DEVELOPMENT OF HEIFERS ON RANGE OR RANGE-PROGRAMMED FEEDING

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Story in Brief

One hundred, 7 month-old spring-born beef heifers (473 lb) were allotted by breed and weight in November to four treatments to evaluate effects of level of supplementation and short-term concentrate feeding on age and weight at puberty. In each of two years, heifers were wintered on 2 lb/day of a 40% crude protein supplement (SBM), or 4 or 6 lb/day of a 20% protein supplement (LOW-20 or HIGH-20, respectively) while grazing dormant native pastures. A fourth treatment (DRYLOT) consisted of feeding 2 lb/day of SBM until mid-February, then feeding a high-concentrate diet (NE_g=.60 Mcal/lb) in drylot so that DRYLOT heifers weighed the same as HIGH-20 heifers on May 1. From November 1 until mid-February, weight gains were similar for SBM, DRYLOT and LOW-20 (.51, .62 and .68 lb/day) and greatest for HIGH-20 (1.12 lb/day). From mid-February until May 1, SBM and LOW-20 gained the least (1.08 and 1.19 lb/day), while HIGH-20 and DRYLOT gained 1.47 and 1.91 lb/day, respectively. Weights on May 1 were similar for HIGH-20 and DRYLOT (704 and 691 lb, respectively) and were heavier than LOW-20 (636 lb) or SBM (612 lb). Pubertal weights were similar for SBM, LOW-20, and DRYLOT (638, 651, and 653 lb, respectively) and heaviest for HIGH-20 (715 lb). DRYLOT heifers reached puberty 29 days younger than the other treatment groups. Percentage of heifers puberal on May 1 were 0, 9, 13 and 72 for SBM, LOW-20, HIGH-20 and DRYLOT, respectively. Pregnancy rates were significantly lower for SBM (67%) than for LOW 20, HIGH 20 or DRYLOT, (94, 94, 86%, respectively). Milk production after first parturition, was similar for all treatments. Age and weight at puberty may be altered by short-term feeding of high-concentrate diets. The amount of supplemental energy can affect pregnancy rates of heifers even though body weight and condition score are not affected.

(Key Words: Heifers, Puberty, Energy, Forage, Weight, Age.)

Introduction

Heifers must achieve puberty and conceive by 15 months of age in order to calve at 24 months and optimize production. However, fall-weaned heifers grown on dormant forages during the winter often do not reach sufficient

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weight to achieve puberty during spring breeding. Increasing winter weight gains of spring-born heifers usually reduces puberal age and therefore age at breeding, but is often expensive and difficult to achieve when dormant forages compose the basic feed source. While it has been noted that the onset of puberty may not differ when heifers are grown at different rates on the same diet but weigh the same at the initiation of the breeding season, dietary changes which decrease the acetate:propionate ratio in the rumen (concentrates or monensin) have been suggested to reduce the age at puberty of heifers. The objective of this study was to determine the effects of level of supplementation and short-term feeding of concentrate diets on age and weight at puberty.

Materials and Methods

Forty-eight Hereford and Hereford x Angus heifers in yr 1 and 52 in yr 2 were used. Heifers were born between February 7 and April 8 and were weaned in October. Initial weights were the average of weights recorded on two consecutive days after 16-hour withdrawal from feed and water.

Treatments (Table 1) were 2 lb/day of a 40% CP supplement (SBM), or 4 or 6 lb/day of a 20% CP supplement (LOW-20 or HIGH-20, respectively) while grazing winter range. All supplements were prepared as a 3/16 inch pellet and individually fed in covered stalls with the daily supplement amounts prorated for 5-day/week feeding. Heifers grazed native tallgrass pastures during the trial and had free access to a trace mineral, salt mixture (Salt 63.47; dicalcium phosphate 33.33; copper sulfate .40; zinc oxide .43; mineral oil 2.85%). From January 20 until the end of supplementation, grazing heifers were allowed free access to native grass hay (CP=4.5%, ADF=43.9%).

A fourth treatment (DRYLOT) consisted of feeding 2 lb/day of SBM until mid-February, then feeding a high-concentrate diet (NE_g=.60 Mcal/lb) in drylot. While in drylot, daily feed intake was restricted to control growth rate (approximately 2.25 lb/day) so that DRYLOT and HIGH-20 would have similar weights on May 1, the start of the breeding season. Intake adjustments were made at 2-week intervals. DRYLOT heifers were group-fed daily at 0800 in bunks. The adaptation period for DRYLOT heifers to the high concentrate ration lasted approximately one week. During the last week of April, all heifers were gathered into a drylot with free access to native grass hay and were fed 2 lb/day of SBM in order to equalize fill between DRYLOT and pasture supplemented heifers. After five days of the common diet, heifers were weighed following 16-hour removal from feed and water on two consecutive days. These weights were averaged and used as ending weights for the winter period. Heifers then grazed together in summer pastures until November 1. Intermediate weights were taken at 28-day intervals following 16-hour withdrawal from feed and water. Body condition scores (BCS; scale 1 to 9; 1=extremely thin, 9=obese) were assigned by two independent evaluators on May 1 and November 1.

Table 1. Composition and nutrient content of the supplements and the drylot ration fed to heifers (DM basis).

	Supplement or ration		
	40% CP Supplement	20% CP Supplement	DRYLOT Ration
Ingredient			
Soybean meal	91.20	15.00	11.50
Soybean hulls	3.45	81.00	
Molasses	4.00	4.00	3.10
Dicalcium phosphate	1.80	.50	
Vitamin A	.10	.05	.015
Copper sulfate	.01		
Rolled Corn			73.50
Alfalfa Pellets			4.90
Cottonseed hulls			5.40
Limestone			1.30
Salt[a]			.30
Nutrient levels			
Crude protein, %	42.96	19.83	13.52
NE_m, Mcal/lb[b]	.84	.80	.93
NE_g, Mcal/lb[b]	.56	.43	.60
Calcium, %[b]	.59	.57	.68
Phosphorus, %[b]	1.09	.40	.33
Potassium, %[b]	2.48	1.50	.85
Amount fed, lb/day	2.0	LOW/HIGH[c]	See footnote[d]

[a] Heifers had free access to salt, trace mineral when grazing.

[b] Calculated from NRC (1986), except for soybean hulls (NRC, 1988).

[c] Daily supplement intake was LOW (4.0 lb/day) or HIGH (6.0 lb/day) for the 20% CP supplement.

[d] Daily intake was 2.0 lb/day of the 40% CP supplement from November 1 until February 8, then 13.9 to 16.3 lb/day (as-fed basis, adjusted in 2-week intervals) of the DRYLOT ration until late April.

Weekly blood samples were taken from the tail from early February until the end of breeding or until puberty was established for a heifer. Puberty was defined as the first day of two consecutive plasma samples with greater than 1 mg/ml of progesterone (an indication of luteal activity). Weight at puberty was determined by regression of intermediate weights. Five heifers failed to achieve puberty by the end of the breeding season (SBM, n=4; DRYLOT, n=1) and their data were deleted from the analysis of age and weight at puberty.

On May 1, heifers were exposed for 65 days to at least two bulls that had passed breeding soundness exams. Pregnancy was determined by rectal palpation in November. Conception date was calculated by subtracting 285 d from the actual calving date. Milk production was estimated during the last week of April following calving. The weigh-suckle-weigh technique was modified to measure three consecutive 8-hr periods.

Analysis of variance was conducted using the GLM procedure of SAS (1985). Data were analyzed as a randomized complete block design. Dietary treatment, breed and year were the independent sources of variation in the model. Significant main effects were interpreted by comparison of individual means using paired t-test. Data of one DRYLOT heifer was removed from all analyses because of health reasons.

Results and Discussion

From November 1 until February 1, ADG of HIGH-20 heifers was greater (P<.01) than the other heifers (Table 2). Weight gains from November 1 until February 1 were similar (P=.23) between SBM and DRYLOT heifers, but both treatment groups gained less weight (P<.01) than LOW-20. Rate of gain increased after February for SBM and LOW-20 heifers because of the free access to native grass hay. Weight gain of DRYLOT heifers from February 1 until May 1 was greater (62 lb, P<.01) than for other treatments. Weights of DRYLOT and HIGH-20 heifers were similar at the beginning of breeding. On May 1, HIGH-20 and DRYLOT heifers weighed 62 lb more than LOW-20 and 86 lb more than SBM heifers. The SBM heifers weighed the least (P<.01) at the beginning of the breeding season. Daily weight gain for the entire supplementation period was greater (P<.01) in yr 1 than yr 2 (1.1 vs .88 lb/day, respectively).

During the breeding season, SBM and LOW-20 heifers compensated for decreased winter ADG and gained .51 lb/day more (P<.01) than HIGH-20 and DRYLOT heifers. DRYLOT heifers gained the least (2.0 lb/day; P<.01) during the breeding season. From the end of breeding to November, heifer gains were similar (P=.49) for all treatments. At the end of the summer grazing period, HIGH-20 heifers maintained a 48 lb weight advantage over heifers on the other treatments. SBM heifers weighed 18 lb less (P=.09) than LOW-20, whereas DRYLOT heifers were heavier (P<.01) than either SBM or LOW-20 heifers at the end of the summer grazing period.

Table 2. Puberal and reproductive parameters of heifers wintered on 2 lb/day of a 40% CP (SBM); 4 lb/day (LOW-20) or 6 lb/day (HIGH-20) of a 20% CP supplement; or 2 lb/day of a 40% CP supplement until February then limit fed a high concentrate ration (DRYLOT).

	Treatments			
Item	SBM	LOW-20	HIGH-20	DRYLOT
Heifer weights, lb				
Initial, November	466	464	455	455
February	519^{a}	532^{a}	576^{b}	526^{a}
May	598^{b}	625^{c}	689^{d}	682^{d}
July	719^{b}	737^{c}	787^{e}	750^{d}
November	860^{b}	878^{b}	928^{d}	904^{c}
Birth date, Julian	59	59	61	62
Pubertal age, days	447^{b}	443^{b}	441^{b}	414^{c}
Age of conception, days	453^{bc}	447^{bc}	454^{c}	444^{b}
Breeding date, Julian	148^{bc}	142^{bc}	150^{b}	140^{c}
Pregnancy rate, %	67^{b}	94^{c}	94^{c}	86^{c}
Body condition score[a]				
May 1	5.2^{b}	5.3^{b}	5.7^{c}	5.8^{c}
November 1	5.7	5.7	5.8	5.7
Calving age, days	454	448	454	443
Early milk production, lb/day	12.5	11.4	11.0	12.8
Pubertal wt, lb				
Yr 1	673^{b}	642^{b}	713^{d}	673^{c}
Yr 2	634^{b}	660^{c}	717^{d}	634^{b}

[a] Scale (1 = very thin to 9 = obese).

[b,c,d,e] Row means that do not have a common superscript differ (P<.05).

For both years of the study, heifers fed HIGH-20 or DRYLOT had greater (P<.01) BCS on May 1 than LOW-20 or SBM heifers (5.7, 5.8, 5.3, 5.2, respectively), but by the end of summer grazing there was no difference (P>.62) between treatments (Table 2). Body condition scores on May 1 were greater (P<.01) in yr 1 than yr 2.

DRYLOT heifers reached puberty 29 days younger (P<.05) than heifers in the other treatments (Table 2), with no difference between heifers fed SBM, LOW-20 or HIGH-20. Hereford × Angus heifers were pubescent 11 days younger than Herefords (P<.03).

Although average weight at puberty did not differ between years, the year x treatment interaction was significant. In year 1, lightest puberty weights were found for SBM and LOW-20 heifers with DRYLOT intermediate and HIGH-20 heaviest (P<.05). In yr 2, HIGH-20 heifers again had the heaviest weights at puberty (P<.05). In yr 2, the lowest puberal weights were observed for SBM and DRYLOT with LOW-20 intermediate (P <.05). At three weeks prior to the start of the breeding season (April 10), significantly more DRYLOT heifers had reached puberty than SBM, LOW-20 and HIGH-20 (Figure 1). When compared to the other treatments, fewer SBM heifers achieved puberty (P<.03) by the end of the breeding season.

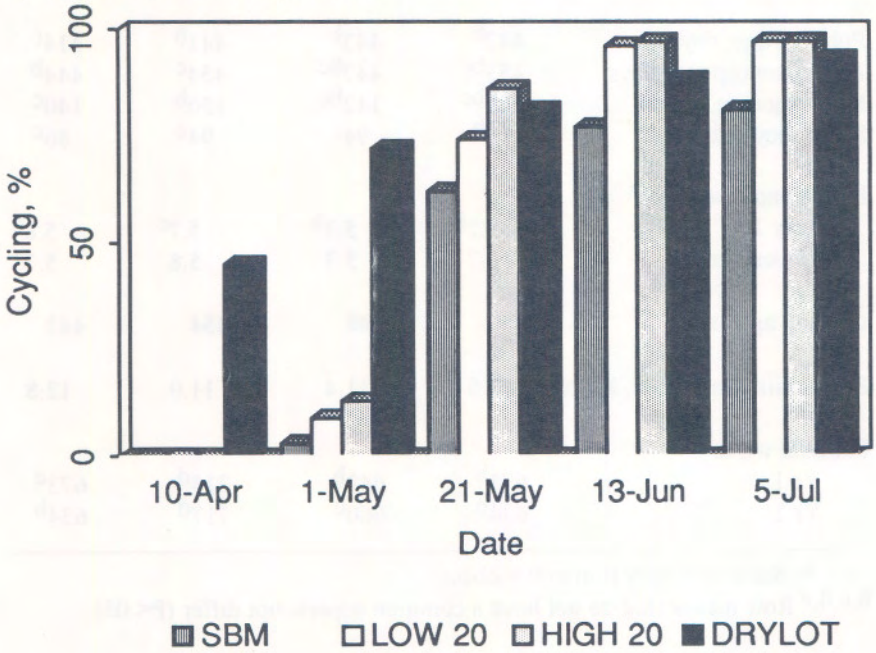

Figure 1. Cumulative percentage of heifers cycling before and during the breeding season when wintered on SBM, LOW-20, HIGH-20 or SBM followed by DRYLOT.

Pregnancy rates (Table 2) were similar for the LOW-20, HIGH-20 and DRYLOT treatments and greater (P<.05) than pregnancy rates for SBM heifers (67%). Heifers fed SBM tended to have the lowest percentage cycling at all times during the breeding season. Greater cycling and pregnancy rates for LOW-20 compared to SBM (P<.05), even with similar body weights and BCS throughout the breeding season suggests that level of supplemental energy may affect reproduction in heifers without significantly increasing weight or body condition. Heifers fed SBM and HIGH-20 had similar ages at calving (P>.20), while DRYLOT and LOW-20 heifers were 10 days younger (P<.03).

Milk production was similar for heifers raised to breeding on the four prebreeding treatments (Table 2), suggesting that limit-feeding a high concentrate diet for about 60 days prior to breeding does not affect subsequent milk producing ability.

In conclusion, reduction in age of puberty can be achieved by short-term feeding of high-concentrate diets compared to feeding supplements to heifers grazing low-quality roughages. The amount of supplemental energy fed from weaning to breeding can alter pregnancy rate in heifers even though body weight and condition score may not be affected. Subsequent milking ability is not affected.