North Dakota State University * Dickinson Research Extension Center
1133 State Avenue, Dickinson, ND 58601 Voice: (701) 483-2348 FAX: (701) 483-2005

CONTROLLING GROWTH RATES IN HEIFER DEVELOPMENT PROGRAMS

W.W. Poland, L.J. Tisor and G.L. Ottmar

Research Summary

Heifers were developed under one of two nutritional regimen. One group of heifers (CONT) were fed for constant rates of gain for 31 wk. Two other groups of heifers (SSCN) were fed for alternating (6-wk periods) low and high rates of gains. One of these groups started the study with a 6-wk high-growth phase before beginning alternating low and high rates of gain phases, while the other group started with a 3-wk high growth phase. Initial body weight (BW) and as fed feed intake were not affected by dietary regimen. Final BW and average daily gain (ADG) were greater in SSCN- compared to CONT-developed heifers. There was also a numerical tendency for feed efficiency and overall pregnancy rate to be improved in SSCN heifers. Data suggest that ADG can be regulated with intake restriction followed by ad libitum intake of a high energy diet. Data future suggest that manipulating ADG in a stair-stepped manner between weaning and breeding can improve overall feed efficiency and not adversely affect subsequent reproductive performance.

Introduction

Lifetime production from beef cattle is influenced by age and weight at puberty and subsequent first calving. In striving to achieve adequate body weight at an early age in beef heifers, producers need to keep in mind that rapid growth rates during specific phases of heifer development can result in decreases in subsequent milk production and calf weaning weights. This seems to be the cause in some breeds of cattle of lower subsequent calf weaning weights from high milk producing cows or exposure to high energy creep feeds preweaning. In difference to this classical response, carefully controlling postweaning growth rates (very low rates of gain followed by compensating high rates of gain) in replacement heifers has been suggested to potentially increase lifetime milk production and/or

decrease feed costs of heifer development.

A study was conducted at the Dickinson Research Extension Center during the winter of 1996 - 1997 to determine whether heifer growth rates could be limited by intake restriction in a predictable manner and whether subsequent compensatory growth would occur when heifers were given ad libitum access to a high-energy diet following restricted growth.

Materials and Methods

Seventy-two heifer calves were randomly assigned to one of 12 feedlot pens (6 heifers/pen). Pens were then assigned one of three dietary regimes. In the first dietary regime (CONT), heifers were managed for one of two constant rates of gain so that they would be at approximately 70% of their expected mature body weight prior to the initiation of the breeding season (June 19). Heifers were ad libitum fed a diet balanced for 1.5 lb/d gain from December 5 until April 1 and then fed for 1.0 lb/d gain from April 1 through the breeding season. The other two dietary regimes nutritionally managed heifers for either low gains (diets balanced for 0.5 and 0.0 lb/d before and after April 1, respectively, with intakes of crude protein and dry matter set at 100 and 60% of CONT) or high gains (diets balanced for 2.5 and 1.5 lb/d before and after April 1, respectively, with diets fed ad libitum). One of these two groups (SSCN-1) started with a 6-wk period of high gain and then alternated between 6-wk periods of low gain followed by 6-wk periods of rapid gain. The other group (SSCN-2) was similar to SSCN-1, except that it began with a 3-wk high gain period. The intent of SSCN-1 and SSCN-2 was to test whether switching from a high growth phase to a low growth phase immediately after estrous synchronization and artificial insemination would affect breeding performance. This phase of the experiment was not implemented. Diets fed and expected body weight (BW) changes are shown in Table 1 and Figure 1a, respectively.

Diets were mixed and fed daily. Bunks were cleaned weekly and weight of feed refusals recorded. Body weight and body condition score (BCS) in morning before feeding was record every 21 d. Estrus in heifers was synchronized and heifers were weighted on June 9 and artificially inseminated 12 hr following standing heat from June 9 - June 13. Heifers were then exposed to bulls until July 16 (35-d total breeding season).

Results and Discussion

The winter of 1996-1997 was one of the worst winters recorded in terms of cold temperatures and snowfall. Desired and actual performance is depicted in Figure 1. Drops in interim performance on 22 January and 16 April reflect the occurrence of winter storms at or immediately before scheduled weigh days.

Overall animal performance is reported in table 2. Initial BW and as fed feed intake were not affected by dietary regimen. Final BW (P<.05) and average daily gain (ADG; P<.05) were greater in SSCN-raised heifers. There was also a tendency for feed efficiency to be improved by SSCN.

Actual breeding BW (P<.05) and breeding BW as a percentage of mature BW (P<.05) was lower in CONT- compared to SSCN heifers. There was a tendency toward increased overall pregnancy rate in SSCN heifers.

Average daily gain for each 3-wk period is presented in table 3. Despite wide swings in interim gains, heifers raised under the CONT regimen achieved overall performance very similar to desired performance (1.2 vs 1.3 lb/d). Heifers raised under the SSCN regimens had very different interim performance with respect to low and high gain phases. Daily gain during the low phases of SSCN-2 were slightly less than desired, while daily gain during the high phases were generally greater than expected. Overall, daily gains exceeded desired gains by .2 lb/d (1.5 vs 1.3 lb/d) indicating compensatory gain occurred during the high gain phases. Daily gains under SSCN-1 were very different from desired gains. Low phase gains were greater, while high phase gains were lower, than expected. Nonetheless, overall performance (4 low and 5 high 3-wk phases) was very similar between SSCN-1 and SSCN-2. This suggests that weighing conditions on specific days (i.e. winter storms at the end of a 6-wk high gain phase in SSCN-1; see figure 1b) can grossly affect interim daily gain calculations.

In conclusion, when using nutritionally-balanced diets overall performance tends to correct itself over a longer periods of time. Making dramatic dietary changes in the face of, or subsequent to, a particular storm event to offset lower expected performance is probably not necessary. When diets are balanced for average climatic changes, heifers seem to adapt to storm insults and compensate for lost performance. Limiting average daily gains with intake restriction seems to be a feasible on-farm procedure. Following restricted average daily gains with ad libitum intake of a higher energy diet will promote compensatory growth. Six-week diet changes are very difficult to implement during severe winter conditions and the timing of storm events can overshadow specific treatment effects when gain periods are relatively short.

These data suggest that if specific growth patterns can be used to enhance milk production, protocols involving restricted dry matter intake and periods of compensatory gain are feasible. Data future suggest that manipulating average daily gains between weaning and breeding in replacement beef heifers does not seem to adversely affect subsequent reproductive performance. Future research will be conducted to further refine a stair-step developmental regimen and to determine if growth manipulation between weaning and breeding or during the winter prior to first calving will enhance subsequent milk production and weaning weights.

Literature cited

None

Table 1. Diet composition on an as-fed basis.

	Control[a]		Stair-step	
	moderate gain		high gain	low gain
	December 12, 1996 - March 31, 1997[c]			
Corn silage	34.8		24.2	13.9
Mixed hay	18.5		12.7	33.2
Alfalfa hay	18.4		12.9	33.2
Grass hay	10.7		0.0	17.5
Corn grain	15.8		48.5	0.0
Mineral supplement	1.5		1.5	1.8
White salt	.3		.3	.4

	April 01, 1997 - June 15, 1997			
Corn silage	84.6		86.5	33.0
Alfalfa hay	10.7		12.0	65.3
Corn grain	3.3		0.0	0.0
Mineral supplement	1.3		1.4	1.3
White salt	.2		.1	.4
	June 16, 1997 - July 13, 1997			
Corn silage	93.1		88.5	57.7
Mixed hay	6.2		10.8	41.2
Mineral supplement	.6		.7	1.0
White salt	.1		.1	.2

[a] Control and stair-step refer to general dietary regimens. Control diets were balanced for constant rates of grain over a period. Stair-step diets were balanced for either low or high rates of gain over alternating 6-wk periods.

Table 2. Animal performance of beef heifers fed either a diet formulated for constant average daily gain (Control) or alternating diets formulated for either low or high average daily gain (Stair 1 and Stair 2).

	Control[a]	Stair 1	Stair 2	SE

Body Weights, lb				
Initial	550.2	549.3	554.7	7.63
Final	798.6[x]	841.4[y]	843.0[y]	7.67
Daily gain	1.27[x]	1.50[y]	1.49[y]	0.034
Feed Intake, lb/d	31.0	29.4	29.5	1.25
Feed/Gain	24.4	19.6	19.8	-
Breeding Weights, lb				
Desired BW (70% MBW)	807.7	810.2	807.5	6.53
Actual BW[b]	780.3[x]	824.2[y]	819.8[y]	4.96
% MBW[c]	67.6[x]	71.1[y]	71.1[y]	0.367
ADG during AI period (May 28 - 18 June)	0.64	0.95	0.22	0.305
Breeding Performance, % of total				
Pregnant	79.2	95.8	95.8	na[d]
AI	8.4	25.0	12.5	na
Natural Service	70.8	70.8	83.3	na
Open	20.8	4.2	4.2	na

[a] Control, Stair-1 and Stair-2 are dietary regimen based upon expected weight gains depicted in figure 1a.

[b] Weight on June 9, non-standard weigh day.

[c] Breeding weight expressed as a percentage of expected mature weight. Mature weight estimated from hip height measurements taken on December 5, 1996.

[d] Not applicable.
[x,y] Means within a row with different superscripts differ (P<.05).

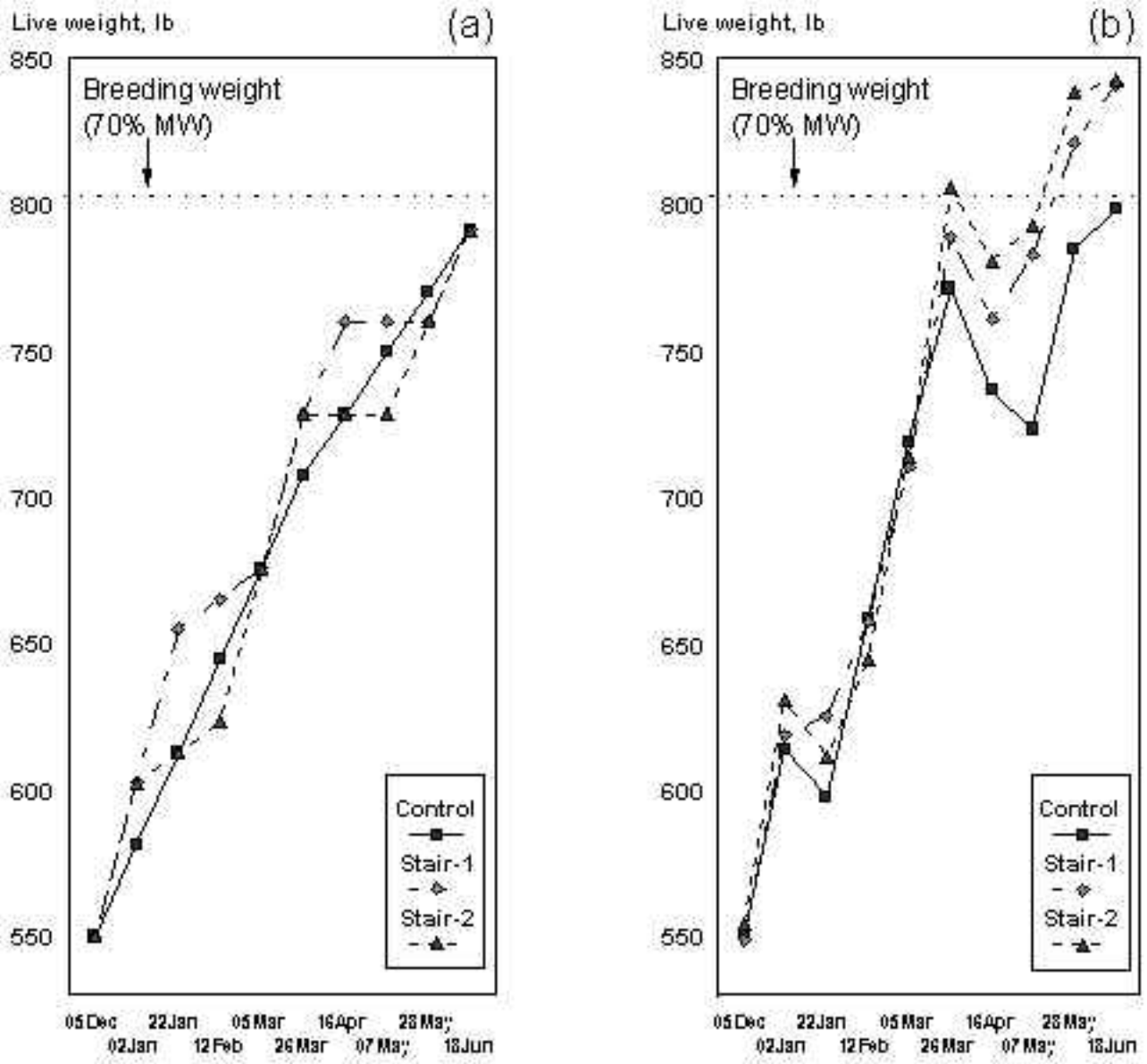
Table 3. Average daily gains by period for heifers fed either a diet formulated for constant average daily gain (Control) or alternating diets formulated for either low or high average daily gain (Stair 1 and Stair 2).

	Dietary Treatments				
	Control[a]	Stair 1		Stair 2	
Dates	Medium	Low	High	Low	High
05 Dec - 02 Jan	2.3	-	2.5	-	2.7
02 Jan - 22 Jan	-0.8	-	0.3	-1.0	-
22 Jan - 12 Feb	2.9	1.5	-	1.5	-
12 Feb - 05 Mar	2.9	2.5	-	-	3.3
05 Mar - 26 Mar	2.5	-	3.7	-	4.4
average	1.9	2.0	2.2	0.3	3.5
desired[b]	1.5	0.5	2.5	0.5	2.5
26 Mar - 16 Apr[c]	-1.7	-	-1.3	-1.2	-
16 Apr - 07 May	-0.6	1.0	-	0.6	-
07 May - 28 May	2.9	1.8	-	-	2.2
28 May - 18 Jun	0.6	-	1.0	-	0.2

average	0.3	1.4	-0.2	-0.3	1.2
desired[d]	1.0	0.0	1.5	0.0	1.5
05 Dec - 18 Jun					
average	1.2	1.7	1.2	0.0	2.6
desired[e]	1.3	0.3	2.1	0.3	2.1

[a] Control, Stair-1 and Stair-2 are dietary regimen based upon expected weight gains depicted in figure 1a.
[b] Desired performance from December 5 - April 1.
[c] Diet change occurred on April 1.
[d] Desired performance from April 1 - June 18.
[e] Desired overall performance from December 5 - June 18.

Figure 1. Desired (a) and actual body weights of heifers fed diets to achieve either moderate- (Control) or alternating high- and low-gain phases (Stair-1 and Stair-2).



[Back to 1999 Research Reports Table of Contents]

Email: drec@ndsuext.nodak.edu
