Nitrogen Use Efficiency and Biomass Yield in *Paspalum* Interspecific Hybrids in Response to Nitrogen Fertilization

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Abstract

The genetic improvement of *Paspalum* spp. through hybridization has made available novel genetic resources for livestock production; however, it is unknown the fertility requirements on the productive potential of these new hybrids. The goal of this study was to evaluate biomass yield and nitrogen use efficiency (NUE) in hybrids of *Paspalum plicatulum* x *P. guenoarum* in response to nitrogen (N) fertilization. Treatments consisted of 6 genotypes [4 hybrids: 1020133, 102069, 103084, 103061, *P. guenoarum* ecotype "Azulão" and *Megathyrsus maximus* (Jacq.) cv. "Aruana" used as controls] and 5 levels of N (0, 60, 120, 240 and 480 kg N ha^{-1}), under a RCBD in split-plot arrangement with three replicates. Dry-matter yield (DMY) and NUE were affected by N fertilization. We observed greater DMY with higher N levels, and during harvests on December and January. Hybrids 1020133 and 102069 produced similar DMY compared to the controls. A decrease in NUE was observed when N levels increased from 60 to 480 kg N ha^{-1}. NUE ranged from 21.4 kg DM kg^{-1} N (103061) to 32,2 kg DM kg^{-1} N (1020133). Interspecific hybrids of *Paspalum* responded to increasing levels of N fertilization and show variability for NUE.

Introduction

The genus *Paspalum* is composed of several species that have been informally classified into groups/sections. Plicatula is a taxonomic group that contains interesting species considering their phenotypic diversity for forage attributes (Novo et al., 2017). The genetic improvement of the Plicatula group through hybridization has made available novel genetic resources for livestock production; however, it is unknown the fertility requirements on the productive potential of these new hybrids. The goal of this study was to evaluate biomass yield and nitrogen use efficiency (NUE) in hybrids of *Paspalum plicatulum* x *P. guenoarum* in response to different levels of nitrogen (N) fertilization.

Materials and Methods

The study was conducted in the southern region of Brazil from October 2015 to March 2016 (Figure 1-A). The experimental design was a randomized complete block in split-plot arrangement with three replicates (Figure 1). Treatments consisted of 6 genotypes [4 novel hybrids: 1020133, 102069, 103084, 103061, *P. guenoarum* ecotype "Azulão" and *Megathyrsus maximus* (Jacq.) cv. "Aruana" used as controls] and 5 levels of N (0, 60, 120, 240 and 480 kg N ha^{-1}).

Dry matter yield was assessed by cutting two random squares (0.50 x 0.50m) per plot at 15 cm stubble height. NUE was calculated using the following formula:

$$NUE = \frac{\text{yield fertilized plot} - \text{yield unfertilized plot}}{\text{applied N level}}$$

Data were analyzed using linear models on R statistical software and graphs were created using the package *ggplot2*.

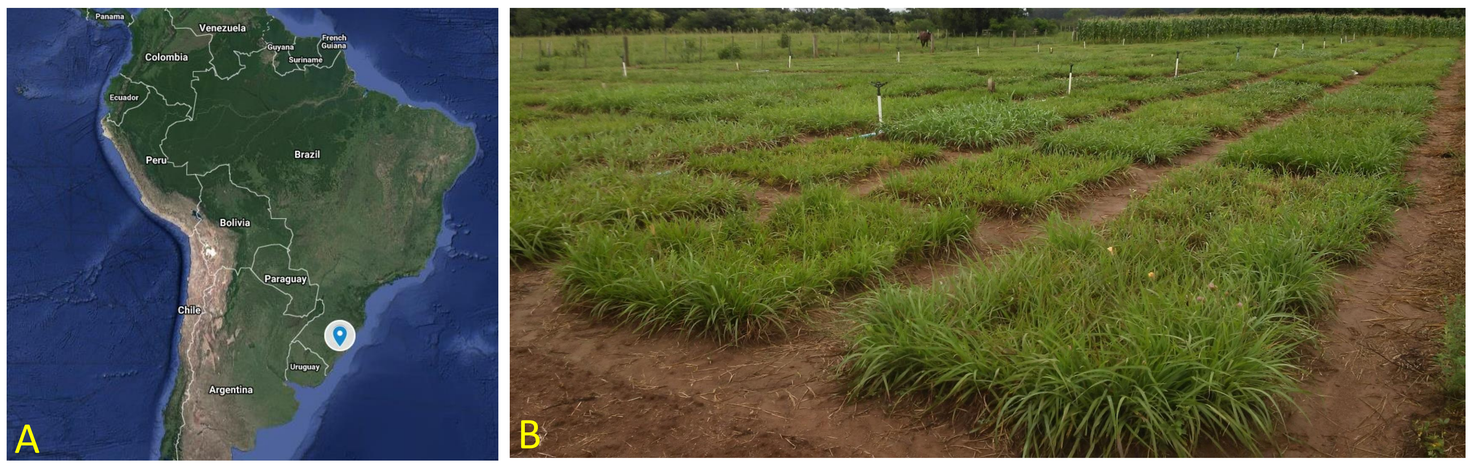

Figure 1. Location of the experiment in south of Brazil (A), and overview of the field experiment (B).

Results

Dry matter yield

There was a significant (P<0.001) three-way interaction among genotype, nitrogen rate and harvest for DMY. In general, greater DMY was harvested with higher N level applications (Figure 2 A-E), especially during the harvests carried out in December and January. All genotypes exhibited a similar response to harvest date, with an increase in DMY in December and January, except when N was not applied (Figure 2-A). Significant differences were found for DMY among genotypes depending on harvest date and N level; however, larger differences were found at higher N rates and during December, January and February harvests. Hybrids 1020133 and 102069 produced similar DMY compared to the controls across harvest dates and N rates.

NUE

There was a significant N rate (P<0.001) on NUE, while the *P-value* for genotypes (P=0.0564) was slightly higher than significance level 0.05. A decrease in NUE was observed when N levels increased from 60 to 480 kg N ha^{-1}. NUE ranged from 21.4 kg DM kg^{-1} N (hybrid 103061) to 32,2 kg DM kg^{-1} (hybrid 1020133).

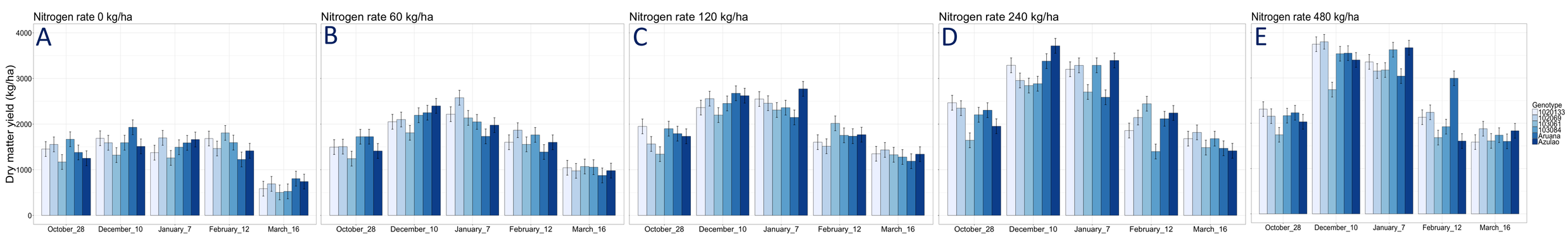

Figure 2. Dry biomass yield (kg ha^{-1}) of interspecific hybrids of *Paspalum* in response to increasing N fertilization rates: 0 kg ha^{-1} (A), 60 kg ha^{-1} (B), 120 kg ha^{-1} (C), 240 kg ha^{-1} (D), and 480 kg ha^{-1} (E).

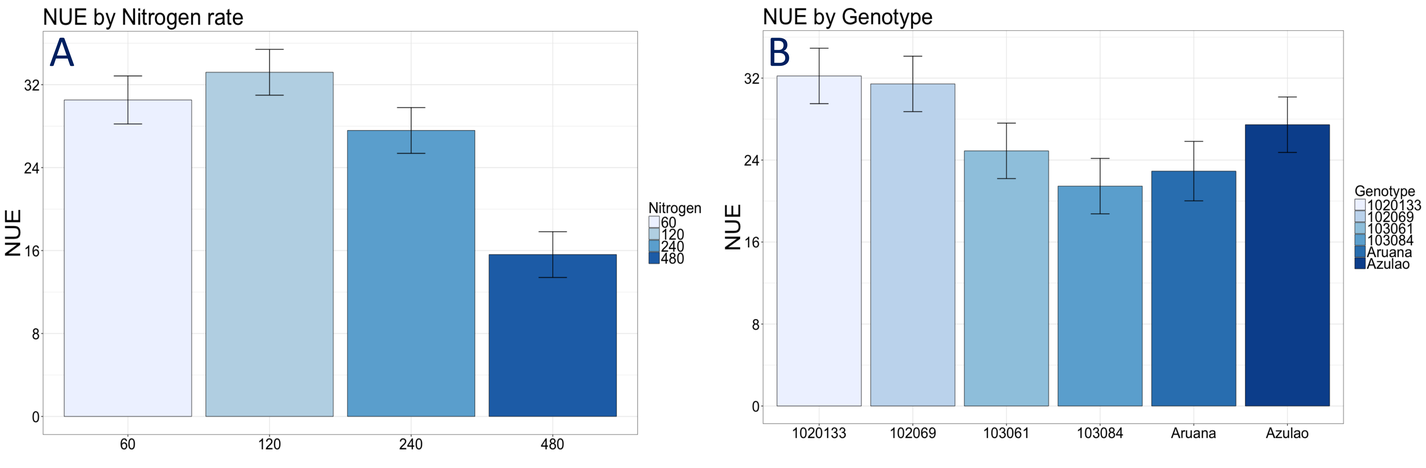

Figure 3. Nitrogen use efficiency (NUE = Kg DM kg^{-1} N) of interspecific hybrids of *Paspalum* in response to N rates (A) and genotypes (B).

Conclusion

DMY harvested in *Paspalum* interspecific hybrids responded to increasing levels of N fertilization; however, that response varied across harvests dates. During early and late harvests, less differences were observed among genotypes and a lower response to increasing N rates. Peak of forage production occurred in December and January and it was increased by higher N rates.

NUE decreased with increasing N levels. There was variability between genotypes for NUE, even though not statistically significant.

References

NOVO, P.E. et al. Hybridization and heterosis in the Plicatula group of *Paspalum*. **Euphytica**, p. 198-213, 2017.