

# EFFECTS OF LIMIT FED GROWING PROGRAMS ON FINISHING PERFORMANCE AND CARCASS TRAITS OF STEERS IN A COMMERCIAL FEEDLOT

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## Story in Brief

Spring born Limousin x Hereford Angus calves (762 calves, 535 lb) from one Nebraska ranch were weaned and shipped to a commercial feedlot in the Texas panhandle in November. Steers were randomly allotted to be (1) limit fed a ration containing 61 Mcal NEg/cwt of DM to gain 2.20 lb/day; (2) limit fed a ration containing 66 Mcal NEg/cwt to gain 2.20 lb/day; or (3) fed ad libitum a ration containing 61 Mcal NEg/cwt until weight reached 750 pounds. All pens were full fed ration 3 when the calves averaged 750 pounds. The first pen was slaughtered when visual conditions indicated that the majority of that pen would attain choice quality 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 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 for Treatments 1 and 2 compared to Treatment 3. The number of days from the time calves weighed 750 pounds 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. Slaughter weight and carcass weights tended to be increased for limit fed calves 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.

## 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,

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traditional growing programs have utilized ad libitum access 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 a 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. The objectives of this research were to determine the effect of limit feeding rations containing two energy levels on performance of weaned calves during the growing phase, and 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 (3 pens); (2) limit feeding a ration containing 66 Mcal NEg/cwt to gain 2.20 lb/day (3 pens); or (3) ad libitum a ration containing 61 Mcal NEg/cwt until weight reached 750 lbs (2 pens). Approximately 95 calves were assigned to each pen and provided 12 in. 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 a choice quality grade. All other pens were then slaughtered so that all pens had equal days to slaughter from the end of the growing period.

All calves were initially implanted with Synovex-S<sup>®</sup>, vaccinated with Bovishield<sup>®</sup> 4 (Norden) and injected with Ivomec<sup>®</sup> (MSD Agvet). Cattle were revaccinated with Bovishield<sup>®</sup> 4 on day 10 after arrival. At 90 days post arrival, cattle were reimplanted with Synovex-S<sup>®</sup> (Syntex), revaccinated with Bovishield<sup>®</sup> 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 demonstrated stable consumption. At

Table 1. Rations fed during the limit feeding period.

| Ingredient           | % DM | Percent in Ration, as fed |                  |                  |
|----------------------|------|---------------------------|------------------|------------------|
|                      |      | 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             |
| Wheat midds          | 88.0 | 9.0                       | 10.0             | 12.0             |
| Supp, grower         | 93.0 | 5.7                       | 6.6 <sup>a</sup> |                  |
| Supp, finisher       |      |                           |                  | 2.5 <sup>b</sup> |
| 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              |

<sup>a</sup> Grower supp(%): 65 CP; 32.5 NPN; 6.1 Ca.; .6 P; 1.1 K.

<sup>b</sup> Finisher Supp (%): 78.5 CP; 63.5 NPN; 11.8 Ca.; .5 P; 1.7 K.

that time all calves were weighed full by pen. Three pens each were 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 regardless of treatment, were switched to full feeding of the finishing ration (Table 2) when individual 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 were 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 finishing 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 <sup>a</sup> | 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 |                           |

<sup>a</sup> 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 536 lbs with a 3% pencil shrink in Nebraska. Transit shrink to the feedlot was 3.5% from pay weight. Gains were minimal (<8 lbs) 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 died from respiratory disease and one from bloat.

Gains during the growing period (Table 4) were 2.36 and 2.37 lbs/day for Treatments 1 and 2, compared to 2.79 lb/day ( $P < .05$ ) for full fed calves.

Table 3. Performance of steers during the warm up period.

|  | Limit fed                   |                | Full fed       |
|--|-----------------------------|----------------|----------------|
|  | Treatment <sup>a</sup><br>1 | Treatment<br>2 | Treatment<br>3 |
| No. steers   | 283                         | 284            | 191            |
| No. pens   | 3                           | 3              | 2              |
| Pay wt, Nebraska                                     | 538                         | 537            | 535            |
| Arrival wt, Dalhart, TX                              | 517                         | 517            | 516            |
| Warm up period, pay wt to start<br>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, %                                 | .3                          | 0              | 0              |
| Digestive deads, %                                   | 0                           | .3             | 0              |

<sup>a</sup> Treatments 1 & 3 = 61 Mcal/100 lb dry matter; Treatment 2 = 66 Mcal/100 lb dry matter.

**Table 4. Performance of steers during the growing period.**

|                              | Limit fed                   |                   | Full fed           |
|------------------------------|-----------------------------|-------------------|--------------------|
|                              | Treatment <sup>a</sup><br>1 | Treatment<br>2    | Treatment<br>3     |
| Beginning wt, growing period | 545                         | 544               | 539                |
| Growing days                 | 87                          | 89                | 78                 |
| Respiratory pulls, %         | 14.8 <sup>b</sup>           | 11.6 <sup>c</sup> | 11.3 <sup>c</sup>  |
| Digestive pulls, %           | 1.0                         | .3                | 0                  |
| Respiratory deads, %         | 1.0                         | .3                | 0                  |
| Digestive deads, %           | 1.1                         | .7                | .5                 |
| Daily gain, lb               | 2.36 <sup>b</sup>           | 2.38 <sup>b</sup> | 2.79 <sup>c</sup>  |
| DM intake, lb                | 12.98 <sup>b</sup>          | 11.9 <sup>b</sup> | 15.15 <sup>c</sup> |
| Feed:gain                    | 5.50 <sup>b</sup>           | 5.02 <sup>c</sup> | 5.43 <sup>b</sup>  |
| Cost of Gain (\$/cwt)        | 42.84                       | 39.73             | 40.18              |
| Condition score <sup>d</sup> | 5.2 <sup>b</sup>            | 5.2 <sup>b</sup>  | 6.7 <sup>c</sup>   |

<sup>a</sup> Treatments 1 & 3 = 61 Mcal/100 lb dry matter; Treatment 2 = 66 Mcal/100 lb dry matter.

<sup>b,c</sup> Means on row with different superscript letters differ ( $P < .05$ ).

<sup>d</sup> Scale of 1 = very thin to 9 = very fat.

Gains of limit fed calves were slightly greater than the target gain of 2.20 lb/day. As expected, Treatment 2 calves fed the 66 Mcal ration were more efficient ( $P < .05$ ) than Treatment 1 calves fed the 61 Mcal ration, although feed efficiency for both limit fed groups was excellent and comparable to or above that 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 period were fatter at the end of the growing period ( $P < .05$ ) than limit fed calves. Condition scores for limit fed treatments were similar.

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 similar 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

ration 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 min. 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 accurately determine the economic feasibility of a growing period, subsequent performance during finishing and effects on carcass traits must be considered. Calf weights at the end of the growing period were 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.

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 thinner at the beginning of finishing. Feed intake was similar for all treatments while feed efficiency tended to be improved for calves previously

**Table 5. Performance of steers during the finishing period.**

|                             | Limit fed                   |                   | Full fed          |
|-----------------------------|-----------------------------|-------------------|-------------------|
|                             | Treatment <sup>a</sup><br>1 | Treatment<br>2    | Treatment<br>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 <sup>b</sup>              | .3 <sup>b</sup>   | 1.5 <sup>a</sup>  |
| Daily gain, lb              | 3.10 <sup>c</sup>           | 3.19 <sup>c</sup> | 2.96 <sup>b</sup> |
| 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              |

<sup>a</sup> Treatments 1 & 3 = 61 Mcal/100 lb dry matter; Treatment 2 = 66 Mcal/100 lb dry matter.

<sup>b,c</sup> Means on row with different superscript letters differ ( $P < .05$ ).

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 than controls (Table 6). Daily gains were not significantly different, although overall average feed intake tended to be lowest for limit fed calves. Cost of gain tended to favor limit fed calves.

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 fewer standard grade carcasses. Yield grades were similar for all groups. More ( $P < .05$ ) condemned livers were noted among 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.

**Table 6. Performance of steers during the total feeding period.**

|                       | Limit fed                   |                | Full fed       |
|-----------------------|-----------------------------|----------------|----------------|
|                       | Treatment <sup>a</sup><br>1 | Treatment<br>2 | Treatment<br>3 |
| Total 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                        | 5.34           | 5.65           |
| Cost of Gain (\$/cwt) | 41.17                       | 40.63          | 42.00          |

<sup>a</sup> Treatments 1 & 3 = 61 Mcal/100 lb dry matter; Treatment 2 = 66 Mcal/100 lb dry matter.



Table 7. Carcass characteristics of steers.

|                   | Limit fed                   |                   | Full fed          |
|-------------------|-----------------------------|-------------------|-------------------|
|                   | Treatment <sup>a</sup><br>1 | Treatment<br>2    | Treatment<br>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 <sup>c</sup>           | 27.2 <sup>c</sup> | 15.2 <sup>b</sup> |

<sup>a</sup> Treatments 1 & 3 = 61 Mcal/100 lb dry matter; Treatment 2 = 66 Mcal/100 lb dry matter.

<sup>b,c</sup> Means on row with different superscript letters differ ( $P < .05$ ).

## Conclusions

This study shows that weaned calves can be successfully grown on a commercial feedlot scale. No management problems related to the limit feeding procedure were noted. Prefinishing limit feeding tended to increase steer slaughter weights (live and carcass) with no adverse effects on carcass quality and yield grade. Total cost of gain tended to favor limit fed calves.