Supplementation Strategies for Stockpiled Bermuda grass: II. Forage Utilization

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Story in Brief

Four crossbred steers were used in a Latin square design to evaluate effects of supplemental energy source and degradable intake protein level (DIP) on forage intake, apparent total tract digestibility of organic matter, fiber constituents (NDF and ADF), and protein from stockpiled Bermuda grass hay. Each period consisted of a 12-d diet adaptation period followed by a 5-d collection of feed, feces, and orts. Forage was offered with ad libitum access and contained (DM basis) 93.4% OM, 43.7% ADF, 7.2% CP, and 4.4% DIP. The pelleted supplements were individually fed at .17% of body weight and included: 1) a soybean hull based supplement (53 g DIP/d; SH), 2) a corn based supplement with additional soybean meal to provide equivalent DIP of SH (49 g DIP/d; LDC), 3) a corn based supplement with additional soybean meal to provide two times the DIP of SH (111 g DIP/d; HDC), and 4) a non-supplemented control (CON). Supplementation did not significantly influence forage intake or apparent digestibility of organic matter and fiber constituents. The negative effects that have historically been associated with starch supplementation of low quality forages were not observed under the conditions of this experiment.

Key Words: Forage Utilization, Stockpiled Forage, Supplementation, Digestibility

Introduction

The incorporation of a stockpiled Bermuda grass component in a forage management system has the potential to reduce cow wintering costs (Lalman et al., 2001). However, cured forages tend to leach soluble nutrients during the fall and winter months. Small package protein supplements have been shown to consistently and dramatically improve low quality native warm season forage utilization. Recently, Wheeler et al. (1999a) demonstrated that stockpiled Bermuda grass accumulated from September through October, maintained moderate crude protein levels during November through February. Furthermore, Wheeler et al. (1999a, 1999b) concluded that ruminally degradable protein supplementation had minimal impact on animal performance, while energy supplementation, in the form of a digestible fiber energy source, resulted in increased animal performance and utilization of stockpiled Bermuda grass forage. While cereal grains are readily available in Oklahoma, these starch based energy sources are not thought of as being compatible with low-quality forages. The objective of our study was to evaluate the effects of energy source and degradable intake protein level on intake and digestibility of stockpiled Bermuda grass forage.

Materials and Methods

To determine the effects of supplementation on intake and apparent digestibility of stockpiled Bermuda grass hay we used four crossbred steers (BW 930±4.0 lb) in a 4 x 4 Latin Square design. Treatments included a non-supplemented control (CON), soybean hull based supplement (53 g DIP/d; SH), corn based supplement with additional soybean meal to provide similar DIP to

SH (49 g DIP/d; LDC), and corn based supplement with additional soybean meal to provide two times the DIP of SH (111 g DIP/d; HDC). The steers were fed supplements (Table 1) at the rate of .17% of BW or an average of 1.6 lb per day and hay was fed ad libitum. This supplement feeding rate was chosen because mature cows were fed this amount (BW basis) in a companion study (Johnson et al., 2001). Stockpiled Bermuda grass forage was grown under the conditions described in the companion study (Johnson et al., 2001). Hay was harvested from an ungrazed stockpiled Bermuda grass pasture at the Eastern Oklahoma Research Station near Haskell, OK, on December 5, 1999. The hay was stored in a covered barn prior to being chopped to an approximate 2-in length before feeding.

This experiment included four periods, each consisting of a 12-d adaptation prior to a 5-d collection period. For each period, daily forage intake, refusal, and fecal output were measured directly and orts and fecal samples were collected. Hay and supplement samples were collected daily and composited for the entire experiment. Data were analyzed as a Latin Square design using the GLM procedure of SAS (SAS Inst. Inc., Cary, NC) with the effects of steer, period, and treatment in the model. If model effects were significant, contrasts were evaluated and least squares means were separated using the least significant difference. Pre-planned contrasts included the effects of energy source (SH vs LDC), DIP level (LDC vs HDC), and supplementation (CON vs all supplement treatments).

Dry matter, organic matter, ash, nitrogen (N), and fiber constituents (NDF and ADF) were determined. Degradable protein was estimated by measuring nitrogen disappearance during either a 48- (forages) or 18-h (supplements) incubation in a borate-phosphate buffer containing protease type XIV from *Streptomyces griseus*. A 48-h in vitro procedure was used to estimate organic matter disappearance (OMD).

Table 1. Stockpiled Bermuda grass hay and supplement chemical composition

	Treatment[a]			
Parameter	Hay	SH	LDC	HDC
OM, % DM	93.4	90.2	93.9	92.4
NDF, % DM	80.8	56.2	9.1	9
ADF, % DM	43.7	39.4	5.7	6.3
IVOMD	50.4	91	96.3	97.8
CP, % DM	7.2	14	14.2	23.3
DIP, % DM	4.4	7.8	7.4	16.4

[a]Soybean hull supplement (SH); corn supplement with similar DIP to SH (LDC); corn supplement with two times the DIP of SH (HDC)

Results and Discussion

Intake and digestibility of dietary components are shown in Table 2. Treatment was not a significant ($P>.1$) source of variation for hay OM intake, total OM intake, or apparent OM and fiber (NDF and ADF) digestibility. Recent studies evaluating increasing levels of supplemental DIP for cattle consuming stockpiled Bermuda grass forage (Wheeler et al., 1999b) or summer harvested Bermuda grass forage (Mathis et al., 2000) and also found no significant improvement in forage utilization with supplemental DIP. There is a strong positive relationship between DIP intake and total digestible organic matter intake (TDOMI) until DIP intake equals approximately 10% of TDOMI. The 1996 National Research Council Nutrient Requirements for Beef Cattle uses this relationship to estimate the DIP requirement and suggests that when approximately 8 to 10% of the TDOMI is DIP, microbial protein production is optimized. Our supplement regimes supplied between 9.5 and 11.8% DIP, expressed as a percentage of TDOMI. Since these values approximate or exceed the estimated requirement for DIP, it is not surprising that forage intake and TDOMI did not differ among treatments.

In the study of Wheeler et al. (1999b), energy supplementation, in the form of soybean hulls, did improve organic matter digestibility by 14% compared to the non-supplemented treatment. The reason for inconsistent results in these experiments relative to energy supplementation is unclear, particularly since chemical composition of forage was similar. When corn grain was used as the energy source, and compared to the SH energy source, forage intake and digestion was certainly not reduced, as has been reported in other research. We believe this is due to the fact that supplements were fed at low levels (Garces-Yepez et al., 1997) and that DIP supply was adequate (Bodine et al., 2000).

Supplementation resulted in higher ($P<.01$; Table 2) apparent CP digestibility compared to CON. This difference was not totally due to the fact that more digestible protein was supplied through the supplement. Interestingly, steers receiving LDC consumed equal CP, but had higher apparent CP digestibility compared to SH supplemented steers ($P<.05$). Perhaps the numerical, but nonsignificant increase in TDOMI observed for LDC compared to SH fed cattle suggests improved microbial growth and protein synthesis.

Table 2. Daily intake and apparent digestibility of dietary components

	Treatment[a]					
Parameter	CON	SH	LDC	HDC	SEM	TRT[b]
Intake						
Hay OM, lb/d	15.2	15.0	15.0	15.4	.55	.9
Supplement OM, lb/d	--	1.3	1.4	1.4	--	--
Total OM, lb/d	15.2	16.5	16.3	16.7	.55	.3
Total DIP, lb/d[c]	.71	.82	.80	.96	.03	.01
TDOMI, lb/d	7.5	7.7	8.4	8.4	.59	.6
DIP/TDOMI[d]	9.5	10.8	9.6	11.8	.62	.1
Digestibility, % DM						
OM	49.7	46.6	51.8	49.9	3.0	.68
CP[e]	31.0	34.1	40.6	42.9	1.7	.01
NDF	45.3	44.9	47.6	46.0	2.1	.82
ADF	36.7	35.1	38.6	37.0	2.7	.84

[a]Non-supplemented control (CON); soyhull supplement (SH); corn supplement with similar DIP to SH (LDC); corn supplement with two times the DIP of SH (HDC)
[b]Probability for effect of treatment in the model
[c]Contrasts: Energy ($P<.1$); DIP ($P<.01$); Supplementation ($P<.01$)
[d]Contrasts: Energy ($P>.2$); DIP ($P<.05$); Supplementation ($P=.1$)
[e]Contrasts: Energy ($P<.05$); DIP ($P<.01$); Supplementation ($P<.01$)

Implications

A small package of supplement improved apparent dietary protein utilization, but did not result in significant improvements in forage intake or digestibility. Under these conditions, there was no advantage of soybean hulls as a supplemental energy source over corn grain. Stockpiled Bermuda grass forage typically contains adequate degradable protein to meet microbial protein requirements

Literature Cited

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