Impact of Commercial Mycorrhizal Product on Plant Growth and Survival

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Background

Arbuscular mycorrhizal fungi (AMF) have a symbiotic relationship with plant roots. They increase the surface area of the hosts plant's roots, allowing the plant to more efficiently access water and nutrients, particularly phosphorus. Thus, AMF helps promote plant growth, as well as increase a plant's tolerance to environmental stress. Mycorrhizae products are commercially available and popular among home gardeners. Companies market products for general use and promise impressive results. While studies show AMF may benefit multiple aspects of plant growth, many mycorrhizal interactions may be specific to certain species and are still being studied.

Hypotheses

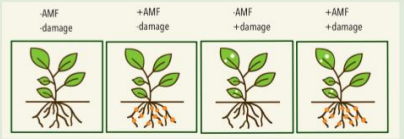
- Application of commercial mycorrhizal products will lead to AMF root colonization in members of the genus Symphyotrichum (Asteraceae): S. lateriflorum and S. laeve
- Plants receiving AMF will have increased rates of growth and increased biomass
- Plants that are subjected to herbivore-simulated damage and AMF will be differentially affected compared to damaged plants with no AMF

S. Laeve (Smooth Aster)
Conservation Value: 9

S. Lateriflorum (Calico Aster)
Conservation Value: 4

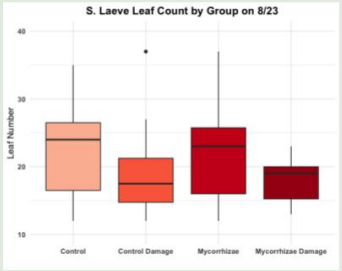
Methods

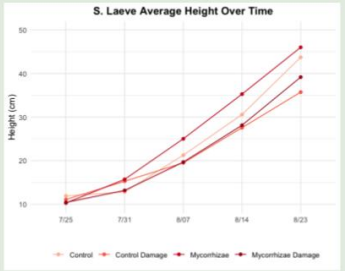
- This study took place in the greenhouses at the Chicago Botanic Garden, Glencoe, IL, USA
- 40 individuals of each species were transplanted into 6.5" pots (7/18/23)
- Individuals were randomly organized (using a random number table) across all treatments
  - Within each species, 4 treatment groups were assigned, 10 individuals to each group



- Plants were fertilized once, three days after transplantation (7/21/2023), with 20-10-20 fertilizer to simulate low phosphorus conditions
- About a week after transplantation (7/26/23), MycoSupreme®(10% Rhizophagus irregularis @50 spores/g, and 90% dextrose) was mixed with water following manufacturer's recommended application rate and applied to all +AMF treatments. Treatments not receiving AMF received the same volume of just water.
- For +damage treatments, simulated herbivore damage was applied three weeks after transplantation(8/7/23). This involved using a hole-punch to make holes in the lowest and uppermost plant leaves
- Plant growth measurements and observations were recorded weekly for 5 weeks. These included leaf number, leaf size and plant height.
- For analysis, leaf number and plant height were compared between treatment groups to test for significant differences. One-way analysis of means method was used through the software package R.

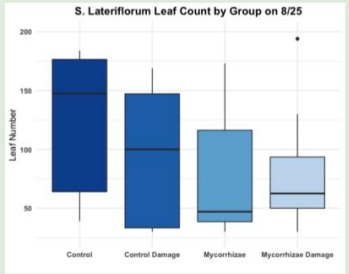
Analysis

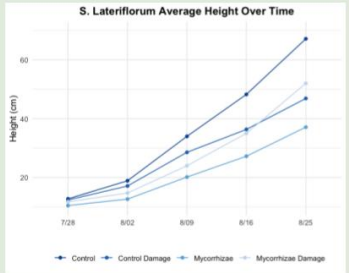




S. Laeve	P Value	Method
Leaf Count	0.41	One-way analysis of means
Average Height	0.93	One-way analysis of means

No statistical significance in leaf count or average height between S. Laeve groups.





S. Lateriflorum	P Value	Method
Leaf Count	0.20	One-way analysis of means
Average Height	0.58	One-way analysis of means

No statistical significance in leaf count or average height between S. Lateriflorum groups.

Discussion

Statistical significance between treatment groups was not found for any observation in either Smooth or Calico Aster, suggesting that the application of AMF has no effect on plant growth – at least in early growth stages. However, there are two important items to note. First, this study was conducted over a short period. Calico and Smooth Aster are perennial plants that have a long growth period, and it may take longer than five weeks to see any effects of AMF or damage. Additionally, the plants were too young to flower, so no data regarding the possible effects on reproductive output could be measured. Second, it should be noted that application of the AMF product does not necessarily guarantee that root colonization successfully occurred.

Future Directions

- Continue to collect data of plants through later life stages, specifically to flowering
- Harvest and stain roots to test for AMF inoculation
- Harvest and weigh above ground biomass to assess overall growth

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