Improving Mycorrhizal Status of Soil Using Cover Crops

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Cover crops have a multitude of benefits for agriculture production including improvement in soil structure, nutrient retention, weed control, increased soil organic matter, and continued arbuscular mycorrhizal associations. Cover crops also significantly reduce soil loss from both wind and water erosion.

Intensive agriculture practices in many parts of the West require close monitoring of soil fertility, but much less attention has been paid to the mycorrhizal status of Western agricultural soils. Establishing temporary cover crops on agricultural soils can be used to increase presence of arbuscular mycorrhizal (AM) fungi in cultivated soil, but research is required to assess the potential for improving soil health characteristics such as aggregate formation and stable soil organic matter (SOM) content.

AM fungi form a symbiosis with land plants, including many that are agriculturally important. AM can increase the uptake of nutrients such as phosphorus and zinc from the soil. The management of AM fungi may be useful because AM fungal inoculum potential can be reduced significantly during fallow periods, or when non-mycorrhizal plant species occur in a crop rotation. The consequence of reduced inoculum potential may be a significant reduction in nutrient uptake and yield of subsequent mycorrhizal crops. Some studies show that AM fungi increase water uptake, which is associated with increased soil hyphal biomass when mycorrhizal plants are subjected to severe water stress (hyphae are filaments that constitute the body—or mycelium—of fungus). Other researchers have stated that tillage can lead to decreased root colonization by AM fungi because tillage cut network hyphae and also impact major components in the rhizosphere, i.e., water, temperature, and soil structure.

Objectives

Determine if use of AM cover crops 1) can increase the microaggregate and macroaggregate content as well as the concentration of stable SOM of cultivated soil and 2) have a positive impact on biomass production in soil by AM fungi.

Materials and Methods

This study was initiated in 2014 (with its continuation to be made this year and 2016) at the Powell Research and Extension Center (PREC). The experiment was designed to examine the influence of different levels of irrigation (75% and 100%), conventional tillage (CT) and strip tillage (ST) practices, and different crops (bean and barley) have on the development of AM. Soil samples and root samples were collected for the analysis of arbuscular fungal presence in June 2014. Roots were examined using the methods of Phillips and Hayman (1977), and arbuscular fungal biomass in soil was estimated using a biochemical technique that utilized lipid biomarkers.

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Results and Discussion

Results from the first year (before cover crops were established) indicate AM fungi colonizing the root of bean and barley were affected by both soil tillage practices and level of irrigation. Preliminary results show that AM fungi were more prevalent on roots of plants grown under strip-till treatment (Figure 1). Results also indicate that crops grown at the 75% irrigation level developed more AM than those grown at the 100% irrigation level (Figure 2).

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Literature Cited