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SUPPLEMENTAL DEGRADABLE PROTEIN REQUIREMENT FOR CATTLE FED STOCKPILED BERMUDAGRASS FORAGE

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Story in Brief

Stockpiled bermudagrass forage intake and apparent digestibility was determined for steers fed increasing levels of supplemental degradable protein (DIP). Four crossbred steers (807± 8.1 lb) were used in a 4 x 4 Latin Square design. Forage was fed ad libitum and contained 10.3% CP, 54.3% DIP, and 45% ADF. Treatments were: 1) no supplement (C); 2) .06 g of DIP/lb BW (L); 3) .13 g of DIP/lb BW (M); 4) .20 g of DIP/lb BW (H); and were fed at a rate of 1.39 lb of dry matter/day. Forage intake increased 18% and digestibility increased 7% in supplemented steers. Total energy intake was greater in supplemented steers. Calculated DIP supplied by forage was adequate to meet all steers’ DIP requirements. Improved digestion and intake of supplemented steers was due to the combination of energy and DIP supplied in the supplements. Supplemental energy may have increased passage rates and improved microbial efficiency.

Key Words: Beef Cattle, Protein Supplementation, Bermudagrass

Introduction

In 1996, the National Research Council adopted the metabolizable protein system for beef cattle. This system requires knowledge of forage and supplemental protein degradability in the rumen. Degradable protein (DIP) requirements have been reported to range from 8 to 10% of TDN intake. Little information is available regarding the protein characteristics of bermudagrass forage stockpiled for fall and winter grazing. Wheeler et al. (1998) found that weight and body condition loss was minimized when cows grazing stockpiled bermudagrass were supplemented with 2 lb of a mixture of soybean hulls and soybean meal. In a similar study, Wheeler et al. (1999) found DIP supplied by forage alone was adequate and by providing 2 lb of supplement, gain was maximized and body condition loss was minimized. Dietary energy supplied in the form of soybean hulls improved cow performance. The objective of this experiment was to determine the amount of DIP needed to maximize utilization of stockpiled bermudagrass hay harvested in December.

Materials and Methods

Bermudagrass pasture was grazed heavily during August to remove excess standing forage. On August 21, 1997, residual forage was clipped to a 2-in stubble height and 50 lb of actual N fertilizer per acre was applied on

August 22, 1997. Forage to be harvested as hay was not grazed. First killing frost occurred on November 4, 1997. One inch of rainfall was received between November 4 and December 6. On December 6, 1997, forage was swathed, baled, and stored in a barn.

Four crossbred steers (807 ± 8.1 lb) were used in a Latin Square design to determine the effects of protein supplementation on intake and apparent digestibility of stockpiled bermudagrass hay. Treatments were: 1) no supplement (C); 2) .06 g of DIP/lb B, (L); 3) .13 g of DIP/lb BW (M); 4) .20 g of DIP/lb BW (H); and were fed at a rate of 1.39 lb of dry matter/day. Supplement composition is shown in Table 1. Each period consisted of a 14-d adaptation followed by a 5-d collection. Steers were fed 130% of the previous day□s hay intake, and daily hay intake, refusal, and fecal output were measured directly. Hay, supplement, orts, and feces were composited by steer for each period. Thirty grams of composite was sub-sampled, weighed, dried at 55° C for 48 h and re-weighed to determine dry matter. Dried sub-samples were ground through a 2 mm screen and analyzed for crude protein (CP), acid detergent fiber (ADF), neutral detergent fiber (NDF), acid detergent insoluble nitrogen (ADIN), ash, and *in vivo* organic matter digestibility (OMD). Forage and supplement protein degradability was determined using the protease method described by Krishnamoorthy et al. (1983).

Model One of the Beef Cattle NRC (1996) was used to estimate DIP balance of steers within each treatment. Measured values for weight, forage intake, forage digestibility (TDN), and supplemental protein characteristics were used. Microbial efficiency was assumed to be 10% of TDN.

Data were analyzed by general linear model procedures of SAS for a Latin Square design (SAS, 1985). Means were tested for differences in supplemented versus non-supplemented treatments. Supplemented treatments were tested for linear and quadratic effects.

Results and Discussion

Stockpiled hay nutritive value is shown in Table 2. Protein degradability in this hay harvested in December was similar (54.3%) to that reported by Mathis et al. (1998) (58.6% DIP) for bermudagrass hay harvested during the summer (8.2% CP). Dietary intake and digestibility values are shown in Table 3. Forage intake increased 18% and organic matter digestibility increased 7% in supplemented steers compared with non-supplemented steers ($P<.05$). Total OM and DOM intake increased ($P<.05$) in supplemented steers compared with non-supplemented steers. Total diet organic matter digestibility tended to increase ($P=.08$) in supplemented over non-supplemented steers (Table 3). As DIP increased in the supplement, CP digestibility increased (linear $P<.05$). Assuming constant supplement protein digestibility of 80%, hay apparent digestibility of crude protein increased by 29% in H-fed steers compared with control steers.

Degradable protein balance was 31, 67, 168, and 234 for C, L, M, and H treatments, respectively. Cochran et al. (1995) concluded that maximum DOM intake occurs when DIP composes 10% of DOM intake (or TDN). In this study, maximum energy intake did not appear to be related to total DIP intake and may be due to the fact that DIP was adequate in non-supplemented steers (Table 3).

Protein supplementation had little influence on forage intake or digestion. However, supplementing energy, in the form of soybean hulls, resulted in a dramatic improvement in hay utilization.

Literature Cited

Cochran, R.C. 1995. Research Progress Report. p 58. Kansas State Univ., Manhattan.

Krishnamoorthy, U. et al. 1983. Br. J. of Nutr. 50:555.

Mathis, C.P. et al. 1998. J. Anim. Sci. 76(Suppl. 1): 205.

NRC. 1996. Nutrient Requirements of Beef Cattle (7th Ed.). National Academy Press, Washington, DC.

SAS. 1985. SAS User's Guide: Statistics (Version 5 Ed.) SAS Inst. Inc., Cary, NC.

Wheeler, J.S. et al. 1998. Okla. Agr. Exp. Sta. Res. Rep. P-965:54.

Wheeler, J.S. et al. 1999. Okla. Agr. Exp. Sta. Res. Rep. P-973:

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Table 1. Supplement composition and nutrients supplied.

	% dry matter		
Item	L	M	H
Soybean hulls	92.9	61.3	31.2
Soybean meal	0.0	31.7	61.9

Molasses	3.2	3.3	3.3
Dical phosphate	2.8	2.4	1.2
$CaCO_3$	.5	1.2	2.5
KCl	.5	0.0	0.0
CP%, actual	12.1	23.2	35.0
	Nutrients supplied per day		
CP, caluculated, g	59	137	211
DIP, calculated, g	49	108	156
CP, actual, g	77	145	222
DIP, actual, g	37	113	191
Calcium, g	9	9	9
Phosphorus, g	4	5	4
Potassium, g	9	9	9
Mcal NEm	1.5	1.5	1.6

[a]Calculated values were determined using NRC (1996).

[b]Actual values were determined using the Strep Griseus procedure (Krishnamoorthy et al. 1983).

Table 2. Stockpiled bermudagrass hay nutritive value.

Item	%DM	%CP
Crude protein	10.3	-
Neutral detergent fiber	75.4	-
Acid detergent fiber	44.7	-
Organic matter	94.0	-
Organic matter digestibility	47.6	-
Lignin	8.6	-
Ether extract	1.7	-
Degradable intake protein	5.6	54.3
Acid detergent insoluble nitrogen	1.6	15.5
Neutral detergent insoluble nitrogen	5.1	49.5

Table 3. Daily intake of dietary components, lb of organic matter and apparent digestibility of dietary components.

Item	C	L	M	H	SEM
	Treatments				
Hay DM intake[a]	9.5	10.8	11.2	11.0	.79
Supplement	0.0	1.39	1.39	1.39	-
Total[a]	9.5	12.1	12.6	12.3	.79
DOM[a]	4.6	6.6	7.0	7.0	1.0
DIP, g/d	238	308	397	473	-
DIP/DOM	10.9	10.3	12.5	14.7	-
	----------------------Apparent Digestibility----------------------				
Organic matter[b]	48.8	54.8	55.4	57.4	2.9
CP [ac]	48.0	57.1	62.4	69.2	2.9
ADF	49.2	52.4	51.9	53.8	2.6
NDF	54.4	55.5	55.5	58.3	2.6
ADIN	11.5	12.2	14.5	16.4	3.3

[a]C treatment differs from supplemented treatments P<.05.

[b]C treatment differs from supplemented treatments P=.08.

[c]Linear effect for supplemented treatments P<.05.

1999 Research Report - Table of Contents