Impact of Wild and Commercial Mycorrhizae on Stem Height and Biomass

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Introduction

Background

- 80% of terrestrial plants associate with this fungus to increase nutrient uptake, water uptake, and geographic variation (Rua et al, 2016), while the mycorrhizae now have a source of food. Mycorrhizae/plant mutualism has also been shown to reduce parasitism, pests, and pathogens in host plants (Saia et al, 2014).
- Single mycorrhizae inoculations have been shown to increase fitness by being linked to higher shoot and root biomass, chlorophyll content, and NPK content, with compatible mixtures further increasing this effect due to their synergistic nature, which suggests coevolution (Vafadar, 2012).
- Stem length, biomass, and leaf count have all been previously linked to increased reproductive success (Lechowicz and Blais, 1988),and all of these have been shown to be increased in the presence of mycorrhizal fungi (Turjaman *et al,* 2006; Schreiner, 2007).
- Earth Juice® Rooter's Mycorrhizae is a commercial inoculation sold with the claims of improving crop or garden growth, and making your plants hardier.
- There are currently no studies to our knowledge comparing these commercial mycorrhizae, with wild, native mycorrhizae species.
- We will use two different prairie-native species, *Desmanthus illinoensis*, a legume species, and *Monarda fistulosa*, a perennial forb species, to compare the effects of these two mycorrhizae sources.

Hypothesis

- We hypothesize that a mixture of commercial and wild mycorrhizae will yield the best results, since the commercial inoculation contains a great range of mycorrhizal species that can fill potential "gaps" left by the wild mycorrhizae.

Methods

Overall Process

- To begin the study we transferred all of the seedlings from sterile vermiculite flats into RC10 containers. The control group will be transferred first, then commercial inoculum only, then wild and commercial inoculum, and then wild only, ensuring to sterilize all equipment before moving onto the next group.
- Each plant was extracted from the vermiculite flat carefully to keep the roots intact by submerging each plant in a bowl of water. A small hole was dug in each container, and a fourth of a teaspoon of the Earth Juice® Rooter's Mycorrhizae was placed in the bottom of the inoculated samples. Then the plants were transferred into their own container. Sterile soil was added to the top of each container to help prevent contamination of sterile treatments.
- The plants were watered four times a week. The survival of the plants was measured in a four week span and measurements of stem height and leaf count were measured for three weeks after that.
- To analyze all of the recorded results, we used SPSS software to run ANOVA tests to compare treatments.

De-potting and Drying Process

- By the end of our experiment, we went through a process of de-potting the plants to measure the above and below ground biomass (including the roots). To do this, we carefully loosened the plant and washed the root of all the soil and placed them on a paper towel to dry.
- After the plants were mostly dried, we placed them in labeled paper bags to be weighed after one week.

Rack setup of *Monarda fistulosa* and *Desmanthus illinoensis* plants; arranged in rows by species type with colored tags coding for soil treatment.

Monarda fistulosa after depotting and washing process, drying off before being stored in the bags.

Data

		Soil Treatment	Inoculum Treatment	Soil Treatment * Inoculum Treatment
Aboveground Biomass	F value	.019	.646	2.027
	Significance	.892	.427	.163
Belowground Biomass	F value	1.176	.056	.092
	Significance	.285	.815	.764
Stem Length (final)	F value	.266	2.217	.351
	Significance	.609	.145	.557
Total Leaf Count	F value	2.177	1.391	4.278
	Significance	.149	.246	.046

Table.(1) F and P values on treatments with UNIANOVA analysis

Treatment Key

LI – Wild + Inoculated Mycorrhizae Soil
LN – Wild Mycorrhizae Soil
SI – Sterile Inoculated Mycorrhizae Soil
SN - Sterile Soil

Species Key

Desmanthus illinoensis
Monarda fistulosa

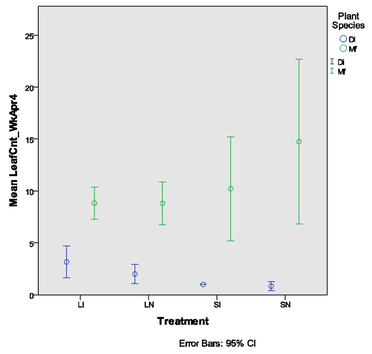

Fig.(1) Mean leaf count on the last day of data collection.

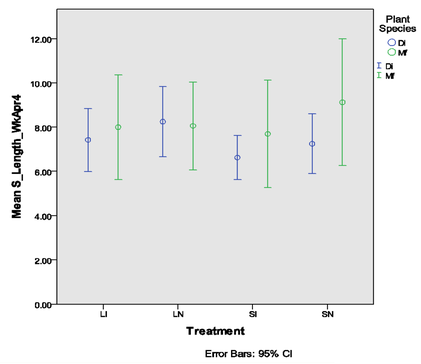

Fig.(2) Mean stem length on the last day of data collection.

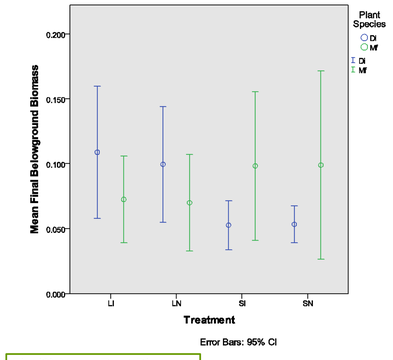

Fig.(3) Mean Root Biomass

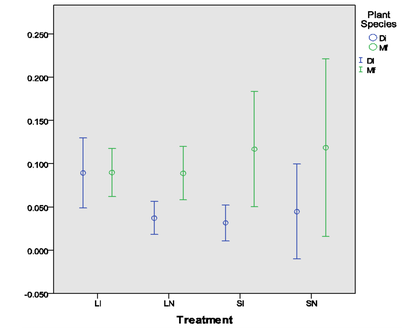

Fig.(4) Mean Aboveground Biomass

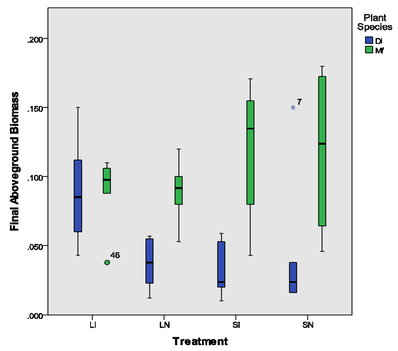

Fig.(5) Final Aboveground Biomass

Results

- Using the Program SPSS we found a statistically significantly effect of Wild + Commercial mycorrhiza treatment on Total Leaf count (p=0.046) when compared to the control. (Table 1.)
- All other variables were not found significant. (Table.1)
- *Desmanthus illinoensis* shows a higher mean on leaf count, root biomass, and aboveground biomass for the Wild + Commercial mycorrhiza treatment. (Fig. 1,3,4)
- *Monarda fistulosa* showed no positive correlation with all mycorrhizae , as overall growth was greatest with the sterile soil. (Fig. 1,2,3,4)

Discussion

Our hypothesis, that the wild and commercial treatments together would benefit the plant the most, was only supported by the average leaf count. All other variables did not support our hypothesis. We believe this is because of the limited time frame that we had with this experiment, and that if we had more weeks to record data we would hope to see more significant results. There is also a possibility that *Monarda fistulosa* did not interact with the mycorrhizae, or was negatively impacted by the presence of any mycorrhizae. In the future, we would extend the length of the experiment and increase the number of plants per treatment group as well as add more variables to test the significance of mycorrhizae on other areas of growth in the plant.

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