Supplementation Strategies for Stockpiled Bermudagrass: I. Cow Performance

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Story in Brief

Sixty-three mature spring-calving beef cows were used in a completely randomized design to determine the effects of energy source and DIP level on cow performance while grazing stockpiled bermudagrass pastures. Twenty-eight and 35 cows were allocated to one of four supplement regimes, at each of two locations, Stillwater and Haskell, OK. The pelleted supplements were individually fed at .17% of body weight and included: 1) a soybean hull based supplement (SH), 2) a corn based supplement with additional soybean meal to provide equivalent DIP of SH (LDC), 3) a corn based supplement with additional soybean meal to provide two times the DIP of SH (HDC), and 4) a non-supplemented control (CON). Pastures were grazed until late August when fertilized with 50 lb N/acre. Grazing was deferred until November 15, upon which treatments were initiated and continued for 70 d. Cow weight change and forage intake were unaffected by treatment, although supplementation did slightly improve cow body condition score by the end of the experimental period. Under the conditions of this experiment, corn grain was an effective supplemental energy source and supplemental degradable protein, beyond the energy control, was unnecessary.

Key Words: Cows, Stockpiled Forage, Supplementation, Intake

Introduction

Costs associated with feeding harvested forages during winter represents one of the major inputs in cow/calf production systems. By extending the grazing season into the fall and winter months through stockpiling of forages, lower production costs can be achieved. Bermudagrass has the potential to be stockpiled during late summer for fall and winter grazing, although little work has been conducted to establish supplementation recommendations. Wheeler et al. (1999) demonstrated that stockpiled bermudagrass accumulated from September through October, maintained moderate crude protein levels during November through February. Degradable intake protein (DIP) has been shown to have minimal impact on animal performance in this system, whereas readily fermentable energy source (soybean hulls) can improve cow body condition (Wheeler et al., 1998 and 1999). High levels of starch-based energy sources (corn) have been shown to impair forage utilization of low-quality forages. However, recent research suggests that by supplying adequate DIP in conjunction with starch supplements, these negative associative effects are reduced (Bodine et al., 2000). The objective of our study was to evaluate the effects of energy source and degradable intake protein level on cow performance while winter grazing stockpiled bermudagrass pastures.

Materials and Methods

In May of 1999, we applied 71 lb/acre of actual nitrogen (N) to bermudagrass (*Cynodon dactylon*) pastures at two locations; the Range Cow Research Center, located west of Stillwater, OK (STW) and the Eastern Oklahoma Research Station in Haskell, OK (HASK). The study pastures were grazed from May through late August to achieve an approximate forage height of 4 in. Upon removal of the cattle (late August), pastures were fertilized with 50 lb N/acre. Forage accumulated until the grazing trial began on November 15. Forage accumulation was estimated at both locations by determining forage dry matter (DM) yield in late August and at the initiation of grazing (mid-November).

The grazing period associated with the supplementation experiment continued for 70 d during the autumn and winter of 1999-2000. Twenty-eight spring-calving cows were used at STW and 35 spring-calving cows were used at HASK. Initial cow weight and body condition score did not differ by location or treatment. On d 0, 21, 49, and 70 cows were weighed and two independent evaluators assigned body condition scores (BCS). Supplements (Table 1) were individually fed at the rate of 2 lb/d (.17% BW) and prorated for 4 d/wk feeding. Treatments included a non-supplemented control (CON), soybean hull based supplement (53 g degradable intake protein (DIP)/d; SH), corn based supplement with additional soybean meal to provide equivalent DIP of 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).

Table 1. Ingredients and chemical composition of dietary supplements

	Treatments[a]		
Composition	SH	LDC	HDC
Ingredient:			
Soybean hulls, % DM	93.2	-	-
Corn, % DM	-	80.0	56.4
Soybean meal, % DM	-	12.9	36.8
Molasses, % DM	2.6	2.7	2.8
Dicalcium phosphate, % DM	3.0	3.1	2.6
Potassium chloride, % DM	.6	.6	-
Calcium carbonate, % DM	.6	.6	1.4
Chemical:			
OM, % DM	91.5	93.1	92.5
CP, % DM	11.3	14.1	22.3
DIP, % DM	4.6	7.3	14.0
NDF, % DM	60.3	44.5	42.5
ADF, % DM	45.7	4.9	5.5
OMD, %	86.6	91.3	92.2

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

Forage was sampled for nutritive value on d 0, 21, 49, and 70 of the experiment. At STW, esophageally fistulated steers and heifers (4 steers, 3 heifers) were used to collect forage nutritive value samples. At HASK, we collected hand-plucked samples representing the grazed portions of the pasture. Samples from both locations were dried at 55°C for 48 h and ground to pass through a 2-mm screen.

Dry matter, organic matter, ash, nitrogen (N), and fiber constituents (NDF and ADF) were determined. We estimated DIP 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).

Forage intake was estimated at STW using slow release chromic oxide boluses (Captec Chrome for Cattle, Captec Ltd., Auckland, New Zealand) to estimate fecal output. Boluses were administered on d 20, 6 d prior to a 5 d fecal collection period. Fecal grab samples were collected daily at 0800. To validate chromium release rate of the boluses, four crossbred steers were equipped with total fecal collection bags and allowed to graze the same pasture as the cows during the 5-d collection period.

We analyzed the data using the GLM procedure of SAS (SAS Inst. Inc., Cary, NC) including the effects of location, supplement treatment, and location x 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 (Energy; SH vs LDC), DIP level (DIP; LDC vs HDC), and supplementation (Supplementation; CON vs all supplement treatments). Forage nutritive value data were evaluated for the effect of date within location, due to the confounding of sampling technique.

Results and Discussion

More forage was accumulated at HASK (2,965±211 lb DM/acre) compared to STW (1,417±113 lb DM/acre; $P<.05$). Observed forage yields were lower than the previous 2-yr average by 20% at HASK and 39% at STW (Wheeler et al., 1998 and 1999). During the stockpiling period (September and October) mean temperature was lower than normal (30 yr mean), which may have limited forage growth. Warm-season grasses like bermudagrass are more susceptible to lowered temperatures than their cool-season counterparts and thus the lowered average daily temperature could have inhibited forage growth.

Forage nutritive value data were analyzed separately by location because sampling technique would be expected to contribute to location differences. Within each location CP, NDF, ADF, and OMD differed over time ($P<.05$; Table 2). At STW, fiber levels declined and OMD increased during the grazing period. Furthermore, protein and DIP levels were high in November, declined in December, and recovered during January. The combination of lower forage accumulation, warmer temperatures, and more precipitation during the grazing period at STW may have established more conducive growing conditions for cool-season annuals, allowing them to increase as a proportion of the available DM. In contrast, at HASK, peak NDF and ADF occurred in January, with peak OMD occurring early in the grazing period (November and December). Furthermore, CP concentration of the bermudagrass was greatest during December, yet maintained moderate levels through the grazing period. Wheeler et al. (1999) reported a decrease in TDN and increases in ADF and lignin concentration of similar bermudagrass pastures at both the STW and HASK locations. Others have also reported declines in bermudagrass dry matter digestibility during late autumn and early winter (Taliaferro et al., 1987).

Table 2. Nutritive value of stockpiled bermudagrass pastures during winter grazing					
	Month[b]				
Parameter [a]	Nov 17	Dec 8	Jan 5	Jan 23	SEM
STW - CP, % DM	19.4[c]	16.6[d]	16.5[d]	17.9[c]	.5
DIP, % DM	15.4[c]	12.0[d]	12.1[d]	13.4[e]	.5
NDF, % DM	58.0[c]	58.2[c]	54.4[d]	55.2[d]	1.1
ADF, % DM	31.3[c]	33.7[d]	31.4[c]	31.1[c]	.8
OMD, %	69.6[c]	69.3[c]	72.8[d]	73.6[d]	1.1
HASK - CP, % DM	7.6[a]	9.6[b]	9.1[b,c]	8.6[a,c]	.8
DIP, % DM	4.5	6.4	5.7	5.4	.8
NDF, % DM	77.5[a,c]	74.1[b,c]	78.8[a,b]	78.6[a,b]	2.3
ADF, % DM	38.8[a]	40.1[a]	43.4[b]	42.8[b]	1.2
OMD, %	54.7[a,b]	56.6[a]	46.9[c]	47.8[b,c]	3.3

[a]Samples were collected using esophageally fistulated animals.
[b]Samples were hand-plucked.
[c,d,e]Means were separated if date main effect was significant, therefore, within a row, means without a common superscript differ (P<.05).

The treatment by location interaction was not significant (P>.1), therefore data were pooled and are presented in Table 3. Supplement treatment did not have a significant effect on cow weight change or forage dry matter intake. Wheeler et al. (1999) observed maximal response in cow body condition with a digestible fiber energy source. In this case, and similar to the current study, supplemental DIP did not enhance cow performance.

Supplementation did improve cow BCS, regardless of energy type (starch or digestible fiber). It has been shown that feeding high levels (>.5% of body weight) of cereal grains results in suppressed forage utilization of low-quality forages. The mechanism of the “negative associative effects” is at least partially contributed to reduced ruminal ammonia available for microbial fermentation (Bodine et al., 2000). Since ruminal ammonia levels represent a balance between fermentable organic matter and DIP, high starch supplements that are low in DIP would amplify reduced ruminal ammonia levels. Recent literature has suggested that there is an energy source by level of DIP interaction and that by supplying adequate DIP in conjunction with high levels of starch supplements (Bodine et al., 2000), the negative associative effects that have been observed with starch supplementation of low-quality forages can be minimized. Our lack of an observed energy source or DIP response in this study and our companion digestion trial (Johnson and Lalman, 2001) support the argument that low levels of corn supplementation does not impair performance of spring-calving cows winter grazing stockpiled bermudagrass pastures.

Table 3. LS means for weight change, body condition change, and forage dry matter intake in spring-calving beef cows grazing stockpiled bermudagrass						
	Treatment[a]					
Parameter	CON	SH	LDC	HDC	SEM	TRT[b]
Initial cow weight, lb	1,190	1,192	1,234	1,212	41.4	.86
Initial condition score	5.11	5.10	5.19	5.13	.15	.91
Total weight change, lb	71.3	83.2	82.9	62.9	8.2	.23
Total BCS change[c]	-.06	.20	.18	.14	.09	.10
Forage DMI, % BW	2.0	2.1	2.0	1.9	.15	.82

[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]Contrast: Supplementation ($P<.05$)

Implications

Stockpiled bermudagrass pastures can extend the grazing season into late autumn and early winter, although forage accumulation is dependent on climatic conditions during the stockpiling period. Forage quality was high and protein levels were maintained during the grazing period. Supplementation of a degradable protein source, beyond that of the energy control, was not necessary. Supplementation did slightly improve cow body condition, suggesting that energy may have been limiting. Supplemental energy source (starch vs fiber) did not differ, suggesting that low levels of corn supplementation did not impair forage intake and animal performance.

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