Effects of Frequency of Protein Supplementation on Performance by Beef Calves Grazing Dormant Native Range

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Introduction

Stocker calves that graze forages before entering a feedlot account for more than 75% of the beef calves raised in the United States each year. A large proportion of those will be calves born in the spring and weaned in the fall. Modest growth rates are expected when the quality of fall and winter forages is poor. Growing calves in confinement systems during fall and winter typically allows for greater average daily gain (ADG) than grazing low-quality forages; however, modest overall costs associated with grazing perennial, dormant forages may be competitive during times when feed prices are relatively high.

Providing supplemental protein to beef cows grazing dormant, warm-season, native forages (i.e., ≤ 6% crude protein [CP]) has been demonstrated to increase body condition score (BCS), body weight (BW), improve dry matter digestibility (DMD), and forage dry matter intake (DMI). Furthermore, beef cows grazing low-quality forages and supplemented with protein either daily, every third day, or every sixth day had similar BW and BCS.

Reducing the frequency of supplement delivery can reduce labor costs and equipment depreciation without negatively affecting animal performance; however, this practice has variable success when used with growing beef cattle. In previous research, steers supplemented with cottonseed cake 3 times weekly had similar BW gain during winter compared to steers supplemented daily. Conversely, in another study, steers grazing winter range and supplemented with dried distillers grain daily had greater ADG than steers supplemented 3 times weekly. Therefore, the objective of this study was to evaluate the performance of young, lightweight stocker calves grazing dormant, native tallgrass pastures and supplemented with protein either daily or 3 times weekly throughout the winter.

Experimental Procedures

Angus × Hereford steer and heifer calves (n = 233; initial BW = 408 ± 61.9 lb; initial age = 162 ± 21 d) originating from the commercial cow-calf herd at Kansas State Uni-

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versity in Manhattan, KS, were used in our study. At approximately 60 d of age, male calves were surgically castrated; all calves were vaccinated against clostridial diseases (Ultrabac 7; Pfizer Animal Health, Exton, PA) at that time, and, where applicable, surgical dehorning was performed. Following weaning in October, calves were confined to a single, dormant, native tallgrass pasture at the Kansas State University Commercial Cow-Calf Unit and were assigned randomly to 1 of 2 treatments related to protein-supplementation frequency: daily (7×) or thrice weekly (3×).

Upon separation from their dams, calves were weighed individually and given initial vaccinations against viral respiratory pathogens (Bovi-Shield Gold 5; Pfizer Animal Health, Exton, PA) and clostridial pathogens (Ultrabac 7; Pfizer Animal Health, Exton, PA). Calves were also given an injection of trace minerals (Multimin 90; Multimin USA Inc., Fort Collins, CO), and treated for internal and external parasites (Dectomax Injectable; Zoetis Inc., Kalamazoo, MI). In addition, steer calves were given a growth-promoting implant (Ralgro; Intervet Inc., Merck Animal Health, Summit, NJ) at that time. Calves were re-vaccinated against viral respiratory pathogens and clostridial pathogens 14 d after maternal separation.

Immediately following separation from dams, calves were confined to a single earth-floor pen (minimum area = 215 ft^2/calf) and allowed ad libitum access to native tall-grass prairie hay (88.9% DM, 8.71% CP) via 6 ring feeders (diameter = 9.8 ft) for 4 d. Calves were released into the pasture designated for the study on the afternoon of d 4. The previously non-grazed, burned, native tallgrass pasture (321 acres) provided continual access to surface water and was stocked at 1.38 acres/calf for the duration of the study.

Pasture forage quality was estimated by clipping all plant material from within randomly-placed sampling frames (2.69 ft^2; n = 2/pasture) at a height of 0.4 inches on 10/03, 10/31, 11/28, 01/02, 01/28, and 03/09. Samples were composited by sampling date at the conclusion of the experiment and submitted to a commercial laboratory (SDK Laboratories, Hutchinson, KS) for analysis of DM, CP, NDF, and ADF. Nutrient composition was fairly consistent over the period of our study (Table 1).

Pelleted sunflower meal (SFM; 93% DM, 32.1% CP), purchased from Archer Daniels Midland in Goodland, KS, was used as the supplemental CP source for our study. All calves were fed 15.4 lb of SFM weekly, with supplementation frequency depending on treatment group. Once released on pasture, calves were sorted daily into either 3× or 7× treatment groups and confined to two separate pens. Both treatments were group-fed in concrete bunks (18 inches of linear bunk space/calf). Calves assigned to 7× were fed 2.2 lb SFM/calf daily (DM basis). Calves assigned to 3× were sorted and confined in a pen daily but were supplemented with 5.1 lb SFM/calf on Monday, Wednesday, and Friday only.

Sunflower meal pellets were delivered at approximately 6-wk intervals during our study in four separate truckloads. Grab samples were collected from each truckload and frozen at -4°F. Samples were composited by weight at the conclusion of the experiment and submitted to a commercial laboratory (SDK Laboratories, Hutchinson, KS) for analysis of DM, OM, CP, NDF, ADF, Ca, and P (Table 2).

Calves were individually weighed at 28-d intervals over the 157-d study (Table 3). To attempt to reduce the influence of gut fill on BW, calves were penned without access to feed for 24 h before BW measurements. Calves were monitored daily for symptoms of respiratory disease and conjunctivitis. Calves with clinical signs of BRD, as judged by animal caretakers, were removed from pastures and evaluated. Calves were assigned a clinical-illness score (scale: 1 to 4; 1 = normal, 4 = moribund), weighed, and assessed for febrile response. Calves with a clinical illness score > 1 and a rectal temperature > 104°F were treated with therapeutic antibiotics according to label directions (first incidence = Baytril, Bayer Animal Health, Shawnee Mission, KS; second incidence = Resflor Gold, Merck Animal Health, Summit, NJ). Calves were evaluated 72 h following treatment and re-treated if clinical signs of BRD persisted. Calves showing signs of conjunctivitis (i.e., pinkeye) were treated using oxytetracycline (LA 200; Zoetis Inc., Kalamazoo, MI). Calves were evaluated 14 d following treatment and re-treated if clinical signs of conjunctivitis persisted.

Results and Discussion

Calf BW was not different ($P \geq 0.31$) between treatments at any time during the study. Likewise, calf BW change over the course of the study was not influenced ($P = 0.49$) by supplementation frequency. Calf ADG was not different ($P \geq 0.22$) between treatments from d 0 to 28, d 29 to 56, d 57 to 91, or d 118 to 157; moreover, ADG from d 0 to 157 was not different ($P = 0.48$) between treatments. For a brief period between d 92 and 117, calves assigned to 7× had greater ($P < 0.01$) ADG than calves assigned to 3×; however, this result was inconsequential to overall ADG. Calf BW changes during our study were modest but typical of winter grazing operations in the tallgrass prairie region of Kansas. Poor forage quality likely limited performance (Table 2).

Dormant-season grazing with calves is common for ranchers in the tallgrass prairie region of Kansas. Calves are purchased in the late fall when seasonal price discounts are relatively high, and then grown at modest rates on dormant, native tallgrass range until spring. From approximately April 15 to July 15, calves then graze actively-growing native tallgrass range and can achieve an ADG that exceeds 2 lb. Although winter BW gains are modest in this system, subsequent summer BW gains are thought to offset poor winter performance.

The contracted price of SFM at the initiation of our study was $235.38/ton; feed cost per calf was estimated at $41.45 for the 157-d period of our study (i.e., 2.4 lb SFM × 157 d × $0.11/lb; as-fed basis). Feed delivery cost for 7× was estimated at $39.25/calf (i.e., 157 d × $0.25/calf), whereas feed delivery cost for 3× was only $16.25/calf for the 157-d period (i.e., 65 d × $0.25/calf).

Implications

Daily protein supplementation did not improve growth performance relative to thrice-weekly protein supplementation when total weekly CP delivery was held constant between treatments. Supplementing CP to stocker calves thrice weekly saved 59% ($23.00/calf) in feed-delivery cost throughout the winter compared with daily CP supplementation.

Table 1. Nutrient composition of range forage

Sampling date	CP, % DM	NDF, % DM	ADF, % DM
October 3	4.4	67.4	46.8
October 31	4.1	69.9	49.6
November 28	3.7	71.2	50.9
January 2	3.6	72.8	51.5
January 28	3.6	73.7	51.9
March 9	3.9	69.1	47.6

Table 2. Nutrient composition of sunflower meal

Nutrient composition	
DM %	93.0
OM, % DM	25.6
CP, % DM	32.1
NDF, % DM	44.2
ADF, % DM	31.3
Ca, % DM	0.37
P, % DM	0.96

Table 3. Post-weaning growth of calves supplemented with sunflower meal (SFM) either daily (7×) or thrice (3×) weekly while grazing dormant native tallgrass range during winter

Item	7×[1]	3×[2]	SEM	*P*-value
Weaning BW, lb	403	410	8.2	0.42
BW on d 28, lb	425	434	8.6	0.31
BW on d 56, lb	443	452	9.5	0.44
BW on d 91, lb	443	452	9.3	0.33
BW on d 117, lb	454	456	9.3	0.84
BW on d 157, lb	465	467	9.3	0.68
BW change 0 to 157 d, lb	59.5	56.4	4.37	0.49
ADG d 0 to 28, lb	0.73	0.82	0.077	0.28
ADG d 29 to 56, lb	0.64	0.60	0.086	0.70
ADG d 57 to 91, lb	0.00	0.02	0.075	0.64
ADG d 92 to 117, lb	0.44	0.15	0.082	< 0.01
ADG d 118 to 157, lb	0.24	0.31	0.042	0.22
ADG d 0 to 157, lb	0.37	0.35	0.029	0.48

[1]Calves were supplemented with 2.2 lb SFM (DM basis) daily for 157 d.
[2]Calves were supplemented with 5.1 lb SFM (DM basis) thrice weekly for 157 d.