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Timing of gain does not alter puberty and reproductive performance of beef heifers fed a high-roughage diet

J.M. Lynch

G.C. Lamb

B.L. Miller

See next page for additional authors

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Abstract

Eighty crossbred heifers (549 lb initial body weight) were developed in drylot and limit-fed a forage sorghum silage diet predicted to produce gains of either 1 lb/day for the entire developmental period (EVENGAIN) or .25 lb/day for the first two-thirds of the period followed by 2 lb/day during the last third (LATEGAIN). Treatments began on November 7, 1994 and continued until April 24, 1995 (onset of the breeding season). Actual daily gains over the entire feeding period averaged 1.18 and 1.10 lb/day for EVENGAIN and LATEGAIN heifers, respectively. Age and weight at puberty were not affected by feeding treatment. Body condition score, frame score, and pelvic area were similar at the end of the experiment regardless of growth regimen. At the conclusion of the 168-day feeding period, estrus was synchronized using two injections of prostaglandin F2", and heifers were inseminated artificially during a 45-day breeding season. Open heifers were mated naturally for an additional 15 days. First service and overall pregnancy rates were similar between treatments. In summary, timing of gain did not affect the onset of puberty or breeding performance. These data indicate that bee f producers may be able to utilize low quality feedstuffs early in heifer development without adversely affecting reproductive performance. Because feed inputs are major costs for developing beef heifers, such a management alternative may decrease costs.

Keywords

Cattlemen's Day, 1996; Kansas Agricultural Experiment Station contribution; no. 96-334-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 756; Beef; Heifers; Puberty; Heifer development; High-roughage diet

Authors

J.M. Lynch, G.C. Lamb, B.L. Miller, J. Ernest Minton, R.C. Cochran, and Robert T. Brandt

TIMING OF GAIN DOES NOT ALTER PUBERTY AND REPRODUCTIVE PERFORMANCE OF BEEF HEIFERS FED A HIGH-ROUGHAGE DIET

J. M. Lynch, G. C. Lamb, B. L. Miller, J. E. Minton, R. C. Cochran, and R. T. Brandt, Jr. [1]

Summary

Eighty crossbred heifers (549 lb initial body weight) were developed in drylot and limit-fed a forage sorghum silage diet predicted to produce gains of either 1 lb/day for the entire developmental period (EVENGAIN) or .25 lb/day for the first two-thirds of the period followed by 2 lb/day during the last third (LATEGAIN). Treatments began on November 7, 1994 and continued until April 24, 1995 (onset of the breeding season). Actual daily gains over the entire feeding period averaged 1.18 and 1.10 lb/day for EVENGAIN and LATEGAIN heifers, respectively. Age and weight at puberty were not affected by feeding treatment. Body condition score, frame score, and pelvic area were similar at the end of the experiment regardless of growth regimen. At the conclusion of the 168-day feeding period, estrus was synchronized using two injections of prostaglandin $F_{2\alpha}$, and heifers were inseminated artificially during a 45-day breeding season. Open heifers were mated naturally for an additional 15 days. First service and overall pregnancy rates were similar between treatments. In summary, timing of gain did not affect the onset of puberty or breeding performance. These data indicate that beef producers may be able to utilize low quality feedstuffs early in heifer development without adversely affecting reproductive performance. Because feed inputs are major costs for developing beef heifers, such a management alternative may decrease costs. (Key Words: Heifers, Puberty, Heifer Development, High-Roughage Diet.)

Introduction

Yearling beef heifers that conceive early in their first breeding season and calve early as 2-year olds will have greater lifetime productivity than heifers that calve older. In addition, heifers that produce their first calf early in the calving season tend to continue to calve early in subsequent calving seasons, resulting in increased lifetime production and efficiency. To ensure that heifers conceive early in the breeding season, they must attain sufficient weight to initiate their first estrous cycle before the onset of the breeding season. Current management practices target heifers to reach 60 to 65% of their estimated mature body weight by the start of the breeding season, but little is known regarding the importance of the timing of this weight gain. Previous research at Kansas State University (1995 Cattlemen's Day Report, KAES Report of Progress 727:107) indicated that, when the majority of weight gain is delayed until the last third of the developmental period, heifers may be raised in a more cost-efficient manner; a smaller heifer can be maintained on less feed for a longer period of time. On a relatively high concentrate diet, we saved about 12% on feed cost without sacrificing mature weight or reproductive performance.

The objective of this study was to evaluate the effect on forage-fed heifers of feed restriction early in the developmental period followed by rapid weight gain.

[1]Adjunct Faculty, Hoechst-Roussel Agric-Vet, Overland Park, KS.

Experimental Procedures

Eighty spring-born, Angus x Hereford heifers (549 lb initial body weight) were blocked by weight and assigned randomly within weight blocks to two treatments. Heifers were fed to gain 1 lb/day for the entire 168-day development period (EVENGAIN; n=40) or to gain .25 lb/day for the first two-thirds of development period followed by approximately 2 lb/day for the last third (LATEGAIN; n=40). Heifers were housed in drylot with eight head per pen and five pens per treatment. The feeding period began on November 7, 1994 and continued until April 24, 1995 (onset of the breeding season). LATEGAIN heifers were switched to the higher rate of gain on February 27, 1995. Diets were formulated according to NRC (1984) recommendations. Based on previous research with restricted gains, dry matter intake was adjusted to compensate for increased efficiency at the predicted rate of gain. The diet (as fed) was 92.5% forage sorghum silage and 7.5% vitamin-mineral supplement, which included soybean meal and rolled milo to meet protein requirements for the desired gain. Heifers were weighed every 28 days, and intakes were adjusted as necessary.

Beginning in January, weekly blood samples were collected via tail venipuncture. Serum was harvested and stored at -20°C until progesterone analysis was completed. Two consecutive samples with progesterone >1 ng/ml indicated first ovulation and luteal function. The day of puberty was estimated by subtracting 3 days from the first day when progesterone was >1 ng/ml, followed by an estrous cycle of normal duration.

Body weight and body condition score (1=extremely thin, 9= extremely fat) were determined at day 0 (initial), day 112 (feed switch), and day 168 (onset of breeding season). In addition, pelvic area and frame score were determined at the conclusion of the experiment. Estrus was synchronized using two injections of prostaglandin $F_{2\alpha}$ (Lutalysefi) given 14 days apart. Heifers were inseminated artificially at estrus according to the AM-PM rule for the first 45 days of the breeding season. Heifers then were exposed to a mature bull for 15 days to complete the 60-day breeding season. First-service and overall pregnancy rates were determined by transrectal ultrasonography approximately 30 days after breeding.

Results and Discussion

The results for EVENGAIN and LATEGAIN treatments are summarized in Table 1. Age and weight at puberty were similar between treatments. Treatment had no effect on body condition score, frame score, or pelvic area at the conclusion of the experiment. In addition, we found no differences in first-service or overall pregnancy rates in heifers.

Because LATEGAIN heifers did not reach the programmed .25 lb/d for the first two-thirds of development (actual gain = .12 lb/d), dry matter intake for the last third of development was adjusted to provide an adequate daily gain to reach a projected end weight similar to that of EVENGAIN heifers. Overall gains for the entire feeding period were 1.10 and 1.18 lb/d for LATEGAIN and EVENGAIN heifers, respectively. Dry matter intake was approximately 2.5% less for the LATEGAIN heifers, but this amount was not statistically significant.

Our data indicate that the timing of gain did not affect the onset of puberty or breeding performance in these beef replacement heifers. Also, utilizing a high-forage diet did not provide the feed savings that were observed previously with heifers on similar treatments and fed high-concentrate diets. Even so, collectively, the data indicate that considerable latitude exists relative to the timing of gain in beef replacement heifers. This may allow producers to winter replacements on low quality, lower-cost feeds such as dormant native range and crop residues. However, heifers should be switched to higher quality feedstuffs far enough in advance of the breeding season to ensure reaching puberty and the appropriate body weight. This approach may reduce the cost of developing beef replacement heifers without degrading reproductive performance.

Table 1. Performance and Reproductive Characteristi cs of Heifers Developed at Different Rates and Times of Gain

		Dietary Treatment [a]		
Item		EVENGAIN	LATEGAIN	SE
No. of heifers		40	40	
Initial weight, lb		551	547	19.3
Prebreeding weight,lb	739.2	722.6	17.25	
Daily gain, lb/head		1.18	.12; 3.45 [b]	.037
Age at puberty, days		386	405	8.75
Weight at puberty, lb		690	687	17.8
Body condition score [c,d]	5.40	5.38	.09	
Pelvic area [d], cm^2		191.1	201.8	5.8
Frame score [d]		4.99	5.05	.16
First-service conception, %		56.4	71.0	
Overall pregnancy rate, %		87.5	87.5	
Daily feed intake, lb DM/hea d	12.1	11.8	.28	

[a]EVENGAIN heifers were fed to gain 1 lb/day (November 7, 1994 to April 24, 1995) and LATEGAIN heifers were fed to gain .25 lb/day from November 7, 1994 until February 27, 1995, when predicted rate of gain was increas ed to reach the projected end weight of EVENGAIN heifers on April 24, 1995.
[b]Daily gain for LATEGAIN heifers represents the gains during the first two-thirds and last third of the feeding period.
[c]BCS: 1 = extremely thin, 9 = extremely fat.
[d]Determined at the onset of the breeding season (April 24, 1995).