ASSESSING FIELD DISTRIBUTION, CROP IMPACT AND STING NEMATODE MANAGEMENT IN FLORIDA STRAWBERRY

J.W. Noling, A.W. Schumann, and M. Cody.
University of Florida, IFAS, Citrus Research & Education Center,
Lake Alfred, FL 33850

In Florida, the Sting nematode (*Belonolaimus longicaudatus*) infests an estimated 40% of strawberry acreage. Any loss of nematode control typically results in a higher incidence of plant stunting in the field. A gradient of plant stunting is typically observed to radiate outward from field areas where soil densities are highest and recolonization of the plant bed is earliest and most rapid. Plant stunting and yield losses are very well correlated with initial soil population density of the nematode. The patchiness and spatial variability in plant sizing (and thus yield) does not appear suddenly before harvest, but reflects a slowing or a failure to continue growth during the time continuum from planting in October to final harvest in March / April. In most years, plant stunting is expressed relatively early in the season, with ultimate size and yield functionally determined by nematode concentration x time products over the season. Given the inability to monitor nematode population density and distribution in real time, yield loss maps were developed based on indirect measures, such as plant canopy size and post harvest season counts of fruit stems. Since 2005, over 70 commercial strawberry fields have been studied to characterize field distribution and nematode impact using plant sizing and estimates of relative strawberry yield. For studies reported herein the experimental objective were to 1) compare relative strawberry yields determined from ground truth survey of plant size categories with NDVI (Normalized Difference Vegetation Index) using GreenSeeker®, a plant reflectance optical sensor measuring canopy cover; and 2) to relate differences in plant sizing and NDVI to differential fumigant treatment.

Methods: The numbers of plants in four plant size categories were systematically enumerated and recorded at 40 to 50 ft intervals in monitored fields. Plant size categories, measured as average canopy diameter, were dead (0), small (<20 cm), medium (>20 and < 30 cm) and large (>30 cm). Using plant sizes, fumigant treatment evaluations based on relative yield were determined in commercial fields with recurring histories of sting nematode problems. Hyperspectral reflectance field imaging technology was used to characterize and relate differences in relative strawberry crop yield (based on plant sizing) to within row, green vegetative cover. A tractor mounted GreenSeeker optical sensor (NTech Industries; Ukiah, Ca) was used to scan strawberry rows to provide estimates of green canopy cover (NDVI) against a backdrop of black plastic mulch covering the raised bed. Cumulative differences in plant numbers and relative yield contribution within each plant size category were then

statistically compared with NDVI, and both values used to independently compare differences between various soil fumigant treatments.

Results: Plant stunting and yield losses were well correlated with final harvest soil population density of the nematode. Accurate maps of nematode distribution, crop yields and loss indices were related to the intensity of field sampling and spatial resolution describing nematode, crop, or soil characteristic. Ground truth surveying of plant size distribution repeatedly demonstrated the accuracy of in-field, remotely sensed GreenSeeker information (Fig. 1). Strawberry yields from commercially hand harvested large plots were well correlated with relative yield values determined from plants of different sizes within the plots. An overlay of the results of six field studies during spring 2010 Dover, FL illustrates the well defined nonlinear, logarithmic relationship between relative strawberry yield (0-1) and NDVI (Normalized Difference Vegetation Index) within fields displaying varying degrees of Sting nematode stunting severity. These results clearly illustrate how NDVI can be used as a numerical indicator of strawberry plant size (L,M,S) derived from measurements utilizing the GreenSeeker®, a plant reflectance optical sensor measuring canopy cover. Differences in plant size distribution and of relative yield also occurred between various alternative to methyl bromide chemical treatments. A comparison of 5 farm locations and five preplant soil fumigant treatments is presented in Figure 2. No significant differences (P=0.05) in canopy cover express by NDVI or relative strawberry yield (lb/a) determined from enumeration of differences in plant sizes were observed between fumigant treatments including methyl bromide chloropicrin 50/50 (225 lb/a) with VIF or in combination with LDPE plastic mulch film, drip applied chloropicrin EC (150 lb/a) +LDPE, and prebed disk hiller applied Telone C35® (22 gpa) alone or combined with minicoulter application of Vapam® (46 gpa) to the bed top on in Dover, FL during Spring 2010. Overall, field scale changes in strawberry crop productivity due to sting nematode and chemical treatment were again effectively determined, on a farm by farm or industry-wide basis, from post harvest assessments of counts of different plant sizes and NDVI measurement. The methodology is being used to provide growers guidance and quantitative performance data on alternatives to methyl bromide soil fumigation for nematode management.

KEY POINTS:

- Relative yield determination is a simple process conducting within a few days of seasons end in which field distributions of plant sizes within the field are characterized.

- Strawberry yields ascertained from commercially harvested small plots were again well correlated with relative yield values determined as a cumulative sum of relative yield contributions from plants of different sizes within the small plots.

- Relative strawberry yields determined from ground truth survey of plant size categories was well correlated with NDVI estimates of canopy cover using Greenseeker optical sensors of strawberry plant reflectance.

- Nematode induced crop losses on a field scale could be easily and economically derived from simple end of season plant size assessments (relative yield) and by NDVI.

- These data again suggest that the impacts of various chemical and soil fumigant treatments can be meaningfully determined, on a farm by farm basis, from post harvest assessments of counts of different plant sizes.

- Relative yield and the NDVI methodology is being used to provide growers guidance and quantitative performance data on alternatives to methyl bromide soil fumigation for nematode management.

Figure 1. Overlay of the results of six field studies during Spring 2010 Dover, FL illustrating the nonlinear relationship between relative strawberry yield (0-1) and NDVI (Normalized Difference Vegetation Index) within fields displaying varying degree of stunting severity by the Sting Nematode, *Belonolaimus longicaudatus*. NDVI is a numerical indicator of strawberry plant size (L,M,S) derived from measurements utilizing the GreenSeeker®, a plant reflectance optical sensor measuring canopy cover.

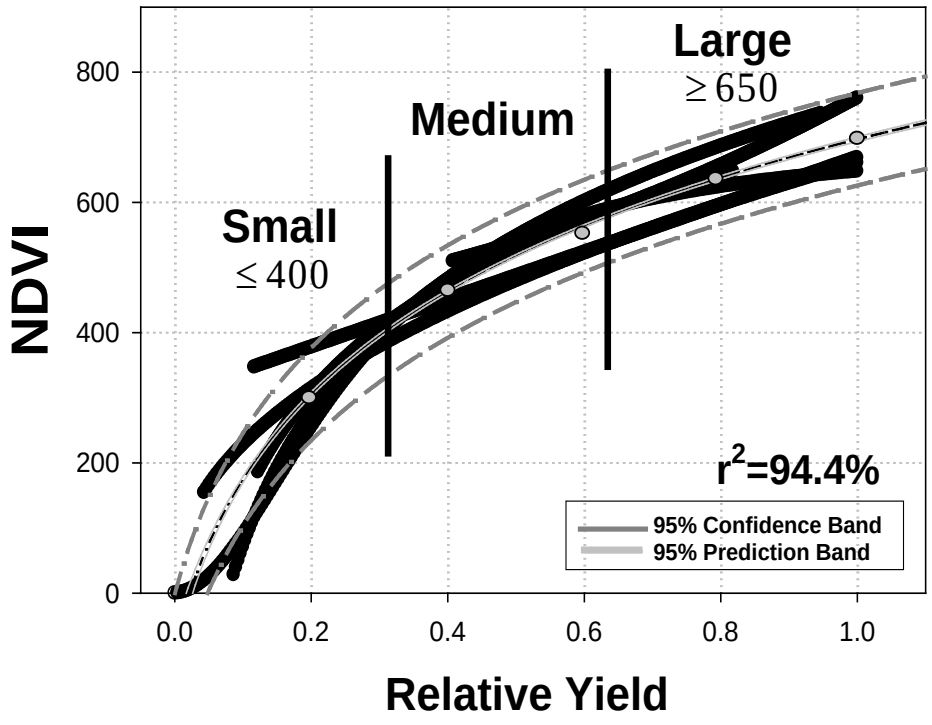

Fig. 2 Comparison of 5 farm locations and fiver preplant soil fumigant treatments, including methyl bromide chloropicrin 50/50 (225 lb/a) with VIF or in combination with LDPE plastic mulch film, drip applied chloropicrin EC (150 lb/a) +LDPE, and prebed disk hiller applied Telone C35® (22 gpa) alone or combined with minicoulter application of Vapam® (46 gpa) to the bed top on NDVI and relative strawberry yield (lb/a) in Dover, FL during Fall 2009 - Spring 2010. (LDPE- low density polyethylene film)