Back To The Roots: an Analysis of Mycorrhizal Fungi Interaction on Leaf Area and Chlorophyll Content

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Results

A two-way ANOVA did not reveal statistically-significant treatment effects for any measured plant traits. Inoculum treatments on leaf length and width (.022) and aboveground biomass (.050) were significantly harmed by this lack of interaction, and that supported our hypothesis. Ratibida columnifera grown in soil on the other hand, in the presence of wild and commercial mycorrhizae, outperformed other plant groups. Our treatments had little to no effect on SPAD and leaf area in Helianthus annuus; however, the final aboveground biomass of the species was significantly larger in the SI soil treatment (Fig. 1, 3). This suggests two things, an evolutionary relationship with mycorrhizae may not be as important for helianthus annuus, and, Helianthus annuus may be more prone to pathogens or harmful microorganisms present in the live soil and not in the sterile soil.

Discussion

Significant effects on leaf area could be seen in Ratibida columnifera, as there was a noticeable difference from the LI, LN, SI, to SN treatments (Fig. 1). This showed that plants growing in complete absence of mycorrhizae (SN), were significantly harmed by this lack of interaction, and that supported our hypothesis. Ratibida columnifera grown in soil on the other hand, in the presence of wild and commercial mycorrhizae, outperformed other plant groups. Our treatments had little to no effect on SPAD and leaf area in Helianthus annuus; however, the final aboveground biomass of the species was significantly larger in the SI soil treatment (Fig. 1, 3). This suggests two things, an evolutionary relationship with mycorrhizae may not be as important for helianthus annuus, and, Helianthus annuus may be more prone to pathogens or harmful microorganisms present in the live soil and not in the sterile soil.

Ratibida columnifera, a P demanding perennial forb (Karanka 2008), has evolved utilizing mycorrhizae to obtain the phosphorus it needed to reproduce. The dependence upon a specific local strain of mycorrhizae is likely a derived trait from a historical dependence on mycorrhizae in general. Helianthus annuus, while commonly found in nutrient poor grassland much like the Ratibida columnifera, does not have the same evolutionary dependence on mycorrhizae as the perennial forb. In this case, the added stimulation of non-AM fungi in the commercial inocula could benefit the plant more, especially in sterile soil, absent from pathogens.

Methods and Materials

We created four mycorrhizal treatment groups for both Ratibida columnifera and Helianthus Annuus (8 groups and 48 plants total) utilizing commercial mycorrhizal inoculum and the manipulation of arbuscular mycorrhizal fungi that naturally occur in soils. To test the effect of wild and commercial mycorrhizae on leaf area, biomass, and chlorophyll content. Groups were separated as: 1. Commercial mycorrhizal inoculum present in non-sterilized prairie soil (wild mycorrhizae present), 2. commercial mycorrhizal inoculum present in sterilized prairie soil (wild mycorrhizae absent), 3. commercial mycorrhizal inoculum absent in non-sterilized prairie soil (wild mycorrhizae present), and 4. commercial mycorrhizal inoculum absent in sterilized prairie soil (wild mycorrhizae absent). Plants were placed under constant light and watered as needed throughout experimentation. Each week we collected data on chlorophyll content, using a SPAD meter, and leaf length X width with digital calipers. Dry aboveground and belowground biomass measurements taken one week post-harvest. An ANOVA test was conducted using SPSS to determine treatment significance for each variable.

References