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Performance of Beef Replacement Heifers Supplemented with Dried Distillers Grains or a Mixture of Soybean Meal and Ground Sorghum Grain

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Abstract

The feed, labor, and equipment costs of developing heifers in a confined feeding system are relatively high. High Plains beef producers can reduce input costs by developing heifers on dormant native range; however, heifers are typically unable to consume sufficient crude protein (CP) from the low-quality (< 7% CP) forage base.

Insufficient dietary protein reduces forage digestion and performance potential of growing heifers. Supplementing protein when forage quality was poor has previously been reported to increase forage intake and forage digestibility, which resulted in acceptable levels of performance.

An efficient means of supplying supplemental protein to heifers consuming low-quality forage is through the use of supplements with relatively high crude protein concentrations (> 30% CP). Traditionally, producers have used oilseed meals in this capacity, but with the expansion of the ethanol industry, dried distillers grains with solubles (DDG) have become widely available as an alternative protein source for producers in corn and sorghum-producing regions. Adequate heifer body weight and body condition score at first breeding are essential to minimize age at first calving and to increase lifetime productivity. Therefore, the objective of our study was to evaluate the effects of supplementation of DDG or an approximately isonitrogenous mixture of soybean meal and ground sorghum grain on growth and reproductive performance of replacement heifers grazing low-quality, dormant native range.

Keywords

Beef Cattle Research

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Performance of Beef Replacement Heifers Supplemented with Dried Distillers Grains or a Mixture of Soybean Meal and Ground Sorghum Grain

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Introduction

The feed, labor, and equipment costs of developing heifers in a confined feeding system are relatively high. High Plains beef producers can reduce input costs by developing heifers on dormant native range; however, heifers are typically unable to consume sufficient crude protein (CP) from the low-quality (< 7% CP) forage base.

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Experimental Procedures

Animals and Experimental Design

Spring-born Angus × Hereford heifers (n = 88; initial BW = 582 ± 6.2 lb; initial BCS = 5.0 ± 0.03) were maintained on dormant, native range pastures for 84 d (Table 1).

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Botanical composition of pastures included: sideoats grama (*Bouteloua curtipendula*), western wheatgrass (*Pascopyrum smithii*), blue grama (*Bouteloua gracilis*), Japanese brome (*Bromus arvensis*), and buffalograss (*Bouteloua dactyloides*). Free-choice mineral and salt were available throughout the study. Dried distiller's grains with solubles originated from a single location and were stored in bulk for use during the study (Table 1). Soybean meal and ground sorghum grain were also procured from single sources and were mixed on site before each feeding. The relative proportions were 73.6% soybean meal and 26.4% sorghum grain (Table 1).

Heifers were stratified by age, body weight and body condition score, and assigned randomly to one of eight 38.3 acre pastures (n = 4 pastures/supplement treatment). Supplement feeding levels were designed to meet crude protein requirements of 660-lb growing calves with a targeted ADG of 2.00 lb. Supplements consisted of 3.64 lb DM dry distillers grain (DDG; supplying 1.26 lb CP/d) or 3.02 lb DM soybean meal and ground sorghum grain (SBM-S; supplying 1.23 lb CP/d). Supplement was delivered daily at 0930 h into a bunk for consumption. Heifers were allotted 28.0 inches of linear bunk space/head.

Data Collection

Range forage samples (n = 48) were collected from 6 sites in each 38.3 acre pasture before initiation of the trial and analyzed for nutrient content. Weekly, approximately 2.2 lb of DDG and SBM-S were collected at delivery and analyzed for DM, CP, NDF, ADF, Ca, P, and S. Energy values were calculated according to NRC.

Treatments were administered from January 15 to April 8. Body condition scores were assigned by two independent, qualified observers using a 9-point scale (1= extremely emaciated, 9 = extremely obese) on 1/15 and 4/8; body weights were also measured at those times.

Puberty Determination

Blood samples were collected via jugular venipuncture 10 d before and on the day ovulation synchronization was initiated. Samples were analyzed for concentration of progesterone (P4). Blood collected on the 2 sampling dates was used to verify the presence of a functional corpus luteum (when concentrations of P4 exceeded 1 ng/mL). If either sample contained P4 >1 ng/mL (typical of heifers that have attained puberty and in the luteal phase of the estrous cycle), heifers were assumed to be pubertal before the onset of ovulation synchronization treatment. If P4 concentrations in both samples were <1 ng/mL, heifers were considered to be pre-pubertal.

Pregnancy Determination

Thirty-five days after AI, the first service conception rate (FSCR) was determined by ultrasound. A positive pregnancy outcome required the presence of uterine fluid and an embryo with a heartbeat. Final pregnancy rate (PR) was determined 35 days after the end of the breeding season with ultrasound.

Results and Discussion

Initial body weight and body condition score were not different ($P \geq 0.29$) between treatments (Table 2). Final body weight and body condition score also did not differ ($P \geq 0.55$) between treatments: moreover, rates of body weight change and body condition score change were not different ($P > 0.30$) between treatments. Under the conditions of our study, developing replacement heifers on dormant rangeland with supplemental dry distillers grain was an acceptable management strategy.

These observations agree with previous research where ruminants were supplemented high-rumen undegradable feedstuffs while consuming low-quality forages. Previous researchers have also demonstrated the importance of rumen degradable protein supplementation to cattle consuming low quality tallgrass-prairie hay by infusing with casein (a highly degradable protein) ruminally; cattle that were infused with casein postruminally had roughly half the DMI of ruminally infused cattle. When examining the ruminal degradable protein requirements of steers consuming low-quality (4.3% CP) sorghum hay, previous researchers have reported that the rumen degradable protein requirement may be as low as 0.082% of body weight, suggesting only a small amount of ruminal degradable protein may be required to sustain microbial populations for cattle grazing low-quality forage. Based on those findings, when dry distillers grain is fed at the proper level, its ruminal degradable protein fraction (approximately 45% of CP) should provide adequate N to the rumen to sustain the microbial populations.

Proportions of heifers pubertal before ovulation synchronization, first service conception rate, and pregnancy rate were not affected ($P > 0.40$) by treatment (Table 3). Previous research at this location reported that heifers developed with wet distillers grains with solubles in place of soybean meal as the primary dietary protein source gained less body weight and had lower proportions of pubertal heifers after 28 and 56 d of feeding; moreover, fewer wet distillers grain-supplemented heifers were pubertal at those times. Conversely, in that previous study, the proportion of pubertal heifers was not different prior to ovulation synchronization, nor was FSCR or PR. Thus, heifers in both studies achieved sufficient growth and body condition score to initiate puberty by consuming either distillers grains or soybean meal.

Implications

Dried distillers grains with solubles may be utilized as an alternative to a mixture of soybean meal and ground sorghum grain without adversely affecting growth or reproductive performance of replacement heifers grazing low-quality dormant native range.

Table 1. Nutrient composition[1] (DM basis) of native range, dried distiller's grains with solubles (DDG), and a mixture of soybean meal and ground sorghum grain (SBM-S)

Item	Native Range	DDG[2]	SBM-S[3]
DM, %	87.3	88.4	87.7
CP, %	4.4	32.7	42.1
NE_m[4], Mcal/kg	0.99	1.98	1.98
NDF, %	71.3	29.7	8.6
ADF, %	46.8	18.7	7.0
Calcium, %	0.33	0.09	0.33
Phosphorus, %	0.09	0.82	0.59
Sulfur, %	0.08	0.80	0.35

[1]Analysis conducted by SDK Laboratories, Hutchinson, KS.
[2]DDG: dried distillers grain plus solubles.
[3]SBM-S: 73.6 % soybean meal and 26.4% sorghum grain, DM basis.
[4]Calculated according to NRC (2000).

Table 2. Growth performance of beef replacement heifers supplemented with dried distillers grains with solubles (DDG) or a mixture of soybean meal and ground sorghum grain (SBM-S)

	Supplement			
Item	DDG[1]	SBM-S[2]	SEM	*P*-value
Number of heifers	44	44		
Initial BW, lb	589.1	575.0	18.96	0.29
Final BW, lb	690.0	685.0	22.31	0.68
BW change, lb	101.0	110.0	7.89	0.17
ADG, lb	1.32	1.32	0.09	0.17
Initial body condition score[3]	5.0	5.0	0.03	0.92
Final body condition score[3]	5.8	5.8	0.06	0.55
Body condition score change	0.8	0.8	0.06	0.53

[1]DDG: dried distillers grains with solubles.
[2]SBM-S: 73.6 % soybean meal and 26.4% ground sorghum grain, DM basis.
[3]Scale of 1 to 9; 1 = extremely emaciated, 9 = extremely obese.

Table 3. Reproductive performance of beef replacement heifers supplemented with dried distillers grains with solubles (DDG) or a mixture of soybean meal and ground sorghum grain (SBM-S)

	Supplement		
Item	DDG[1]	SBM-S[2]	*P*-value
Estrual heifers, %	18.2	11.6	0.40
FSCR[3], %	68.2	74.4	0.52
PR[4], %	100.0	86.0	0.97

[1]DDG: dried distillers grains with solubles.
[2]SBM-S: 73.6% soybean meal and 26.4% ground sorghum grain, DM basis.
[3]FSCR: First service conception rate determined 35 d after AI.
[4]PR: Final pregnancy rate determined 35 d after removal of bulls.