Ecology and Over-Wintering Ability of *Rotylenchulus reniformis* on Cotton in Arkansas

*Joshua A. Still and Terry L. Kirkpatrick*

**RESEARCH PROBLEM**

Reniform nematode populations in cotton in northeastern Arkansas, although persisting from year to year, have not reached the high densities that are common in the central and southern parts of the state (T. Kirkpatrick, pers. comm.). Population densities in the spring in northeastern Arkansas are much lower than population densities in the more southern areas, implying that winter mortality may be higher in the north. However, soil temperature records from northern and southern Arkansas do not indicate sufficient difference to explain enhanced overwintering mortality due to cold temperatures. An experiment to evaluate the impact of soil texture on the temporal population dynamics and over-wintering survival of the reniform nematode on cotton in these two regions was initiated in 2005.

**BACKGROUND INFORMATION**

Cotton is one of the oldest and most important fiber crops worldwide (Stewart, 2001). Arkansas cotton growers produce approximately 1.9 million bales of cotton annually (National Agricultural Statistics Service, 2004). The reniform nematode was first discovered in the continental United States in Georgia in 1940 (Smith and Taylor, 1941) in cotton Fusarium wilt trials, and has since spread throughout much of the Cotton Belt. In Arkansas, the nematode was first reported in cotton in 1988 (Robbins et al., 1989), and was responsible for an estimated 4.3% yield loss in the crop in 2005 statewide (Blasingame and Patel, 2005). Reniform nematodes have generally been regarded as a primarily tropical nematode (Heald and Thames, 1982) due to their slightly higher temperature optima for infection and reproduction in relation to the southern root-knot nematode, and survival and reproduction have been linked to the silt or clay content of the soil. Nevertheless, the reniform nematode has been reported in relatively sandy soils recently at the northern fringe of the Cotton Belt in southeastern Missouri (Wrather et
al., 1992), Virginia (Koenning et al., 2004), and extreme northeastern Arkansas (Batemman and Kirkpatrick, 2004).

RESEARCH DESCRIPTION

Two production cotton fields were chosen for this study. One field (MS) was located near Leachville, Ark. (35° 52' 31", 90° 14' 48"). The second field (MR) was in east-central Arkansas near St. Charles (34° 25' 52", 91° 4' 21"). Both fields have been planted with cotton each year for at least the past 10 years. In June 2005, 10 individual sampling points were established using a Global Positioning System in each of three distinctly different soil types in the MS field. Ten sampling points were also established in the MR field, which had a relatively uniform soil type throughout. The soil types in the MS field were: loamy sand (LS) (79% sand, 16% silt, 5% clay), sandy loam (SL; 63% sand, 27% silt, 10% clay), and sandy clay loam (SCL; 63% sand, 17% silt, 20% clay). The soil type in the MR field was a silt loam (19% sand, 70% silt, 11% clay). Monthly soil samples were collected from all sites from June 2005 through May 2006 by taking 20 cores (2.5 cm diameter) to a depth of 15 cm from the point and arbitrarily in a circular pattern approximately 1 meter from the point. In addition, single cores (5 cm diameter) were collected vertically to a depth of 120 cm from each sampling point in October 2005 and in February and April 2006. These vertical cores were divided into 20 cm sections and assayed separately for nematodes. Nematodes were extracted using a semi-automatic elutriator (Byrd et al., 1976) and sugar floatation (Jenkins, 1964).

RESULTS AND DISCUSSION

Reniform nematode population dynamics varied relatively little over time in the MS field, but were higher in the soil type that had the greatest clay content (Fig. 1). Population densities were much greater in the MR field than in any of the MS soils, although populations declined in September and October. The low nematode density recovered from samples in the fall in this field may have been due to the vertical stratification of the nematode population at that time. Vertical sampling indicated that most of the reniform population in the MR field during October was in the 20- to 40-cm depth range, considerably below the depth at which the monthly samples were collected (Fig. 2). In October, reniform nematodes were recovered at a depth of 120 cm in both the MS-SCL and MR sites (Fig. 2A). Populations were also higher throughout the soil profile in October than in February and April. Nematodes were detectable in the MR sites in February to a depth of 120 cm while the reniform in the MS soils was not detected below 60 cm. In April, most nematodes that were present in both fields were in the upper 60 cm, with the greatest numbers found at 0 to 20 cm.

PRACTICAL APPLICATIONS

Finer textured soils containing an appreciable clay percentage appear to support higher reniform populations throughout the growing season and may enhance survival
during the winter months. Controlled studies are currently underway to more thoroughly define the relationship between clay content, temperature, and over-winter survival. This research indicates that in a field setting, reniform nematodes will generally exist at higher populations in finer textured soils. This information could be useful to a grower who knows the soil texture throughout a production cotton field and could play a role in planning site-specific management strategies for the reniform nematode.

ACKNOWLEDGMENTS

Support for this research was provided by the Division of Agriculture, University of Arkansas.

LITERATURE CITED


Fig. 1. Reniform nematode temporal population dynamics in Mississippi County (MS) and Monroe County (MR).

Fig. 2. Reniform nematode vertical distribution in MS and MR fields during (A) October 2005, (B) February 2006, and (C) April 2006.