Optimizing PGPR Inoculation to Enhance 'Tifton-85' Bermudagrass (Tifton-85) Yield and Root Growth Under Reduced Nitrogen Fertilization

Jennifer Crabtree[1,2](jbc0123@auburn.edu), S. Leanne Dillard[1,2](dillasa@auburn.edu), Alvaro Sanz-Saez[1], W. Brandon Smith[2], A.O. Adesemoye[3]
[1]Department Crop, Soil and Environmental Sciences, Auburn University, Auburn, Alabama; [2]Department of Animal Sciences, Auburn University, Auburn, Alabama; [3]USDA-ARS National Soil Dynamics Laboratory, Auburn, Alabama

Introduction

- *Cynodon dactylon,* Tifton-85, is a C4 grass that is commonly used for livestock grazing, hay production, and stockpiling in the southern US.
- Plant growth-promoting rhizobacteria (PGPR) have emerged as a potential tool for improving forage productivity by enhancing plant growth, particularly under low-input or stressful conditions. PGPR inoculation can be especially beneficial in nitrogen-limited systems, but their effects on yield are often inconsistent (Rubin et.al, 2017).
- One possible reason for this variability is the frequency of application; infrequent inoculations may limit PGPR colonization or effectiveness, especially in fast-growing perennial grasses like bermudagrass.
- **Objectives:**
- Test inoculation frequency to see how they affect yield.
- Test inoculation frequency to see if they affect root mass.

Methods

- Tifton-85 Bermudagrass was transplanted into 1-gallon pots at Auburn University's Plant Science Research Center, Auburn Alabama.
- Treatments (5 Replicates per treatment)
- PGPR inoculation: No PGPR, DH44.
- N rate: 25% of recommended rate of ammonium sulfate (21-0-0).
- 6 Total Treatments: No inoculation, Inoculation at cutting only, Inoculation at cutting + post harvest, Inoculation at cutting +7DAC (Days After Cutting), Inoculation at cutting +14DAC, Inoculation at cutting +7&14DAC.
- Plants were transplanted, cut to 4in, inoculated, and fertilized when the experiment began.
- Harvests were done every 28 days, for a total of 3 harvests, in addition one-third of the pots were destructively harvested for root mass.
- Dry matter yield (DMY) and dry root mass were recorded.

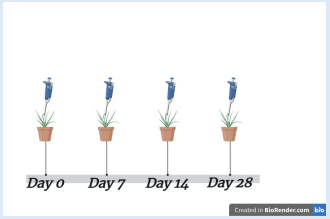

Figure 1. A.) Timeline of Inoculation. All treatments were fertilized and cut on Day 0 **B.)** Bermudagrass being inoculated with PGPR strain DH-44.

Conclusion

- The plants treated with "inoculation at cutting +14DAC" and "inoculation at cutting +7&14DAC" performed the best with both yield and root mass.
- Inoculation with PGPRs can be beneficial in stablishing bermudagrass but when it stablishes seems to lose efficacy. This could be due to a "space" limitation.

Future Work

Conduct a greenhouse experiment to investigate if different pot sizes has an effect on yield and root mass with the same inoculation timing as this project.

Acknowledgements

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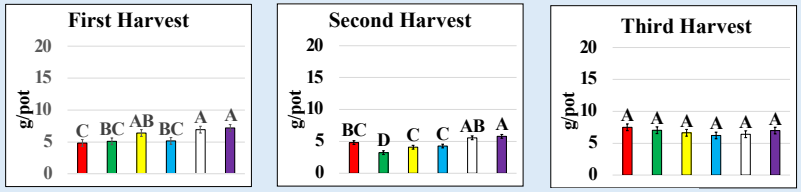
Results and Discussion

Effect	DMY (g/pot)	Root Mass (g/pot)
First Harvest	0.0042*	0.8555
Second Harvest	<0.0001*	0.2069
Third Harvest	0.5722	0.0111*
Harvests Combined	0.0007*	0.0138*

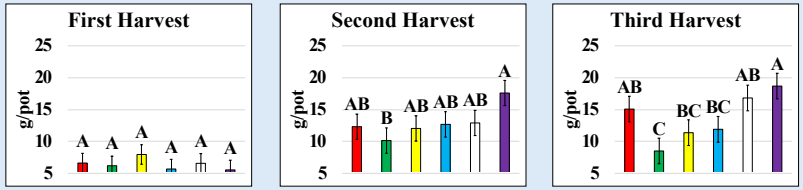
Table 1. P-Values for Harvests 1-3 and Combined Harvest for Treatment Effect on Yield and Root Mass for Inoculation Times

Dry Matter Yield



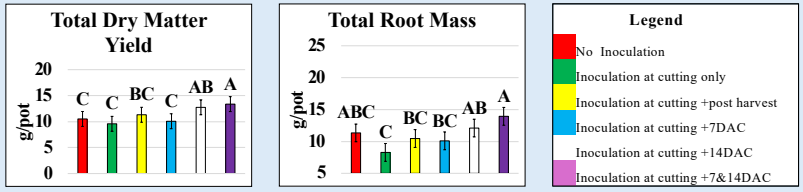
Figures 2-4. Effect of Inoculation Timing on Dry Matter Yield in Tifton-85

Root Mass



Figures 6-8. Effect of Inoculation Timing on Root Mass in Tifton-85

Total Dry Matter Yield & Root Mass



Figures 9-10. Effect of Inoculation Timing on Total Dry Matter Yield and Root Mass

- There was an inoculation timing effect in the first and second harvests (Fig. 2 &3 and Table 1) with the inoculation at cutting +14DAC and inoculation at cutting +7&14DAC treatments yielding the highest dry matter. This effect being seen in the first and second harvests but not the third is likely due to the plants establishing and benefiting from the extra growth provided by PGPR in the first two harvest but not in the last.
- In the Total Dry Matter Yield (Fig. 9), inoculation at cutting +14DAC and inoculation at cutting +7&14DAC treatments yielded the highest and more than the control.
- Root mass increased throughout the experiment (Fig. 6-8), with significant effects in the third harvest (Fig. 8) for treatment inoculation at cutting +7&14DAC.

References

- Rubin, R. L., Van Groenigen, K. J., & Hungate, B. A. (2017). Plant growth promoting rhizobacteria are more effective under drought: a meta-analysis. *Plant and Soil*, *416*(1–2), 309–323.
- Sá, G. C. R., Hungria, M., Carvalho, C. L. M., Moreira, A., Nogueira, M., Heinrichs, R., & Filho, C. V. S. (2019). Nutrients Uptake in Shoots and Biomass Yields and Roots and Nutritive Value of Zuri Guinea Grass Inoculated with Plant Growth-promoting Bacteria. *Communications in Soil Science and Plant Analysis*, *50*(22), 2927–2940.