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January 1997

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Lardy, Greg; Klopfenstein, Terry J.; Adams, Don C.; Lamb, Jim; and Clark, Dick, "Rumen Degradable Protein Requirement of Gestating Summer Calving Beef Cows Grazing Dormant Native Sandhills Range" (1997). *Nebraska Beef Cattle Reports*. 443.
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Rumen Degradable Protein Requirement of Gestating Summer Calving Beef Cows Grazing Dormant Native Sandhills Range

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Summer calving cows require small amounts of rumen degradable protein supplementation to meet their requirement during late winter.

Summary

Sixty-three summer calving cows were used to determine the rumen degradable protein requirement during

late winter (March-April). Treatments were 1) Control, no supplemental rumen degradable protein; 2) 29%; 3) 65%; 4) 100%, or 5) 139% of the estimated supplemental rumen degradable protein requirement. Supplements were based on combinations of corn steep liquor and soyhulls. Control cows lost more weight and consumed less forage than cows receiving supplemental rumen degradable protein. Body condition score change and in vivo digestibility of range forage were not different. Summer calving cows require between .2 and .4 lb of supplemental rumen degradable protein to meet their daily requirement of 1.0 to 1.3 lb of rumen degradable protein.

Introduction

A common practice in most range areas in the United States is supplementing gestating spring calving cows with protein during the winter. Supplemental protein may be overfed in many situations because the actual rumen degradable protein requirement and the proportion of forage protein which is degraded are unknown. Many factors, including selectivity, weather, rate of passage, stage of production, previous grazing treatment, and degree of weathering may play a role in determining degradability of protein in a particular forage. If the actual rumen degradable protein requirement were more precisely defined, producers may be able to reduce supplementation costs.

Rumen degradable protein is degraded in the rumen and available to the rumen microorganisms for use in microbial growth and protein synthesis. Undegradable protein escapes degradation in the rumen and is available to the host animal at the small intestine. Metabolizable protein is the sum of the digestible microbial protein and the digestible escape protein. Metabolizable protein is the protein that the animal can use for maintenance, growth, lactation, and fetal development.

Very little is known about how the nutrient requirements of summer calving cows (June 15-Aug 15 calving season) interact with the nutrient supply from forage. Hollingsworth-Jenkins et al. (1996 Beef Cattle Report, p. 14) reported research on the supplemental rumen degradable protein requirement for gestating spring calving cows. No research data are available regarding the requirement for supplemental rumen degradable protein in the summer calving cow during late winter. Therefore, the objective of this trial was to determine the supplemental rumen degradable protein requirement for gestating summer calving beef cows grazing dormant native Sandhills Range.

Procedures

Sixty-three MARC II (1/4 Hereford, 1/4 Angus, 1/4 Simmental, 1/4 Gelbvieh) gestating summer calving cows were assigned randomly to one of five treatments: 1) control, no supplement; 2) 29%, 3) 65%, 4) 100%, 5) 139% of the estimated supplemental rumen degradable protein requirement. Supplements were based on combinations of corn steep liquor and soyhulls to provide varying levels of rumen degradable protein while providing all supplemented cows with isocaloric supplements (Table 1). Corn steep liquor is a byproduct of the corn wet milling industry and is a source of protein, peptides, and amino acids and is 100 percent rumen degradable. The estimated daily rumen degradable protein requirement was 1.28 lb of which .8 lb was supplied by the forage. Cows were fed daily, in groups of 7, from March through mid April (2 pastures per treatment, except for the 139 percent treatment which only had one pasture). Forage intake was estimated on six cows per treatment in late March. Cows were dosed with a Captec chromium bolus that releases chromium at a steady rate into the rumen. Cows were individually fed during the fecal collection period. Fecal output was determined by dividing the amount of chromium released by the Captec device by the chromium concentration in the feces. Forage intake was determined by dividing the fecal output by the indigestibility of the range diet. Diet samples were collected in March and April using six to eight esophageally-cannulated cows to determine rumen degradable protein, escape protein, ADF, NDF, and digestibility of the diets. Weights were taken on two consecutive days at the beginning and the end of the trial and on one day about midway through the trial. Body condition score (BCS) was determined at the beginning and the end of the trial by palpating the ribs and thoracic vertebrae.

Results

Cows receiving no supplemental rumen degradable protein lost more weight than cows receiving supplemental rumen degradable protein (Table 2).

Table 1. Supplement composition for gestating summer calving cows grazing dormant Sandhills native range.

	Treatment				
	CON	29%	65%	100%	125%
Soyhulls, lbs	0	1.7	1.2	.62	0
Corn steep liquor, lbs	0	0	.57	1.1	1.7

Table 2. Weight and body condition score (BCS) change of gestating beef cows grazing winter Sandhills range.

	Treatment				
	CON	29%	65%	100%	125%
Weight change, lbs[a]	-49.1	1.7	5.9	-7.1	1.5
BCS change[b]	-.4	-.7	-.2	-.4	-.1

[a]Control vs. supplemented cattle, P = .0001.
[b]Cubic effect, level of rumen degradable protein, P = .03.

Table 3. Crude, escape, and rumen degradable protein, acid and neutral detergent fiber, and in vitro OM disappearance of Sandhills winter range.

	Date	
	March 22	April 8
	---------- % DM ----------	
Crude protein, %	5.0	8.4
Escape protein, %	.9	1.0
Rumen degradable protein,%	4.1	7.4
ADIN, %	.1	.1
NDIN,%	.3	.6
NDF, %	71.4	69.9
ADF, %	46.4	43.4
IVOMD,%	53.5	57.7

Table 4. In vivo organic matter digestibility (%) and organic matter intake of native Sandhills range as affected by rumen degradable protein supplementation.

	Treatment				
	CON	29%	65%	100%	125%
In Vivo OM Digestibility	59.5	59.3	58.0	58.3	57.2
Forage OM Intake (lbs)[ab]	16.3	17.5	22.8	22.9	27.9
Cow Weight	1179.1	1167.4	1186.0	1200.1	1178.5
Forage OM Intake (% of BW)[ab]	1.39	1.51	1.91	1.91	2.38
Supplement RDP Intake, lb	0	.23	.36	.51	.65
Forage RDP Intake, lb[ab]	.68	.73	.95	.95	1.16
Total RDP Intake, lb[ab]	.68	.96	1.31	1.46	1.81

[a]Control vs. supplemented cows, P < .001.
[b]Linear effect, level of rumen degradable protein, P < .0001.

No differences in body weight change were detected among cows receiving supplemental rumen degradable protein. Body condition score change increased cubically for cows receiving supplemental rumen degradable protein, but was not different for cows receiving supplement compared to unsupplemented cows. It is difficult to explain the cubic response in body condition score change.

Esophageally-fistulated cows were able to select diets high in CP and rumen degradable protein in early April (Table 3). However, because no estimates of total quantity of forage available for grazing at this time were made and esophageal diets were not collected over an extended period of time, it is not clear that cows would be able to select diets this high in quality continually in early spring. Diets selected in March were typical of dormant winter range samples previously collected at the Gudmundsen Sandhills Laboratory.

Cows supplemented with rumen degradable protein consumed more forage organic matter than did cows that did not receive a supplement (Table 4). It is not known why the high level of steep liquor stimulated an increase in intake, above the other supplements. Intakes averaged 1.8% of body weight in this study, while Hollingsworth-Jenkins et al. (1996 Beef Cattle Report, p. 14) reported an average intake of 2.1% of body weight in two years of work with spring calving cows. Unlike Hollingsworth-Jenkins et al., in vivo digestibility of the range diets consumed was not different among treatments.

This trial demonstrated that summer calving cows require small amounts of rumen degradable protein to maintain weight in late winter. The results of this research suggest that the summer calving cow has a requirement for supplemental rumen degradable protein similar to the spring calving cow. The requirement for rumen degradable protein appears to be between 9 and 10 percent of the digestible OM intake.

With respect to rumen degradable protein requirement, it is apparent that the summer calving cow has a need for a small amount of supplemental rumen degradable protein during late winter. This requirement is best met using protein sources that are highly degradable such as sunflower meal, corn steep liquor, or some combination of natural protein and NPN. A producer could use .9 lb (as fed basis) cottonseed meal to meet this requirement. However, cottonseed meal is 40% escape/60% degradable, so excess escape protein is fed which adds unnecessary cost to the supplementation program. This requirement could be met with approximately 1 lb of sunflower meal that is 80 percent degradable. Since all the protein in corn steep liquor is rumen degradable, 1.4 lb (as fed basis) could be used to meet the requirement. Wheat midds could also be fed with 1.6 lb meeting the requirement.

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