THE INFLUENCE OF APPARENT ELECTRICAL CONDUCTIVITY OF THE SOIL ON NEMATICIDES IN COTTON

Charles Overstreet
E. C. McGawley
LSU Agricultural Center
Department of Plant Pathology and Crop Physiology
Dennis Burns
County Agent
St. Joseph, LA
R. L. Frazier
County Agent
Tallulah, LA
R. Barbosa
Department of Biological and Agricultural Engineering
Baton Rouge, LA

Abstract

A nematicide study was undertaken to evaluate a seed treatment nematicide (Avicta Complete Cotton), Telone II at different application rates, and combinations of the two over a range of soil texture as measured by apparent electrical conductivity (EC_a). The test field had a moderate to high infestation of the Southern root-knot nematode and some slight reniform nematode. Nematicide response was greatest at the lower range of EC_{a-dp} for all the nematicides and combinations. As the EC_{a-dp} reading increased, the combinations of nematicides were not different from the single use of the seed treatment nematicide. Soil texture impacts the response of nematicides and can be utilized to better define areas within a field for specific nematicides or combinations when required.

Introduction

Both the reniform nematode (*Rotylenchulus reniformis*) and Southern root-knot (*Meloidogyne incognita*) are major nematode pests of cotton in many production fields in Louisiana (Overstreet and Wolcott, 2003). Damage may often be visible as severe stunting or loss of stand in various areas within a field. These damaged areas are often in association with soil texture. Damage may not be expressed in parts of the field which have a different soil texture (usually more clay content) even though nematode populations may be present in equal or even higher levels. These soil texture changes have best been identified in production fields in Louisiana with the use of the Veris 3100 Soil EC Mapping System. The Veris machine uses a series of emitting and receiving coulters to measure electrical current as it moves through the soil. The shallow reading is referred to as the EC_{a-sh} and gives information down from 0-1 foot in the soil. Deep readings are EC_{a-dp} and measures resistance from 0-3 feet down in the soil. High readings indicate a greater amount of clay content that is present in the soil. Low readings usually indicate a higher level of sand content. The Veris 3100 Soil EC Mapping System is operated by running the machine through a field where the coulters are in contact with the soil and the current is being emitted by two of the coulters. Data is recorded every second for both readings as well as an exact location in the field using a GPS receiver. The machine is run every 40-50' through the field. The data is brought in to a GIS program where it further processed by eliminating erroneous points, interpolated, and divided into 3-5 zones based on the EC_a readings.

EC_a readings vary from one location to another in the country because of the different types of soil present, the parent material that the soil is derived from, weathering, and types of clay. Louisiana has a number of rivers and soil origins that has influenced the formation of soils in the state. When these fields are divided into soil zones, differences may be rather striking as to the EC_{a-dp} reading from these different soils. Differences are observed in both the starting and ending readings as well as the ranges found within each field. Differences have been observed in nematicide response across soil zones in the past. Previously, we have reported that the response of nematicides varied with soil zones and even within years (Overstreet et al. 2007).

The objectives of this current study were to evaluate the response of several current nematicides and various combinations across a wide range of EC_{a-dp} reading within a cotton field infested primarily with the Southern root-knot nematode.

Methodology

An area within the Gin Ridge field located on the Northeast Research Station at St. Joseph was identified as having some variability in soil texture based on previous experience. The field was intensely mapped with a Veris 3100 EC Mapping System to provide data for each plot. An $EC_{a\text{-}dp}$ reading was determined for the center of each plot in the test. Nematicide trials were conducted in this area to look at various combinations of nematicides across soil texture in locations having primarily the Southern root-knot nematode with some slight reniform nematode. Treatments include a fumigant (Telone) at 1.5, 3.0, and 6 gal/a, a seed treatment nematicide (Avicta Complete Cotton), combinations of Telone at 1.5, 3.0, and 6 gal/a plus Avicta Complete Cotton, and an untreated control. Plots were 4-rows wide and 50' long with a 15' border between blocks. A total of 10 soil cores each 0.8 inches X 8 inches deep were collected from each plot for nematode extraction. The test was a randomized block design replicated 4-7 times with the entire test repeated 5 more times to increase the number of plots occurring within different soil textures. Telone was applied using a six-row applicator with 30' Yetter coulters and the premier applicator system in the spring of 2010 and in the fall of 2010 for the 2011 crop. Yield data was collected using cotton pickers available on the research station and compared across all treatments and the various $EC_{a\text{-}dp}$ reading.

Results

The test field was divided into 10 soil zones to demonstrate the location and range of $EC_{a\text{-}dp}$ readings within this field (Figure 1). The $EC_{a\text{-}dp}$ reading ranged from a low of 14.4 to a high of 98.4 in this field. Figure 2 shows the relative population levels of root-knot nematode in the field after the first harvest. Populations were fairly high in both the untreated control and Avicta Complete Cotton. All the treatments that included Telone had significantly reduced levels of root-knot nematode ($P< 0.05$). Figure 3 shows the trend lines for the two year average for yield (seed cotton) of the untreated and the single nematicide treatments. Both the untreated and Avicta Complete Cotton treatments showed a fairly good correlation with yield with increasing $EC^{a\text{-}dp}$ readings ($R^2 = 0.65$; P=0.0005 and R^2 =0.67; P=0.001, respectively). The single rates of Telone were not well correlated with $EC_{a\text{-}dp}$ and remained fairly flat with increasing levels of $EC_{a\text{-}dp}$. Figure 4 shows the trend lines for the two year average for yield (seed cotton) of the untreated and the combination of Avicta Complete Cotton and the various Telone rates. The combinations of Avicta and Telone at 1.5 and 3.0 gal/a rate were much higher in yield than the untreated control at the lowest ECa-dp readings. These yield trends tended to decrease as the $EC_{a\text{-}dp}$ reading increased.

Summary

Nematicides have changed considerably during the past several years with the advent of seed treatment nematicides and loss of Temik (Kemerait et al., 2008; Kirkpatrick and Overstreet, 2011). Seed treatment nematicides are normally recommended for use only in situations where nematode populations are fairly low. However, in many fields found in Louisiana, nematode populations are considered very high and supplemental control would be required. Recent work (Overstreet et al., 2011) has also found that differences in responses to nematicides are present within a field irrespective of nematode populations. Since seed cannot easily be changed during planting, seed treatment nematicides would likely be applied throughout the entire field. However, site-specific applications of a fumigant such as Telone could be applied to areas of a field where this supplemental control is needed.

Our results show that the greatest responses with the combinations of nematicides occurred in the plots within the field which had the lowest $EC_{a\text{-}dp}$ readings. Yield trends increased in all the treatments as the $EC_{a\text{-}dp}$ reading increased. At the highest levels of $EC_{a\text{-}dp}$, the response of the combinations was not different from the seed treatment nematicide alone. This is a similar finding to what we have previously reported with soil zones and nematicides. Combinations of nematicides may be required in certain areas within a field while other areas may require nothing more than the seed treatment nematicide. Soil texture does have an impact on the response of nematicides. Soil texture may be characterized by the use of apparent electrical conductivity for development of management zones within fields.

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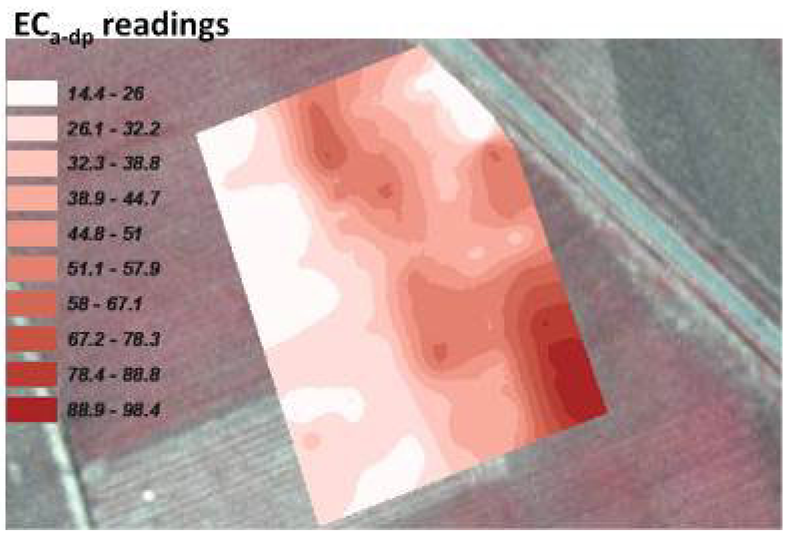

Figure 1. The test area located at the Northeast Research Station at St. Joseph, LA that has been divided into 10 soil zones to show the differences in soil texture within the test.

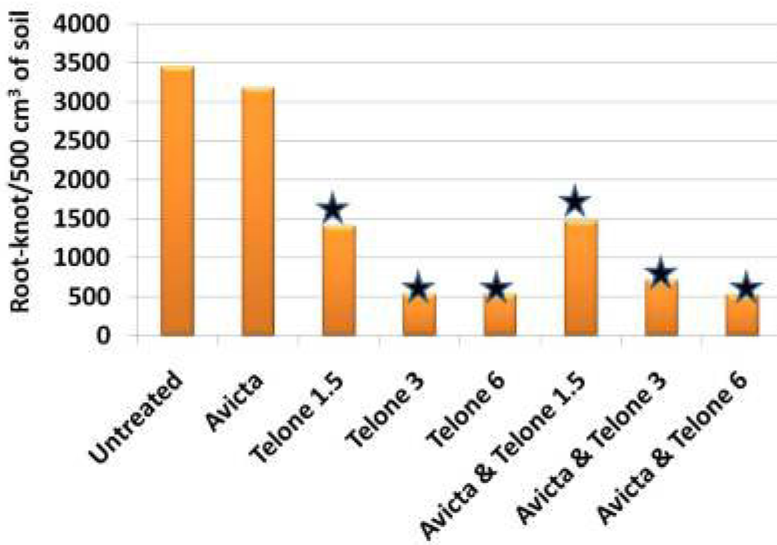

Figure 2. Response of the various treatments to the final population of Southern root-knot nematode at the end of the first year in the test. The number of replications ranged from 24-40 for each treatment.

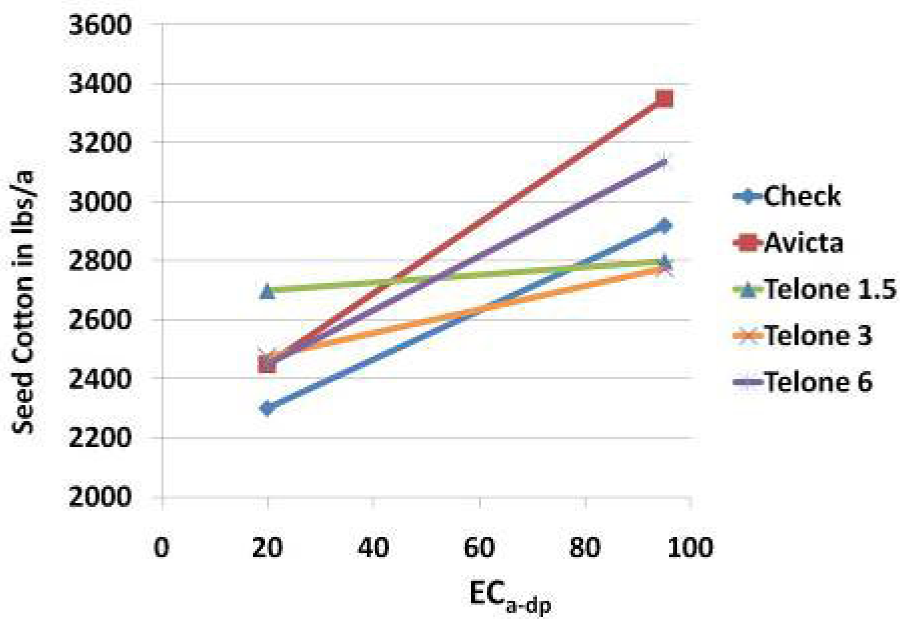

Figure 3. The regression lines of seed cotton of the single applications of nematicides over the changing $EC_{a\text{-}dp}$ reading in the test. Regression lines were based on the two year average of each plot (2010-11).

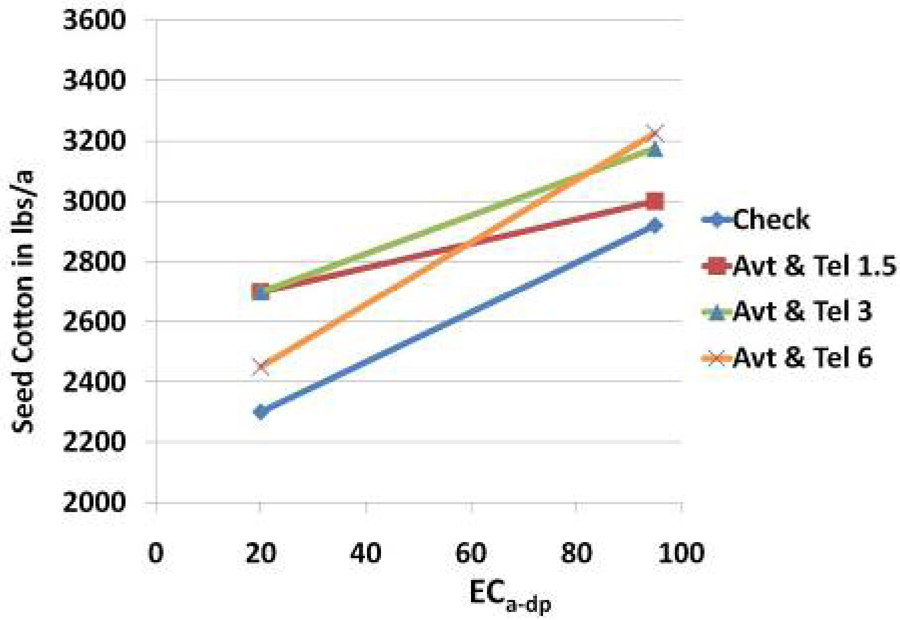

Figure 4. The regression lines of seed cotton of the combination of Avicta and Telone rates over the changing $EC_{a\text{-}dp}$ reading in the test. Regression lines were based on the two year average of each plot (2010-11).