

Effect of Ruminant Protein Degradability and Supplementation Interval on Nutrient Utilization and Performance of Ruminants Consuming Low-quality Forage

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Introduction

Many cattle in the western United States consume low-quality forage (<6 percent crude protein [CP]) from late summer through winter. Supplementation with protein increases cow weight gain and body condition score, forage intake and digestibility, and can improve reproductive performance. However, winter supplementation can be very expensive, with winter-feed costs in the Intermountain West often totaling \$100–200 per cow per year. In addition to that, winter supplementation includes other expenses such as the labor and fuel associated with supplement delivery.

Decreasing the frequency of protein supplementation is one management practice that decreases labor and fuel costs. In addition, research has shown that protein can be supplemented at infrequent intervals and cows still maintain acceptable levels of performance; however, data are limited comparing the effects of rumen degradable protein (DIP; broken down within the rumen by ruminal microorganisms) and rumen undegradable protein (UIP; “escapes” ruminal degradation and enters the small intestine for digestion) supplemented at infrequent intervals. Consequently, three experiments were conducted to evaluate the affect of rumen CP degradability and supplementation frequency on ruminant performance and nutrient utilization.

Experimental Protocol

Seven steers in Experiment 1, 7 wethers in Experiment 2, and 84 pregnant (approximately 200 days) Angus × Hereford cows in Experiment 3 were provided 5 percent CP meadow hay and allotted to one of seven treatments: no supplementation or provision of a DIP or UIP supplement daily, once every 3 days, or once every 6 days. All supplemented treatments provided the same quantity of supplemental protein over a 6-day period. In other words, the once every 3 and 6 days treatments received 3 and 6 times the quantity of supplement on the day of supplementation, respectively, compared with the daily supplemented treatments. The DIP supplement was soybean meal and the UIP supplement was a mixture of soybean meal and blood meal.

Results and Discussion

Experiment 1 was conducted to determine the effects of rumen CP degradability and supplementation frequency on nutrient intake and digestibility by steers consuming low-quality forage. Results indicated that protein supplementation increased nutrient intake and digestibility. There was no difference between DIP and UIP treatments or supplementation intervals. These data suggest that livestock producers can provide a protein supplement as infrequently as once

every 6 days to cattle consuming low-quality forage without negatively affecting nutrient intake and digestibility compared with daily supplementation.

Experiment 2 was conducted to determine the effect of rumen CP degradability and supplementation frequency on efficiency of protein use and nitrogen excretion by wethers consuming meadow hay. Protein intake and the quantity of protein digested that was incorporated into body tissues was increased with CP supplementation. As in Experiment 1, no differences were noted between DIP and UIP treatments or supplementation interval. Also, no difference was noted between DIP and UIP treatments, or between supplementation intervals, in the quantity of nitrogen excreted in urine or feces. These data indicate that infrequent supplementation of CP to ruminants consuming low-quality forage can result in efficiency of protein use (maintenance of body protein status), even when provided as infrequently as once every 6 days.

Experiment 3 was conducted to evaluate cow performance during the last third of gestation, as affected by rumen CP degradability and supplementation interval. Similar to the previous results, CP supplementation improved cow weight and body condition score at calving compared with no supplemental protein (Fig.1). Additionally,

no differences were noted regarding CP source or supplementation frequency. This experiment illustrated that nutrient intake and nutrient utilization can be maintained in a production setting with infrequent supplementation of CP to ruminants consuming low-quality forage.

Management Implications

Infrequent supplementation of sources of natural protein (soybean meal, cottonseed meal, blood meal, etc.) to ruminants consuming low-quality forage is an acceptable management alternative to daily supplementation. In addition to similar nutrient utilization and performance by ruminants, infrequent supplementation can reduce labor and fuel costs by as much as 83 percent compared with daily supplementation (Table 1). However, producers should consider the use of an Extension agent, specialist, or nutritional consultant when designing an infrequent supplementation regime, because certain sources of supplemental CP (urea-containing supplements, for example) can cause toxicity concerns and may potentially result in death of livestock if not managed properly.

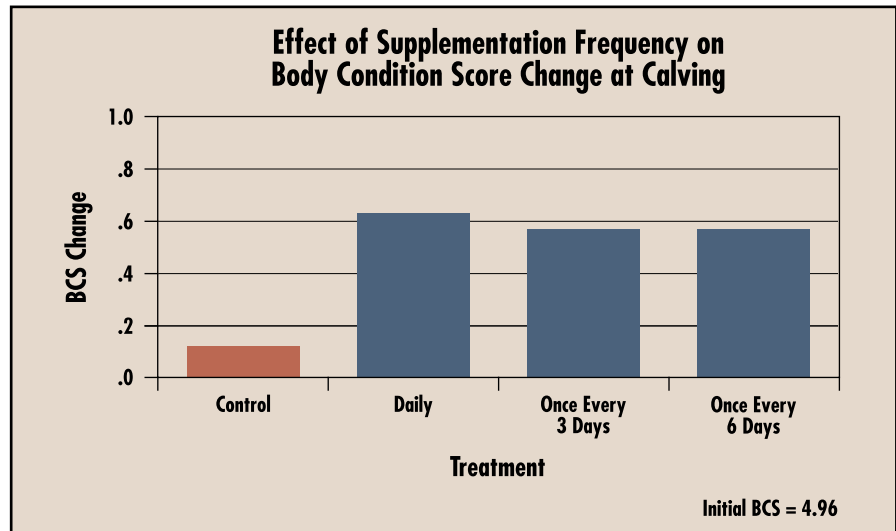


Figure 1. The effect of CP supplementation frequency on cow performance.

Table 1. Economics of infrequent supplementation over a 30-day period.

Item	Supplementation interval			
	Daily	2 days	3 days	6 days
Fuel cost (\$) ^a	225.00	112.50	75.00	37.50
Labor cost (\$) ^b	543.75	271.88	181.25	90.62
Total costs	768.75	384.38	256.25	128.12
Cost reduction	0	50%	67%	83%
Benefit (\$)	0	384.38	517.50	640.63

^a Fuel cost calculated as 3 gallons/supplementation day at \$2.50/gallon.

^b Labor cost calculated as 2.5 hours/supplementation day at \$7.25/hour.