EFFECT OF LOW SOIL TEMPERATURE AND SOIL DISTURBANCE ON EARLY ROOT GROWTH AND MYCORRHIZAL ASSOCIATION IN COTTON

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Abstract

The growth and survival of cotton seedlings on the Southern High Plains have been shown to benefit from their association with arbuscular mycorrhizal (AM) fungi. Seedlings that quickly developed mycorrhizal were better able to survive wet soil conditions than plants with low levels of AM colonization. The study presented here is part of an ongoing effort to understand how management practices in cotton production systems and abiotic conditions on the Southern High Plains interact to impact the survival and production of AM inoculum from year to year. Specifically we examined the effects of soil disturbance, soil temperatures, and soil moisture on AM colonization of cotton.

A three year field evaluation (1994 to 1997) of AM inoculum from a conventional cotton system and cotton planted into terminated winter wheat found that AM inoculum levels were consistently higher when cotton was planted in the terminated wheat system than for conventional cotton. However, the region experienced a major decrease in precipitation during this period and an increase in winter soil temperatures. Subsequently, while the AM inoculum levels were higher in the terminated wheat system than under conventional cotton, AM inoculum levels declined steadily from 1995 through 1997. To understand the effects of soil conditions on ;the survival of AM inoculum a series of growth chamber studies was conducted that examined the effects of soil moisture, soil temperatures and soil disturbance on subsequent colonization levels.

In the first experiment, cotton was grown under controlled conditions in soil that was either kept saturated, or dry at 28°C. for one month. Plants were either grown at 28 or 18°C soil temperatures. Mycorrhizal colonization was highest for plants grown at 28°C regardless of soil moisture levels. Soil moisture did have an impact when soil temperatures were sub-optimal for root growth (18°C). In experiments 2 and 3 we examined the effects of soil disturbance and soil moisture on subsequent AM colonization of cotton. There were no differences in colonization levels of plants in any treatment (wet soil; dry soil; wit soil disturbed, and dry soil disturbed) for either experiment when plants were grown at 28°C.

The planting of a mycorrhizal crop before planting cotton does increase AM inoculum levels. The observed decline in AM inoculum may be due to the warm winter temperatures that are occurring in the Lubbock region. Soil disturbance does not appear to have contributed to the decline. Soil temperature does appear to be a major factor affecting AM survival. Moisture and temperature will interact to affect AM colonization levels in cotton.

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