EASTERN GAMAGRASS RESPONSE TO NITROGEN FERTILIZER

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ABSTRACT: Response of eastern gamagrass (accession 9062680) to nitrogen fertilizer was determined at the Prairie Experiment Station on a Houston clay soil. Nitrogen rates of 0, 134, 268, 402, and 536 kg ha^{-1} were applied in three equal split applications using ammonium nitrate as the N source. Harvests were made in 2002 on 21 May, 9 July and 23 August. Season total yields and percent crude protein percentages of 9062680 increased linearly with increasing rates of N in 2001 and 2002. Yield efficiency varied between years with the greatest yield efficiency occurring in 2002.

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KEY WORDS: Eastern gamagrass, nitrogen, yield, crude protein, yield efficiency

MATERIALS AND METHODS: Vegetative propagules of accession 9062680 (680) were established in 6 by 9 ft plots in April 2000 at the Prairie Experiment Station on a Houston clay soil (very fine, montmorillonitic, thermic, Typic, Chromuderts). Nitrogen fertilizer rates were 0, 120, 240, 360, and 480 lb/ac and applied in three equal split applications in a randomized complete block with three replications. Phosphorus and K were maintained at a medium to high level according to soil tests. Nitrogen fertilizer was applied at green-up and after first and second harvest using ammonium nitrate as the N source. Harvests were made 21 May, 9 July, and 23 August. Grab samples were collected for dry matter yield and N content. Crude protein (CP) was estimated by multiplying percent N concentration by 6.25. Yield efficiency was determined by subtracting the yield obtained from the fertilized plot from the yield obtained from the control plot and dividing the difference by the N application rate. Linear and quadratic regression analyses were used to define response to N rates.

RESULTS AND DISCUSSION:

Yield

Season total yields in 2001 and 2002 increased linearly with increasing rates of N (Fig. 1.a). Apparently the highest N rate (536 kg ha^{-1}) was not enough to obtain a maximum N peak in the response curve in either year. Response to N was greater in 2002 despite low rainfall in mid and late season (Fig. 1.b). It is anticipated residual soil NO_3-N accumulation from previous forage and row crop experiments may have limited N response in 2001. As this residual N was

removed in the above ground biomass in 2001, a higher correlation to applied N was observed in 2002. (2001, $y = 7431 + 10.07N$ $r^2 = .69$; 2002, $y = 2807 + 20.38N$ $r^2 = .95$). Bredja et al. (1996) reported that eastern gamagrass did not respond to N the first year because of N accumulation from prior management for seed production. In subsequent years, the yields increased linearly with increasing rates of N.

Crude Protein

Growth stage of 680 in the first and second harvests was characterized by reproductive stems at different stages of maturity (i.e. boot stage to emerged inflorescence) and primarily vegetative growth in the third harvest. These different stages of maturity appeared to have a limited effect on CP percentages. This conflicts with Douglas et al. (2002) that reported higher CP for 680 in the first harvest, which was made at the boot stage of maturity, than subsequent harvests made on 45 day intervals. Crude Protein percentages increased linearly with increased N rates in the first and second harvests in 2001 and the first and second harvests in 2002 (Table 2). Crude protein percentages reported in this study agree with those reported by Brakie (1998) and Brejda et al. (1996).

Yield Efficiency

Yield efficiency varied between years, with the greatest yield efficiency occurring in 2002 (Table 3). Yield efficiency values are directly related to the response curve (Brock, 1984). Response to N rates increased greatly in 2002 compared to 2001 (Fig. 1a.) resulting in a yield efficiency increase of 60 percent. Bredja (2000) reported yield efficiency range of 0-46 lb/lb N for PMK-24 eastern gamagrass in northern Missouri with increasing rates of N ranging from 50-200 lb/ac.

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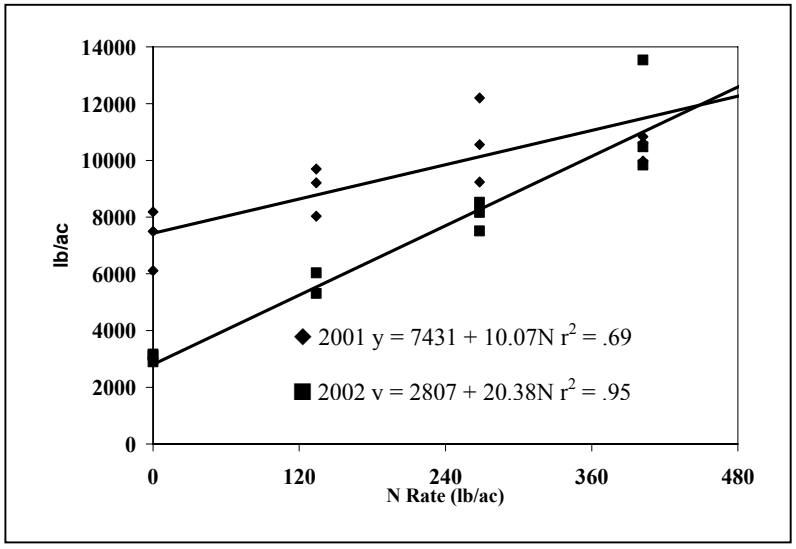

Fig. 1a. Season total dry matter yield for accession 9062680 in 2001 and 2002 as a function of N rates at Prairie, MS.

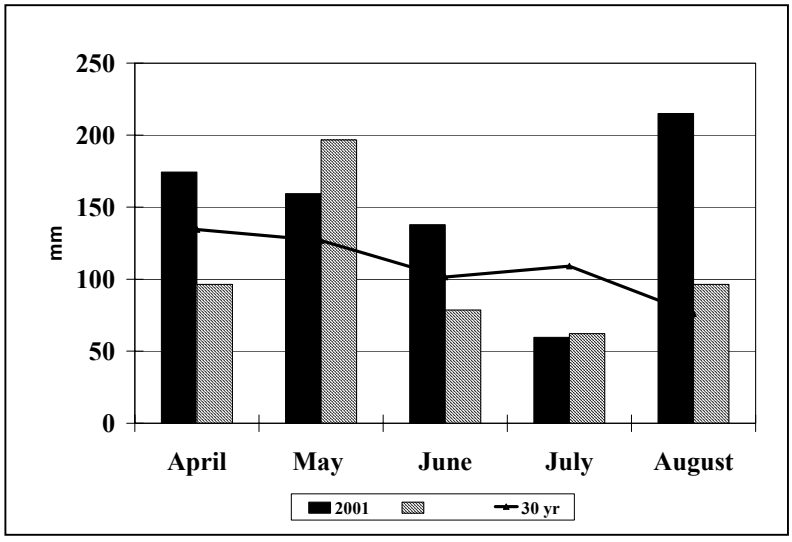

Fig. 1b. Monthly rainfall totals in 2001 and 2002 during the growing season and the 30 year monthly average at Prairie, MS.

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Table 2. Percent N content and CP percentages of accession 9062680 by harvest date and N rates in 2001 and 2002 at Prairie, MS.

N Rate	2001			2002		
(lb/ac)	1st	2nd	3rd	1st	2nd	3rd
	----------%----------					
0	1.1 (6.9)[1]	.90 (5.6)	1.2 (7.5)	1.1 (7.0)	.91 (5.7)	.96 (6.0)
40	1.3 (8.1)	.77 (4.8)	1.0 (6.3)	1.4 (8.9)	1.1 (7.0)	1.3 (8.1)
80	1.7 (10.6)	.87 (5.3)	1.3 (8.1)	1.4 (8.9)	.92 (5.8)	1.1 (6.9)
120	1.6 (10.0)	1.1 (6.9)	1.2 (7.5)	1.6 (10.0)	1.3 (8.1)	1.4 (8.8)
160	1.7 (10.6)	1.1 (6.9)	1.4 (8.8)	1.6 (10.0)	1.4 (8.8)	1.1 (7.0)
N Linear (P<.05)	.05	.05	NS[2]	.05	.05	NS

1 = Protein concentration are listed in parenthesis. 2 = Not significant

Table 3. Yield efficiency of accession 9062680 by N rate and year at Prairie, MS

N Rate	Year	
(lb/ac)	2001	2002
	--------lb/lb N --------	
120	13	16
240	13	19
360	8	20
480	11	20

Yield efficiency = forage yield (fertilize) – forage yield (control) / N fertilizer applied.