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Abstract
Ninety pregnant Angus Hereford cows consuming low-quality, tallgrass-prairie hay were used to evaluate the influence of changing the amount of supplemental degradable intake protein (DIP) derived from urea on body weight and body condition changes, pregnancy rate, and calf performance. Supplemental treatment groups were: 0, 20, and 40% of the supplemental DIP from urea. Supplements were formulated to contain 30% CP . When sufficient DIP was offered to prepartum cows to maximize DOMI, urea could replace up to 40% of the DIP in a high-protein (30%) supplement without causing problems of supplement palatability. However, trends in body weight and condition indicate that performance may be enhanced if the percent of supplemental DIP from urea is less than 40%.

Keywords
Cattlemen's Day, 1996; Kansas Agricultural Experiment Station contribution; no. 96-334-S; Report of progress (Kansas State University. Agricultural Experiment Station and Cooperative Extension Service); 756; Beef; Cows; Forage; Nonprotein nitrogen; Intake; Digestibility

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EFFECT OF INCREASING UREA LEVEL IN PROTEIN SUPPLEMENTS ON PERFORMANCE BY BEEF COWS CONSUMING LOW-QUALITY TALLGRASS-PRAIRIE FORAGE [1]

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Summary

Ninety pregnant Angus Hereford cows consuming low-quality, tallgrass-prairie hay were used to evaluate the influence of changing the amount of supplemental degradable intake protein (DIP) derived from urea on body weight and body condition changes, pregnancy rate, and calf performance. Supplemental treatment groups were: 0, 20, and 40% of the supplemental DIP from urea. Supplements were formulated to contain 30% CP. When sufficient DIP was offered to prepartum cows to maximize DOMI, urea could replace up to 40% of the DIP in a high-protein (30%) supplement without causing problems of supplement palatability. However, trends in body weight and condition indicate that performance may be enhanced if the percent of supplemental DIP from urea is less than 40%.

(Key Words: Cows, Forage, Nonprotein Nitrogen, Intake, Digestibility.)

Introduction

Feeding degradable intake protein (DIP) to pregnant beef cows grazing low-quality forage will increase forage intake and digestion and subsequently enhance animal performance. True proteins such as soybean meal commonly are used as DIP sources in protein supplements. However, to minimize supplement costs, previous research has evaluated the efficacy of substituting nonprotein nitrogen (e.g., urea) for true protein. A ruminal infusion study conducted at Kansas State University found that a limited amount of urea (≤50% of supplemental DIP) can replace DIP from true protein without negatively affecting forage intake and digestion. However, earlier studies have reported supplement unacceptability and reduced animal performance when higher levels of urea (>50% of CP equivalent) are included in supplements.

This study was conducted to evaluate supplement palatability and animal performance when urea accounted for up to 60% of the supplemental DIP in supplements fed to beef cows consuming low-quality, tallgrass-prairie forage.

Experimental Procedures

A performance study was conducted to evaluate the influence of changing the amount of supplemental degradable intake protein (DIP) derived from urea on body weight and body condition changes and pregnancy rate of beef cows consuming low-quality, tallgrass-prairie hay and calf performance.

The experiment was intended to have four supplement treatment groups: 1) 0% of the supplemental DIP from urea (0% of the supplemental CP from urea), 2) 20% of the supplemental DIP from urea (15% of the supplemental CP from urea), 3) 40% of the supplemental DIP from urea (30% of the supplemental CP from urea), and 4) 60% of the supplemental DIP from urea (45% of the supplemental CP from urea). However, refusal to consume the high-urea supplement (60% DIP

[1]The authors express their appreciation to Gary Ritter and Wayne Adolph for their assistance in conducting this experiment.

[2]KSU Agricultural Research Center - Hays.

from urea) by the cows grazing tallgrass prairie resulted in elimination of this treatment.

Ninety Angus Hereford cows (BW = 1111 lb; final 3 to 5 months of pregnancy) were assigned randomly to supplemental treatments. Cows received approximately 4.76 lb/day of supplement DM. Supplements were formulated with soybean meal, urea, sorghum grain, and molasses to contain approximately 30% CP and a N:S of 10:1. Based on previous KSU research, the amount of DIP provided by the supplements and forage should have been sufficient to maximize digestible OM intake (DOMI) of the grazed forage.

Body weight and body condition were measured at approximately 5-wk intervals until calving, starting on November 28, with additional measures postcalving (48 h after calving), before breeding (April 27, actual breeding season was from May 15 to July 15), and at weaning (October 5). After calving, all cows were handled as a group and received 10 lb/day of alfalfa hay (as fed basis; 88.3% DM; 23% CP and 34% NDF on DM basis) until sufficient new grass growth was available (end of April).

Birth weights of calves were recorded within 48 h. Calf ADG was calculated as weaning weight minus birth weight divided by the number of days from birth. Cows were bred by natural service. A single shot of $PGF_{2\alpha}$ was given at the beginning of the breeding season.

Results and Discussion

The palatability problems experienced with the high-urea supplement (60% of supplemental DIP from urea) clearly indicates that caution must be exercised in determining the quantity of urea to include in supplements for beef cattle grazing low-quality forage.

Body weight (BW) change of cows decreased (linear; P=.02) with increasing urea levels within the first 5-wk period of supplementation (Table 1). Treatment had limited influence ($P \geq .17$) on BW change within subsequent periods until breeding. In contrast, body condition (BC) change was not affected greatly ($P \geq .18$) by treatment during individual periods or when cumulative response was evaluated. However, the numerical trends were similar to those observed for BW change. In general, the treatment differences for BW and BC change were not great, although their trends indicated some decline in performance for the group receiving 40% of supplemental DIP as urea.

The birth weight of calves, calf ADG, and calf weaning weight were not affected ($P \geq .25$) by the level of urea fed to their dams before calving (Table 2). Pregnancy rate tended to be affected (P=.13) by treatment, with the lowest pregnancy rate observed with the greatest level of urea. Therefore, for prepartum supplementation of pregnant beef cows, we recommend not exceeding 40% of the supplemental N in the DIP as urea. Maximal performance likely would be observed at a somewhat lower urea level.

Table 1. Effect of Different Proportions of DIP from Urea on Cumulative and Period Body Weight (BW) and Body Condition (BC)[a] Change in Beef Cows Grazing Dormant, Tallgrass-Prairie Forage

Item	% Supplemental DIP from Urea[b]				Contrasts[c]	
	0	20	40	SEM[d]	L	Q
No. of cows	30	30	30			
Initial BW, lb	1115	1104	1115	22.55	.97	.67
Period BW change, lb						
28 November - 3 January	17.4	11.9	-5.3	4.30	.02	.32
4 January - 7 February	31.1	30.0	19.6	4.87	.17	.48
8 February - 21 March (calving)	-145.2	-148.3	-143.9	12.7	.94	.82
calving - 27 April (breeding)	-54.7	-45.2	-42.3	6.44	.24	.68
27 April - 5 October (weaning)	196.3	218.2	199.2	7.71	.81	.09
Cumulative BW change, kg						
28 November - 7 February	48.3	41.9	14.3	7.32	.03	.31
28 November - 21 March (calving)	-97.0	-106.5	-129.6	15.85	.22	.75
28 November - 27 April (breeding)	-151.6	-151.6	-171.9	14.3	.37	.59
28 November - 5 October (weaning)	51.6	62.4	27.3	10.1	.17	.14
Initial BC	5.04	5.00	5.02	.04	.70	.71
Period BC change						
28 November - 3 January	-.03	-.01	-.13	.05	.27	.32
4 January - 7 February	-.07	-.06	-.11	.06	.67	.73
8 February - 21 March (calving)	-.24	-.14	-.22	.08	.84	.45
calving - 27 April (breeding)	-.21	-.29	-.26	.05	.55	.43
27 April - 5 October (weaning)	.88	.90	1.07	.08	.18	.53
Cumulative BC change						
28 November - 7 February	-.10	-.07	-.23	.08	.32	.38
28 November - 21 March (calving)	-.34	-.21	-.45	.10	.50	.21
28 November - 27 April (breeding)	-.55	-.50	-.71	.11	.37	.40
28 November - 5 October (weaning)	.38	.39	.36	.16	.93	.95

[a]Body condition scal e: 1 = extremely emaciated; 9 = extremely obese. [b]Percent of the total supplemental N from urea is 0, 15, and 30, respectively. [c]L = Linear, Q = Quadratic. [d]Standard error of the mean (n=3).

Table 2. Effect of Different Proportions of DIP from Urea on Calf Birth Weight and Gain and Pregnancy Rate in Beef Cows Grazing Dormant, Tallgrass-Prairie Forage

	% Supplemental DIP from Urea [a]				Contrasts [b]	
Item	0	20	40	SEM [c]	L	Q
No. of cows	30	30	30			
Calf birth weight, lb	91.9	88.8	87.7	2.18	.25	.76
Calf ADG, birth-weaning, lb	2.23	2.27	2.20	.04	.91	.30
Calf weaning weight, lb	560	566	544	10.45	.34	.34
Pregnancy rate , % [d]	92.6	100	86.2	-	-	-

[a]Percent of the total supple mental N from urea is 0, 15, and 30, respectively. [b]L = Linear, Q = Quadratic. [c]Standard error of the mean (n=3). [d]Calculated by chi-square data analysis; *P*=.13.