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## EFFECTS OF FREQUENCY OF SUPPLEMENTATION ON THE INTAKE AND DIGESTION OF LOW-QUALITY FORAGE BY BEEF STEERS

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### Summary

A 43% CP (dry basis) supplement was fed to 16 ruminally fistulated steers on 2, 3, 5, or 7 days a week. Supplement was offered at .36% BW (dry basis) daily for steers that received supplement every day. For other treatments, the same amount of supplement was split equally among supplementation events. Forage intake and digestibility increased with increasing supplementation frequency. However, the difference in forage intake tended (cubic,  $P=.07$ ) to be most prominent for the two extremes; the 3- and 5-days-a-week treatments tended to be similar. Forage intake for steers supplemented on 2 days a week decreased on the days when they were supplemented. Although forage utilization may improve with increasing frequency of supplementation, the impact on performance is likely to be small unless differences in frequency of supplementation are extreme.

(Key Words: Steers, Forage, Intake, Digestion, Supplementation Frequency.)

### Introduction

Supplementing low-quality forages with protein, particularly highly degradable protein, improves performance. Producers with sufficient time and labor frequently supplement daily. Unfortunately, time and labor constraints in some cow/calf operations make such frequent supplementation infeasible. If effective, less frequent supplementation would be an advantage where time and labor are scarce. A previous study at Kansas State University revealed that daily supplementation resulted in a slight

improvement in digestible diet intake over three-times-weekly supplementation. Our objective was to see the effects of an array of supplementation frequencies on forage intake, digestion, and selected ruminal fermentation characteristics.

### Experimental Procedures

Sixteen ruminally fistulated Hereford  $\times$  Angus steers (avg. BW=565 lb) were blocked by weight and assigned randomly to receive a 43% crude protein (CP) supplement 2 (Tuesday and Friday); 3 (Monday, Wednesday, and Friday); 5 (Monday-Friday); and 7 days a week.

Each steer was offered tallgrass-prairie hay (4.8% CP; 73.5% neutral detergent fiber, NDF) at 130% of the average voluntary intake for the preceding 5-day period. The amount of supplement fed was similar to that provided to grazing beef cows in a companion trial (.36% BW per day, dry basis).

All treatments received the same amount of supplement on a weekly basis, but the weekly allotments were divided into equal portions fed at the different frequencies. For instance, steers supplemented on 2 days a week received their total weekly allotment of supplement in two portions.

Forage intake and digestion were determined in a 7-day intake and total fecal collection period following a 14-day adaptation period. Following the fecal collection pe-

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riod, two separate fermentation profiles were conducted; one on a day when only the steers that received supplement every day were supplemented and the other on a day when all steers were supplemented. Ruminal fluid was sampled just before feeding and at 3, 6, 9, and 12 hours postfeeding.

## Results and Discussions

Forage organic matter (OM) intake, total OM intake, and total digestible OM intake increased (linear,  $P < .01$ ) as frequency of supplementation increased (Table 1). However, the response to increasing frequency tended to be cubic ( $P = .07$ ) for forage OM intake and total OM intake.

A large difference in intakes occurred for the daily versus twice weekly supplementation. The three- and five-times-weekly groups were similar to each other and intermediate to the extremes. Digestibilities of OM and NDF also increased ( $P = .02$ ) as supplementation frequency increased, with some evidence of a more substantive difference for the two highest frequencies (cubic,  $P = .05$  and  $P = .12$ , respectively).

A treatment  $\times$  day interaction ( $P < .01$ ) was observed for daily DM intake. Steers supplemented on 2 days a week had a sharp decrease in forage DM intake on days when they received supplement.

Ruminal pH increased ( $P = .05$ ) as frequency of supplementation increased (Table 2), but the differences were small. All ru-

minal pH's were well within the range acceptable for uninhibited fiber digestion.

On the day when only the daily treatment group was supplemented, the supplemented steers had higher ruminal ammonia concentrations than steers that were not supplemented (quadratic,  $P = .01$ ). Ruminal ammonia decreased linearly ( $P = .01$ ) with frequency of supplementation on the day that all steers received supplement. Clearly, this was because steers supplemented less frequently received more supplement each time. Interestingly, steers supplemented on 2 days a week had their peak ruminal ammonia concentration and the lowest pH later (6 hours after feeding) than other groups on the day that all groups were supplemented. This may indicate microbial adaptation in response to receiving large amounts of supplemental protein only twice per week.

In addition, on days when they were supplemented, steers supplemented twice per week had a slower rate of liquid passage (4.75 %/hr) than those supplemented 3 (6.72 %/hr), 5 (6.15 %/hr), or 7 (6.61 %/hr) days per week. No significant differences in liquid passage rates occurred on the day when only 7-day steers received supplement.

Increasing supplementation frequency likely will maximize the proportion of nutrients derived from low-quality forage. However, our treatment differences suggest that only with extreme differences in supplementation frequency (twice weekly vs. daily) will performance be impacted.

**Table 1. Influence of Frequency of Supplementation on Intake and Digestion by Beef Steers**

Item	Treatment <sup>a</sup>				SEM	Contrasts (P-Values) <sup>b</sup>		
	2-day	3-day	5-day	7-day		L	Q	C
Forage OM intake								
g/kg BW <sup>.75</sup>	63.2	74.2	70.7	84.0	3.71	<.01	.74	.07
% BW	1.58	1.86	1.77	2.10	.093	<.01	.70	.07
Total OM intake								
g/kg BW <sup>.75</sup>	75.9	86.9	83.3	96.7	3.71	<.01	.72	.07
% BW	1.90	2.17	2.08	2.41	.092	<.01	.70	.07
Digestible OM intake								
g/kg BW <sup>.75</sup>	40.6	45.5	46.1	53.5	1.90	<.01	.68	.15
% BW	1.01	1.14	1.15	1.34	.048	<.01	.66	.16
OM digestion, %	53.5	52.5	55.3	55.4	.62	.01	.96	.05
NDF digestion, %	51.0	50.4	53.7	53.5	.86	.02	.55	.12

<sup>a</sup>Treatment: The number of days per week where supplement was offered: 2-day=2 days a week; 3-day=3 days a week; 5-day=5 days a week; 7-day=7 days a week.

<sup>b</sup>Contrasts: L=Linear; Q=Quadratic; C=Cubic.

**Table 2. Influence of Frequency of Supplementation on Ruminal Fermentation Characteristics on Supplemented and Unsupplemented Days**

Item	Treatment <sup>a</sup>				SEM	Contrasts (P-Values) <sup>b</sup>		
	2-day	3-day	5-day	7-day		L	Q	C
pH								
only 7-day group supplemented	6.69	6.75	6.70	6.56	.052	.05	.13	.62
all groups supplemented	6.48	6.53	6.59	6.64	.033	<.01	.57	.81
Ammonia, mM								
only 7-day group supplemented	.20	.12	.16	.57	.080	<.01	.01	.86
all groups supplemented	1.18	.91	1.06	.53	.146	.01	.33	.10

<sup>a</sup>Treatment: The number of days per week where supplement was offered: 2-day=2 days a week; 3 day=3 days a week; 5-day=5 days a week; 7-day=7 days a week.

<sup>b</sup>Contrasts: L=Linear; Q=Quadratic; C=Cubic.