FORAGE QUALITY, STEER GRAZING PERFORMANCE AND MILK PRODUCTION USING TIFTON 85 BERMUDAGRASS PASTURES AND CONSERVED FORAGES

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ABSTRACT

Forage quality and steer performance were determined in a two-year grazing study using replicated .81 ha pastures of Coastal bermudagrass (*Cynodon spp.*), Tifton 78 and Tifton 85 bermudagrasses. Pastures received 252 kg N/ha annually in three applications. Forage quality of esophageal masticate in July and September indicated that crude protein was higher ($P < .05$) for all pastures in September than in July. In vitro dry matter disappearance was higher ($P < .05$) for Tifton 85 than Coastal at both sampling dates. Steer daily gains were similar for the three bermudagrass treatments, but steer gain/ha was higher ($P < .10$) for Tifton 85 than for Coastal and Tifton 78 pastures. In a dairy cattle experiment (40 cows; 20 Holstein, 20 Jerseys; average 49 days in milk; six-week treatment period), Tifton 85 and alfalfa hay were fed at 15% and 30% of dietary DM, substituted for corn silage in total mixed diets. Cows consumed more DM when offered alfalfa hay than Tifton 85 hay diets (21.2 vs 19.1 kg/day, $P < .01$), had higher DM intake on low than high hay diets (20.4 vs 19.9 kg/day, $P <.10$) and had higher DM intake on the control silage-based diet than on hay diets (21.1 vs 20.1 kg/day, $P < .05$). Average daily milk yield and 3.5% fat corrected milk yield followed trends similar to DM intake for forage source and hay level in diets. Tifton 85 bermudagrass produced higher gains in beef steers than two other cultivars, and Tifton 85 hay has potential for utilization in dairy diets.

KEYWORDS

Cattle grazing dairy bermudagrass hay protein milk fiber

INTRODUCTION

Hybrid bermudagrass cultivars supply forage for grazing and hay production in the southern United States and other regions. Tifton 85 bermudagrass (Burton et al., 1993) has high yield capability and high forage quality for grazing steers (Hill et al., 1993). Tifton 85 produced 46% higher steer gains per hectare than Tifton 78 bermudagrass in a three-year grazing trial (Hill et al., 1993). In previous trials, Tifton 78 bermudagrass had 25% higher yields and 7% higher in vitro dry matter disappearance rates than Coastal (Burton and Monson, 1988). Conserved forages supply substantial portions of nutrients in beef and dairy diets. Alfalfa hay is a primary feedstuff in dairy diets, but it is expensive to transport this hay from western production areas to southern dairies in the United States. Experiments were conducted to further evaluate forage quality and steer performance on Tifton 85 pastures, and feed intake and milk production of dairy cows fed Tifton 85 bermudagrass hay or alfalfa hay in total mixed rations.

MATERIALS AND METHODS

Steer grazing experiment. During 1992 and 1993 yearling beef steers were assigned to replicated .81 ha Coastal, Tifton 78 or Tifton 85 bermudagrass pastures on Tifton sandy loam soils. Pastures were fertilized with 252 kg N/ha each year, in three equal applications in mid-March, late-June and early-August. Phosphorus and potassium were applied to provide a 4:1:2 ratio of $N:P_2O_5:K_2O$. British-based steers (n=48) were assigned to six groups by weight and breed-type each year. Groups containing four tester steers each were randomly assigned to treatment pastures each year (April 16, 1992; April 14, 1993). Tester steers (24/year; 295 kg initial weight) grazed in a put-and-take grazing system (Mott et al., 1952) for 168 and 126 days, respectively, in 1992 and 1993. Similar grazer steers were used to adjust forage mass to 2,800 kg/ha of dry matter (DM). Pasture herbage mass was determined at 14-day intervals as described by Hill et al., (1993), and stocking rates were adjusted to achieve the targeted forage mass in each pasture. Initial and final steer weights were means of two consecutive full weights.

Pasture forage quality was evaluated using mature esophageal cannulated steers (two steers in 1992; three steers in 1993) that grazed each pasture at seven-day intervals in late-July and mid-September each year, following procedures of Fisher et al., (1989) and Hill et al., (1993). Freeze-dried masticate samples were analyzed for crude protein (CP), using AOAC (1990) procedures, and acid detergent fiber (ADF) and neutral detergent fiber (NDF) components were determined using methods of Goering and Van Soest (1970). Methods after Moore and Mott (1974) were used to determine in vitro dry matter disappearance (IVDMD) of masticate from pastures. Residues were not ashed, disappearance was determined on a dry matter basis. Data were analyzed as a split plot in time with year as the main plot, rep x pasture as the subplot, date of sampling as the sub-sub-plot, and weekly samples as the sub-sub-sub-plot. Esophageal steers were treated as sampling units within each pasture.

Dairy cattle experiment. Forty dairy cows (20 Holstein, 20 Jersey) in early lactation were used in a trial that was conducted during cool weather. Cows housed in freestalls had constant access to Calan feeding gates and were milked twice daily. Cows were ranked by DMI during a standardization period, were blocked into groups of five cows by intake ranking during standardization period and by breed, and were randomly assigned within blocks to treatments. Diets contained 41.2% concentrate, 13.8% whole cottonseed, and 45% forage (DM basis), with differing forage sources. Forage to concentrate ratio was constant, and experimental treatments were a control diet (corn silage forage, no hay), 15% or 30% of dietary DM from Tifton 85 bermudagrass hay (4-week maturity; 87.9% DM, 17.3% CP, 80.7% NDF; 35.0%ADF), or 15% or 30% of dietary DM from alfalfa hay (91% DM; 16.6% CP; 48.1% NDF; 38.6% ADF) being substituted for corn silage (37.6% DM; 8.4% CP; 45.8% NDF; 25.8% ADF) on a DM basis. Bermudagrass hay was coarsely ground, and alfalfa hay was shredded. The five diets were fed as total mixed rations (TMR) and the contents of DM, CP, ADF and NDF (%), respectively, were: Control= 59.1, 19.4, 17.9, 33.5; Low Tifton 85 Hay= 63.1, 18.7, 20.3, 39.5; High Tifton 85 Hay= 73.5, 18.5, 22.8, 46.6; Low Alfalfa Hay= 63.4, 18.6, 21.0, 35.5; High Alfalfa Hay= 73.7, 18.5, 20.5, 33.5.

Data were analyzed as a randomized complete block with a 2 X 2 factorial arrangement of treatments, using contrasts: 1) alfalfa vs. Tifton 85 hays, 2) low vs. high dietary hay, 3) hay source X hay level interaction, and 4) control vs. low hay level.

RESULTS AND DISCUSSION

The steer grazing experiment was conducted on pastures established more than four years before grazing was initiated. In 1992, rainfall amounts and distribution were near normal, and steers grazed pastures for 168 days. In 1993, drought occurred during late April and May, forcing removal of all cattle on day 43 for a six-week interval, and grazing resumed on July 8, 1993, after substantial rainfall in late June. Consequently, steers grazed treatment pastures for 126 days in this year. Two-year mean forage quality in late-July and mid-September (Table 1) shows that date of sampling affected CP, with higher ($P < .05$) CP in September masticate. The ADF was higher ($P < .05$) for Tifton 85 than for Tifton 78 in July, but ADF was similar ($P > .10$) for all pastures in September. The NDF was higher ($P < .10$) for Tifton 85 than other pastures in July. The IVDMD was unaffected by sampling date, but IVDMD tended to be higher ($P < .10$) for Tifton 85 than for Coastal in July, and was higher ($P < .05$) for Tifton 85 than for Coastal in September. Tifton 78 had intermediate values for IVDMD at both sampling dates. Year affected CP and NDF, with higher ($P < .05$) values for each variable in 1992, but IVDMD was higher ($P < .05$) in 1993 than 1992. The relatively high IVDMD values for Tifton 85, despite high NDF concentrations, suggests that fiber in this forage is highly digestible. It is noteworthy that IVDMD of Tifton 85 remained above 65% in late season (mid-September), while IVDMD was reduced for Coastal and Tifton 78 pastures. Hill et al., (1993) reported similar NDF for Tifton 78 and Tifton 85 pasture masticate in September, but IVDMD was higher for Tifton 85 than Tifton 78.

The two-year mean performance of grazing steers (Table 2) indicated that average daily gains were unaffected ($P > .10$) by pasture treatment. During 1992, steers grazed continuously for 168 days, and forage mass averaged 1720, 1315, and 1742 kg DM/ha, respectively, for Coastal, Tifton 78 and Tifton 85 pastures. Stocking rates were limited during the drought period in 1993, and forage mass was less than 800 kg DM/ha before steers were removed from pastures. After grazing resumed (July 8 to October 1), forage mass averaged 2567, 2117 and 2847 kg DM/ha, respectively, in Coastal, Tifton 78 and Tifton 85 pastures. In both years the target forage mass was not consistently achieved for the pastures. Forage mass accumulated faster in Tifton 85 pastures, resulting in more ($P < .10$) grazing days for Tifton 85 than other treatments (Table 2). Consequently, gain/hectare was highest ($P < .10$) for Tifton 85, intermediate for Coastal, and lower for Tifton 78. Hill et al., (1993) reported similar tester gains, but higher gain/hectare for steers grazing Tifton 85 than for Tifton 78 pastures when forage mass was targeted at 2800 kg/ha.

In the dairy cattle experiment, cows consumed more DM when offered diets containing alfalfa hay than when offered diets with Tifton 85 hay, had higher DMI on low than high hay diets, and had higher DMI on control than hay diets (Table 2). Diets with higher DMI were the diets with lower NDF concentrations. A breed by forage source interaction occurred for DMI, and while Holstein cows consumed similar amounts of control and Tifton 85 hay diets, Jersey cows displayed a sharp linear decline in DMI as Tifton 85 hay increased in the diet. Alfalfa and Tifton 85 diets contained similar amounts of hay, but the high NDF content of the Tifton 85 hay increased the dietary NDF of the diets containing this hay source. Average daily milk yield and 3.5% fat corrected milk (Table 2) followed trends similar to DMI for forage source and level of hay in diets, and there were no breed by treatment interactions for these variables. West et al., (1997) reported no effects of treatments on CP and DM digestibilities of these diets, NDF and ADF digestibilities were higher for Tifton 85 than for alfalfa diets, and high hay diets had higher NDF digestion than low hay diets. These results suggest that high quality Tifton 85 hay may be a suitable substitute for alfalfa in Holstein dairy cattle diets in cooler seasons of the year.

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Table 1

Forage quality of Coastal, Tifton 78 and Tifton 85 pastures

	Quality of forage masticate (DM basis, %)			
Item	CP	ADF	NDF	IVDMD
Sampling date				
July				
Coastal	14.6	33.1^{c}	71.6^{e}	62.5
Tifton78	14.2	32.3^{c}	72.5^{de}	65.3
Tifton 85	15.1	34.8^{b}	74.6^{d}	66.9
September				
Coastal	17.0	32.0^{bc}	70.5	60.2^{c}
Tifton 78	18.3	31.3^{c}	69.5	62.9^{bc}
Tifton 85	18.1	32.9^{b}	71.8	65.2^{b}
SE	0.61^{a}	0.40	0.84	1.24
Year				
1992	14.9^{w}	33.1	72.5^{w}	61.6^{w}
1993	17.5^{x}	32.4	71.0^{x}	66.1^{x}
SE	0.39	0.31	0.34	0.56

Acronyms: DM=dry matter; CP=crude protein; ADF and NDF=acid and neutral detergent fiber; IVDMD=in vitro dry matter disappearance, SE=standard error.
[a]Sampling dates are different for each treatment (P<0.05).
[bc]Means within a sampling date differ (P<0.05).
[de]Means within a sampling date differ (P<0.10).
[wx]Year means within a column differ (P<0.05).

Table 2

Grazing steer and dairy cow performance using pastures and hays

Item	Treatment				Effect
Steer performance					
Pasture	Coastal	Tifton 78	Tifton 85	SE	
Tester initial wt, kg	294	295	295	0.5	NS
Tester ADG, kg	0.65	0.74	0.72	0.03	NS
Grazing d/ha, d	874	761	1019	64.0	Y^{**},$C^{\dagger}$
Gain/ha, kg	566	550	747	48.3	Y^{**},$C^{\dagger}$

Dairy cow performance										
Main effects	Hay Source (S)			Hay Level (L)			Diet (D)			
Contrasts	B	A	SE	High	Low	SE	Hay	Silage	SE	
DMI, kg/d	19.1	21.2	.2	19.9	20.4	.2	20.1	21.1	.2	S^{**},$L^{\dagger}$,D^{*}
Milk, kg/d	26.3	27.8	.2	26.6	27.5	.2	27.1	27.4	.2	S^{**},L^{**}
FCM, kg/d	29.3	30.4	.2	29.4	30.3	.2	29.9	29.7	.3	S^{**},L^{**}

Acronymns: SE=standard error; BW=initial body weight; ADG=average daily gain; D=day; Y=year; C=cultivar; A=alfalfa; B=Tifton 85 bermudagrass; DMI=dry matter intake; FCM=3.5% fat corrected milk.
$^{**}P<0.01$; $^{*}P<0.05$; $^{\dagger}P<0.10$