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METHIONINE ADDITION TO A UREA-GRAIN SUPPLEMENT FOR COWS GRAZING DORMANT WINTER RANGE

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Summary

A 2-year grazing study involving 103 mature pregnant Simmental x Angus cows grazing dormant winter range was conducted to determine the effects of methionine addition to a urea-grain supplement on forage intake and digestibility and on cow performance. Four protein supplements designed to supply .8 lb crude protein per head daily were fed from mid-November to mid-February. Supplements contained (1) urea (CON), (2) urea plus methionine (MET), (3) urea plus sodium sulfate (SUL) and (4) soybean meal (SBM). Twice during the second winter (late November and late January), cows were administered controlled release chromic oxide boluses and fecal samples were collected to determine grass intake by the fecal output/indigestibility ratio technique. Organic matter intake (OMI) and digestibility (OMD) were higher in November than January. No differences in OMI between supplemental treatments were detected. A treatment x grazing period interaction was detected for OMD. In late January and November, OMD was higher for cows fed SBM than cows fed supplements containing urea. In late January, OMD was lower for MET compared to SUL fed cows. Cows supplemented with MET gained less weight and body condition over each winter grazing period than SUL fed cows. Methionine addition to a urea-grain supplement did not improve digestibility or intake of range forage or cow weight gains.

(Key Words: Cow, Methionine, Urea, Range Grass, Digestibility, Intake.)

Introduction

Most research would indicate that nonprotein nitrogen supplementation of cattle consuming mature low protein forages results in decreased animal performance compared to natural protein sources. Addition of sulfur or methionine (a sulfur containing amino acid) has been shown to increase urea utilization in the rumen of cattle fed nonprotein nitrogen supplements while consuming low quality forages. As a result of increased microbial activity, diet digestibility is increased which may result in an increase in forage intake and(or) animal weight gains. The objective of this study was to determine if the value of urea supplements for cows grazing dormant winter range could be improved with the addition of methionine.

Materials and Methods

Mature, pregnant Simmental x Angus cows grazing dormant winter range over two years at the SDSU Range and Livestock Research Station near Cottonwood were fed one of four protein supplements (Table 1) from mid-November to mid-February. Supplements contained urea (CON), methionine and urea (MET), sodium sulfate and urea (SUL) and soybean meal (SBM) and were balanced to provide .8 lb crude protein/cow each day. Total sulfur supplied by MET and SUL was similar. Chemical composition of daily supplemental intake is listed in Table 2. Cows on each treatment were group fed pelleted (7/8 inch diameter) supplements each morning. For 12 days during the first winter, cows on each treatment were fed equal amounts of mature prairie hay (6% crude protein, 70% NDF, 39% ADF) when snow cover prevented grazing. No hay was fed during the second winter grazing period.

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TABLE 1. COMPOSITION OF SUPPLEMENTS FED TO COWS ON DORMANT WINTER RANGE[a]

	Supplement			
Ingredient	SBM	MET	SUL	CON
Soybean meal	91.4	19.8	19.9	21.4
Corn	3.1	57.4	57.7	59.1
DL-methionine		3.3		
Urea		8.3	8.3	8.3
Sodium sulfate			3.0	
Sodium bentonite	1.7	5.1	5.1	5.1
Liquid molasses	3.4	3.3	3.3	3.3
Potassium chloride		1.6	1.6	1.6
Dicalcium phosphate		1.1	1.1	1.1

[a] Percentage, dry matter basis.

TABLE 2. DAILY NUTRIENT INTAKE FROM SUPPLEMENTS FED TO COWS

	Supplement			
Item	SBM	MET	SUL	CON
Dry matter, lb	1.73	1.92	2.02	1.96
Metabolizable energy, Mcal[a]	2.57	2.59	2.63	2.61
Crude protein, lb	.78	.79	.86	.85
Nonprotein nitrogen, lb	.016	.069	.085	.080
Methionine, lb	.011	.064	.009	.006
Sulfur[b], lb	.008	.015	.017	.004
Calcium, lb	.007	.009	.009	.009
Phosphorus, lb	.011	.010	.010	.011
Potassium, lb	.040	.033	.033	.033

[a] Calculated from NRC feed tables.
[b] Total sulfur.

Initial (mid-November) and final (mid-February) cow weights were averages of two shrunk weights (overnight feed and water removal) taken on consecutive days. Condition scores (1-9, 1 = extremely emaciated) were assigned at the start and end of each winter grazing period by two trained technicians. Cows were bred to Simmental and Angus bulls and calved from mid-March until late April (mean calving date = March 30).

Supplemental treatment groups were randomly allotted to one of four pastures and were rotated across pastures every 2 to 3 weeks. Treatment groups occupied each pasture a similar length of time during the grazing period. During the second winter estimations of range forage availability and utilization were made of the predominant grass species in November (11/20/89) and January (1/6/90). Total biomass and percentage utilization were estimated for each species on 32 plots per pasture. Approximately one-half of those plots were also clipped to calibrate the estimates at each date. Species composition of forage samples collected by esophageally fistulated cows was determined by microhistological analysis[4].

To determine forage intake and digestibility 12 cows/treatment were administered controlled release chromic oxide boluses[5] in late November and again in late January of the second winter grazing period. Seven days after bolus administration fecal grab samples were collected each morning for five consecutive days. Four esophageally fistulated cows were used to collect forage samples during the November and January fecal collection periods. Fecal chromic oxide concentrations, determined using a microdigestion-oxidation procedure and flame atomic absorption spectrophotometry, were used as an external marker to predict fecal output. Forage and feces acid insoluble ash were used as an internal marker to predict organic matter digestibility. Organic matter intake was predicted by the fecal organic matter/organic matter indigestibility ratio.

Supplemental treatment effects on forage intake and digestibility were analyzed in a split-plot design. Treatment effects on animal performance data were analyzed in a completely random design. Least squares means were generated utilizing General Linear Model of the Statistical Analysis System. Treatment differences were obtained by orthogonal contrasts which included (1) MET vs SUL, (2) CON vs MET, SUL and (3) SBM vs MET, SUL, CON.

Results and Discussion

Western wheatgrass comprised 69% of the forage available in November (Table 3). Both vegetation and esophageal samples indicated that 94% of the range grass removed from pastures during the grazing period consisted of western wheatgrass. Later in the grazing period percent fiber and amount of Japanese brome in the selected diet was higher (Table 4).

Fecal organic matter output of cows in late November and late January were similar (Table 5). Organic matter intake and digestible organic matter intake, expressed as lb/day or as a percentage of initial cow body weight, were higher ($P<.01$) in late November compared to late January. The supplemental treatment x grazing period interaction was nonsignificant for fecal organic matter output, organic matter intake and digestible organic matter intake. No differences in fecal organic matter output, organic matter intake or digestible organic matter intake were attributable to supplemental treatments (Table 6).

Organic matter digestibility was higher ($P<.01$) in late November compared to late January (Table 7). The supplement x grazing period interaction was significant ($P<.01$) for OMD. In late November and January, OMD was higher ($P<.01$) for SBM than cows fed urea-containing supplements. In late January, OMD was higher ($P<.01$) for SUL vs MET. The addition of methionine or sulfur to a urea-grain supplement did not increase OMD compared with CON.

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[4]Appreciation expressed to Terry Foppe, Composition Analysis Laboratory, Range Science Department, Colorado State University, Fort Collins, CO, for species identification of esophageal samples.

[5]Captec Chrome, NuFarm Industries, Aukland, New Zealand.

Mature pregnant cows grazing dormant winter range and supplemented with MET gained less weight ($P<.01$) and less body condition ($P=.08$) than SUL (Table 8). Winter weight gains for SBM-fed cows were higher ($P<.01$) compared to cows fed supplements containing urea, and it appears reasonable to assume that this difference is largely due to the depressed performance of MET-fed cows.

These results indicate that methionine addition to a urea-grain supplement did not improve intake or digestibility of mature dormant grasses or performance of cows grazing winter range. It appears that methionine supplementation decreased forage digestibility during the latter part of the grazing period resulting in depressed animal performance.

TABLE 3. FORAGE AVAILABILITY IN LATE NOVEMBER AND UTILIZATION DURING THE WINTER GRAZING PERIOD

	Range grasses			
Item	Western wheatgrass	Japanese brome	Shortgrass mixture[a]	Total
Forage availability				
Lb dry matter/acre	428	163	27	618
Forage utilization				
Lb dry matter/acre	67	1	2	71
% of available forage	16	1	8	12

[a] Undifferentiated mixture of buffalograss and blue grama.

TABLE 4. CHEMICAL AND SPECIES COMPOSITION OF ESOPHAGEAL SAMPLES[a]

	Collection period	
Item	Late November	Late January
Crude protein	6.7	6.8
Acid insoluble ash	9.5	11.4
Neutral detergent fiber	63.4	66.2
Acid detergent fiber	39.8	44.1
Western wheatgrass	96.1	92.4
Japanese brome	2.4	6.2
Other	1.5	1.4

[a] Percentage, organic matter basis.

TABLE 5. FECAL OUTPUT AND INTAKE OF COWS GRAZING DORMANT WINTER RANGE IN LATE NOVEMBER AND LATE JANUARY

Item	Collection period: Late November	Late January	SE
No. of cows	33	27	
Fecal organic matter output, lb/day	8.9	8.2	.4
Organic matter intake, lb/day[a]	18.3	14.5	.9
Organic matter intake, % of initial body weight[a]	1.6	1.3	.1
Digestible organic matter intake, lb/day[a]	9.5	6.4	.4

[a] Late November vs late January (P<.01).

TABLE 6. EFFECT OF SUPPLEMENTATION ON FECAL OUTPUT AND INTAKE OF COWS GRAZING DORMANT WINTER RANGE

	Supplement				
Item	SBM	MET	SUL	CON	SE
No. of cows	18	15	14	13	
Fecal organic matter output, lb/day	8.1	8.4	8.8	9.0	.7
Organic matter intake, lb/day	16.5	15.6	16.7	16.7	1.1
Organic matter intake, % of initial body weight	1.4	1.3	1.4	1.4	.1
Digestible organic matter intake, lb/day	8.6	7.3	8.1	7.7	.7

TABLE 7. EFFECT OF SUPPLEMENTATION ON DIGESTIBILITY OF DORMANT WINTER RANGE[a]

	Supplement				
Item	SBM	MET	SUL	CON	SE
No. of cows/period	12	12	12	12	
Organic matter digestibility, %					
Late November[b]	54.8	50.1	49.4	49.1	.8
Late January[bc]	46.6	39.0	43.3	41.7	.8

[a] Supplement x grazing period (P<.01).
[b] SBM vs MET, SUL, CON (P<.01).
[c] MET vs SUL (P<.01).

TABLE 8. EFFECT OF SUPPLEMENTATION ON PERFORMANCE OF COWS GRAZING DORMANT WINTER RANGE

	Supplement				
Item	SBM	MET	SUL	CON	SE
No. of cows	42	43	43	43	
Mid-November					
Initial weight, lb	1198	1195	1203	1198	15
Initial condition score, 1-9	5.8	5.8	5.9	5.8	.1
Mid-November to mid-February					
Weight change, lb[ab]	112	86	108	102	4.3
Condition score change[c]	.3	.1	.3	.3	.1

[a] MET vs SUL ($P<.01$).
[b] SBM vs MET, SUL, CON ($P<.01$).
[c] MET vs SUL ($P=.08$).