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Evaluation of Three Rations on Growth and Reproductive Performance for Replacement Heifers

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Summary

The effect of limit feeding various rations was studied for developing replacement heifers. Over a 3-year period, 280 head of Angus-Simmental heifers were purchased at weaning, given an adjustment period of 1 month and placed on trial at Redfield, South Dakota. Each year heifers were allotted to one of three feeding treatments: (1) a low energy diet fed ad libitum (LEA), (2) same diet with fixed intake (LEF) or (3) a high energy diet with intake fixed (HEF). The base low energy and high energy diets were varied in composition and energy levels from year to year. The heifers were fed these rations for 120, 127 and 142 days, respectively. In 1983 and 1984, they were subsequently bred and pregnancy rates determined. The animals in the high energy fixed intake group had higher average daily gains and the most advantageous feed efficiency and cost of gain. There were no differences in energetic efficiency between treatments. Cost of gain was greatly affected from year to year by fluctuating feedstuff prices. Higher conception rates were observed for the high energy limit fed groups and lower rates for the low energy groups.

Introduction

Nutrition following weaning of replacement heifers affects their performance as cows. Low levels of energy can delay puberty and reduce conception rates. Excessively high levels can decrease milk production and life span. Previous research indicates that gains should be kept to about 220 pounds from weaning to first breeding. This level of gain precludes high concentrate rations, curtailing flexibility and ability to minimize feed costs when concentrates are a cheaper source of energy. Limiting feed intake to supply desired total energy consumption would allow flexibility and use of higher percentage grain when economical. Limit feeding has been studied with finishing cattle regarding its influence on digestibility of feedstuffs. Limit feeding has been used to produce desired gains in heifers but not studied as a possible feeding program for replacement heifers. This study was conducted to determine if the use of rations containing various energy levels with intake limited could be successfully used to raise replacement heifers.

Procedures

In late November of 1982, 1983 and 1984, 93, 93 and 95 head, respectively, of Angus-Simmental crossbred heifers were purchased from producers in

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South Dakota. After weaning, heifers averaging approximately 220 days of age were shipped to James River Valley Research and Irrigation Center at Redfield, South Dakota. Calves were vaccinated (Brucellosis, IBR, BVD, vibrio and internal parasites) and individually identified. Following a 1-month adjustment period, calves were weighed and randomly allotted to six drylot pens. Two rations were formulated each year (table 1) of differing energy levels (referred to as low or high energy). Both rations were formulated to provide adequate amounts of minerals and protein with use of a commercial soybean base protein and mineral supplement. Of the six pens, animals in two pens were fed the low energy ration ad libitum (LEA treatment), two were fed that same ration at a calculated target intake (LEF treatment) and two were fed the high energy ration at a calculated intake (HEF treatment). Similar feeding procedures were used each year, but rations (table 1) and days on feed varied. Rations were varied from year to year because of restrictions on feed availability. In 1982, the feeding period was 120 days, 1983, 127 and 1984, 142 days. Monthly individual weights were taken. In 1983 and 1984, heifers were synchronized, artificially inseminated and exposed to bulls for 35 days at the end of the feeding trial and 4 months later pregnancy was determined by rectal palpation.

Table 1. Feed Composition, Net Energy for Maintenance and Gain, Crude Protein and Dry Matter of Rations for Replacement Heifers With Different Feeding Procedures and Rations

Item[a]	Low energy rations, %			High energy rations, %		
	1982	1983	1984	1982	1983	1984
Alfalfa hay		74	10		30	7
Barley	4			4		
Corn	50		35	59	13	56
Corn silage		24			55	
Oats	4			4		
Oat silage	10		13	7		4
Prairie hay	28			22		
Sorghum silage			39			30
Protein supplement	4	2	3	4	2	3
NEm, Mcal/lb[b]	.79	.58	.66	.84	.71	.79
NEg, Mcal/lb[b]	.51	.33	.41	.55	.44	.51
Crude protein	11.4	12.9	11.5	11.5	11.1	11.5
Total dry matter	71.9	56.6	34.5	75.6	39.7	42.5

[a] All values dry matter basis.
[b] Estimated by NRC values.

Intakes for the fixed groups in 1982 were calculated by using the Net Energy maintanance (NEm) and Net Energy gain (NEg) values of rations with a target gain of 1.8 pounds per head per day. Calculated (desired) intakes and actual intakes are presented in table 2 for all years. The variation in 1982 between desired intake and actual intake reflects physical difficulty in controlling actual feed amounts metered into bunks. In 1983, intakes were calculated on a 1.3 pounds per head per day gain basis because of restrictions on feed availability. The 1984 intake values were calculated on a 1.8 pounds

Table 2. Initial and Final Weights, Mean Daily Dry Matter Intake, Desired Daily Dry Matter Intake, Average Daily Gain, Feed/gain and Calculated Net Energy for Observed Gain/Net Energy for Gain Consumed (CNEg/NEg) of Replacement Heifers with Different Feeding Procedures

Ration	Low energy		High energy
	Feeding procedure		
Item	Ad libitum	Fixed intake	Fixed intake
1982			
Initial wt, lb	561	548	550
Final wt, lb	750	719	746
Actual DM intake, lb	16.74	15.22	13.46
Desired DM intake, lb		14.7	13.6
Avg daily gain, lb	1.65	1.50	1.70
Kg feed/lb gain	22.7	22.5	17.5
CNEg/NEg[a]	.76	.77	.91
1983			
Initial wt, lb	541	543	537
Final wt, lb	717	706	744
Actual DM intake, lb	11.73	11.81	10.89
Desired DM intake, lb		17.60	14.1
Avg daily gain, lb	1.39	1.28	1.63
Kg feed/lb gain	18.61	20.24	14.65
CNEg/NEg	1.56	1.46	1.40
1984			
Initial wt, lb	484	473	458
Final wt, lb	700	691	722
Actual DM intake, lb	14.96	14.83	14.87
Desired DM intake, lb		17.6	14.7
Avg daily gain, lb	1.52	1.54	1.89
Kg feed/lb gain	21.78	21.43	17.60
CNEg/NEg	.92	.93	.86

[a] Observed net energy gain/estimated net energy gain.

per head per day gain. The low energy rations (LEF, LEA) did not result in desired intakes and the LEF group was then fixed at 14.7 pounds per head per day.

Feedlot performance was determined by calculating average daily gain, cost of gain, amount of feed per unit of gain and the ratio of calculated net energy needed for observed gain to that actually consumed. All feedlot performance data are for the entire period and values in table 2 are calculated on total period values to avoid rounding errors. All feedstuffs were analyzed by Station Biochemistry, South Dakota State University, for the proximate analysis, calcium and phosphorus.

Results and Discussion

There were important differences in dry matter intake (table 2) between the three feeding treatments (LEA, LEF and HEF). Dry matter intake (DMI) was different between the treatments as per design, with the most important difference between the high energy limit fed treatment and the two low energy treatments. The different rations for 1982, 1983 and 1984 resulted in considerably different animal intakes. Intakes for all years were different, with intakes being higher in 1982 (highest energy ration) than the other 2 years. The lowest intake was in 1983 (lowest energy ration). These rations were formulated from poor quality feedstuffs resulting in unexpectedly low intakes. An interaction existed between the treatments and year for intake. Intakes were dissimilar each year within treatments, indicating a strong influence of ration composition on intake.

Average daily gains were dissimilar for heifers fed the different rations (table 2). The HEF group gained more than the other two groups. The variation in energy level of HEF groups and LEA and LEF was greater than the difference in energy between year groups, partially explaining the stronger difference in average daily gains between treatments and years.

Feed efficiency was affected by treatment and year (table 2). HEF was more efficient than the other treatments and the higher energy rations (1982) less efficient than lower energy rations (1983). In 1983, rations consisted of forages that were of poor quality which decreased intake to a level lower than expected. The HEF treatment was the most efficient and economical.

To estimate energetic efficiency, the actual net energy for gain consumed was compared to the calculated net energy needed to produce observed gain (table 2). Treatments were not different from each other in energetic efficiency. However, years were. The difference in energetic efficiency by years was due mostly to the effect of abnormally low intakes in 1983. An interaction existed between treatments and years. The only year treatments were different in efficiency was 1982. Energetic efficiency was different for each year within each treatment.

In 1983, the HEF group had a higher conception rate than either low energy groups (table 3). There was no difference between the treatments in 1984. However, more heifers conceived in the HEF and LEA groups than the LEF group in 1984, indicating a trend for increased reproductive efficiency with higher total energy intake. Feeding the low energy ration with fixed intake resulted in lower conception rates than the other two treatments each of the two years. Rations in 1983 and 1984 had different energy levels. Lower conception rate resulting from the low energy treatments in 1983 reflect the overall lower energy values in those rations.

The results of this study indicate satisfactory growth and reproductive performance can be accomplished from limiting intake to provide a desired gain when rations are sufficiently high in energy.

Table 3. Number of Pregnant Heifers 4 Months After Feedlot Phase for Replacement Heifers With Different Feeding Procedures

Item	Total number palpated	Total number pregnant[a]	Percent conception
1983			
Low energy, ad libitum	31	23[a]	74
Low energy, fixed intake	30	17[a]	57
High energy, fixed intake	30	28[b]	93
1984			
Low energy, ad libitum	32	25	78
Low energy, fixed intake	31	21	68
High energy, fixed intake	32	25	78

[a,b] Means in the same column in the same year with different superscripts differ ($P<.05$).