Mycorrhizal fungi colonization and community dynamics in a long-term rotation as influenced by preceding crop and weed management intensity

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Objectives

To examine root growth, AM fungal colonization and AM fungal community structure in a durum wheat trap crop over time grown on soils with different preceding crops (flax or canola) and weed seedbank densities (Low, Medium, High) collected from a long-term experiment.

Background

In 1990, a study investigating the effects of reduced-in-row herbicide use (Peatfleeve Product) was initiated at the University of Manitoba. This experiment contains an annual crop rotation (wheat-sorghum-soybean-wheat) under no-tillage production that is replicated three times in a split plot. Each replication of the 2 x 2 factorial treatment design including four levels of AM fungal inoculation intensity (0 = no-inoculation treatment; 1 = inoculation with specific AM fungi; 2 = inoculation with AM fungal roots; 3 = no AM fungal inoculation) was separated in four blocks. The experiment was conducted in a 2 x 2 factorial treatment design with four levels of AM fungal inoculation intensity (0 = no-inoculation treatment; 1 = inoculation with specific AM fungi; 2 = inoculation with AM fungal roots; 3 = no AM fungal inoculation) in a randomized complete block design with four replications.

Methods

In 1995, canola was sown in the fall, and subsequent sowing of the crop was done as follows: spring wheat was sown in 1995, spring barley in 1996, flax in 1997, and durum wheat in 1998. Each treatment was replicated three times in a split plot. Each replication of the 2 x 2 factorial treatment design including two levels of AM fungal inoculation intensity (0 = no-inoculation treatment; 1 = inoculation with specific AM fungi) was separated in four blocks. The experiment was conducted in a 2 x 2 factorial treatment design with two levels of AM fungal inoculation intensity (0 = no-inoculation treatment; 1 = inoculation with specific AM fungi) in a randomized complete block design with four replications.

Summary

AM fungal colonization and community structure in durum wheat grown in soils retrieved from this long-term study showed that subtle changes in crop management had significant effects on durum root growth and the dynamics of the AM fungal community. Increased weed seedbank densities contributed to greater root exploration of the soil through increased root length and root colonization by AM fungi. The colonization of durum roots was not linked to the soil macrofungal phase. The influence of the weed seedbank density on the AM fungal community was higher under low seedbank densities. The presence of a variety of fungal species was lower in the crop under high seedbank densities.

Results & Discussion

Nitrogen-fixing attributes of AM fungal species were not affected by the preceding crop and weed seedbank density. However, the treatments significantly affected the root length and colonized root length of AM fungi. The colonization of durum roots was not linked to the soil macrofungal phase. The influence of the weed seedbank density on the AM fungal community was higher under low seedbank densities. The presence of a variety of fungal species was lower in the crop under high seedbank densities.

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Table

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