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Abstract

Two trials were conducted to evaluate effects of protein versus energy level in milo/soybean meal supplements on intake and utilization of dormant, bluestem forage. Forage dry matter intake and utilization of dormant bluestem forage appears to increase at higher levels of supplemental protein. Increased supplemental energy may be associated with depressed intake and utilization, particularly when supplements are low in protein.

Keywords

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Influence of Supplemental Protein Versus Energy Level on Intake, Fill, Passage, Digestibility, and Fermentation Characteristics of Beef Steers Consuming Dormant Bluestem Range Forage

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Summary

Two trials were conducted to evaluate effects of protein versus energy level in milo/soybean meal supplements on intake and utilization of dormant, bluestem forage. Forage dry matter intake and utilization of dormant bluestem forage appears to increase at higher levels of supplemental protein. Increased supplemental energy may be associated with depressed intake and utilization, particularly when supplements are low in protein.

Introduction

Previous research at Kansas State University suggests that winter supplementation with moderate to high crude protein (CP) supplements is preferable because of their ability to stimulate forage intake and utilization. Supplements low in CP (e.g., cereal grains) tended to promote lower levels of forage intake and significantly depressed fiber digestibility. However, low CP supplements are frequently much cheaper. The question exists whether feeding increased quantities of low CP supplements (i.e., increasing the level of energy offered) would sufficiently offset some of their negative impacts on forage utilization. Therefore, our study was designed to evaluate how varying the levels of protein and energy in winter supplements would affect the intake and utilization of dormant, bluestem range.

Experimental Procedures

In two trials, 16 ruminally cannulated steers were randomly assigned within weight group (avg. = 732 and 884 lb. for trials 1 and 2, respectively) to each of four treatments. Treatments consisted of supplementing steers with soybean meal (SBM)/milo mixtures that were combinations of various protein and energy levels (Figure 9.1). Crude protein (CP) concentrations in supplements and the level at which they were fed were: 1) 22% CP fed at .3% of body weight (SW); 2) 11% CP fed at .6% BW; 3) 44% CP fed at .3% BW; and 4) 22% CP fed at .6% BW. Protein concentration was altered by varying the quantities of SBM and milo. Because SBM and milo are nearly equivalent in energy value, level of supplemental energy provided was varied by feeding different quantities of supplement. Dormant prairie hay was provided at 130% of the previous 5-day average intake.

Trial 1 was a 28-day digestion study with 14-day adaptation, 7-day intake, and 7-day fecal collection periods.

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Crude Protein (CP) Level in Supplements	Metabolizable Energy (ME) Level in Supplements: LOW	Metabolizable Energy (ME) Level in Supplements: HIGH
LOW	.3 g CP/lb BW 4.2 Kcal ME/lb BW	.3g CP/lb BW 8.4 Kcal ME/lb BW
HIGH	.6 g CP/lb BW 4.2 Kcal ME/lb BW	.6 g CP/lb BW 8.4 Kcal ME/lb BW

Figure 9.1. Treatment Arrangement

Rumen fill values were obtained by complete ruminal evacuations, and subsamples of solid digesta were collected. The alkaline peroxide lignin component of the subsamples was used to describe fill and passage of an indigestible component of the diet. On day 28, CoEDTA was given intraruminally, and rumen samples collected at 0, 3, 6, 9, 12, and 24 hours after feeding to measure liquid volume and passage.

Trial 2 was a 26-day study consisting of 18-day adaption, 5-day intake, and 2-day ruminal sampling periods. Procedures were similar to those of trial 1, except fecal collections were not made. On day 26, CoEDTA was given intraruminally, and rumen samples were taken at 0, 3, 6, 9, 12 and 24 hours after feeding to measure liquid volume, and passage.

Results and **Discussion**

In trial 1, influence of protein level on forage dry matter intake (DMI) depended on the corresponding energy level (Table 9.1). Increased supplemental energy at the low protein level depressed forage DMI. Influence of protein level on total diet dry matter digestibility (DMD) was also dependent on the corresponding energy level. Increased supplemental energy at the low protein level had a positive influence on total diet DMD. Increased DMD in this case may be explained by the reduction in forage DMI and the increased consumption of the highly digestible supplement. However, forage fiber digestibility (e.g., acid detergent fiber) was increased only by increasing supplemental protein levels. Increased supplemental energy at the low level of protein depressed forage fiber digestibility. In trial 2, forage DMI increased in response to high supplemental protein levels but tended to decrease with increased energy levels (Table 9.2). Liquid volume and flow increased with higher protein levels.

Results from both trials indicated providing supplemental protein to cattle grazing dormant winter rangelands increases forage intake. Increasing the level of supplemental energy at low levels of crude protein appears to decrease intake and forage digestibility. At higher levels of supplemental protein, this effect is not as dramatic.

Table 9.1. Influence of Supplemental Protein versus Energy Level on the Intake, Digestibility, Fill, and Passage for Cattle Consuming Dormant Bluestem Range-Forage (Trial 1)

Energy Level[1]	.3 g CP/lb BW 4.2	.3 g CP/lb BW 8.4	.6 g CP/lb BW 4.2	.6 g CP/lb BW 8.4	SE[2]
Forage DMI[2], % BW	1.21	.82	1.07	1.15	.05
Supplement DMI, % BW	.30	.60	.30	.60	---
TOTAL DMI, % BW	1.51	1.42	1.37	1.75	.06
TOTAL DMD, %[b c]	39.1	46.1	45.9	47.5	3.5
ADF Digestibility, %[b]	31.9	24.3	36.1	34.8	10.6
Dry Matter Fill, lb	9.8	9.7	9.9	9.4	2.9
APL Fill, lb	.6	.6	.6	.6	.7
APL Passage, %/hr	4.0	4.9	4.2	5.4	.7
Liquid Volume, 1	43.3	36.8	43.6	48.8	16.2
Dilution Rate, %/hr	5.9	5.5	4.8	5.6	.3
Liquid Flow, l/hr	2.5	2.0	2.1	2.7	.2

[1] Energy Level = kcal ME/lb BW

[2] SE = Standard Error

[3] Dry matter intake

[4] Alkaline peroxide lignin

[a] response due to protein*energy interaction (P<.10)

[b] response due to protein level (P<.10)

[c] response due to energy level (P<.10)

Table 9.2. Influence of Supplemental Protein versus Energy Level on the Intake, Fill, Liquid Volume, and Passage for Cattle Consuming Dormant Bluestem Range Forage (Trial 2)

Energy Level	.3 g CP/lb BW 4.2	.3 g CP/lb BW 8.4	.6 g CP/lb BW 4.2	.6 g CP/lb BW 8.4	SE
Forage DMI[1], % BW[a]	1.30	1.17	1.71	1.49	.31
Supplement DMI, % BW	.30	.60	.30	.60	---
Total DMI, % BW[a]	1.60	1.77	2.01	2.09	.34
Dry Matter Fill, lb[a]	23.3	23.2	26.6	26.5	3.5
Liquid Volume, 1	62.7	63.1	76.4	69.0	4.1
Dilution Rate, %/hr[a]	5.3	5.6	5.4	5.6	.1
Liquid Flow, l/hr	3.3	3.6	4.1	3.8	.1

[1] Dry matter intake.

[a] response due to protein level (P<.10).