2	Treatment 3
No. Steers	283	284	191
No pens	3	3	2
Pay wt, Nebraska	538	537	535
Arrival wt, Dalhart	517	517	516
Warm-up period, Pay wt to start of Growing period,			
Total gain, lb	7.9	6.7	2.1
Respiratory pulls, %	20.9	22.4	28.4
Digestive pulls, %	0	0	0
Respiratory deads, %	.5	0	0
Digestive deads, %	0	.3	0

Gains during the growing period (Table 4) were 2.36 and 2.37 lbs/day for Treatment 1 and 2, compared to 2.79 lb/day ($P < .05$) for full-fed calves. Gains of limit-fed calves were slightly greater than the target gain of 2.20 lb/day. Treatment 2 calves fed the 66 Mcal ration were more efficient ($P < .05$) than Treatment 1 calves fed the 61 Mcal ration, as expected, although feed efficiency for both limit-fed groups was excellent and equaled or exceeded feed efficiency for full-fed calves. Cost of gain was lowest for Treatment 2 and 3 calves during the growing period. Calves that were full-fed during the growing perod was fatter ($P < .05$) than limit-fed. Condition scores for limit-fed treatments were similar.

TABLE 4 Performance of steers during growing period.

	Limit-fed		Full-fed
	Treatment 1	Treatment 2	Treatment 3
Beginning wt, growing period	545	544	539
Growing days	87	89	78
Respiratory pulls, %	14.8[a]	11.6[b]	11.3[b]
Digestive pulls, %	1.0	.3	0
Respiratory deads, %	1.0	.3	0
Digestive deads	1.1	.7	.5
Daily gain, lb	2.36[a]	2.38[a]	2.79[b]
DM intake, lb	12.98[a]	11.9[a]	15.15[b]
Feed:gain	5.50[a]	5.02[b]	5.43[a]
Cost of Gain ($/cwt)	42.84	39.73	40.18
Condition score[c]	5.2[a]	5.2[a]	6.72[b]

[ab]Means on row with different superscript letters differ ($P < .05$)
[c] Scale of 1 = very thin to 9 = very fat.

More calves from Treatment 1 were pulled during the growing period ($P < .05$) than from Treatments 2 and 3.

Reasons for this difference are not apparent. The number of calves treated for respiratory or digestive disorders during the growing period was small for all treatments. No bullers were observed in any pens during the entire study.

Limit-fed calves received their feed allocation at one feeding daily at 8:00 AM. Early in the limit feeding period calves would consume all their rations by about 5:00 PM. By the time the calves were mid-way through the growing period, this time approached 2:30 PM. Limit-fed cattle never appeared hungry, although they were very aggressive during the first 15 minutes after each feeding. On the day the calves were switched to the three-times-daily full feeding regimen, excitement was noted in their behavior at the first feeding, apparently because the first feeding contained much less than they expected. However, after 4 to 5 days, this pattern was no longer noticeable.

In order to determine the economic feasibility of any practice during a growing period, subsequent performance during finishing and effects on carcass traits must be considered. Calf weight at the end of the growing period was very close to the target of 750 lbs (Table 5). The number of calves pulled for respiratory disorders was small during finishing, as expected. It is interesting that significantly more calves from Treatment 3, full-fed throughout the study, died of bloat than previously limit-fed calves.

TABLE 5 Performance of steers during finishing period.

	Limit-fed		Full-fed
	Treatment 1	Treatment 2	Treatment 3
Finishing days	123	122	121
Beginning wt, finish period	750	754	758
Respiratory pulls, %	.3	.3	.5
Digestive pulls, %	.4	0	.5
Respiratory deads, %	0	.7	.5
Digestive deads	0^{b}	$.3^{b}$	1.5^{a}
Daily gain, lb	3.10^{b}	3.19^{b}	2.96^{a}
DM intake, lb	16.73	17.56	17.17
Feed:gain	5.40	5.50	5.79
Cost of Gain ($/cwt)	40.29	41.05	43.22
Final live wt, lb	1130	1143	1115

^{ab}Means on row with different superscript letters differ (P < .05)

Daily gains during finishing were greater (P < .05) for Treatments 1 and 2 compared to Treatment 3. This would be expected because limit-fed calves were apparently thinner at the beginning of finishing. Feed intake was similar for all treatments and feed efficiently tended to be improved for calves previously limit-fed. Limit-fed treatments tended to be heavier at slaughter than full-fed calves, suggesting that limit feeding can increase slaughter weight of weaned calves when placed directly in the feedlot. The number of days from the time calves weighed about 750 lbs to slaughter was 122 days for all treatments.

The total feeding period was 11 days longer for limit-fed calves (Table 6). Daily gains were not significantly different, although overall average feed intake tended to be lowest for limit-fed calves. Cost of gain, although not significantly different, tended to favor limit-fed calves.

TABLE 6 Carcass characteristic of steers.

	Limit-fed		Full-fed
	Treatment 1	Treatment 2	Treatment 3
Carcass wt, lb	736	746	723
Dressing %	65.11	65.31	64.85
Quality grade			
Prime %	.4	0	0
Choice %	43.1	43.1	47.3
Select %	47.8	49.7	50.0
Standard %	8.7	7.2	2.7
Yield grade			
1	.4	0	1.0
2	21.4	21.8	22.7
3	65.2	66.7	68.6
4	3.6	7.6	4.3
5	.4	.7	0
Condemned liver %	31.7^{b}	27.2^{b}	15.2^{b}

^{ab}Means on row with different superscript letters differ (P < .05)

Carcass weight (Table 7) followed live weight with limit-fed calves tending to have the heaviest carcasses. Dressing percent was similar for all groups. Quality grade was also similar for all treatments with Treatment 3 tending to have more choice and less standard carcasses. Backfat was not measured, but it is possible that limit-fed pens could have been fed slightly longer. Yield grades were similar for all groups. Significantly more condemned livers were noted for limit-fed treatments. Whether the greater incidence of condemned livers is related to eating behavior during the limit feeding period or during the subsequent finishing phase is not known and bears further study.

Conclusions

This study shows that weaned calves can be successfully grown on a commercial scale in a feedlot. No management problems related to the limit feeding procedure were noted. Slaughter weight and carcass weight tended to be increased and carcass grade was not changed. Total cost of gain tended to favor limit-fed calves.

Summary

Seven hundred and sixty two spring-born Limousin x

TABLE 7 Performance of steers during total feeding period.

	Limit-fed		Full-fed
	Treatment 1	Treatment 2	Treatment 3
Finishing days	210	210	199
Daily gain, lb	2.79	2.85	2.90
DM intake, lb	15.16	15.18	16.36
Feed:gain (DM)	5.43	5.43	5.65
Cost of Gain ($/cwt)	41.17	40.63	42.00

Hereford-Angus calves (535 lb) from one Nebraska ranch were weaned and shipped to a commercial feedlot in the Texas panhandle. Steers were randomly allotted by limit-fed a ration containing 61 Mcal NEg/CWT of DM to gain 2.20 lbs/day; (2) limit-fed a ration containing 66 Mcal NEg/CWT to gain 2.20 lb/day; or (3) *ad libitum* a ration containing 61 Mcal NEg/CWT until weight reached 750 lbs. All pens were switched to full feeding of a ration containing 66 Mcal NEg/CWT when the calves averaged 750 lbs. The first pen was slaughtered when visual conditions indicated that the majority of that pen would attain choice grade. All other pens were then slaughtered to approximate equal days from the end of the growing period. Gains during the growing period were 2.36 and 2.37 lbs/day for Treatment 1 and 2, compared to 2.79 lb/day ($P < .05$) for full-fed calves. Cost of gain was lowest for Treatment 2 and 3 calves during the growing period. Daily gains during finishing were greater ($P < .05$) for Treatments 1 and 2 compared to Treatment 3. The number of days from the time calves weighed 750 lbs to slaughter was similar (122 days) for all treatments. The total feeding period was 11 days longer for limit-fed calves. Daily gains for the total trial were not different although feed intake tended to be lowest for limit-fed calves. Cost of gain tended to favor limit-fed calves. Slaughter weight and carcass weights tended to be increased but quality and yield grades were not different. This study shows that weaned calves can be successfully grown on a commercial scale with high concentrate, limit-fed rations. No management problems related to the limit feeding procedure were noted.

Buiatrics is the study of cattle diseases.