

Analyze the effect of drought on the arbuscular mycorrhizal symbiosis

Starting date:

February to August 2025

(I am open to slight changes in the timeframe if needed)

Background:

Arbuscular mycorrhizal (AM) fungi are symbiotic organisms that colonize the roots of most plants, establishing a vital link between plants and the soil. These fungi rely on carbohydrates from plants to sustain their growth while offering multiple advantages in return. AM fungi develop extensive networks of fungal filaments (hyphae), forming extraradical mycelia (ERM). By increasing plant roots' surface area, ERM allow plants to access a larger volume of soil for essential nutrients and water. Further, AM fungi may enhance plant physiology and tolerance to biotic and abiotic stresses. Specifically, plants colonized by AM fungi may experience improved physiological functions, such as increased gas exchange and leaf hydration, along with enhanced stomatal regulation. However, the impact of abiotic stress, such as drought, on AM fungi remains unclear. Given drought affects plant performance, including photosynthesis, it likely has carry-over effects on AM fungi and thus, ERM. Changes in ERM may in turn affect root colonization and the establishment of subsequent mycorrhizal crops. As such, drought may alter legacy effects, i.e. persisting effects of previous crops on the soil and subsequent crops, via changes in the AM fungal symbiosis.

Research question:

Does drought during the cover-cropping season reduce AM hyphal density in the soil and eventuate in lower root colonization of subsequent maize plants and altered physiological performance?

Activities:

With this greenhouse experiment, you would join an ongoing research project examining the role of ERM in enhancing drought tolerance in maize plants. The greenhouse facilities are located at Campus Klein Altendorf, in Rheinbach

Main tasks:

Greenhouse work (at Campus Klein-Altendorf, Rheinbach)

- Plant monitoring
- Plant physiological measurements
- Soil sample collection

Lab work (will take place at Auf Dem Hügel 6, Bonn)

- Extracting AM fungal hyphae and quantifying under a microscope
- Clearing and staining roots to assess AM fungal colonization rates under a microscope

(all the methods will be demonstrated)

Requirements:

- No experience or background knowledge on AM fungi is required however, I am looking for students with interest in learning about the subject.

- Being comfortable with doing practical work (i.e.: completing physical tasks in the greenhouse and potentially outdoors, in contact with soil, crops and water) and being willing to work independently (with strong support) are a must.

Contact:

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