Effects of Nitrogen Rate on Yield and Quality of Tifton 85 Bermudagrass

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Tifton 85 Bermudagrass Response to Nitrogen Rate

Abstract

Improved bermudagrasses are one of the most important sources of forage in the Southern United States, with more tonnage harvested for hay in the region than any other perennial grass cultivar. A new selection increasing in popularity is Tifton 85. Tifton 85 is a very productive forage which has high digestibility and produces excellent weight gains. While it has been managed similar to Coastal, very little is known about the specific nutrient requirements of Tifton 85. The effects of nitrogen fertilizer rates ranging from 56 to 224 kg N ha^{-1} on yields and quality of Tifton 85 bermudagrass were evaluated on a Burleson clay soil near Thrall, Texas. Individual plots were 3.05 m wide by 6.1 m long, and the study was arranged as a randomized complete block with four replications. Treatments in 2001 and 2002 included nitrogen rates of 56, 84, 112 and 140 kg N ha^{-1}. Nitrogen rates of 168 and 224 kg N ha^{-1} were added in 2003 and 2004, respectively. Fertilizer was applied at spring green up and following each harvest. Increasing the recommended N rate from 112 to 140 kg ha^{-1} significantly increased yields in only two of five years, but increased crude protein content for most harvests. Increasing the N rate to 168 kg ha^{-1} increased forage yields in only one of three years. Considering current input costs for nitrogen fertilizer, the standard 112 kg ha^{-1} cutting^{-1} nitrogen rate recommended for warm-season bermudagrasses appears to be optimum for production of Tifton 85 on Blackland soils in central Texas.

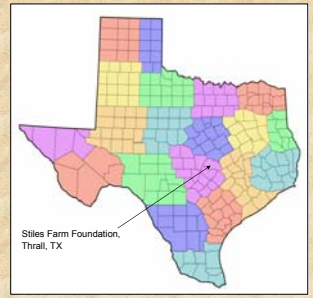

Fig. 1. Location of trial on Blackland soils in central Texas.

Introduction

Improved bermudagrasses represent an important source of forage in the Southern United States. Greater biomass of improved bermudagrass is harvested for hay in this region than any other perennial grass cultivar. Tifton 85, a recent selection of improved bermudagrass, offers potentially greater dry matter digestion which is closely correlated with weight gain, and digestible intake compared to Coastal bermudagrass (Burns and Fisher, 2007). Recent studies in the Southern High Plains region demonstrated high irrigation water use efficiency of Tifton 85 compared to other perennial grasses (Marsalis et al., 2007). While Tifton 85 may be managed similar to Coastal bermudagrass produced in Central and Southeast Texas, little is known about its specific nitrogen (N) requirement for the soils and climate of this region.

Management of N fertility in forage production systems in an increasing concern among producers. Nitrogen is one of the most important nutrients in forage production. Nitrogen is usually required in large amounts and, as a result, represents a significant input cost (Stichler and McFarland, 2001). Given the escalating costs of N fertilizer inputs, optimizing nutrient use efficiency is essential to achieve optimum economic goals. Because N is surface applied in most forage production systems, it is susceptible to considerable loss through runoff and/or leaching, and volatilization of ammonia from urea. According to Brink et al. (2004), Tifton 85 may be a suitable candidate grass for reducing the threat that excess N poses to surface and ground water quality. In their study using broiler litter, N and P uptake of Tifton 85 increased in each of four years, exceeding that of Coastal and Tifton 44 bermudagrass by the final year of the study.

It has been speculated that Tifton 85 may respond differently than other bermudagrass cultivars either by requiring less total N to achieve similar yields or by producing superior yields with similar or slightly higher rates of N.

Objective

To evaluate the effects of nitrogen rate on yields and quality of Tifton 85 bermudagrass.

Materials and Methods

Tifton 85 was planted into a Burleson clay at the Stiles Farm Foundation near Thrall, Texas. The experimental design was a randomized complete block with experimental units replicated four times. Individual plots were 3.05 m wide by 6.1 m long. Treatments included nitrogen rates of 56, 84, 112, 140, 168, and 224 kg N ha^{-1} in trials depending on the particular season (Table 1).

Table 1. Seasons corresponding to various rates of N fertility applied to an improved bermudagrass cv. Tifton 85 planted at the Stiles Farm Foundation, Williamson County, TX.

N Rate (kg ha^{-1})	Season of Production				
	2001	2002	2003	2004	2005
56	X[†]	X	X	X	X
84	X	X	X	X	X
112	X	X	X	X	X
140	X	X	X	X	X
168	-[‡]	-	X	X	X
224	-	-	-	X	X

[†] Corresponding rate of N fertilizer was applied.
[‡] No N fertilizer was applied, treatment was not active.

Nitrogen source was solid ammonium nitrate. Fertilizer was broadcast at spring green up and following each harvest by hand. Soil pH was 8.0. Plots were harvested by cutting a 0.7 m strip of forage from the center of each plot. Cut forage was immediately weighed and a sub sample collected from each plot was used to determine moisture content and forage quality. Cuttings were scheduled approximately 28 d after green up in the Spring and after each subsequent harvest. The cumulative number of cuttings varied from two to four per season and largely depended on seasonal rainfall amounts (Plate 1).

Plate 1. Layout of Tifton 85 plots at first green up in Spring when nitrogen and phosphorous fertilizers were first applied.

Results & Discussion

Nitrogen treatments consistently reflected differences in canopy color (Plate 2). Cumulative forage yields in 2001 showed a significant increase for additional increments of N applied above 56 kg N ha^{-1} (Fig. 4a).

Plate 2. Contrasting color of Tifton 85 plots just prior to the third seasonal cutting.

In 2002, cumulative yield only differed numerically between the 140 and 112 kg N ha-1 treatments, but was greater for either of the treatments compared to applying 84 kg N ha-1 (Fig 4b). There was a trend for cumulative forage yield to improve in response to additional increments of N applied above 112 kg N ha-1 in 2003; however, differences between treatments weren't significant (Fig. 4c). Forage yields showed that the 224 kg N ha^{-1} treatment was statistically superior to other treatments in 2004 and 2005 (Fig. 4d-e). Overall, increasing the recommended N rate from 112 to 140 kg N ha^{-1} improved forage yields in only two of five years (Fig 4a-e).

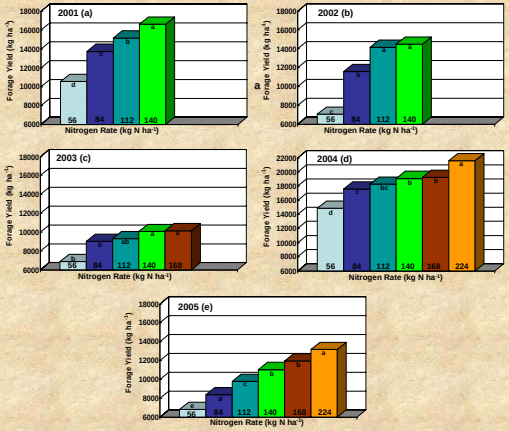

Fig. 4a-e. Effect of nitrogen rate on cumulative annual forage yield of Tifton 85 bermudagrass in 2001 (a), 2002 (b), 2003 (c), 2004 (d), and 2005 (e) at Thrall, TX. Different letters indicate that treatment means were different according to protected LSD (P≤0.1).

In all years, average annual crude protein content increased with each increment of additional N fertilizer up to 140 kg N ha^{-1} (Table 2). In 2005, every additional increment of N fertilizer up to 224 kg N ha^{-1} resulted in significant increases in crude protein levels. Crude protein levels in forage were higher as a result of applying 224 versus 140 kg N ha^{-1} during 2004 and 2005. Menegatti, D. de P. et al., (2002) reported enhanced dry matter yield and crude protein content of Tifton 85 to N fertilization in Brazil. As with the current study, application of 100 kg N ha^{-1} resulted in highest rates of utilization efficiency and recovery of nitrogen.

Table 2. Effect of nitrogen rate on average annual crude protein content of Tifton 85 bermudagrass at the Stiles Farm Foundation, Thrall, TX.

N Rate (kg/ha)	Average Annual Crude Protein				
	2001	2002	2003	2004	2005
	%				
56	8.6 d[†]	8.1 d	9.1 d	9.1 e	8.4 f
84	9.3 c	9.3 c	10.2 c	10.4 d	9.3 e
112	10.4 b	10.7 b	11.5 b	12.3 c	10.6 d
140	11.3 a	13.2 a	13.4 a	14.8 b	11.7 c
168	-[‡]	-	13.7 a	15.3 ab	12.7 b
224	-	-	-	15.8 a	14.0 a

[†] Within columns, means followed by the same letter are not significantly different according to LSD (0.1).
[‡] Treatment was not initiated during the season.

Summary

- ✓ Nitrogen rates greater than the standard 112 kg/ha/cutting did not consistently increase forage yields of rainfed Tifton 85 bermudagrass in central Texas over multiple seasons.
- ✓ Crude protein concentration of Tifton 85 bermudagrass was consistently increased by to N rates greater than 112 kg/ha/cutting; however, current market value may not support the additional cost of N.
- ✓ Given current input costs for nitrogen fertilizer, the standard 112 kg/ha/cutting recommended for warm-season bermudagrasses appears to be optimum for production of Tifton 85 on Blackland soils in central Texas.

Acknowledgements

The authors recognize the contributions of Frank Mazac, Jr. in plot establishment, data collection and data analysis.

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