Nitrogen Use Efficiency Screening of Forage Bermudagrass Germplasm

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INTRODUCTION

Bermudagrass is grown over millions of acres in southeastern United States for forage and hay production due to high yields and high quality forage for beef and dairy operations. However, significant fertilizer, especially nitrogen, is needed to produce high yields and highly digestible protein contents. To reduce costs to ranchers and hay producers more efficient use of nitrogen fertilizer (NUE) is needed. No studies have been reported to determine whether NUE variation occurs among forage bermudagrass genotypes. A three year study was conducted to compare NUE among 50 forage bermudagrass plant introductions. If significant variation occurs, cultivars could be developed through plant breeding efforts.

METHODS AND MATERIALS

Fifty forage bermudagrass genotypes were selected from a bermudagrass core collection developed at Tifton, GA to determine nitrogen-use efficiency over three years. Tests were conducted by establishing plugs in 30 cm diameter and 30 cm deep corrugated tubing in 2010. Starting in the spring of 2011, each genotype was given either 50 kg ha^{-1} equivalent N or 200 kg ha^{-1} equivalent N plus 40 kg ha^{-1} P and 100 kg ha^{-1} K over each year split over four times corresponding with clipping times and replicated 4 times. Plots were harvested five times in 2011 and four times in 2012 and 2013. Dry matter yield and fiber quality were measured for each plot. Nitrogen content was determined from two replications by combining over harvests and years.

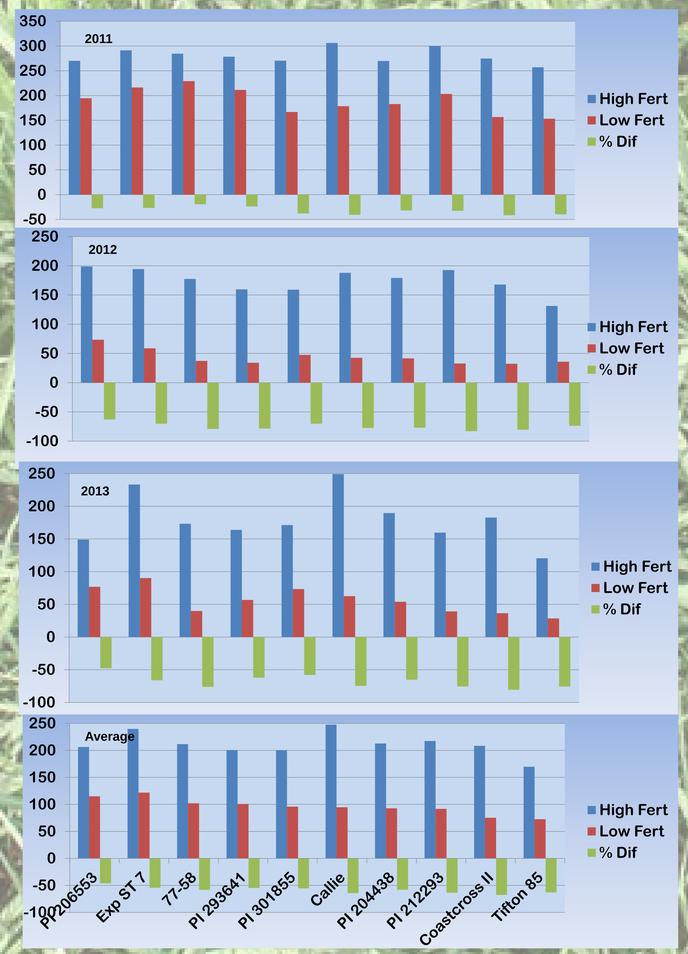
RESULTS

Quantity

Mean yield losses (%) over years of study in Tifton, GA

Year	Harvest 1	Harvest 2	Harvest 3	Harvest 4	Harvest 5	Total
2011	+0.01	-0.02	-0.32	-0.61	-0.60	-0.35
2012	-0.81	-0.84	-0.75	-0.72		-0.78
2013	-0.73	-0.79	-0.64	-0.67		-0.73

Yield with and without fertilizer (g pot^{-1}) and % reduction for years 2011, 2012, 2013 and averaged over years



Quality

Forage N Concentration (% by weight) and % Reduction Affected by Fertilizer Rate for Entries Averaged Over Years.

Entry	High Rate	Low Rate	Reduction
PI 206553	1.544 c-i	1.180 a-e	23.5 a-e
Exp ST # 7	1.866 a-d	1.180 a-e	37.8 c-f
77 - 58	1.562 c-i	1.272 a-e	18.5 a-d
PI 293641	1.427 e-i	1.157 a-e	18.9 a-d
PI 301855	1.622 b-h	1.299 a-d	19.9 a-e
Callie	1.250 h-i	0.974 d-e	22.2 a-e
PI 204438	2.103 a	1.182 a-e	43.8 f
Coastcross II	1.570 c-i	1.112 a-e	29.1 b-f
Tifton 85	1.395 f-i	1.184 a-e	15.1 a-c
African Star	1.564 c-i	1.428 a	8.7 a
PI 291164	1.479 d-i	1.338 a-c	9.5 a
PI 290891	1.461 d-i	1.303 a-d	10.8 a
PI 316416	1.462 d-i	1.291 a-d	11.7 a-b
Tifton 68	1.946 ab	1.302 a-d	33.1 b-f

Forage Digestibility (IVDMD) was unaffected by N fertilization in 2011 with only slight reductions in 2012 and 2013. Both NDF and ADF were slightly higher in the lower N fertilizer rates as compared to the high N fertilizer rates.

CONCLUSIONS

Over three years, yields and N uptake of bermudagrass declined significantly with low N input. PI 206553 had the lowest decline in yield (less than 50%) averaged over three years, while Experimental line 7 had the highest yield under low N. However, these two lines had a sharper decline in N uptake than other lines such as African Star and PI 291164. Improvements in N use efficiency should be attainable through further plant breeding.

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