USE OF HYPERSPECTRAL IMAGERY AND SOIL ELECTRICAL CONDUCTIVITY FOR SITE SPECIFIC RENIFORM NEMATODE (*R. RENIFORMIS*) EVALUATIONS AND MANAGEMENT

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Abstract

The reniform nematode is an economically serious pest to cotton production in the southeast United States and is spreading across the southeast cotton belt. This nematode has become the most economically serious cotton pest in Alabama, Louisiana, and Mississippi. To implement a successful reniform nematode management program, the producers must first identify that the nematode is present in a field and determine population densities present in each location before implementing nematicide applications. Studies in Louisiana have demonstrated that nematicides have been less effective relative to soil EC measurements. In Mississippi, remotely sensed hyperspectral imagery has been correlated with reniform nematode population levels to obtain an accurate estimation of the infield nematode distribution without taking a soil sample. Alabama is currently working with the Greenseeker for on-the-go collection of NDVI readings regardless of cloud cover. In 2008, a cotton production fields naturally infested with the reniform nematode was selected in Alabama Hyperspectral reflecrance data, shallow and deep EC soil electrical conductivity zones and NDVI vegetative index maps were prepared. High yielding areas in the field were distinguished from the low yielding regions by cotton root mass (r = -0.80), *R. reniformis* per gram of root (r = 0.93), and NDVI at 45 DAP (r = -0.93). Regression analysis indicated a significant (P = 0.06) relationship of *R. reniformis* counts with NDVI at 45 DAP, with an equation of *R. reniformis* counts (Y) = 91.998 + 1.763 NDVI (X), although the coefficient of determination was very small.

Introduction

The reniform nematode, *Rotylenchulus reniformis* is the limiting factor in cotton production in nematode infested fields in the south. Soil sampling is the primary method of identifying nematode problems and the smaller the area the sample represents typically the more accurate the estimate of the populations of nematodes present. In 2007, a test was established to evaluate if the new technology of real time NDVI could be used to estimate *R. reniformis* nematode numbers or yield damage in a larger scale cotton production field. Therefore this study was established to determine the utility of real-time NDVI for predicting nematode numbers in specific soil electrical conductivity zones to determine potential relationships to cotton yields.

Materials and Methods

A cotton field naturally infested with *R. reniformis* was selected in the northern region of Alabama. The Alabama field has recently been infested with the *R. reniformis* and population levels, although above economic thresholds, are less than half of those found in Mississippi and Louisiana. Soil electrical conductivity data (ECa) was collected from the field utilizing a Veris 3100 soil electrical conductivity mapping system prior to planting. Soil electrical conductivity zone maps were created for both shallow (0-30 cm) and deep (0-91 cm) electrical potential (Fig.1).

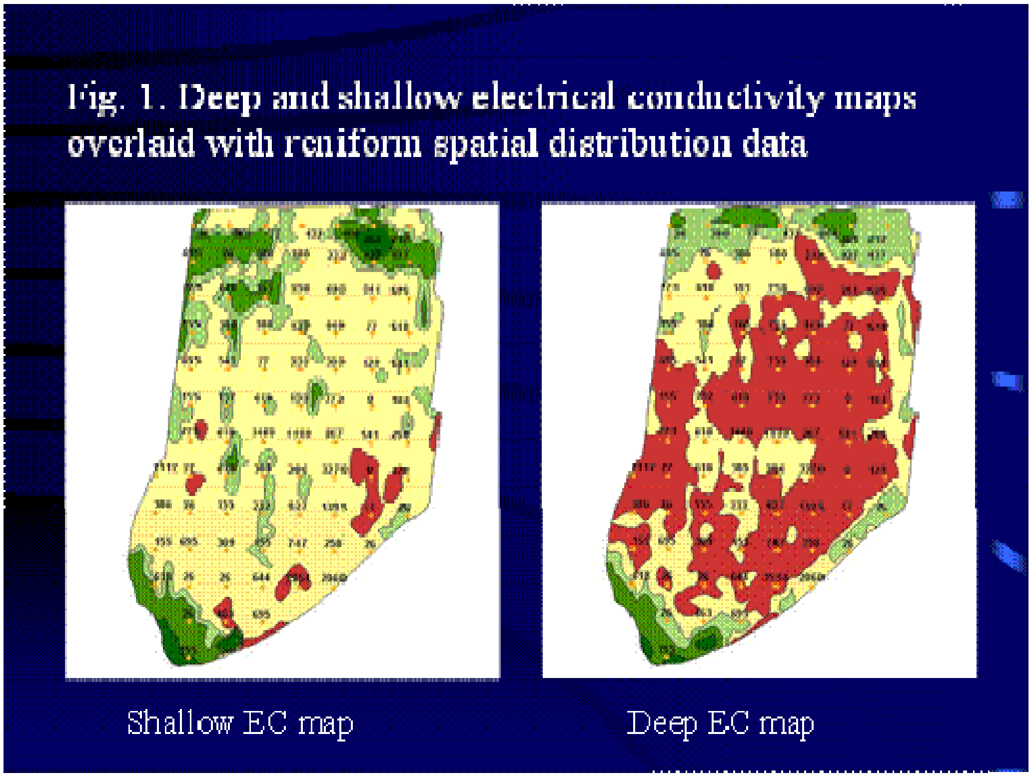


Fig. 1. Deep and shallow electrical conductivity maps overlaid with reniform spatial distribution data

When cotton had grown to the physiological 6 to 7 true leaf growth stage, or approximately 6 to 8 weeks after planting, the field was placed on 0.1-hectare grids and *R. reniformis* samples were collected from the soil near the cotton roots (Fig. 2).

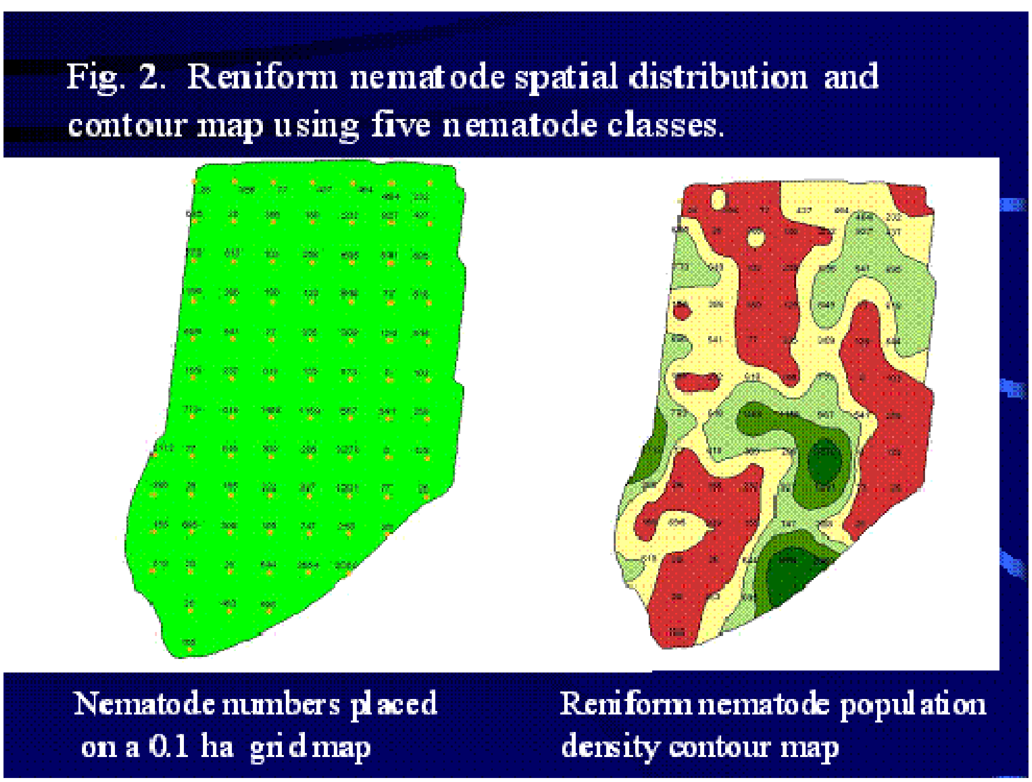
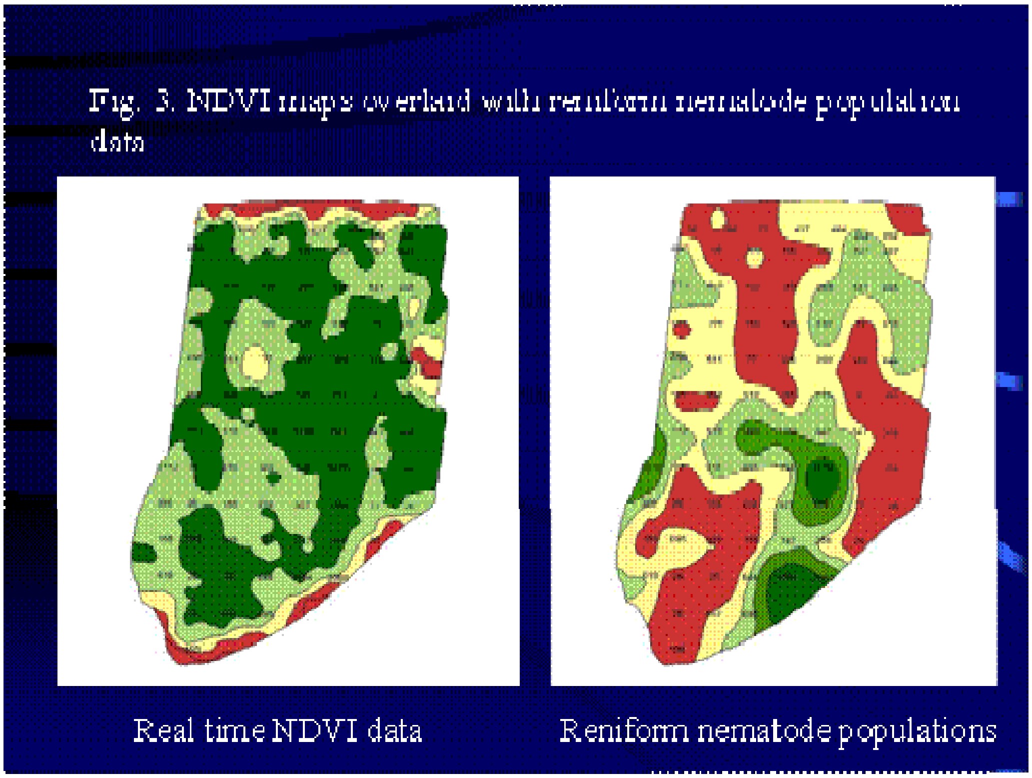
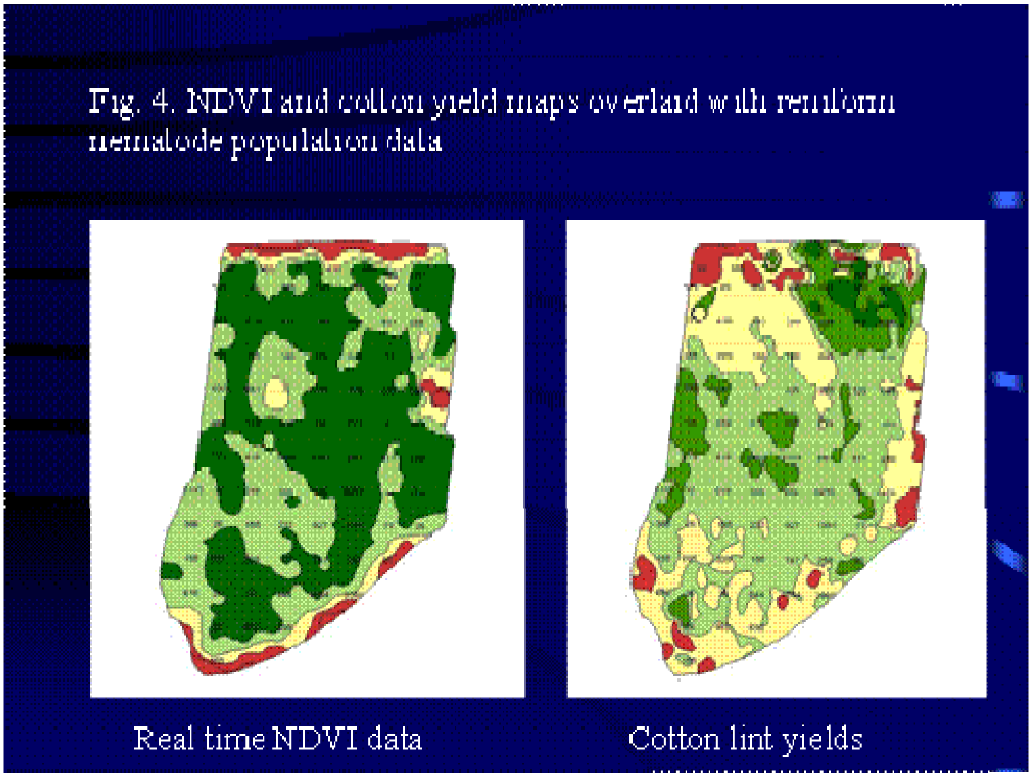


Fig. 2. Reniform nematode spatial distribution and contour map using five nematode classes.

Real time NDVI data was collected with a handheld Greenseeker. The Greenseeker emits its own light source, allowing for on-the-go collection of NDVI readings regardless of cloud cover. NDVI data was collected from the same row from which the *R. reniformis* samples were collected (Fig. 3). Yield estimates were collected with an Ag leader yield monitor model PF3000 system at plant maturity. All yield estimates were placed into four low to high yielding categories (Fig. 4).





Yield estimates were placed into four high to low yielding categories. EC shallow and deep, NDVI values, nematode numbers, and cotton root mass and yield were then analyzed with the SAS® CANDISC procedure and the resulting phenotypic correlations (r) were used to determine the relationship of these response variables with yield classes.

Results and Discussion

There was a significant separation of the highest yielding areas from the lower three yield classes along the 1st canonical axis, which accounted for 50% of the multivariance. High yielding areas were distinguished from the low yielding regions by cotton root mass (r = -0.80), *R. reniformis* per gram of root (r = 0.93), and NDVI at 45 DAP (r = -0.93). The 2nd canonical variate discriminated among the three lower yielding areas. These differences were best described by EC values and the *R. reniformis* extracted from the soil. Regression analysis indicated a significant (*P* = 0.06) relationship of *R. reniformis* counts with NDVI at 45 DAP, with an equation of *R. reniformis* counts (Y) = 91.998 + 1.763 NDVI (X), although the coefficient of determination was very small. This region of the state was under extreme drought and received only 15 cm of rainfall throughout the season which probably accounts of the marginal relationships.

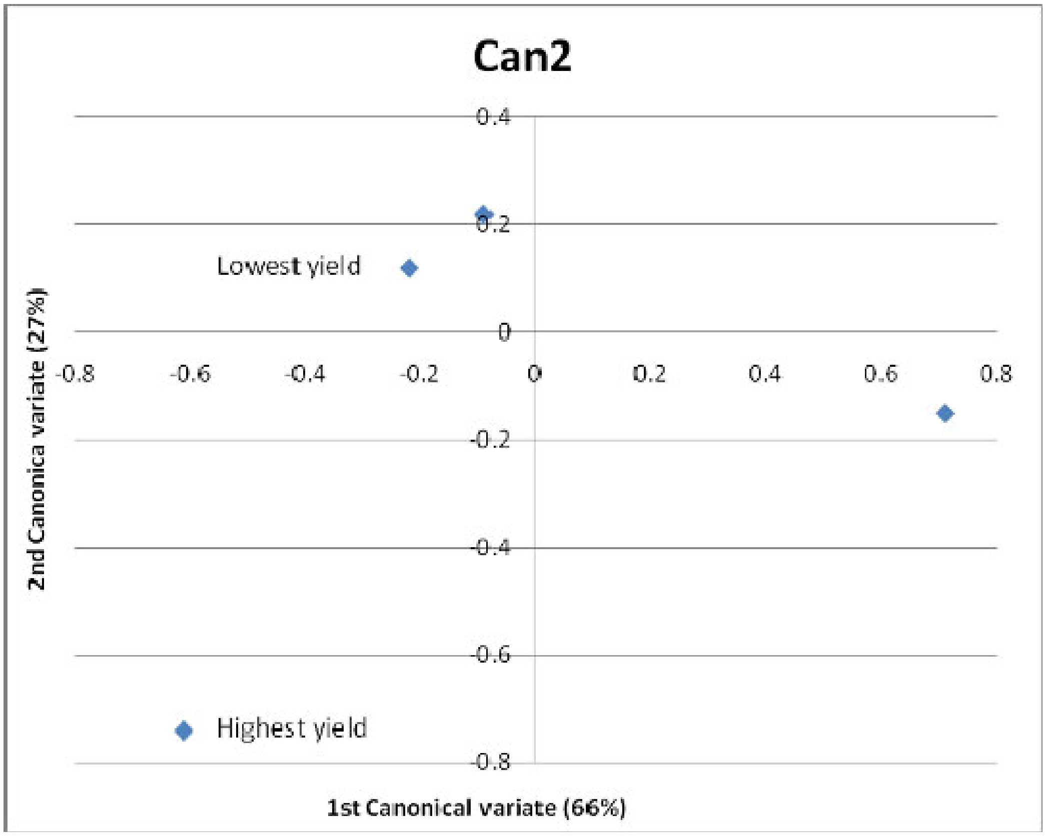


Fig. 5. Canonical correlations between *R. reniformis* numbers, NDVI, Veris, and yield.