The Effect Commercial and Wild Mycorrhizae have on Plant Biomass

Michael Caballero, Drake McEntire, Aaron Rocha, Heinrich van Niekerk

Department of Plant Biology, Ecology and Evolution | Oklahoma State University | Stillwater, OK

Introduction

Background

Mycorrhizae establishes a symbiotic relationship with plants, which has been shown to benefit overall plant fitness (Vogelsang et al., 2006) (Shockley et al., 2004). While the association with crops has been widely explored by researchers, the associations that native plants have with native mycorrhizae in a given area, as compared with introduced mycorrhizae, through inocula, has yet to be explored. This research looks at how well plants can grow in a variety of conditions which consist of native and non-native mycorrhizae inoculating native plants of Oklahoma. Whether Chlorophyll content (Sheng et al., 2008), water retention (Gastol et al., 2012), or a greater biomass (Sheng et al., 2008); mycorrhizae have been shown to prove the successfulness of plant species which have created a symbiotic relationship with this fungus.

Hypothesis

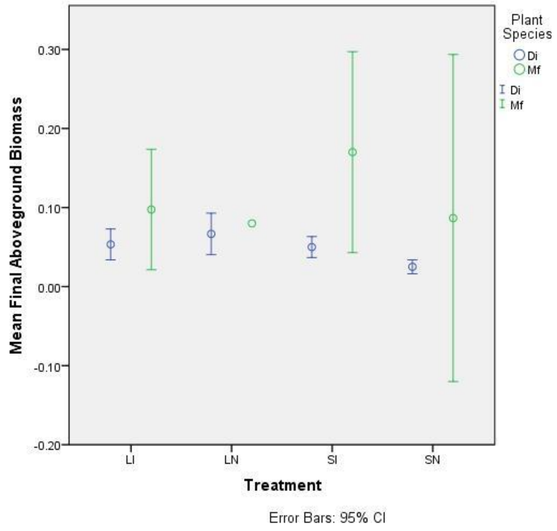
We hypothesize that the combination of non-sterile soil, without commercial mycorrhizae, will yield the greatest increase of biomass, chlorophyll leaf content and leaf area in our plant species.

Methods

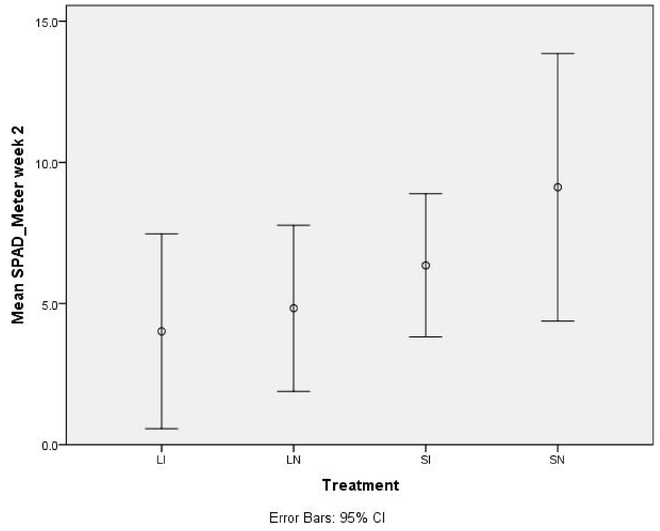
- Two plant species, *Desmanthus illinoensis* (Di) and *Monarda fistulosa* (Mf) studied.
- Four treatment combinations used.
  - Commercial mycorrhizal inoculum present, non-sterilized prairie soil
  - Commercial mycorrhizal inoculum present, sterilized prairie soil
  - Commercial mycorrhizal inoculum absent, non-sterilized prairie soil
  - Commercial mycorrhizal inoculum absent, sterilized prairie soil
- Chlorophyll content measured, in single leaf of each plant, weekly using SPAD meter.
- Stem diameter measured, at base of plant, final week using digital calipers.
- Dry above and below ground biomass measured final week.

Results

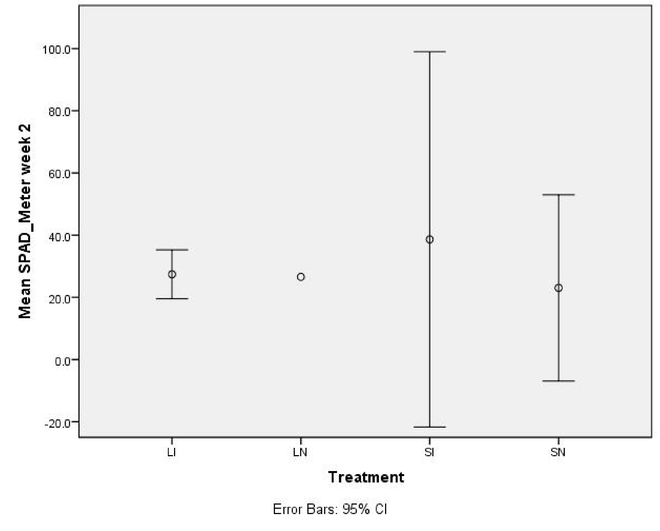
Effects of treatments on the aboveground biomass of Di and Mf.



Effects of treatments on SPAD meter readings of DI plants.



Effects of treatments on SPAD meter readings of Mf plants.



Conclusions and Future Directions

- Significantly greater dry biomass found in living soil with inoculum in *Desmanthus illinoensis* (P=0.045, P=0.028)
- No significant increase of dry biomass found in living soil with inoculum in *Monarda fistulosa* (P=0.062, P=0.107)
- Significant decrease in chlorophyll content in living soil with inoculum in *Desmanthus illinoensis* (P=0.025)
- No significant increase of chlorophyll content in living soil with
- inoculum in *Monarda fistulosa* (P=0.543)
- No significant increase of mean stem diameter between soil treatments (P=0.864) and inoculums (P=0.237)
- Larger sample sizes needed for *Monarda fistulosa* to account for high mortality rate.
- The data did not support our hypothesis that non-sterile soil without commercial mycorrhizae inoculum would yield the greatest increase in dry biomass and chlorophyll content. Shockley et al found no significant difference in dry biomass when mycorrhizae was added to *Desmanthus illinoensis* (Shockley 2004). Sheng et al did find that the presence of mycorrhizae increased chlorophyll content under salt stress (Sheng 2008).

Acknowledgements

Justin Dee: Helped teach us how to properly set up our experiment and poster. He served as a valuable source of advice when we had questions of how to carry out the experiment.

Dr. Janette Steets: Proposed the idea for the experiment, and moreover lead the entirety of the research making sure both her TA's and undergraduate students were doing the research correctly.

Literature Cited

Gastol, M., I. Domagala-Swiatkiewicz, and M. Bijank. 2015. The effect of mycorrhizal inoculation and phosphorus application on the growth and mineral nutrient status of apple seedlings. *Journal of Plant Nutrition*.

Sheng, M., M. Tang, H. Chen, B. Yang, F. Zhang, and Y. Huang. 2008. Influence of arbuscular mycorrhizae on photosynthesis and water status of maize plants under salt stress. *Springer Link*.

Shockley, F.W., McGraw, R.L., Garrett, H.E. (2004), Growth and nutrient concentration of two native forage legumes inoculated with Rhizobium and Mycorrhiza in Missouri, USA. *Agroforestry Systems*, 60: 137-142

Vogelsang, K. M., Reynolds, H. L. and Bever, J. D. (2006), Mycorrhizal fungal identity and richness determine the diversity and productivity of a tallgrass prairie system. *New Phytologist*, 172: 554–562.