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Effect of diet energy content and level of restriction on performance, nutrient digestibility, and puberty in replacement beef heifers (1993)

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EFFECT OF DIET ENERGY CONTENT AND LEVEL OF RESTRICTION ON PERFORMANCE, NUTRIENT DIGESTIBILITY, AND PUBERTY IN REPLACEMENT BEEF HEIFERS

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Summary

Eighty Angus × Hereford crossbred weanling heifers (548 lb) were used in a 2 × 2 factorial experiment to evaluate dietary energy concentration (NEg .51 vs .61 Mcal/lb) and intake restriction (to produce 1.25 and 2.0 lb/d gain). Intake of the diets (corn - corn silage based; 14% CP) was adjusted every 2 weeks. Steer counterparts to the heifers were used in a 2 × 3 factorially arranged digestion experiment using the same treatments with an additional ad libitum intake level. There were no interactions between energy content and level of restriction. Heifers fed the higher energy diet maintained equal daily gain on 9.7% less (P < .004) feed, the probable result of higher (P < .0001) OM digestibility. Feed efficiency was improved 6.3% (P = .14) for heifers fed the higher energy diet. NRC (1984) energy equations underpredicted rate of gain of 1.25 and 2.0 lb/d by 24.6 and 7.7%, respectively, probably as a result of enhanced (P < .05) nutrient digestibility at the more restricted intake. Puberty (based on serum progesterone) was not influenced by treatment. Limitfeeding grain to produce replacement heifers appears practical when harvested forages are scarce and(or) high-priced.

(Key Words: Beef Heifers, Feed Restriction, Nutrient Digestibility, Performance.)

Introduction

The growing period of heifers between weaning and breeding has traditionally been based on high forage diets, but during dry years, forage supplies may be limited. Some producers have been interested in growing cattle on a higher energy, restricted intake diet because grain is sometimes cheaper per unit of energy than harvested forages. The purpose of this experiment was to evaluate the effects of diet energy content and intake restriction on growth and cyclicity in replacement heifers.

Experimental Procedure

Eighty Angus × Hereford crossbred heifers (548 lb) from the same herd were used in a 2 × 2 factorial experiment. The main effects were dietary concentration of net energy for gain (NEg; .51 or .61 Mcal/lb) and level of feed restriction (calculated for rates of gain of 1.25 or 2.0 lb/day). Thus, heifers on the lower energy diet were fed (DM basis) 1.78 or 2.28% of body weight, and those on the higher energy diet were fed 1.62 or 2.05% of body weight daily. The heifers were allotted to four weight replicates and then to four pens within each replicate. The diets were corn - corn silage based and formulated to 14% crude protein. Diets containing .51 and .61 Mcal NEg/lb contained corn and corn silage in ratios of 1:3 and 3:1, respectively. Initial and final weights were taken after an overnight shrink. Blood samples were collected in the last 30 days of the trial at 10-day intervals. When serum progesterone exceeded 1 ng/ml, heifers were considered to have reached puberty.

Twenty-four steer counterparts to the heifers were used in a companion 2 × 3 factorial digestion experiment. The main effects were the same as for the heifer study with an additional ad libitum intake treatment. Steers were assigned randomly to the six treatments. An 18-day adaptation period was followed by a 7-day total fecal collection period. Digestibility of dry matter, organic matter, starch,

crude protein, neutral detergent fiber, and acid detergent fiber were measured. The heifer trial ran from November 1990 to March 1991, and the digestion trial, from February 20, to March 18, 1991.

Results and Discussion

Results are shown in Table 1. There were no interactions between energy content and level of intake. Heifers fed the higher energy diet maintained similar daily gain on 9.7% less ($P < .004$) feed. This is the probable result of the higher ($P < .0001$) organic matter digestibility of the higher energy diet. Feed efficiency was 6.3% better ($P = .14$) for heifers fed the higher energy diets. Heifers fed to gain 2.0 vs 1.25 lb/d consumed more DM ($P < .0001$) but were no more efficient.

NRC (1984) energy equations underpredicted rate of gain by 24.6 and 7.7% for heifers programmed to gain 1.25 and 2.0 lb/d, respectively. Enhanced ($P < .05$) organic matter digestibility on the more restricted diets may be partially responsible for this result. Treatment had no effect on the incidence of heifers reaching puberty. Heifers programmed to gain 1.25 and 2.0 lb/d were approximately 62 and 67% of mature weight, respectively, at the end of the trial. Daily feed costs were $.18 lower for heifers restricted to 1.25 vs 2.00 lb/d. Although we were unable to follow reproductive performance on these heifers, minimizing total feed costs while maintaining adequate growth is probably more important for replacement heifers than rate or efficiency of gain. Limit-feeding grain to develop replacement heifers appears practical when traditional roughages are scarce and(or) high-priced.

Table 1. Effect of Dietary Energy Concentration and Level of Feed Restriction on Performance and Puberty in Heifers and Nutrient Digestibility

	Diet NEg Mcal/lb			Predicted ADG, lb/d[a]			
Item	.51	.61	PR > F	1.25	2.0	Ad lib	PR > F
Heifer growth trial							
Initial wt., lb	546	550	.88	548	548	—	.95
Final wt., lb	746	744	.89	713	777	—	.016
Daily gain, lb	1.89	1.83	.30	1.56	2.16	—	.0001
DM intake, lb	13.16	11.88	.004	10.71	14.32	—	.0001
Gain/feed	.144	.153	.14	.146	.151	—	.42
Puberal[b], %	47	52	.82	52	47	—	.66
Age[c]	351	351	.94	351	351	—	.89
Day cost, $[d]	.60	.62		.53	.71	—	
Steer digestion trial							
OM dig., %	70.3	79.0	.0001	76.9[e]	73.2[f]	73.4[f]	—
Starch dig., %	87.2	92.3	.026	92.2	88.6	88.4	—
CP dig., %	68.2	72.1	.002	71.4	69.7	69.3	—
NDF dig., %	37.4	44.8	.023	45.6[e]	37.2[f]	40.4[ef]	—
ADF dig., %	39.2	47.6	.022	47.1[e]	38.8[f]	44.3[ef]	—

[a]Mean level of feed restriction (% of BW) to achieve the prescribed ADG was 1.78 and 2.28 vs 1.62 and 2.05% for the .51 vs .61 NEg treatments, respectively. Ad libitum consumption averaged 2.55% of BW.
[b]Heifers attaining puberty by the final 30d of the trial.
[c]Age of puberal heifers.
[d]Feed only ($2.50/bu corn; $25/ton silage, $190/ton supplement).
[ef]Means differ ($P < .05$).