

PROJECT REPORT- ALABAMA COTTON COMMISSION 2007

TITLE: Reniform nematode management investigations - continuing project.

INVESTIGATORS:

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OBJECTIVE:

Our objectives are to: 1) determine the temporal movement of the reniform nematode in the field both vertically and horizontally across the soil profile; 2) determine the actual economic threshold and damage potential of the reniform nematode; 3) to determine the effect of organic (poultry litter) compared to inorganic fertilizer applications on the efficacy of the new seed treatment nematicides for reniform and root-knot nematodes in cotton; 4) investigate the feasibility of predicting nematode population numbers using remotely sensed hyperspectral reflectance data of cotton plants, 5) develop the fatty acid profile of the reniform nematode for potential quick identification; and 6) evaluate the efficacy and economics of recommended and experimental nematicides and biologicals for management of the reniform nematode.

1. Determine the temporal movement of the reniform nematode in the field both vertically and horizontally across the soil profile. The vertical, horizontal, and temporal movement of the reniform nematode from the initial point of infestation was evaluated in a 2007 field study under both irrigated and non-irrigated conditions. Selected rows in each field were inoculated with vermiform life stages of the reniform nematode at planting. Vertical movement of males, vermiform females and juveniles was observed to the maximum sampling depth of 91cm in both the irrigated and non-irrigated test. Horizontal movement of reniform vermiform females and juveniles did not differ between tests. In both the irrigated and non-irrigated fields the nematode spread 75cm from the inoculated row. Movement of males was affected by irrigation. Reniform males in the irrigated test were observed to have moved >150cm from the inoculated row at 60 after planting (DAP). Males in the non-irrigated test had moved only approximately 25cm from the inoculated row at 60 DAP. These results illustrate how quickly the reniform nematode can spread upon introduction in a cotton system.

2) Determine the actual economic threshold of the reniform nematode. To actually determine the yield losses sustained due to the reniform nematode, cotton must be grown with and without the nematode present. Because we are inoculating the field at the Tennessee Valley Research and Education Center with reniform nematodes we have a unique opportunity to determine the real yield loss sustained due to this nematode. Reniform population levels were established at 0, 500, 1000, 5000, and 10000 vermiform life stages per 150 cm³ of soil. Cotton yields were significantly reduced when reniform populations increased over 1000 per 150 cm³ of soil. Yields were 1587, 1663, 1820, 1432, and 1412 lb/A for the 0, 500, 1000, 5000, and 10000 reniform inoculum levels, respectively. Thus yields were reduced by an average of 398 lb/a in the 5000 and 10000 per 150 cm³ of soil reniform levels.

3) Determine the effect of organic (poultry litter) and inorganic fertilizer applications with and without tillage on the efficacy of the new seed treatment nematicides for reniform nematodes in

cotton. Evaluations were conducted in field plots to determine the effect of poultry litter on cotton yield and reniform populations when combined with different nematicides and tillage. Two years of field trials testing the poultry litter, tillage, and nematicide interactions indicate that nematicides tested reduced reniform populations in 2006 but not 2007. Poultry litter and tillage had no effect on nematodes numbers in either season. Greenhouse evaluations confirm that poultry litter has the potential to reduce reniform numbers in cotton; however, field trials indicate that future long-term evaluations with poultry litter should be conducted before recommendations are made.

4) Investigate the feasibility of predicting reniform nematode population numbers using remotely sensed hyperspectral reflectance data collected from of cotton plants. This study will be done with cooperation of Mississippi State University. Mr. Mark Hamilton's 20 acre cotton field was selected for the study. Field soil properties were obtained using the Veris soil electrical conductivity mapping conducted before planting. At 30 to 45 DAP; the field was sampled in quarter acre grids to determine reniform nematode population numbers. Remotely sensed hyperspectral analysis data and NDVI green seeker data were also collected from cotton foliage simultaneously with nematode samples. The hyperspectral reflectance signatures are currently being analyzed and correlated with NDVI and soil electrical conductivity ratings to predicting nematode population numbers extant in the plant's rhizosphere. Yield monitor data was collected and this information is also being compared to all other parameters measured.

5) Develop a quick identification system for the reniform nematode using its fatty acid profiles. Reniform and root-knot nematode populations were characterized by analysis of fatty acid methyl-esters of the total cellular fatty acids. A series of dilutions ranging from 10,000 to a one was used to determine the minimum number of nematodes needed to discriminate between the reniform and root-knot nematodes by FAME gas chromatography. A single vermiform stage nematode can be detected, however, 250 nematodes allowed for the more consistent differentiation of the two nematode genera. At this concentration, five of the six fatty acids significant for discrimination between the reniform and root-knot nematodes are present. The fatty acid observed at the greatest concentration is 18:1 ω 9c, whose concentration in the root-knot nematode is consistently at least twice as high as it that of the reniform. The fatty acids 14:0 and 16:1 ω 5c are present as well at this dilution and are also key to distinguishing between these two nematode genera. The concentration of 14:0 in the reniform is three times that of the root-knot nematode, while 16:1 ω 6c is virtually absent in the root-knot samples but appears in the reniform nematode. Thus early indications are evident that these two genera could be identified using FAME gas chromatography.

6). Determine the efficacy and economics of recommended and experimental nematicides for the management of the reniform nematode. Nineteen trials were conducted in 2007 to determine the efficacy of recommended and experimental nematicides. Tests were established in naturally infested fields located either adjacent to the Auburn University, Tennessee Valley Research and Extension Center, in Belle Mina; at the E. V. Smith Research Station in Tallassee; or in a producer's field near Huxford, AL. Avicta complete pak, AERIS, Temik 15 G, Vydate C-LV and various experimental compounds were examined at variable rates and application timings. Seed cotton yields in north Alabama were averaged across all tests found Temik 15 G and Avicta complete pak produced 13 and 7 % more seed cotton than the Cruiser control treatment. In south Alabama, Avicta complete pak, Temik 15 G and AERIS produced 7, 15, and 6 % more seed cotton than the Cruiser control, respectively.

