DORMANT SEASON PROTEIN SUPPLEMENTATION: HOW OFTEN DO I NEED TO FEED PROTEIN TO MY COWS?

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Impact Statement

Cows consuming low-quality forages (< 7% crude protein) can be supplemented with crude protein as infrequently as once every 6 days and maintain performance similar to daily supplemented individuals.

Introduction

Many cattle in the western United States consume low-quality forage (< 6% crude protein) from late summer through winter; therefore, supplementation with crude protein (**CP**) is necessary to maintain or increase cow weight gain and body condition score (**BCS**; Clanton and Zimmerman, 1970) prior to calving. Crude protein supplementation can be expensive; however, decreasing the frequency of supplementation in one management practice that decreases costs. For example, assuming a livestock producer uses 3 gallons of gas ($1.60/gallon) and 2.5 hours ($6.90/hour) to provide protein supplement to cows grazing rangeland, the costs for providing supplement daily are $662, compared to $221 and $110 for supplementation once every 3 or 6 days, respectively (during a 30 day supplementation period). During a 3 month grazing period, this results in a savings of $1,323 for supplementation once every 3 days, and $1,656 for supplementation once every 6 days. Research has shown that CP supplements can be fed at infrequent intervals to ruminants while maintaining acceptable performance compared to daily supplementation (McIlvain and Shoop, 1962; Huston et al., 1999; Bohnert et al., 2002).

Grazing time has been reported to decrease by 1.5 hours/day for supplemented compared with unsupplemented cows (Krysl and Hess, 1993). However, little research has addressed the affects of SF on livestock distribution and grazing behavior. Multiple researchers have reported that cows supplemented more frequently appeared to anticipate supplementation events more consistently than those supplemented less frequently (McIlvain and Shoop, 1962; Melton and Riggs, 1964; Beaty et al., 1994). However, Huston et al. (1999) reported that cows supplemented infrequently (three times weekly or once weekly) exhibited approximately 33% less variation in supplement intake compared with daily supplemented cows. This observation would indicate that infrequent supplementation would decrease the variation in supplement intake between cows, resulting in less variation in weight and BCS gain within a herd. However, this observation deserves further research in order to further document differences in supplement intake between daily and infrequently supplemented cows.

The objectives of these studies were:

Trial 1: Determine whether infrequent supplementation of low-quality forage with CP would allow for acceptable performance during the 3rd trimester of pregnancy.

Trial 2: Determine whether infrequent supplementation of CP o cows grazing low-quality forage affects cow performance, grazing time, distance traveled, maximum distance from water, cow distribution, dry matter intake, and supplement intake variability during the 1st trimester of pregnancy.

Materials and Methods

Trial 1: Forty-eight pregnant (approximately 200 days) Angus x Hereford cows (1129 lb BW) were stratified by age, BCS (1 = emaciated, 9 = obese), and expected calving date and assigned randomly within stratification to one of four treatments; an unsupplemented control (**CON**) or soybean meal (**SBM**; 55% CP) provided daily (**D**; 1.63 lb), once every 3 days (**3D**; 4.89 lb), or once every 6 days (**6D**; 9.78 lb). Protein supplements were offered D, 3D, or 6D at 8:00 am to provide approximately 0.08% of BW/day of CP (averaged over a 6-day period) until calving. Cows were sorted by treatment and allotted randomly to 1 of 12 pens (four cows/pen; three pens/treatment). A trace mineralized salt mix was available free choice. Cows were provided ad libitum access to low-quality meadow hay (Table 1). The experiment began on January 19, 2000, with experimental diets fed from start date to calving 78 ± 4 days).

Cow body weight (**BW**) and BCS were measured every 14 days until calving and within 24 hours of calving. All weights were obtained following an overnight shrink (16 hours). In addition, calf weights were obtained within 24 hours of birth.

Cow performance data were analyzed as a randomized complete block design using the GLM procedure of SAS (SAS Inst. Inc., Cary, NY). The model included block and treatment. Orthogonal contrasts were used to partition specific treatment effects. Contrast statements included 1) CON vs protein supplementation; and 2) linear effect of supplementation frequency. Response variable included 1) cow weight change; 2) cow BCS change; and 3) calf birth weight.

Trial 2: One hundred-twenty Angus x Hereford cows (1030 lb BW) were used in a 3 x 3 Latin square with one 84-day period in each of 3 years (2000, 2001, and 2002) to evaluate the influence of supplementation frequency (**SF**) on cow performance, grazing time, distance traveled, maximum distance from water, distribution within pasture, dry matter intake, the percentage of supplementation events frequented, and the coefficient of variation (**CV**) of variation for supplement intake. Cows were stratified by age, BCS, and weight before being assigned randomly to one of three pastures (2000 acres/pasture; 40 cows/pasture). Cows were not rotated through the pastures; each cow group remained in the same pasture for all 3 years, and treatments were rotated each year. Between 84-day experimental periods, all cows were managed collectively with the rest of the Experiment Station cow herd. Treatments included an unsupplemented control (**CON**) and cottonseed meal (**CSM**; 43% CP) proved daily (**D**; 2 lb) or once every 6 days (**6D**; 12 lb). Cottonseed meal was provided 10 minutes after an audio cue at approximately 8:00 am for each supplementation event. Approximately 30 inches of trough space was provided per cow. A trace mineralized salt mix was available free choice. Water, mineral/salt, and supplement placement within each pasture was maintained in the same location throughout the experiment.

Experimental periods were 84 days, beginning about August 9 (2 weeks following weaning) and concluding about November 1 of each year. Cow weight and BCS were measured on d 0 and 84. All weights were obtained following an overnight shrink (16 hours). Cow distribution, grazing behavior, and supplement intake behavior were evaluated using global positioning system (**GPS**) collars for 18 days each year (4 cows/treatment/year). Dry matter intake was determined with an intraruminal n-alkane controlled-release device and supplement intake was determined with chromic oxide mixed with cottonseed meal (4 cows/treatment/year).

Cow weight and BCS change, distribution within pasture, dry matter intake, percentage of supplementation events frequented, and CV for supplement intake were analyzed as a 3 x 3 Latin square using the GLM procedure of SAS. The model included treatment, year, and pasture. Orthogonal contrasts, CON vs supplemented treatments and D vs 6D treatments, were used to partition specific treatment effects. Grazing time, distance traveled, and maximum distance from water were averaged by day and year and analyzed used the REPEATED statement with the MIXED procedure of SAS. The model included pasture, year, treatment, day, and treatment x day.

Results and Discussion

Trial 1: Pre- and postcalving (within 14 days and 24 hours of calving, respectively) cow weight and body condition score change were more positive ($P < 0.001$) for supplemented groups than for CON (Table 2). All weight and BCS changes were positive except for postcalving weight change on the CON treatment. The CON cows lost 86 lbs, while the supplemented treatments gained 21 lbs. Precalving weight change exhibited a linear decrease ($P = 0.04$) as supplementation frequency decreased, however, this difference was not evident for postcalving weight change ($P = 0.99$). There was no affect of SF ($P \geq 0.50$) on pre- or postcalving BCS change. Calf birth weights were not affected by supplementation or SF ($P \geq 0.14$). These results indicate that during the 3rd trimester of pregnancy, supplementation of CP to cows consuming low-quality forage increased weight and BCS. Supplementation as infrequently as once every 6 days had no significant affect on cow or calf performance.

Trial 2: Cow weight and BCS change were more positive ($P \leq 0.03$) for supplemented treatments compared with CON (Table 3). Supplemented treatments gained 104 lbs, while the control treatment gained 37 lbs. No weight or BCS differences ($P \geq 0.14$) occurred between D and 6D supplementation treatments. Grazing time was greater ($P = 0.04$) for CON compared with supplemented treatments with no difference ($P = 0.26$) because of SF. Distance traveled, maximum distance from water, cow distribution, and dry matter intake were not affected ($P \geq 0.16$) by CP supplementation of SF. The percentage of supplementation events frequented was not affected ($P = 0.82$) by SF; however, variation in supplement intake decreased by 15% for 6D compared to D. Results suggest that providing CP daily or once every 6 days to cows grazing low-quality forages increases weight and body condition score gain while having no negative affects on pasture utilization and dry matter intake. While there was no difference in the percentage of supplementation events frequented between supplemented treatments, it appears that cows supplemented once every six days consume the targeted level of supplement more effectively than daily supplemented cows.

Conclusions

During the 1st or 3rd trimester of pregnancy, supplementation of CP to cows consuming low-quality forage (< 7% CP) increased weight and body condition score. Supplementation as infrequently as once every 6 days maintained performance similar to daily supplemented individuals. Supplementation once every 3 or 6 days may result in significant cost and labor savings compared with daily supplementation. Additionally, supplementation once every 6 days may result in more of the cows consuming the targeted level of supplement than daily supplementation.

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Table 1. Ingredient and nutrient content of meadow hay, native range, and supplements

	Trial 1		Trial 2	
Item	Meadow Hay	Supplement	Native Range	Supplement
Supplement composition				
Soybean meal, % DM	---	100	---	---
Cottonseed meal, % DM	---	---	---	100
Nutrient composition				
CP, % DM	5	55	7	43
UIP, % DM[a]	19	18	---	---
OM, % DM	92	93	80	---
NDF, % DM	58	9	61	---
ADF, % DM	32	4	38	---

[a]Undegradable intake protein. Estimates are based on in situ degradabilities. Techniques were similar to those described by Mass et al. (1999) and Bohnert et al. (1998) for meadow hay and supplements, respectively.

Table 2: Influence of protein supplementation frequency on cows consuming meadow hay in the 3rd trimester: Performance and calf birth weight (Trial 1)

	Treatment[a]					*P*-value[c]	
Item	CON	D	3D	6D	SEM[b]	Con vs Supp.	L SF
Supplement DMI lb/d[d]	0.0	1.63	1.63	1.63			
Initial weight, lb	1149	1133	1133	1127			
Initial body condition score	5.06	5.00	4.98	4.96			
Weight change, lb							
Precalving[e]	4	126	110	84	9	<0.001	0.04
Postcalving[f]	-86	18	37	7	13	<0.001	0.99
Body condition score change							
Precalving[e]	0.21	0.79	0.77	0.73	0.08	<0.001	0.90
Postcalving[f]	0.12	0.65	0.56	0.50	0.09	<0.001	0.50
Calf birth weight, lb	86	84	88	82	2	0.60	0.14

[a]CON = control; D = daily soybean meal supplementation; 3D = soybean meal supplemented every 3rd d; 6D = soybean meal supplemented every 6th d.
[b]n = 4.
[c]Con vs supp. = control vs supplemented treatments; L SF = linear effect of supplementation frequency.
[d]D received 1.63 lb daily; 3D received 4.89 lb every 3rd d; 6D received 9.78 lb every 6th d.
[e]Within 14 d of calving.
[f]Within 24 h after calving.

Table 3: Influence of protein supplementation frequency on cows grazing native range in the 1st trimester: Performance, behavior, DMI, harvest efficiency, and supplement intake variability (Trial 2)

	Treatment[a]				*P*-value[c]	
Item	CON	D	6D	SEM[b]	Con vs Supp.	D vs 6D
Initial BW, lb	1036	1025	1032	---	---	---
BW change, lb	37	112	95	4	0.01	0.14
Initial body condition score	4.67	4.63	4.67	---	---	---
Body condition score change	0.01	0.45	0.32	0.06	0.03	0.24
Grazing time, h/d	9.57	7.08	7.87	0.36	0.04	0.26
Distance traveled, yd/d	6471	6368	6456	175	0.81	0.76
Maximum distance from water, yd/d	2091	2099	1925	115	0.63	0.40
Distribution, %[d]	70	69	67	2	0.42	0.40
Dry matter intake, % of BW	2.49	2.16	1.86	0.18	0.16	0.36
Supplementation events frequented, %	---	66	70	12	---	0.82
CV for supplement intake,%[e]	---	36	21	7	---	0.22

[a]CON = control; D = daily soybean meal supplementation; 3D = soybean meal supplemented every 3rd d; 6D = soybean meal supplemented every 6th d.
[b]n = 4.
[c]Con vs supp. = control vs supplemented treatments; D vs 6D = daily vs once every 6 d supplementation.
[d]Distribution = percentage of acres occupied/pasture/year.
[e]CV for supplement intake = coefficient of variation for supplement intake.