INFLUENCE OF SOIL PHYSICAL ENVIRONMENT, *THIELAVIOPSIS BASICOLA* AND *MELOIDOGYNE INCOGNITA* ON COTTON ROOT ARCHITECTURE AND PLANT GROWTH IN A MICROPLOT STUDY

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Abstract

Cotton (*Gossypium hirsutum* L.) plants may perform poorly when grown in soils with hard pans (HP) due to the high soil strengths and bulk densities. Two soilborne pathogens with a synergistic interaction that commonly co-exist in Arkansas cotton production areas are the southern root-knot nematode, *Meloidogyne incognita*, and the fungal pathogen, *Thielaviopsis basicola*, which causes black root rot of seedlings. A microplot study was conducted to evaluate the effects of a HP, *T. basicola* and *M. incognita* on cotton root architecture and plant growth at the Southwest Research and Extension Center, Hope, Arkansas. An artificial HP was created 20 cm below the soil surface in half of the microplots. The pathogen treatments included soil infested with *T. basicola* (40 chlamydospore chains/ cm^3 soil) plus four different *M. incognita* levels (0, 4, 8, 12 eggs/ cm^3 soil). Two additional pathogen treatments were non-infested soil and soil infested with *M. incognita* only (4 eggs/ cm^3 soil). A sandy loam topsoil was placed onto the top 20 cm of plots with a HP. The entire plots (76 cm deep) without HP (NHP) were filled with the same soil. The WinRHIZO image analysis software was utilized to analyze the root topological attributes as well as root morphological characteristics for all treatments. In the early growing season, greater plant height, nodes and shoot dry weight were shown in HP plots. However, *M. incognita* infestation tended to decrease these variables more in the HP than NHP plots. *M. incognita* infestation also reduced tap root length. In the late growing season, HP significantly reduced total root surface area, tap root length and root dry weight below the HP layer. Root dry weight, tap root length and seedcotton yield were also reduced after *M. incognita* infestation. This microplot study will facilitate quantifying the effects of soil hard pans and soilborne pathogens on cotton root development and plant growth.