BERMUDAGRASS PASTURES UNDER LONG-TERM STOCKING RATES AND FERTILITY REGIMENS

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ABSTRACT

After 16 years of grazing 'Coastal' and common bermudagrass [*Cynodon dactylon* (L.) Pers.] pastures each at 3 levels of forage mass, N *vs* non-N fertilizer was superimposed to assess stand maintenance of bermudagrass and cow-calf performance. After 7 additional years of fertility treatments, N plus overseeded ryegrass (*Lolium multiflorum* Lam.) provided for 202 days grazing; whereas, K plus overseeded clovers (*Trifolium incarnatum* L.) and (*T. vesiculosum* Savi.) provided adequate forage for 179 days grazing. Coastal supported higher stocking rates (2.3 to 7.9 680-kg animal units(AU)/ha) than common bermudagrass (2.0 to 5.3 AU/ha). Suckling calf daily gains declined from 1.2 kg on low-stocked to 0.4 on high-stocked pastures. Calf gains per ha ranged from 312 to 794 kg/ha from K plus clover to 540 to 1132 kg/ha from N plus ryegrass stocked pastures. At high grazing pressures, non-N common bermudagrass was thinned more than Coastal (18% *vs* 11% bare soil), and had more invasion by (*Paspalum notatum* Flugge).

KEYWORDS

Cynodon dactylon, grazing, stocking rate, nitrogen, potassium, sustained production, *Lolium multiflorum*, *Trifolium incarnatum*

INTRODUCTION

Bermudagrass is the predominant pasture unit for livestock operations in the humid southeastern US where there is an abundance of inherently low fertility, acidic Coastal Plains sandy soils. Numerous small plot and grazing experiments have evaluated bermudagrass (Burton et al., 1963; Holt and Lancaster, 1968), but these have not been of sufficient duration or design to evaluate long-term soil-plant-animal interactions. In view of economic and environmental (Steele et al., 1984) considerations, the objective of this research was to ascertain the long-term influence of grazing pressure and presence or absence of N fertilizer on stand maintenance and vigor of common and Coastal bermudagrass pastures.

METHODS

Common and 'Coastal' bermudagrass pastures received annual, split applications of 224-112-112 kg/ha of N-P_2O_5-K_2O for a 16-year period (1969 to 1984) and were overseeded in October (autumn) each year with annual ryegrass (*Lolium multiflorum* Lam.) and clover (*Trifolium incarnatum* L.) and/or (*T. vesiculosum* Savi.). Each bermudagrass was grazed to three levels of forage mass with beef cows and calves from about mid-February to early October. Pastures were located across two loamy, siliceous, thermic Ultisols (Lilbert and Darco).

In the autumn of 1984 (year 16), each bermudagrass x grazing pressure pasture was subdivided into two equal paddocks. Paddocks were randomly designated to receive only K_2O (125 kg/ha) plus an annual clover or only N (450 kg/ha) plus annual ryegrass. Forage samples were taken at two-week intervals for nutritive value and 4-week intervals for forage mass.

Cows and calves, with a combined weight of about 700 kg, grazed continuously for about 200 days each year. Pastures were vacant from October to February each year to allow for overseeding and growth of annual forages. By using a constant number of animals on each pasture and with pasture sizes of .5, .7, and 1.1 ha, respectively, for high, medium, and low grazing pressure, a graded level of forage mass was achieved. Animals were weighed at 28-d intervals.

After 7 years (1984-1991) of this fertility x grazing pressure study, six 1 m x 1 m point quadrate readings (100 points) were taken at canopy surface from each pasture. Sward components scored were live, dead, (senesced plant parts and/or thatch), bare soil, and other species. Bermudagrass height in the three stocked pastures at the time of the point quadrate readings was about 2, 5 to 15, and 10 to 25 cm, respectively, for common bermudagrass, and about 2, 5 to 20, and 15 to 35 cm, respectively for Coastal bermudagrass. Data were analyzed as a randomized block.

RESULTS AND DISCUSSION

Forage mass at the time (autumn) of quantifying stand density of pastures ranged from 600 to 6,000 kg/ha DM (Table 1). High-stocked bermudagrass had a prostrate growth form; whereas, low-stocked bermudagrass was upright with long stolons. Roth et al. (1990) noted that Coastal bermudagrass assumed a more prostrate growth with increased continuous grazing pressures; however, percent leaf in the animal's diet was 80-90% when high-stocked and declined quadratically with decreased grazing pressure. An average, across years, of the year-long (200 days) stocking rates necessary to create graded levels of forage mass ranged from 2.1 to 5.3 AU/ha for common bermudagrass and 2.3 to 7.9 AU/ha for Coastal bermudagrass. Pastures which received N and overseeded with ryegrass provided about 23 more grazing days per year than pastures with K plus clover. Except for high-stocked pastures, average daily gain of calves was similar for both treatments within each stocking rate. Calf gain/ha on common bermudagrass was maximized at medium stocking rates of about 3.5 AU/ha for either N + ryegrass (744 kg) or K + clover (636 kg). With Coastal bermudagrass, maximum calf gain/ha occurred at high stocking rates of 7 to 8 AU/ha for either N + ryegrass (1132 kg) or K + clover (794 kg). Others have found differences between bermudagrass cultivars for stand maintenance and vigor under clipped plot conditions (Rouquette and Florence, 1981) as well as under grazing (Conrad et al., 1981). As evidenced by forage growth and subsequent stocking rates, common bermudagrass pastures were not as responsive to N rates as Coastal bermudagrass. Thus common bermudagrass stocked at medium or low levels may be ideally suited for non-N, clover overseeding management as compared to Coastal bermudagrass.

Sward composition of the various grazed bermudagrass pastures is shown in Table 2. Bermudagrass, fertilizer, grazing pressure and bermudagrass x grazing pressure were significant ($P<.01$) factors affecting the percent live component. The amount of senesced plant parts and/or thatch (dead) was affected by stocking rate and interactions of stocking rate with bermudagrass and fertility ($P<.01$). Stand density as indicated by percent soil was influenced by N, grazing pressure, and the interaction of these two variables ($P<.01$). The most detrimental impact of sward components on both bermudagrass stands occurred from high stocking in which no N was used. The relatively high percent soil (18.3%) and invading species (4%) on high-stocked common bermudagrass indicated stand deterioration. At the medium stocking rate of both grasses, total cover was affected ($P<.05$) by fertilizer, however, all other sward measurements were not significantly altered. Low-stocked pastures were considered to be well-sustained. Stand density was magnified, however, by sward height since forage removal to a 5-cm height on low-stocked pastures showed a more sparse stand than that of the high-stocked pastures.

Both common and Coastal bermudagrass pastures which have been grazed at three stocking rates for more than 25 years may be sustained under a wide range of management expertise. Bermudagrass, because of its deep rooting characteristics and relatively high biomass production (14 to 20 MT/ha), is apparently an efficient plant in recycling plant food nutrients under grazing conditions. Matocha et al. (1973) and Rouquette et al. (1973) reported that recycling and recovery of fertilizer nutrients vary with source of N and stocking rates. Selection of grazing pressure and forage species are important considerations for intensively managed pastures. In a 13-year study, Common et al. (1991) concluded that using a regimen of episodic summer grazing and the addition of fertilizers, oversown pastures can be maintained over long periods of time. In a 12-year study, Mott et al. (1970) reported that after a high level of N (200 kg/ha) was applied to a *Panicum maximum* pasture for 8 years, much lower rates of N may maintain near maximum levels of production.

Although bermudagrass responds positively to moderate-to-high rates of N fertilization, the long-term economy of production and environmental sustainability may favor the use of clovers and non-N fertilizers under systems of moderate-to-low intensity of utilization.

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Table 1
Trial average animal performance from bermudagrass pastures overseeded with clover (CLV) or ryegrass (RYG) and stocked at three rates.

				Calf Gains		
Annual forage	Stocking rate AU/ha[2]	Forage mass[1] kg/ha	Grazing days	Per day	Per animal	Per hectare
				kg		
			COMMON BERMUDAGRASS			
CLV	4.74	806	174	.38	67	312
RYG	5.31	720	199	.67	134	699
CLV	3.46	1536	178	1.03	184	636
RYG	3.58	1664	200	1.04	209	744
CLV	2.05	3080	178	1.15	205	416
RYG	2.17	3228	202	1.22	247	540
			COASTAL BERMUDAGRASS			
CLV	6.97	597	184	.60	122	794
RYG	7.93	710	206	.75	156	1132
CLV	3.71	2878	178	1.12	199	731
RYG	4.89	2608	204	1.05	215	1005
CLV	2.27	5906	181	1.23	238	500
RYG	2.91	5570	203	1.21	247	707

[1] Forage mass at termination of each grazing season
[2] AU = Animal-unit equivalent to 680 kg

Table 2
Bermudagrass pasture composition after seven years of two overseeding-fertility regimens and three grazing pressures.

		Fertilizer and grazing pressure											
		Clover + K						Ryegrass + N					
Bermuda-grass	Sward	High		Med		Low		High		Med		Low	
		%											
			SE[b]		SE		SE		SE		SE		SE
Common	Live	55.8	5.8	62.6	3.1	62.1	1.6	71.4	2.1	67.1	3.4	66.3	2.2
	Dead	22.0	3.1	32.5	2.9	34.1	1.7	26.4	1.6	32.9	3.4	33.8	2.2
	Soil	18.3	3.9	0.4	.4	0.0	-	2.0	.4	0.0	-	0.0	-
	Other	4.0	1.3	4.5	1.6	3.5	1.6	0.2	.2	0.0	-	0.0	-
	Cover[a]	77.8	4.1	95.1	1.4	96.2	1.4	97.8	.6	100.0	-	100.0	-
Coastal	Live	73.1	3.7	70.8	1.7	49.0	1.3	87.9	1.1	67.5	1.2	62.8	1.3
	Dead	14.6	2.3	24.3	2.6	51.0	1.3	8.6	1.0	32.1	1.2	37.3	1.3
	Soil	10.9	3.7	1.2	1.0	0.0	-	3.5	.6	0.4	.4	0.0	-
	Other	1.4	.7	3.7	1.2	0.0	-	0.0	-	0.0	-	0.0	-
	Cover[a]	87.7	4.2	95.1	1.1	100.0	-	95.5	.6	99.6	.4	100.0	-

[a] Cover rating is combination of live and dead.
[b] Standard Error (SE) of mean.