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Pages 9-13

Effects of Supplemental Undegradable Protein on the Performance of Fall-Calving Cows Grazing Dormant Native Range

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Story in Brief

This experiment was conducted to study the effects of increasing levels of undegradable intake protein (UIP; escape/bypass protein) during early lactation on the performance of fall-calving beef cows (1997, n=58; 1998, n=54). Angus x Hereford cows grazing dormant tall grass prairie were fed supplements formulated to supply adequate degradable intake protein and increasing amounts of undegradable intake protein (142, 196, 248, and 301 g/d). Cows were group fed 3 lb of supplement daily for approximately 130 d. In 1997, cow weight and condition loss was minimized with increasing UIP supplementation, up to 248 g UIP/d, however, UIP in excess of this amount increased weight loss. During 1998, increasing levels of UIP was associated with a linear decrease in weight loss. All cows returned to similar weights by weaning, in both years. Greatest body condition losses were associated with 142 and 301 g UIP/d, regardless of year. Supplemental treatment of the cows did not influence calf weight gains. These data indicate that up to 250 g of supplemental UIP/d is effective in reducing weight and body condition loss in lactating beef cows grazing dormant native tall grass pasture. Effects of supplemental UIP beyond 250 g UIP/d may be dependent on year to year variation in forage characteristics and/or animal requirements.

Key Words: Beef Cows, Undegradable Intake Protein, Tall Grass Prairie

Introduction

The National Research Council recommends using the metabolizable protein (MP) system to evaluate the requirements of beef cattle (NRC, 1996). The MP system accounts for the ruminal degradation of protein and separates protein requirements into the needs of ruminal microorganisms and the needs of the animal. Estimates of undegradable intake protein (UIP) and degradable intake protein (DIP) are required for this system to evaluate protein requirements of beef cows. The previous edition of Nutrient Requirements of Beef Cattle (NRC, 1984) was based on the crude protein system, in which it is assumed that all protein is equally degradable. Due to this assumption, supplements developed with the crude protein system may contain sufficient amounts of DIP but insufficient amounts of UIP to meet the MP requirement of the lactating beef cow grazing dormant tall grass prairie. Increased levels of UIP have resulted in increases in cow body weight (Miner et al., 1990; Dhuyvetter et al., 1993; Sletmoen-Olson et al., 2000). Conversely, other studies have shown no body weight change by adding UIP to grazing cow diets (Triplett et al., 1995; Lents et al., 2000). Added UIP has also shown mixed results on body condition score (BCS) changes. Increased levels of UIP in the diet have resulted in postive responses in BCS change (Miner et al., 1990; Sletmoen-Oleson et al., 2000). However, Triplett (1995) found no response in BCS change due to increased UIP supplementation in Brahman cows grazing bermudagrass during spring and summer. Due to the inconsistency of data reported in the literature, the objective of this study was to evaluate the effects of feeding increasing levels of UIP to fall-calving cows grazing tall grass prairie for the entire dormant season.

Materials and Methods

Fall-calving Angus x Hereford cows (1997: n=58, 1214±34 lb; 1998: n=54, 1232±34 lb) rotationally grazed eight tall grass pastures at the Oklahoma State University Range Cow Research Center from early May through mid-November, each year. Stocking rate was 10.7 acres/cow-calf pair in 1997 and 11.5 acres/cow-calf pair in 1998. During mid-November, cows were allotted to four treatments with two pastures per treatment. The control supplement was formulated to provide adequate DIP (Lents, 2000) using soybean meal as an industry standard protein source. Grazed forage samples collected from similar pastures during the same years contained 3.9 to 5.8% crude protein (Lents, 2000). Using these values and Level 1 of the 1996 NRC model, a daily deficiency of 150 g of metabolizable protein was predicted. The control supplement (C) for this study, provided 142 g of UIP per day. Supplemental UIP was increased incrementally in the remaining three treatments (Table 1): 196 g UIP/d, 248 g UIP/d, and 301 g UIP/d. Cows were group fed 3 lb of supplement daily, through late March (1997, 130 d; 1998, 125 d). Each group of cows was rotated to a different pasture every 14 d to reduce potential pasture effects. Calves were weaned in mid May. Individual weights for both cows and calves, and cow body condition scores were determined upon trial initiation, the end of supplementation, and at weaning, following a 16-h removal from feed and water (Table 2). Body condition scores were based on a scale of 1 to 9 (1=thin, 9=obese), using two independent scorers (Table 2).

Data were analyzed using the general linear models of SAS (1985), with pasture as the experimental unit and individual animal as the sub-sampling unit. The final model included treatment, replicate, year, and treatment x year interaction. Least squares means were calculated and evaluated for differences among supplemental treatments.

Results and Discussion

Cow weight change was influenced differently by treatment for each year (Table 2). In 1997, cows lost less weight ($P<.001$) with increasing UIP supplementation, up to 248 g UIP. Undegradable intake protein in excess of this amount resulted in similar weight loss as C-fed cows ($P<.001$). During 1998, increasing supplemental UIP reduced weight loss linearly ($P<.05$).

After termination of supplementation and during early spring grazing, all cows gained weight. In 1997, greatest weight gains were associated with C and 301 g UIP/d ($P<.001$), which experienced the greatest weight losses during supplementation. However, in 1998, there was a decrease in weight gain with increasing UIP supplementation ($P<.001$). All treatment groups were similar in weight ($P=.91$) at weaning, in both years.

Treatment influenced body condition score change during supplementation with the greatest condition losses associated with C and 301 g UIP/d, in both years, during the supplementation period ($P<.001$). Following the supplementation period, cows regained condition, with the greatest increase in condition associated with the C and 301 g UIP/d groups. Sletmoen-Olson et al. (2000) reported increased body weights in beef cows fed low-quality hay, due to UIP supplementation. These authors suggested that this response might be due to recycling of UIP nitrogen to increase the effective DIP supply.

Year influenced calf weight gain (Table 3). Calves in 1998 had higher gains ($P<.001$) during supplementation and post-supplementation than calves in 1997. Supplement treatment of the cows did not influence calf gains ($P=.62$). Triplett et al. (1995) determined that increasing UIP levels did not influence milk production of mature cows. Lents et al. (2000) reported a linear decrease in mean milk production of spring calving cows supplemented with increasing levels of UIP.

Our data indicate moderate levels of UIP supplementation (250 g UIP/d) is effective in minimizing weight and condition losses in fall-calving cows grazing dormant native tall grass pastures. Additional work is necessary to determine if the animal performance response is due to supplemental UIP nitrogen being recycled to the rumen, or whether animal tissue requirements are being met by the supplemental UIP nitrogen.

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Table 1. Ingredient and nutrient composition of pelleted supplements (DM basis).

	Treatment[a]			
Item	142 (C)	195	248	301
Soybean meal, %	54.50	45.73	37.73	28.91
Soybean hulls, %	41.80	37.43	32.70	28.67
Blood meal, %	-	3.53	6.92	10.46
Corn gluten meal, %	-	9.61	18.86	28.34
Molasses, %	3.69	3.69	3.71	3.71
Vitamin A (30,000 IU), %	.07	.07	.07	.07
Amount fed, g/d	1362	1362	1362	1362
CP supplied, g/d	424	477	530	581
DIP supplied, g/d[b]	282	282	281	280
UIP supplied, g/d[c]	142	195	248	301
NE_m, Mcal/d	2.46	2.44	2.43	2.42

[a]C = control supplement, expressed as g UIP/d.

[b]Degradable intake protein.

[c]Undegradable intake protein.

Table 2. Body condition score and weight (lb) change of fall-calving cows grazing native range and supplemented with increasing amounts of undegradable intake protein.

Item	Treatment – g UIP/d				
	142 (C)	195	248	301	SE
1997-98					
Initial weight (11/14/97)	1192	1208	1228	1229	36
Weight change, lb					
Winter[a,c]	-204	-160	-146	-201	12
Spring[b,c]	127	74	59	99	9
Initial body condition (11/14/97)	5.65	5.53	5.92	5.72	.17
Body condition change					
Winter[a,c]	-1.44	-.97	-.87	-1.15	.11
Spring[b,c]	.60	.17	.15	.27	.10
1998-99					
Initial weight (11/18/98)	1230	1229	1241	1218	36
Weight change, lb					
Winter[a,d]	-158	-150	-134	-120	12
Spring[b,d]	129	120	111	99	9
Initial body condition (11/18/98)	5.36	5.48	5.42	5.43	.17
Body condition change					
Winter[a,c]	-1.11	-.89	-.86	-1.15	.11
Spring[b,c]	.95	.66	.86	.94	.10

[a]Supplementation period: 11/14/97 – 3/24/98 and 11/18/98 – 3/23/99.

[b]Post-supplementation period: 3/24/98 – 5/27/98 and 3/23/99 – 5/25/99.

[c]Quadratic effect, $P<.05$.

[d]Linear effect, $P<.05$.

Table 3. Weight change (lb) of fall-born calves, nursing cows grazing native range and supplemented with increasing amounts of undegradable intake protein.

Item	Treatment – g UIP/d				
	142 (C)	195	248	301	SE
1997-98					
Weight (11/14/97)	202	191	179	206	8
Weight gain					
Winter[a]	148	148	132	154	5
Spring[b]	120	112	109	120	5
Total gain[c]	268	260	241	274	12
1998-99					
Weight (11/18/98)	210	203	209	215	8
Weight gain					
Winter[a]	170	176	175	177	5
Spring[b]	148	151	153	151	5
Total gain[c]	318	327	328	328	12

[a]Supplementation period: 11/14/97 – 3/24/98 and 11/18/98 – 3/23/99.

[b]Post-supplementation period: 3/24/98 – 5/27/98 and 3/23/99 – 5/25/99.

[c]Total gain: 11/14/97 – 5/27/98 and 11/18/98 – 5/25/99.

2000 Research Report - Table of Contents