PROTEIN SUPPLEMENTATION OF AMMONIATED WHEAT STRAW: EFFECT ON PERFORMANCE OF BEEF COWS[1]

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Summary

Mature, crossbred beef cows (n = 87 in 1990-91, n = 84 in 1991-1992) were used to determine the effects of protein supplementation to cows fed ammoniated wheat straw during late gestation. Treatments included: 1) Control (C) - no supplement, 2) Low Protein (LP) - 4.5 lb of a 10% crude protein (CP) supplement, 3) Medium Protein (MP) - 4.5 lb of a 20% CP supplement, and 4) High Protein (HP) - 4.5 lb of a 30% CP supplement. Supplementation increased weight gain over controls ($P < .01$). HP cows gained more ($P = .05$) weight than LP-supplemented cows and tended ($P = .11$) to gain more weight than MP-supplemented cows. Supplementation also increased body condition score (BCS, 1-9 scale) over control cows ($P < .01$), but no difference was noted among supplemented groups. From the end of the feeding period until weaning, cows previously supplemented lost more weight ($P < .01$) than controls and exhibited little change in BCS, whereas controls increased BCS by .5 during the same period. Calving dates, calf birth weights, calf weaning weights, calf average daily gain, percent of cows cycling prior to breeding, and percent of cows pregnant did not differ between treatments. Consequently, although additional protein increased weight gain prior to parturition, this response did not impact economically important traits.

(Key Words: Ammoniation, Wheat Straw, Protein Supplementation, Beef Cows.)

Introduction

Wheat straw is abundant in Kansas and has significant usefulness in the rations of dry, gestating cows. Ammoniation of wheat straw usually doubles the nitrogen content and greatly increases fiber digestibility by breaking bonds between hemicellulose and lignin. Prior research at Kansas State University has shown that even though ammoniated wheat straw has adequate CP for a cow in late gestation (10.5% CP versus requirement of 7.8% CP), additional natural protein may be needed because energy is inadequate for the rumen microorganisms to utilize the high level of nonprotein nitrogen. Our purpose was to examine the effects of increasing levels of protein supplementation on the performance of beef cows fed ammoniated wheat straw during late gestation and on their subsequent performance.

Experimental Procedure

Large round bales of wheat straw were stacked in a 3-2-1 pyramid, covered with 6 mil black plastic, sealed at the base with sand, and treated with anhydrous ammonia at the rate of 60 lb per ton (3%, wt/wt) of forage in late summers of 1990 and 1991. The straw was ground to pass through a 3-inch screen in a conventional tub grinder and fed ad libitum to beef cows in the last trimester of pregnancy.

Cows (n = 87 in 1990-91; n = 84 in 1991-92) were randomized by weight, body condition score, age, and breed type and

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assigned to one of four protein supplementation treatments (Table 1).

Cows were weighed and condition scored on two consecutive days after an overnight shrink, at the beginning and end of the feeding period. There were three pens per treatment each year. The feeding periods lasted 84 days in 1990-91 and 60 days in 1991-92 and ended just prior to initiation of calving.

During and after calving, the cows were maintained as one group on native bluestem range and supplemented with 10 lb per head per day of alfalfa hay. Calves were weighed and identified at birth. Two blood samples were drawn from the cows at 10-day intervals in year 1 just prior to the breeding season and assayed for progesterone to determine cyclicity. Calves were weighed and vaccinated, and bull calves were castrated and implanted prior to the grazing season. The cows and calves grazed native bluestem pasture until weaning. Cows were exposed to bulls during the first 60 days of the grazing season.

Results and Discussion

Supplementation of ammoniated wheat straw increased cow weight gain during the feeding period ($P < .001$; Table 2). Cows fed HP gained more ($P < .05$) than LP cows, but there were no significant differences in weight gain between MP and other supplements. Body condition score was also increased by supplementation ($P < .01$), with no differences noted among supplemented groups. Cows on the control diet compensated in weight and condition score changes prior to weaning in the fall. For example, control cows lost 33 lb from the end of the feeding period to weaning, whereas LP-, MP-, and HP-supplemented cows lost an average of 94 lb. Additionally, control cows gained approximately .5 BCS during the same period, whereas supplemented cows showed little change. No differences were noted between treatments in calving dates, calf birth weights, calf weaning weights, calf average daily gain, percent of cows cycling at the beginning of the breeding season, or pregnancy rates.

Although supplementing cows fed ammoniated wheat straw tended to increase weight gain and body condition in late gestation, nonsupplemented cows compensated during the subsequent grazing season, thereby eliminating any economical benefits of supplementation. Based on these results and previous research, protein supplementation to cows fed ammoniated wheat straw may be cost effective only when the weather is severe.

Table 1. Treatments Used in the Evaluation of Protein Supplementation of Beef Cows Fed Ammoniated Wheat Straw in Late Gestation.

Treatment	% Crude protein	Sorghum grain, lb	Soybean meal, lb
Control	--	--	--
Low Protein (LP)	12.0	4.5	--
Medium Protein (MP)	20.1	3.32	1.18
High Protein (HP)	31.7	2.12	2.37

All treatments received .5 lb of mineral supplement formulated to meet the mineral requirements of a beef cow in late gestation.

Table 2. Effects of Protein Supplementation on the Performance of Beef Cows Consuming Ammoniated Wheat Straw

	Treatment				
Item	C	LP	MP	HP	SEM
During Feeding Period[x]					
Wt. gain, lb	72[a]	134[b]	138[bc]	159[c]	9.8
Change in body condition[d]	-.47[a]	0[b]	.11[b]	.09[b]	.09
From End of Feeding Period to Weaning					
Wt. change, lb	-33[a]	-95[b]	-96[b]	-96[b]	13.1
Change in body condition[d]	.51[a]	-.10[b]	-.04[b]	-.04[b]	.11
Calf birth wt., lb	86	86	86	87	2.2
Calf ADG, lb	2.14	2.08	2.05	2.10	.03
Calf weaning wt., lb	550	539	533	548	9.5
Cycling at start of breeding[e]	61	86	76	81	
Pregnant[f], %	95	94	92	100	

[a,b,c]Means within rows with different superscripts differ ($P < .05$).
[d]Body condition score 1-9 (1 = extremely emaciated, 9 = extremely obese).
[e]Data from 1990-91 only.
[f]Determined via calving for 90-91, via rectal palpation at weaning in 91-92.
SEM = Standard Error of the Mean.
[x]84 days in 1990-1991, 60 days in 1991-1992.