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Evaluation of Performance and Costs of Two Heifer Development Systems[1]

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Summary

Early weaned (EW) heifers must be developed for a longer period of time usually resulting in increased development costs. Developing EW heifers on native range may reduce these costs. Dried distillers grains plus solubles (DDGS) offers protein and energy that compliment native forages for developing heifers. The objective of this study was to evaluate the performance and costs of two heifer development systems in northwest South Dakota. Sixty-five nulliparous crossbred beef heifers were randomly allotted to one of two systems: 1) heifers (n=33) weaned at 132 d of age (461 lb) and developed on range with a DDGS supplement (1.8 to 6.4 lb/hd/d) from Sept. 25 to May 18 (Range); 2) heifers (n=32) weaned at 218 days of age (605 lb) and developed in a drylot with grass hay and a conventional supplement (2.6 to 3.6 lb/hd/d) from Dec. 2 to May 18 (Normal). Supplement levels were established to result in both groups of heifers reaching 65% of mature weight at breeding (863 lb). All heifers were managed similarly after May 18. Heifers were synchronized with a shot of $PGF_{2\alpha}$ and bred natural service beginning June 14. As necessary for target weights to be reached, ADG through the feeding period was greater (*P* < 0.05) for Range (1.68 lb/d) than (Normal 1.34 lb/d). Range heifers tended (*P* = 0.12) to be heavier on May 18 (859 and 830 lb, respectively) and were heavier (*P* < 0.05) at breeding (915 and 834 lb, respectively). Weight differences in May were a result of higher than expected gains by the Range heifers in the spring. From May 18 to June 14, Range heifers gained more (*P* < 0.05) than Normal (2.07 and 0.32 lb/d, respectively). Synchronized conception and overall pregnancy rates were similar (*P* > 0.25) between the Range and Normal heifers (58% vs. 50% and 91% vs. 88%, respectively). Supplement and forage costs for the Range system was similar ($122/hd) to the Normal ($117/hd). Range development provides an alternative method for developing early-weaned heifers that reduces daily costs.

Introduction

Cow-calf production systems that rely heavily on harvested and purchased feeds have less potential to be profitable (Adams et al., 1994). At the Antelope Range and Livestock Research Station near Buffalo, South Dakota, ongoing research is evaluating the effectiveness of early weaning in managing forage supplies and cow body condition in order to reduce the requirement for harvested feeds. An important part of any early weaning system is the reproductive performance and costs associated with developing heifers. Indeed, early-weaning heifers from dams results in more days that heifers must be managed and fed, potentially increasing the costs of the heifer development program. If available, forage spared by early weaning may be used in developing the early-weaned heifers.

Developing heifers on range is not a common practice in northern South Dakota due to the perception that adequate reproduction cannot be maintained in such a system. Recent reports showed that bred heifers could be managed on range with no hay during late gestation by feeding dried corn-gluten feed (Loy et al., 2004), a source of protein and fiber based energy. It is hypothesized that a similar management system could be used to develop replacement heifer calves.

Dried distillers grains plus solubles (**DDGS**) has a unique combination of fat, fiber, and protein that makes the product valuable to young beef

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female management programs. Both fat (Bellows, 1997) and undegradable intake protein (Patterson et al., 2003) supplemented to bred heifers during late gestation has been shown to increase reproductive rates. The effect of DDGS supplementation on reproduction in replacement heifers has not been well documented. Due to the low cost of both protein and energy in DDGS, the product may also be valuable in replacing expensive hay inputs in heifer development programs. Since DDGS compliments native winter range, it has promise as a supplement to heifers being developed on grass.

Materials and Methods

Sixty-five nulliparous crossbred beef heifers at the Antelope Range and Livestock Research Station, located near Buffalo, SD, were randomly allotted into one of two heifer development systems. In the first system (**Range**), heifers (n = 33) were weaned on August 12, 2003, averaging 132 days (range 149 to 93 days) of age and 395 lb (range 276 to 516 lb). Heifers were fed a weaning ration in the drylot consisting of grass hay and 3.5 lb (DM) of weaning pellet (pellet contained adequate protein, vitamins, and minerals and 66 mg/kg Decoquinate). On September 25, 2003, the heifers were turned out to native range and supplemented with DDGS (loose meal; Table 1). The DDGS was fed daily in feed bunks at rate of 1.8 to 6.4 lb/hd/d (DM basis). The feeding rate was established to result in heifers weighing approximately 65% of mature weight at breeding in June (863 lb), for an average daily gain of 1.50 lb/day during the trial (assuming 2.00 lb/day following treatments in early summer). The feeding rate changed over the winter to account for heifer size, weather conditions, expected forage quality and observed interim performance. The level of DDGS supplementation (DM basis: per hd/d) was 1.8 lb in September and increased to 3.5 lb on November 24, 4.4 lb on December 2 and 6.4 lb on February 12. The supplementation level was then decreased to 4.4 lb on April 20 and 1.0 kg on May 4. Hay was fed on two days when snow cover prevented grazing (10.4 lb/hd/d).

The second system (**Normal**), heifers (n = 32) were weaned on November 6, 2003, averaging 218 days (range 239 to 178 days) of age and 565 lb (range 418 to 662 lb). Heifers were fed the same weaning ration as the early-weaned heifers for 37 days. On December 13, immediately following the weaning period, heifers remained in the drylot and were placed on a diet consisting of ad-libitum access to grass hay (8.1% CP, 66% NDF; DM basis) and a conventional supplement fed (Table 1a) at a rate of 2.6 to 3.6 lb/hd/d (DM basis; Table 1). The supplement was fed at a rate to achieve approximately 65% of mature weight at breeding in June (863 lb), for an average daily gain of approximately 1.30 lb/day during the trial (assuming heifers would gain 2.00 lb/day following treatments in early summer). Although hay was fed ad-libitum, each hay bale was weighed to record hay disappearance.

Both treatments were terminated on May 18, 2004, when all the heifers were turned out to native range as a single group.

Heifers were weighed at weaning, the initiation of winter treatments (September 25 and December 13), at the termination of winter treatments on May 18, and at approximately 30-day intervals throughout the treatment period. Heifers were also weighed at the initiation of breeding on June 14 and at time of pregnancy determination on November 9.

On June 14, all heifers were exposed to bulls as a single group. On June 18, heifers were given an injection of $PGF_{2\alpha}$ (25 mg i.m. Lutalyse, Pfizer Animal Health, New York, NY) to synchronize estrus. Bulls were removed 5 d later, on June 23, for a 14 d period so that synchronized conception rates could be determined. Synchronized conception rates were determined by transrectal-ultrasonography 51 d after synchronization. Overall pregnancy was determined by rectal palpation 99 d after the breeding season. Two blood samples were taken 2-weeks apart prior to synchronization to determine estrous cycling status.

The effects of treatments on heifer weights and body condition scores were analyzed by ANOVA with Proc GLM of SAS (SAS Inst. Inc., Cary, NC). The effects of treatments on estrous cycling status, synchronized conception rates and pregnancy rates were analyzed by Chi-Square.

Results and Discussion

Range heifers weighed less ($P < 0.05$) at the initiation of their treatment protocol (September

25) than did Normal heifers at the initiation of their treatment protocol (December 2; Table 2). Range heifers were able to overcome their lighter initial weights by gaining 0.33 lb/d more than the Normal heifers during the experimental period ($P < 0.05$; Table 2). There was a slight difference in ADG between the Range and Normal heifers (1.34 and 1.19 for Range and Normal, respectively; $P = 0.13$) from December through February. The average daily gains between the winter months were lower for both systems than anticipated. This could be attributed to cold weather in December (avg. min. 12 ºF; avg. max. 38 ºF), January (avg. min. 5 ºF; avg. max. 23 ºF) and February (avg. min. 9 ºF; avg. max. 32 ºC). In addition, from December through February there were 44 days when snow cover was measured (average depth of 10 cm). Range heifers had higher ($P < 0.05$) ADG through March (2.13 and 1.30 for Range and Normal, respectively) and April (2.58 and 1.78 for Range and Normal, respectively; Figure 1).

Due to the greater than expected gain in the spring, the Range heifers tended ($P = 0.12$) to be heavier than the drylot heifers (859 lb and 830 lb, respectively) on May 18, the termination of treatment application. Interestingly, there was a difference ($P < 0.05$) between average daily gain of heifers from the two systems from May 18 to June 14, after treatments were applied (2.07 and 0.32 lb/d for Range and Normal, respectively). Although both groups of heifers were near their target weight of 863 lb at breeding on June 14 (Table 2), Range heifers were heavier at breeding ($P < 0.05$) than Normal heifers (Figure 2). The Normal heifers did not overcome the weight difference by November ($P < 0.05$).

There was no difference between treatments in the percentage of heifers that were estrous cycling before the start of the breeding season ($P > 0.25$; 94% and 100% for Range and Normal, respectively). Synchronized conception rates and overall pregnancy rates did not differ ($P > 0.25$) between the Range and Normal heifers (Table 2).

Supplement and forage costs for the Range heifers was similar ($122/hd) to the Normal group ($117/hd). Cost per day for the Range and Normal systems were $0.52 and $0.74, respectively (Tables 3).

Loy et al. (2004) reported that bred heifers could be maintained during the winter without hay feeding. These data show that heifer calves may also perform adequately without significant hay inputs. We observed heifers foraging through snow-cover. It is possible that the increased level of supplementation in February and March was not necessary since the heifer gains were higher than expected in the spring and early summer. It is important to note that more severe winter conditions may result in a requirement for more hay feeding to sustain performance. The improvement in gains for Range heifers compared to Normal during the early summer was higher than expected and also contributed to their weights being higher at breeding. It is not clear if this was due to physiological or behavioral differences in the heifers during the early summer months.

Implications

These results showed that early-weaned heifers developed on range with dried distiller grains supplement can achieve similar reproductive performance as normal-weaned/drylot developed heifers, but at a lower cost per day. The range system resulted in more developed young cows at a similar developmental costs as the conventional system.

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Tables

Table 1. Nutrients in DDGS and conventional supplement (DM basis)

Item	DDGS	Conventional Supplement
Crude Protein (%)	29.7	31.0
Calcium (%)	0.06	0.37
Phosphorus (%)	0.79	1.11
Potassium (%)	1.09	1.31
Magnesium (%)	0.34	0.45
Copper (mg/kg)	6	61
Zinc (mg/kg)	99	112
Manganese (mg/kg)	18	56

Table 1a. Ingredients of conventional supplement

Item	%
Wheat Middlings	49.0
Sunmeal – 35%	30.0
Canola Meal	7.75
Feather Meal Hydrolyzed	5.0
NDM 2003	5.0
Cane Molasses	2.5
Salt	0.46
Minerals	0.16
Vitamins	0.1
Eddi 10% Premix	0.002

Table 2. Performance of heifers that were weaned in August and developed on range (Range) compared to November-weaned heifers developed in a drylot (Normal)

Treatment	Range ± SEM	Normal ± SEM
No. Head	33	32
Initial BW, lb[e]	460 ± 9.3[a]	605 ± 9.5[b]
Final BW, lb[f]	859 ± 12.9[c]	830 ± 13.1[d]
Overall ADG, lb/d[g]	1.68 ± 0.03[a]	1.34 ± 0.03[b]
% pubertal before the breeding season[h]	94	100
Synchronized Conception Rate[i]	58	50
Final Pregnancy Rate[j]	91	88

[a,b] Within a row, means with unlike superscripts differ ($P < 0.05$)

[c,d] Within a row, means with unlike superscripts differ ($P = 0.12$)

[e] Weight at the beginning of treatments
Range: 9-25-03; Normal: 12-2-03

[f] Weight at the end of treatments - both groups 5-18-04

[g] Average daily gain from initial to final weight

[h] Percent of heifer estrous cycling before the start of the breeding season

i Percent pregnant during the 10 d synchronization period to natural service

[j] overall pregnancy (34 d breeding season)

Table 3. Supplement and Forage Costs for heifers that were weaned in August and developed on range (Range) compared to November-weaned heifers developed in a drylot (Normal)

	Range[a]		**Normal[b]**	
	Total Feed (lb)	**Total Cost**	**Total Feed (lb)**	**Total Cost**
Hay	752	$27.07	65,341	$2,352.28
DDGS	36,168	$2,061.58		
Range[c]		$1,947		
Conventional Supplement			17,280	$1,382.40
	Total Cost	$4,035.65	**Total Cost**	$3,734.68
	Cost/heifer	$ 122.29	**Cost/heifer**	$116.71
	$/hd/day	**$0.52**	**$/hd/day**	**$0.74**

[a] 33 early weaned heifers developed on range and DDGS for 236 d

[b] 32 normal-weaned heifers developed in drylot and conventional supplement for 158 d

[c] Rate at $7.50/AUM

Figures

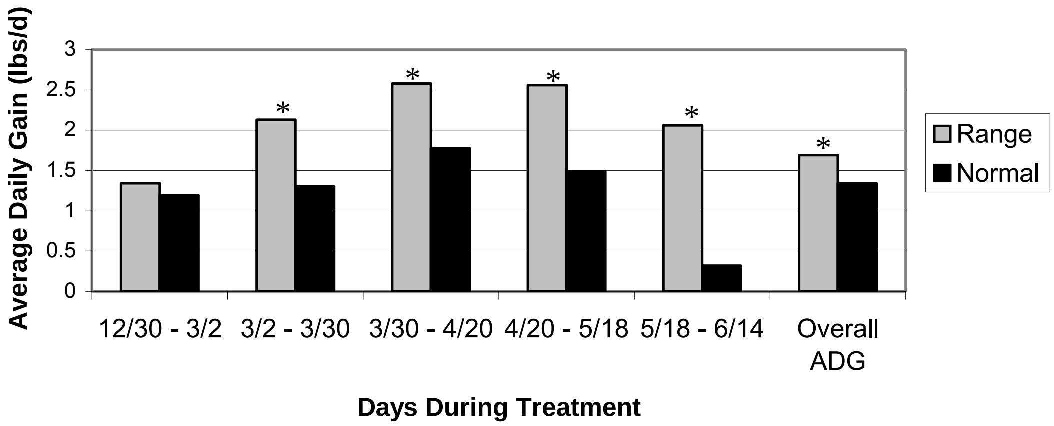

Figure 1. Average Daily Gain (lbs/d) of heifers weaned in August and developed on range (Range) compared to heifers weaned in November and developed in a drylot (Normal). (*$P < 0.05$)

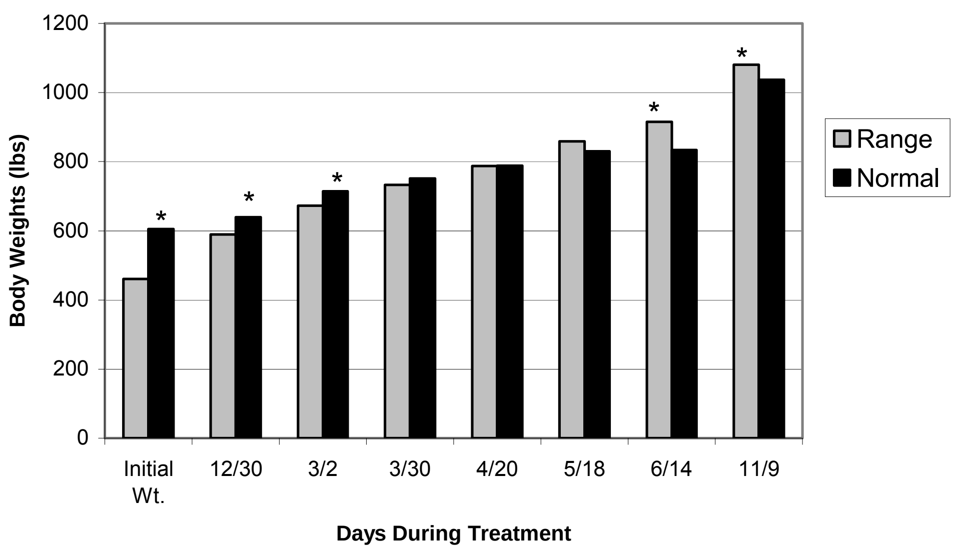

Figure 2. Body weights of heifers weaned in August and developed on range (Range) compared to heifers weaned in November and developed in a drylot (Normal). (*$P < 0.05$)