

## A Limit-Fed, High-Energy Diet Fed During the Growing Phase Does Not Negatively Affect Subsequent Feedlot Growth Performance or Carcass Merit Compared to Feeding a Traditional Roughage-Based Diet *Ad Libitum* During the Growing Phase

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### Abstract

Three hundred seventy crossbred heifers [initial body weight (BW) = 496 ± 44 lb] previously used in a 90-day growing and receiving study at the Kansas State University Beef Stocker Unit were transported to a commercial feedlot (Pratt Feeders, Pratt, KS) for finishing where cattle were fed a common diet. The two backgrounding diets included: (1) 45 Mcal of net energy for gain (NE<sub>g</sub>) per 100 lb of dry matter (DM) fed for *ad libitum* intake (45AL), or (2) 60 Mcal NE<sub>g</sub> per 100 lb of DM limit-fed at 2.2% of BW daily on a DM basis (60LF2.2). Both diets contained 40% of DM as Sweet Bran (Cargill Animal Nutrition, Blair, NE). Cattle were sorted by weight group (light or heavy) and backgrounding diet (45AL or 60LF2.2) and placed in one of four pens. Finishing growth performance and carcass characteristics were measured. Feedlot morbidity was 15.5% greater for 60LF2.2 heifers than 45AL heifers. Light-sort heifers had greater ( $P = 0.01$ ) morbidity than heavy-sort heifers. Feedlot mortality was greater ( $P < 0.01$ ) for 60LF2.2 heifers in the light-sort group than the heavy-sort group. No effect of backgrounding diet was observed for days on feed, average daily gain, or final out-weight. Although heavy-sort carcasses had greater backfat ( $P = 0.02$ ) and greater U.S. Department of Agriculture yield grade scores ( $P = 0.01$ ), light-sort carcasses had less backfat and lower yield grade scores, previous growing phase diet had little to no carryover effect on carcass characteristics.

### Introduction

Previous research suggests limit feeding a high-energy diet to growing cattle during the growing phase may have carryover effects on both finishing growth performance and carcass characteristics. The objective of this experiment was to compare the subsequent

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growth performance and carcass impacts of a high-energy diet limit-fed at 2.2% of body weight to a traditional roughage-based diet fed *ad libitum* during the growing phase and weight sort group in the finishing phase.

## Experimental Procedures

Three hundred seventy crossbred heifers [initial body weight (BW) =  $496 \pm 44$  lb] previously used in a 90-day growing and receiving study at the Kansas State University Beef Stocker Unit were transported to a commercial feedlot (Pratt Feeders, Pratt, KS) for finishing where cattle were fed a common diet. The two backgrounding diets included: (1) 45 Mcal of net energy for gain (NEg) per 100 lb of dry matter (DM) fed for *ad libitum* intake (45AL), or (2) 60 Mcal NEg per 100 lb of DM limit-fed at 2.2% of BW daily on a DM basis (60LF2.2). Both diets contained 40% of DM as Sweet Bran (Cargill Animal Nutrition, Blair, NE). At the end of the growing trial, cattle were sorted into a heavy-sort or light-sort based on final individual weights measured on day 98 or 105 of the backgrounding phase study, depending on block. Sort group weight thresholds were established for each treatment diet group (45AL: BW = 800 lb; 60LF2.2: BW = 790 lb).

To maintain treatment diet integrity, cattle were transported by backgrounding phase diet (45AL or 60LF2.2) and weight-sort group (light or heavy) to a commercial feedlot (Pratt Feeders, Pratt, KS) and fed a common diet in four separate pens containing a similar number of heifers per pen. At the end of the finishing phase, cattle were marketed and transported by backgrounding treatment/weight sort group pen to a commercial abattoir (National Beef, Dodge City, KS) on November 17, 2020 (heavy-sort) and January 12, 2021 (light-sort), and carcass characteristics were measured. Finishing growth performance was calculated as dead-weight by using the individual shrunk weights collected after the gastrointestinal tract fill equilibration period at the end of the growing phase trial as beginning BW (beginning weight). Ending live weight (ending weight) was calculated by dividing hot carcass weight by average dressing percentage collected at the abattoir.

## Results and Discussion

Finishing growth performance is presented in Table 1. A significant ( $P = 0.03$ ) interaction between backgrounding diet and sort group was observed for mortality, as 60LF2.2 cattle had greater ( $P = 0.01$ ) mortality in the light-sort group than the heavy-sort group, and the 60LF2.2 cattle had greater ( $P = 0.04$ ) mortality than 45AL cattle in the light-sort group. No other significant interactions between backgrounding diet or sort group were observed. A main effect of backgrounding diet was observed for morbidity; it was 15.5% greater for 60LF2.2 cattle compared to 45AL cattle. Beginning weight tended ( $P = 0.06$ ) to be greater for 60LF2.2 cattle than for 45AL cattle. No effect between backgrounding diets was observed for days on feed, ending weight, average daily gain (ADG), or mortality. A main effect between sort groups was observed for morbidity, because light-sort cattle had greater ( $P = 0.01$ ) morbidity than heavy-sort cattle. Heavy-sort cattle had a higher ( $P < 0.01$ ) beginning weight, lower ( $P < 0.01$ ) number of days on feed, and better ( $P < 0.01$ ) ADG than light-sort cattle. No effect between sort groups was observed for ending weight or mortality.

Carcass characteristics are presented in Table 2. Live weight ( $P = 0.59$ ) and hot carcass weight ( $P = 0.84$ ) was similar between backgrounding diet/sort groups. No main effects

between backgrounding diets were observed, but there were main effects observed between sort groups. Light-sort cattle had greater backfat ( $P = 0.02$ ) and greater United States Department of Agriculture (USDA) yield grade scores ( $P = 0.01$ ), whereas the heavy-sort cattle had less backfat and lower USDA scores. Heavy-sort cattle tended ( $P = 0.09$ ) to have greater ribeye areas than light-sort cattle. No effects ( $P \geq 0.39$ ) between sort groups were observed for marbling score or USDA quality grades. This suggests that although sort group in the finishing phase appears to affect finishing growth performance and carcass characteristics to some degree, previous backgrounding diet (energy level confounded by intake restriction) had little to no carryover effect on finishing growth performance and carcass characteristics after a long finishing period in which cattle are offered high-energy diets *ad libitum*.

## Implications

A limit-fed, high-energy diet based on corn and Sweet Bran fed during the growing phase had little to no carryover effect on feedlot growth performance or carcass characteristics, but feedlot morbidity may increase in cattle previously limit-fed a high-energy diet compared to a traditional roughage-based diet fed *ad libitum*.

## Acknowledgments

National Cattlemen's Beef Association  
Kansas Corn Commission

*Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. Persons using such products assume responsibility for their use in accordance with current label directions of the manufacturer.*

**Table 1. Effect of a limit-fed high-energy or traditional roughage-based diet in the backgrounding phase or weight sort group in the finishing phase on finishing growth performance**

Item	Sort group <sup>1</sup>				SEM <sup>3</sup>	<i>P</i> -value <sup>4</sup>		
	Heavy		Light			S	B	S × B
	Backgrounding diet <sup>2</sup>							
	45AL	60LF2.2	45AL	60LF2.2				
Number of pens	1	1	1	1				
Number of animals	94	91	92	92				
Days on feed, days	144	144	200	200	0.5	< 0.01	0.99	0.99
Beginning weight, lb	853.0	841.5	742.5	733.7	5.7	< 0.01	0.06	0.78
Ending weight, <sup>5</sup> lb	1329.6	1326.5	1328.3	1312.6	14.1	0.51	0.53	0.59
ADG, <sup>6</sup> lb/day	3.33	3.37	2.93	2.89	0.07	< 0.01	0.90	0.43
DMI, <sup>7</sup> lb/day	21.98	20.81	19.09	19.16	–	–	–	–
Gain to feed ratio, lb/lb	0.151	0.162	0.154	0.151	–	–	–	–
Morbidity, %	5.3	16.0	10.4	30.6	4.5	0.01	< 0.01	0.19
Mortality, %	2 <sup>ab</sup>	0 <sup>a</sup>	1 <sup>a</sup>	5 <sup>b</sup>	1.3	0.14	0.46	0.03

<sup>ab</sup>Least square means in the same row with different superscripts are significantly different ( $P < 0.05$ ).

<sup>1</sup>Sort groups for each treatment were created prior to finishing phase. Heavy and light sort groups were finished in four separate pens at a commercial feed yard (Pratt Feeders, Pratt, KS), then sent to a commercial abattoir (National Beef, Dodge City, KS) on November 17, 2020 and January 12, 2021, respectively.

<sup>2</sup>Diets offered during the backgrounding phase prior to the finishing phase. 45AL = 45 Mcal of net energy for gain (NEg) per 100 lb of dry matter (DM) fed for *ad libitum* intake. 60LF2.2 = 60 Mcal NEg per 100 lb of DM limit-fed at 2.2% of BW daily on a DM basis.

<sup>3</sup>Largest standard error of the mean is reported.

<sup>4</sup>S = sort group; B = backgrounding diet; S × B = sort group × backgrounding diet interaction.

<sup>5</sup>Ending weight is calculated from hot carcass weight multiplied by dressing percentage, both collected at the abattoir (National Beef, Dodge City, KS).

<sup>6</sup>Average daily gain.

<sup>7</sup>Dry matter intake.

**Table 2. Effect of a limit-fed high-energy or traditional roughage-based diet in the backgrounding phase or weight sort group in the finishing phase on carcass characteristics**

Item	Sort group <sup>1</sup>				SEM <sup>3</sup>	P-value <sup>4</sup>		
	Heavy		Light			S	B	S × B
	Backgrounding diet <sup>2</sup>							
	45AL	60LF2.2	45AL	60LF2.2				
Number of pens	1	1	1	1				
Number of animals	92	88	88	83				
Carcass traits <sup>5</sup>								
Live weight, lb	1329.6	1326.5	1328.3	1312.6	14.1	0.51	0.53	0.59
Hot carcass weight, lb	850.3	849.9	847.2	849.9	8.8	0.83	0.91	0.84
Dressing percentage, %	63.95	64.07	63.78	64.74	---	---	---	---
Backfat, in	0.70	0.70	0.75	0.74	0.02	0.02	0.97	0.74
USDA <sup>6</sup> yield grade	2.58	2.65	2.83	2.85	0.10	0.01	0.62	0.80
Marbling score <sup>7</sup>	540	531	523	528	17.4	0.39	0.84	0.56
Ribeye area, sq. in	15.0	14.7	14.5	14.6	0.2	0.09	0.52	0.32
USDA <sup>6</sup> quality grade, %								
Select	4.8	6.4	8.8	5.1	3.1	0.57	0.65	0.26
Choice	86.4	83.7	81.9	87.5	3.5	0.92	0.67	0.24
Prime	8.9	8.8	9.4	6.5	3.4	0.74	0.59	0.62

<sup>1</sup>Sort groups for each treatment were created prior to finishing phase. Heavy and light sort groups were finished in separate pens at a feed yard (Pratt Feeders, Pratt, KS), then sent to a commercial abattoir (National Beef, Dodge City, KS) on November 17, 2020 and January 12, 2021, respectively.

<sup>2</sup>Diets offered during the backgrounding phase prior to the finishing phase. 45AL = 45 Mcal of net energy for gain (NEg) per 100 lb of dry matter (DM) fed for *ad libitum* intake. 60LF2.2 = 60 Mcal NEg per 100 lb of DM limit-fed at 2.2% of BW daily on a DM basis.

<sup>3</sup>Largest standard error of the mean is reported.

<sup>4</sup>S = sort group; B = backgrounding diet; S × B = sort group × backgrounding diet interaction.

<sup>5</sup>Carcass traits collected at the National Beef abattoir in Dodge City, KS.

<sup>6</sup>U.S. Department of Agriculture.

<sup>7</sup>Score ranges are as follows: < 400 = select. 400 to 499 = low choice. 500 to 599 = average choice. 600 to 699 = high choice.