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First Limiting Nutrient of Native Range for Summer Calving Cows During the Breeding Season and Late Lactation

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Rumen degradable and escape protein are co-limiting for summer calving cows during the breeding season and late lactation.

Summary

Trials were conducted to determine the first limiting nutrient of native range for summer calving cows during the breeding season and late lactation. Treatments were 1) control, no supplement; 2) isocaloric energy control; 3) rumen degradable protein supplement and 4) rumen degradable and undegradable protein supplement. During the breeding season, cows receiving rumen degradable and escape protein gained more weight than cows on other treatments. Cows receiving supplemental protein gave more milk and nursed faster gaining calves than other treatments. Rumen degradable protein and escape protein appear to be co-limiting for summer calving cows during the breeding season and late lactation.

Introduction

Limited information is available about supplementation needs for summer calving cows during the breeding season and late lactation. Most supplementation research has focused on the gestating spring calving cow during the winter months or the lactating fall calving cow during the winter. A summer calving cow herd has been developed at the Gudmundsen Sandhills Laboratory (GSL) as part of a larger systems study.

In general, the cow's requirements for energy and crude protein are fairly well defined (NRC, 1984). However, for the summer calving cow grazing native Sandhills range, the breeding season and late lactation periods coincide with a period when forage quality is declining as the warm season grass goes dormant. During this time the cow must rebreed and maintain body condition for the coming winter, while still providing nutrients for her nursing calf. The lactating cow has increased needs for all nutrients compared to the dry cow. Laboratory analysis conducted with esophageal diet samples collected at the GSL showed that both crude protein and digestibility of range forage are declining during late summer and fall (August through October).

The objectives of these trials were to determine the first limiting nutrient for summer calving cows grazing native range during September and October (breeding season) and during November and December (late lactation) for this herd.

Procedure

Breeding Season Trial

Forty-eight lactating summer calving cows (beginning calving date = June 18) were used in each of two years to determine the first limiting nutrient for summer calving cows grazing native range during a 50 day breeding season beginning September 7. Treatments were 1) control (CON), no supplement; 2) isocaloric energy control supplement (ENG); 3) rumen degradable protein supplement (RDP); 4) rumen degradable + escape protein supplement (RDP+EP). Supplement composition amounts fed are shown in Table 1. The energy control supplement was based on a 90:10 blend of soyhulls and tallow. The energy supplement was not intended to fully meet the cow's requirement for net energy during this time but only to be an isocaloric control for the protein supplements. The rumen degradable protein supplement was based largely on corn steep liquor that supplies protein, peptides, and amino acids that are totally rumen degradable. The escape protein supplement used was an 80:20 blend of SBM treated with sulfite liquor and feather meal. The daily amount of supplements fed was purposely kept small to avoid confounding the responses measured with exceedingly large energy intakes.

Eight pastures were used in the trial, two pastures per treatment. Cows were group fed supplements in each pasture six days per week. Cows used in the late lactation trial remained on the same treatment to which they were assigned for the breeding season trial.

Cows were weighed and body condition score (BCS) was estimated by palpating the ribs and thoracic vertebrae at the beginning and end of the trial. Calves were also weighed at the beginning and end of the trial. During September and October of 1995, a 16-hour weigh-suckle-weigh procedure was performed to estimate milk production. Six cow/calf pairs from each treatment were randomly chosen for this measurement. At each weigh-suckle-weigh, pairs were separated at approximately noon each day and calves were allowed to nurse at 4:00 p.m. Following nursing,

Table 1. Supplement composition for lactating summer calving cows during the breeding season.

	Treatment[a]			
	CON	ENG	RDP	RDP+ EP
Ingredient		lbs DM/day		
Soyhulls	—	0.90	0.30	—
Tallow	—	0.10	0.03	—
Corn Steep Liquor	—	—	0.70	—
Sulfite Liquor Treated SBM	—	—	—	1.00
Feather Meal	—	—	—	0.26
Nutrient		Supplemental Nutrient Intakes (lbs/day)		
NE_m (Mcals)	—	1.1	1.1	1.1
Rumen Degradable Protein (lb)	—	0.11	0.31	0.30
Escape Protein (lb)	—	0.03	0.01	0.33

[a]Con = control, Eng = energy control, RDP = rumen degradable protein, RDP + EP = rumen degradable protein and escape protein.

Table 2. Supplement composition for lactating summer calving cows during late lactation.

	Treatment[a]			
	CON	ENG	RDP	RDP+ EP
Ingredient		lbs DM/day		
Soyhulls	—	0.90	—	0.57
Tallow	—	0.10	—	0.06
Corn Steep Liquor	—	—	1.06	—
Sulfite Liquor Treated SBM	—	—	—	0.37
Feather Meal	—	—	—	0.09
Nutrient		Supplemental Nutrient Intakes (lbs/day)		
NE_m (Mcals)	—	1.1	1.1	1.1
Rumen Degradable Protein (lb)	—	0.11	0.42	0.18
Escape Protein (lb)	—	0.03	0.00	0.14

[a]Con = control, ENG = energy control, RDP = rumen degradable protein, RDP + EP = rumen degradable and escape protein.

Table 3. Crude protein, rumen degradable protein, escape protein, IVDMD, NDF, and ADF of esophageally collected range diets.

Date	CP	EP	RDP	NDF	ADF	IVDMD
9/17/94	6.9	.7	6.2	71.7	44.5	58.6
11/3/94	5.2	.6	4.6	74.5	49.5	48.9
12/12/94	5.3	.9	4.5	76.5	48.7	48.9

pairs were separated again. At 8 a.m. the following morning, calves were weighed and allowed to nurse and then weighed again. The difference in weight was estimated to be the 16-hour milk production. When milk production is presented in this paper, it is expressed on a 24-hour basis. Cows were rectally palpated to determine pregnancy approximately 70 days after the end of the breeding season.

Late Lactation Trial

Forty lactating summer calving cows were used in each of two years to determine the first limiting nutrient for summer calving cows grazing native range during late lactation (November and December). Supplement treatments and data collection procedures were similar to those used during the breeding season trial (Table 2). A 16-hour weigh-suckle-weigh was also performed in December of 1995, following a similar procedure as described in the breeding season trial.

Diet samples were collected using esophageally-fistulated cows to estimate diet quality in September, November, and December. Samples were freeze dried and analyzed for CP, NDF, ADF, IVDMD, and in situ protein degradability.

Results

Diet quality (Table 3) in 1994 declined from September to December. Crude protein declined to approximately 5% by early November. In addition, IVDMD for samples collected in November and December were quite low (less than 50%).

During the breeding season, CON cows lost more weight and body condition than cows receiving supplements (Table 3). Cows supplemented with either RDP or RDP+EP also gained more weight than cows receiving ENG supplement. Cows fed RDP+EP also gained more weight than cows fed RDP. Calves nursing cows which received supplements also gained more weight than calves nursing CON cows. Pregnancy rate was not affected by supplement treatment. Cows receiving supplements gave more milk than CON cows, and cows receiving supplemental protein gave more milk than cows receiving ENG supplement. This may partially explain the increased weight gain of calves nursing cows receiving supplemental protein.

There were no significant differences in cow weight change, calf weight

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Table 4. Production of summer calving cows fed energy, rumen degradable protein, or rumen degradable plus escape protein during the breeding season.

	Treatment				
	CON	ENG	RDP	RDP+ EP	Contrast[a]
Cow weight change (lb)	6.7	-28.4	-9.5	9.5	1, 2, 3
Calf weight change (lb)	119.2	126.1	142.1	139.3	1, 2
Cow BCS change	-0.75	-0.52	-0.40	-0.35	1
Pregnancy rate (%)	91.5	95.8	95.8	95.8	NS
Milk production (lb)	14.3	15.0	18.7	19.4	1, 2

[a]Contrasts: 1 = CON vs supplements; 2 = ENG vs RDP + RDP+EP; 3 = RDP vs RDP+EP. Significant at P = .06.

Table 5. Production of summer calving cows fed energy, rumen degradable protein, or rumen degradable plus escape protein during late lactation.

	Treatment				
	CON	ENG	RDP+ RDP	EP	Contrast[a]
Cow weight change (lb)	-161.5	-141.0	-109.1	-134.7	NS
Calf weight change (lb)	52.1	60.7	62.0	66.9	NS
Cow BCS change[b]					
Year 1	-0.9	-0.7	-0.9	-0.4	NS
Year 2	-0.5	-0.6	-0.4	-0.8	NS
Milk production (lb)	7.0	8.6	9.2	13.2	NS

[a]Contrasts: 1 = CON vs supplements; 2 = ENG vs RDP + RDP+EP; 3 = RDP vs RDP+EP. Significant at P = .06.
[b]Significant year*treatment interaction, data are presented by year.

change, cow BCS change, or milk production during late lactation. During late lactation, cows lost large amounts of weight and calf gains were lower compared to the breeding season. However, cows receiving RDP+EP produced more milk and their calves gained more weight than the other treatments, even though differences were not significant. The fact cows receiving RDP+EP gave almost twice the amount of milk that CON cows did may explain why the RDP+EP cows did not respond as they did during the breeding season. Cows appear to need more supplemental energy than was fed during late lactation (as indicated by the large weight losses).

We believe that rumen degradable and escape protein may be co-first limiting nutrients for summer calving cows during the breeding season and late lactation. As the warm season species on the upland sites in the Sandhills decline in quality, supplementation is necessary. Energy does not appear to be limiting during the breeding season. This work indicates, especially during the breeding season, a small amount of a strategic input can help cows maintain body weight and condition while still producing adequate milk for acceptable calf gains. The supplemental needs of the summer calving cow at this time would probably best be met by using a source of protein that contained both rumen degradable and escape protein in approximately equal proportions. Sources that supply this are cottonseed meal, sulfite liquor treated or heat treated soybean meal, pork meat and bone meals, or a blend of high and low degradability sources such as sunflower meal to supply rumen degradable protein and blood meal or feather meal to supply escape protein.

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