Effect of Increasing Energy 30 days Prior to Artificial Insemination in Beef Heifers

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Summary with Implications

A 3-yr study utilized 300 Angus-based, spring-born heifers to evaluate postweaning heifer development systems on gain and reproductive performance. Three groups of heifers were developed over the winter development period either grazing winter range or fed a dry lot diet targeted to 1.5 lb/d of gain in order to achieve 65% of their mature body weight at breeding. Thirty days prior to artificial insemination, heifers grazing winter range entered the dry lot and were fed this same diet, one group of dry lot heifers remained on this diet, and the other received increased energy in the form of wet corn gluten feed. Post development body weight and average daily gain were greater among dry lot developed heifers. There were no differences in artificial insemination or final pregnancy rate. Results indicate that producers may use a 30-day increase in energy prior to artificial insemination to decrease overall development inputs in range heifers without compromising reproductive efficiency when compared to dry lot heifers receiving greater inputs.

Introduction

Heifer development represents one of the greatest costs for cow/calf producers other than the actual feed costs. The goal of this study was to investigate production systems that allow for lower inputs and cost without compromising lifelong reproductive success. A previous study (*2017 Nebraska Beef Cattle Report*, pp. 5–7) evaluated body weights (BW), average daily gain (ADG), and reproductive efficiency in heifers developed for approximately 160 days on four different treatments 1) corn residue & range, 2) winter range, 3) dry lot low (12% wet corn gluten feed (DM basis)), and 4) dry lot high (21% wet corn gluten feed (DM basis)). Despite dry lot heifers being on higher energy diets throughout their development period, no differences were seen in artificial insemination (AI) or final pregnancy rate. While it is understood that an increase in plane of nutrition and body condition at critical timepoints promotes cyclicity, puberty attainment, and lifelong reproductive efficiency, the minimum threshold of inputs to acquire optimal pregnancy rates and development of productive cows is less clear. Furthermore, compensatory gain and grazing behavior also contribute to a heifer's ability to achieve puberty and become pregnant in a timely manner. Therefore, objectives of this study were to evaluate the impact of increased energy 30 days prior to AI on BW, ADG, and pregnancy rates among heifers developed on range and in a dry lot.

Procedure

Heifer Development

A 3-yr study utilized Angus crossbred heifers (n= 100/yr) at the West Central Research and Extension Center in North Platte, NE. Heifers were blocked by BW and randomly assigned to 1 of 3 groups. During the winter development period (average 131 ± 3.5 d/yr) heifers were assigned to either upland range (RANGE) or fed a similar dry lot diet in two pens with a targeted gain of 1.5 lb/d in order to achieve 65% of their mature BW (14 lb/hd/d hay, 5 lb/hd/d wet corn gluten feed [WCGF], and 0.75 lb/hd/d supplement). Thirty days prior to AI, one dry lot group remained on this diet (DLLO) while the other (DLHI) received an additional 9 lb/hd/d WCGF (14 lb/hd/d hay, 14 lb/hd/d wet corn gluten feed [WCGF], and 0.75 lb/hd/d supplement). Heifers developed on RANGE grazed winter range and received the equivalent of 1 lb/hd/d of a 29 % crude protein (CP), dried distillers' grain-based pellet containing monensin until 30 days prior to AI where they entered the dry lot and received the DLLO diet. Average diet composition and nutrient analysis for the 30-day diets prior to AI are presented in Table 1.

As described in a previous study (*2017 Nebraska Beef Cattle Report*, pp. 5–7), all heifers were synchronized with the melengestrol acetate- prostaglandin F2α (MGA-PG) protocol. Heat detection aids (Estrotect™, Rockway Inc., Spring Valley, WI) were applied at the time of PG injection (Lutalyse, Zoetis, Florham Park, NJ). Heifers exhibiting standing estrus were AI 12 hours later. Heifers were placed with bulls 10 days following AI on native upland range at a 1:50 bull to heifer ratio for a 60-day breeding period. Those heifers that did not express estrus within 6 days following the first PG injection were recorded and given a second PG injection, and then immediately placed with bulls. Pregnancy diagnosis was conducted via transrectal ultrasonography (ReproScan, Beaverton, OR) 45 days following AI. Forty-five days after the bulls were removed a second pregnancy diagnosis determined final pregnancy rate.

Statistical Analysis

All analyses were conducted using the GLIMMIX procedure of SAS 9.4 (SAS Inst. Inc., Cary NC). The model statement used contained the effects of treatment group and year. Treatment group within year was considered the experimental unit, with Year and Treatment treated as categorical variables. Response variables include BW recorded throughout the study, ADG during each phase of the study, pregnancy rate to AI, and final pregnancy rate. Response variables related to weight were assumed to follow a normal distribution, while response variables related to pregnancy were treated as binomial. A P-value ≤ 0.05 was considered significant. A P-value ≤ 0.10 was considered a tendency.

Table 1. Dry lot diets during the 30-day treatment period (DM Basis)

Item	RANGE[1], DLLO[2]	DLHI[3]
Ingredient %		
Hay	76.71	57.24
Wet Corn Gluten Feed	18.90	39.49
Heifer Supplement[4]	4.37	3.26
Nutrient Analysis %		
DM	78.35	72.13
CP	12.84	15.42
TDN	62.18	70.56

[1]RANGE heifers were offered the equivalent of 1 lb/hd/d of 29% CP cake while grazing winter range 131 ± 3.5d/yr until they were moved into the dry lot 30-days prior to AI and received 14 lb/hd/d hay, 5 lb/hd/d WCGF, and 0.75 lb/hd/d supplement.

[2]DLLO heifers were developed in the dry lot 131 ± 3.5d/yr and continued through estrous synchronization and AI receiving 14 lb/hd/d hay, 5 lb/hd/d WCGF, and 0.75 lb/hd/d supplement.

[3]DLHI heifers were developed in the dry lot 131 ± 3.5d/yr receiving 14 lb/hd/d hay, 5 lb/hd/d WCGF, and 0.75 lb/hd/d supplement diet until 30 days prior to AI where they then received an additional 9 lb/h/d of WCGF.

[4]Supplement = dry rolled corn (81.35% of supplement, (DM basis)), limestone (11.11%), iodized salt (5.55%), trace mix (1.39%), Rumensin- 90 (0.37%), and Vitamins A- D- E (0.22%).

Table 2. Effect of 30-day increase in energy on gain and reproductive performance

Item	RANGE[1]	DLLO[2]	DLHI[3]	SEM	*P*-value
n[4]	3	3	3		
Initial BW, lb	483	482	483	0.38	0.20
Post Development BW[5], lb	635[b]	743[a]	741[a]	9.19	0.01
Development ADG[6], lb	0.57[b]	1.42[a]	1.40[a]	0.09	0.02
Prebreeding BW, lb	688[b]	801[a]	828[a]	4.30	<0.01
Percent of mature BW[7], %	57[b]	66[a]	68[a]	0.004	<0.01
Synchronization ADG[8], lb	1.49	1.66	2.49	0.16	0.12
AI pregnancy diagnosis BW, lb	773[b]	850[a]	872[a]	3.71	<0.01
Final pregnancy diagnosis BW, lb	911[b]	973[a]	987[a]	2.98	<0.01
Breeding ADG[9], lb	1.45[b]	0.83[a]	0.78[a]	0.02	<0.01
AI pregnancy, %	49	63	69	0.06	0.43
Final pregnancy, %	85	95	96	0.02	0.09
Calving rate[10], %	77	92	90	0.04	0.12
Calved in first 21 d, %	41	42	61	0.12	0.12

[1]RANGE heifers were offered the equivalent of 1 lb/hd/d of 29% CP cake while grazing winter range 131 ± 3.5d/yr until they were moved into the dry lot 30-days prior to AI and received 14 lb/hd/d hay, 5 lb/hd/d WCGF, and 0.75 lb/hd/d supplement.

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[4] Represents number of replications; 1 yr = 1 replication.

[5]BW prior to the 30-day treatment period.

[6]ADG during the 131-day development period.

[7]Percent of mature BW at breeding based on mature cow size of 1200 lb.

[8]ADG between synchronization and breeding.

[9]ADG between prebreeding and first pregnancy diagnosis.

[10]Percent of heifers that calved.

[a, b] Means in a row with different superscripts are different ($P \leq 0.05$)

Results

Heifer ADG in DLLO and DLHI were greater ($P = 0.02$ and $P = 0.03$ respectively) than RANGE during the development period, but there were no differences observed in ADG during the 30-day treatment period between DLHI, DLLO, and RANGE (Table 2). Pre-breeding BW was greater ($P < 0.01$) for DLHI and DLLO compared to RANGE; however, breeding ADG (the time period between pre-breeding and first pregnancy diagnosis) was greater ($P < 0.01$) for RANGE compared to DLHI and DLLO. This may be attributed to compensatory gain and grazing behavior differences in the heifers developed on range. There were no differences in pregnancy rates to AI between DLHI (69%), DLLO (63%), or RANGE (49%). There were also no differences between final pregnancy rates between DLHI (96%) and DLLO (95%) or RANGE (85%). No differences were observed in calving rate or heifers calving in the first 21days.

Conclusion

Ultimately, greater dietary protein and energy for DLHI and DLLO heifers led to greater BW, ADG, but overall short-term nutritional change had no detectable impact on AI conception nor final pregnancy rates across heifer development systems. A greater number of heifers may lead to statistical differences in AI conception, but no differences can be concluded in the current study. When evaluating the best plan for developing heifers, this data may encourage producers to evaluate current development systems and develop heifers on range or decrease the time spent in a dry lot compared to supplying greater inputs throughout the development period. Rather than advocating one of the three systems illustrated over another, the current study illustrates that instead of developing heifers on a high energy diet throughout the winter development period, inputs and cost may be lowered by increasing dietary protein and energy to beef heifers 30 days prior to AI without compromising long-term reproductive efficiency. An economic analysis evaluating the savings associated with lower inputs compared to lower pregnancy in heifers developed on range is needed to make more accurate heifer development decisions.

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