SUPPLEMENTAL RUMINALLY UNDEGRADED PROTEIN FOR FALL CALVING BEEF COWS GRAZING DORMANT NATIVE GRASS PASTURES

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Story in Brief

Fall calving beef cows (n=72) grazed dormant native grass pastures for 104 d (December to March) and received soybean hull-based supplements containing two levels of protein (400 or 600 g CP) and two proportions of ruminally undegraded protein (28 and 50% RUP). All supplements were formulated with soybean meal and soybean hulls. A blend of blood meal and corn gluten meal was used to formulate the 50% RUP supplements. Supplemental energy supply was equalized at 3.3 lb TDN/d. The higher level of protein decreased losses in body weight and condition. Calves suckling cows fed 600 g CP gained 15.0 lb more weight than calves whose dams were fed 400 g CP. The proportion of RUP did not alter body weight change. Although differences were small, cows receiving 50% RUP supplements lost more body condition than cows fed supplements containing 28% RUP. Within 400 g CP, cows fed 50% RUP supplements lost .24 units more body condition than cows receiving 28% RUP supplements. Within 600 g CP supplements, the 28% RUP increased milk production which translated into faster calf weight gain. In summary, greater quantities of supplemental CP increased cow herd performance but supplemental RUP did not benefit lactating beef cows.

(Key Words: Beef Cattle, Native Grass, Protein Supplementation, Protein Degradation.)

Introduction

Fall calving beef cows grazing dormant native grass (<4% CP) require extensive supplementation to maintain productivity. Most range supplements are composed of cottonseed meal or soybean meal blended with cereal grain or

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low-protein byproduct feeds. Formulation of these supplements often is based on total protein, with little regard for protein characteristics such as ruminal degradation. Because the extent of ruminal N degradation of proteinaceous feedstuffs varies (NRC, 1985), supplemental ruminally undegraded protein (RUP) content can be altered. Altered supplemental RUP may increase total N flow or improve the amino acid profile of digesta flowing to the small intestine. Either response could alter beef cow productivity. Thus, the objective of this study was to evaluate supplements formulated to supply two levels of total protein with or without ruminally undegraded protein on cow herd productivity.

Materials and Methods

Fall-calving crossbred cows (n=72; average calving date October 1) were fed one of four supplements in a 2 x 2 factorial design. Cows were blocked by calving date and calf sex and assigned to treatments. Pelleted supplements provided two amounts of total protein (400 g and 600 g CP/d) with two proportions of ruminally undegraded protein (28% and 50% RUP). Supplements were formulated with blends of soybean meal and soybean hulls (Table 1). Extent of ruminal degradation of soybean meal protein was presumed to be 72% (NRC, 1985). Supplemental energy supply (3.3 lb TDN/d) was equalized with soybean hulls (TDN estimated at 75%) to prevent confounding supplemental protein with supplemental energy. A blend consisting of 60% CP from blood meal and 40% CP from corn gluten meal was added to formulate the 50% RUP supplements. Blood meal (82% RUP) and corn gluten meal (55% RUP) were utilized because of their complementary amino acid profiles (NRC, 1985). Supplemental concentrations of calcium, phosphorus, trace mineralized salt, dairy flavors and vitamin A were formulated to meet requirements. In addition, sodium sulfate was included to maintain a nitrogen:sulfur ratio of 12:1 in the supplement Cows were individually fed their respective weekly allotment of supplement on five days per week (Mon-Wed, Fri-Sat). On day 45, cows were rotated to a different native grass pasture.

To equalize fill, cows were fed 5 lb cottonseed meal for one week prior to and for one week following the end of the study. These initial and final weights (24-h shrink) were used to evaluate treatment effects over the entire length of the study. Cow weights and body condition scores also were evaluated at two week intervals following an eight hour shrink. Body condition (1=emaciated, 9=obese) was the average of three independent scorers. Calves were weighed following separation from the dam for 5 hours.

Milk production was estimated every month by the weigh-suckle-weigh procedure. Calves were isolated from their dams at 0800 and were allowed to

Table 1. Composition, feeding rate and nutrient supply of supplements providing two proportions of ruminal undegradable protein.

Item	400 g CP		600 g CP	
	28% RUP[a]	50% RUP	28% RUP	50% RUP
Supplement composition, % (DM basis)				
Soybean hulls	68.52	77.98	43.25	57.39
Soybean meal	22.78	.19	48.57	14.80
Blood meal		6.55		9.79
Corn gluten meal		6.02		8.99
Molasses	3.00	3.00	3.00	3.00
Dical phosphate	2.97	3.43	2.31	3.00
TM salt[b]	2.25	2.25	2.25	2.25
Sodium sulfate	.39	.49	.53	.68
Vitamin A-30	.06	.06	.06	.06
Dairy Flavors	.03	.03	.03	.03
Nutrient, % DM				
CP[c]	19.7	19.4	27.6	28.4
TDN[d]	74.1	72.0	76.3	73.2
Intake, lb/d				
DM	4.41	4.41	4.41	4.41
CP				
Total[c]	.88	.88	1.32	1.32
RDP[e]	.63	.44	.95	.66
RUP[a]	.25	.44	.37	.66
TDN[d]	3.27	3.17	3.36	3.23

[a] RUP = Ruminally undegraded protein.

[b] Trace mineralized salt contained 92% NaCl, .25% Mn, .20% Fe, .033% Cu, .007% I, .005% Zn and .0025% Co.

[c] Actual analysis.

[d] Estimated from NRC (1984).

[e] Ruminally degraded protein (RDP) content estimated from NRC (1985) for soybean meal (82%), soybean hulls (82%), blood meal (18%) and corn gluten meal (45%).

suckle at 1300 to begin the milk production study. Additional sucklings were at 2130 and at 0630 and 1300 the following day. Daily milk production was calculated as the sum of the last three milk productions.

Cow and calf performance were analyzed by least squares procedures with a model that included calf sex, cow age, level of protein (CP), proportion of RUP and CP X RUP interaction using calving date as a covariate. When the CP X RUP interaction was significant ($P<.10$), treatment means were compared with an unprotected t-test.

Results and Discussion

Crude protein content (OM basis) of esophageal samples from steers grazing pasture 1 declined from 4.6% on December 8 to 3.2% on January 17 (Table 2). Due to limited forage availability, all cattle were relocated to pasture 2 on January 23 (day 45). The CP content of pasture 2 was relatively stable (average 4.3%). Concentrations of NDF on both pastures ranged from 80.2 to 85.6% throughout the 104-d study.

The 600 g level of protein supplementation decreased ($P=.004$) loss of cow body weight and condition by 25.6 lb and .26 units, respectively (Table 3). The higher CP level supplements probably increased forage intake and duodenal N flow (Scott et al., 1991), which decreased loss of body weight and condition compared to the lower amount of supplemental CP.

The proportion of supplemental RUP did not alter ($P=.78$) body weight change (Table 3). Scott et al., (1991) reported that higher bypass supplements did not decrease energy intake or duodenal N flow, therefore no response in cow weight change due to the higher proportion of supplement RUP was

Table 2. Chemical composition (%, OM basis) of native grass pastures.

	Chemical component	
	CP	NDF
Pasture 1:		
Day 0	4.6$\pm$ .21	85.6$\pm$ 1.75
Day 45	3.2$\pm$ .29	84.6$\pm$ .42
Pasture 2:		
Day 62	4.3$\pm$ .34	80.2$\pm$ 2.89
Day 90	4.2$\pm$ .23	83.2$\pm$ 2.26
Day 104	4.4$\pm$ .25	84.4$\pm$ 1.52

Table 3. Changes in performance of lactating beef cows grazing dormant native grass pastures as affected by supplemental level of protein and proportion of ruminal undegradable protein.

	400 g CP		600 g CP			Probability[a]		
Item	28% RUP[b]	50% RUP	28% RUP	50% RUP	SE	CP	RUP	CP x RUP
Weight, lb								
Initial	1,035.7	998.7	1,009.9	1,006.4	19.65	.64	.31	.40
Final	880.2	840.5	874.7	878.6	17.07	.34	.31	.20
Change	-155.5	-158.4	-135.2	-127.8	8.46	.004	.78	.55
Body condition, units								
Initial	5.14	5.13	5.14	5.10	.067	.79	.72	.89
Final	4.48	4.22	4.64	4.54	.110	.03	.11	.47
Change	-0.67	-0.91	-0.50	-0.56	.086	.004	.08	.30
Milk, lb/d	8.83[c]	9.21[c]	10.00[d]	9.25[c]	.641	.04	.55	.06
Calf weight, lb								
Initial	218.3	221.1	212.1	214.3	1.94	.0007	.17	.86
Final	301.8[e]	304.8[e]	317.2[f]	306.6[e]	2.73	.002	.17	.01
Change	83.7[g]	83.7[g]	105.1[h]	92.3[i]	1.45	.0001	.0001	.0001

[a] Probability for: CP = 400 g vs 600 g CP; RUP = 28% vs 50% RUP; CP x RUP = CP by RUP interaction.

[b] RUP = Ruminal undegradable protein.

[c,d] Means within a row lacking a common superscript differ ($P < .05$).

[e,f] Means within a row lacking a common superscript differ ($P < .01$).

[g,h,i] Means within a row lacking a common superscript differ ($P < .0001$).

expected. Although differences in body condition were small, feeding 50% RUP supplements tended to increase ($P = .08$) body condition loss.

A CP level by RUP proportion interaction ($P = .06$) was observed for milk production (Table 3). The 600 g CP/28% RUP supplement stimulated the greatest ($P < .05$) milk production. Milk production was relatively low and no differences ($P < .10$) were detected among the other supplements. However, weight gain of calves also showed an interaction ($P < .0001$) for supplemental CP level by proportion of RUP. Calves suckling cows fed the 600 g CP/28% RUP supplement gained the most ($P < .0001$) weight. Calves whose dams received the 600 g CP/50% RUP supplement gained more weight ($P = .01$) than calves from dams supplemented with 400 g CP supplements. No difference ($P > .10$) in weight gain was detected between proportions of RUP for calves from dams receiving 400 g CP supplements.

In summary, providing 200 g more supplemental protein decreased losses of body weight and condition while increasing calf weight gains. Supplements containing 50% RUP increased body condition losses, although differences were relatively small. Although, Hibberd et al. (1988) reported that replacement of 22% of the supplemental RDP fraction with RUP increased cow and calf productivity, no benefit for higher concentrations of RUP was observed in this study. These data are supported by Scott et al. (1991) who reported that higher proportions of supplemental RUP did not alter digestible OM intake or duodenal N flow. These data suggest that increasing the proportion of RUP in range supplements does not improve, and may actually decrease, the performance of lactating beef cows grazing dormant native grass.

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