ASSOCIATIONS OF SOIL FACTORS , FUMIGANT EFFICACY, AND FIELD DISTRIBUTION OF NEMATODES

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Previous research has demonstrated that most plant pathogenic nematodes do not occur evenly distributed within a crop field. Rather, nematodes typically occur as clumps or as aggregations of varying size and distribution pattern. These patterns of clumped field distribution are typically attributed to differences in soil texture or other undefined micro-environmental conditions which limit spread, population increase, or possibly fumigant diffusion and nematicidal efficacy. Previous research has demonstrated that soil compaction, a frequent and unintended result of repeated farm equipment traffic within crop fields, can significantly inhibit downward diffusion of 1,3-dichloropropene to soil depths where nematodes reside. The objective of the present research was to determine if post harvest patterns of nematode field distribution were strongly correlated with physical characteristics of soil, and to determine whether deep tillage practices might economically remediate nematode damage within the field to subsequent crops after fumigation.

Materials & Methods: A strawberry field with long history of severe damage due to the sting nematode, *Belonolaimus longicaudatus*, was identified in Dover, Florida. Soil type within the field is an Ona fine sand. To determine whether specific locations within the field exhibiting either excellent or poor strawberry growth were differentially compacted, a soil cone penetrometer was used to characterize soil strength profiles and penetration resistances. Twenty five locations from areas expressing excellent growth and 25 from poor growth areas were selected using remotely sensed aerial infrared and color digital field images. Immediately after penetrometer measurements were obtained to a depth of 30 inches, a 4 inch bucket auger was used to procure soil cores for soil moisture and nematode population density determinations from 4 depth zones; 0-10, 10-15, 15-20, and 20-25 inches. Soil samples for nematode population density determinations were based on 100 g Baerman funnel subsamples. From the bucket auger samples, another 300 g subsample was then removed and oven dried for soil moisture content determinations. A 100 g subsample of the dried sample was then wet sieved through a series of stacked mesh screens (no. 18, 35, 60, 140, 270) to obtain differences in sand particle sizes with depth and field location. Five coarse (>1 mm) to fine sand (>50 Φm) particle size categories were selected to characterize differences in particle size distribution among samples. Silt and clay fractions from each soil sample were chemically removed and quantified using a wet sieved, sodium metaphosphate procedure. Differences in soil color and organic content is also being determined to further explain pattern of nematode field distribution and soil fumigant efficacy.

Results and Discussion: Sting nematode population density decreased significantly (P#0.001) with soil depth (Fig.1). Even at soil depths in excess of 60 cm, a level fully30 cm below the principal strawberry root zone and base of the mulched covered bed, sting densities remained at damaging levels of 15 to 20 nematodes per 100 cc soil. Somewhat surprisingly, no differences (P#0.05) in sting nematode population densities at any soil depth were observed between sample areas of excellent or poor growth. It is not known whether these differences relate root quality and abundance, i.e., to increasing populations in the excellent growth areas to that of decreasing abundance in poor growth areas, or to increased plant tolerance mechanisms operating within areas of excellent growth. Clearly the depth to which nematodes were found present challenges for consistent soil fumigation efficacy.

Soil moisture content increased significantly (P#0.001) with soil depth in both excellent and poor strawberry growth areas (Fig. 2). At soil depths below 30 cm, soil moisture content was significantly (P#0.05) higher from samples procured from field areas of excellent strawberry growth compared to that of poor growth areas. Even though drip irrigation was provided on a daily basis, enhanced soil water holding capacity within areas of excellent growth may play a role in stress avoidance and improved plant tolerance to sting nematode.

Soil resistances were generally higher within the surface 40 cm of soil within poor growth areas (Fig.4). Highest soil penetrometer resistances were observed within poor growth areas but did not appear to be related to percentage silt or clay content of surface or subsurface soil layers (Fig. 3). In general, no differences (P# 0.05) in the percentage of different size category sands, silt, or clay content were observed between excellent or poor growth areas of the field. A significant (P# 0.01) depth effect was observed for all particle size categories. Percentages of silt and clay increased (P# 0.01) with soil depth in both growth areas.

SUMMARY:

- Sting nematode population levels occurred at highest densities within the zone of the mulch covered bed and decreased with depth, occurring at damaging soil densities at soil depths in excess of 24 inches.
- The final harvest, end of season distribution of nematode stunted plants did not appear to be related to major differences in soil texture; i.e., differences in sand, silt or clay particle size distribution.
- Differences in soil population density of sting nematode did not appear to be related to differences in soil compaction profiles and therefore its

potential impact to inhibited diffusion and efficacy of soil fumigation.

Fig. 1. Nematode population density recovered from soil samples at four depths obtained from field areas exhibiting good growth, and areas where plants were stunted by the sting nematode, *Belonolaimus longicaudatus*.

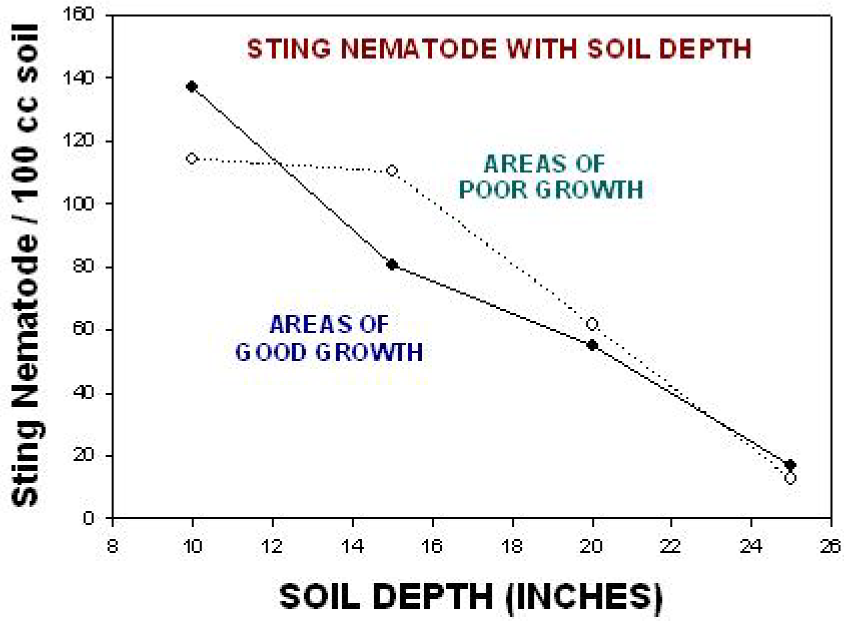


Fig. 2. Soil moisture content of soil samples recovered at four depths obtained from field areas exhibiting good growth, and areas where plants were stunted by the sting nematode, *Belonolaimus longicaudatus*.

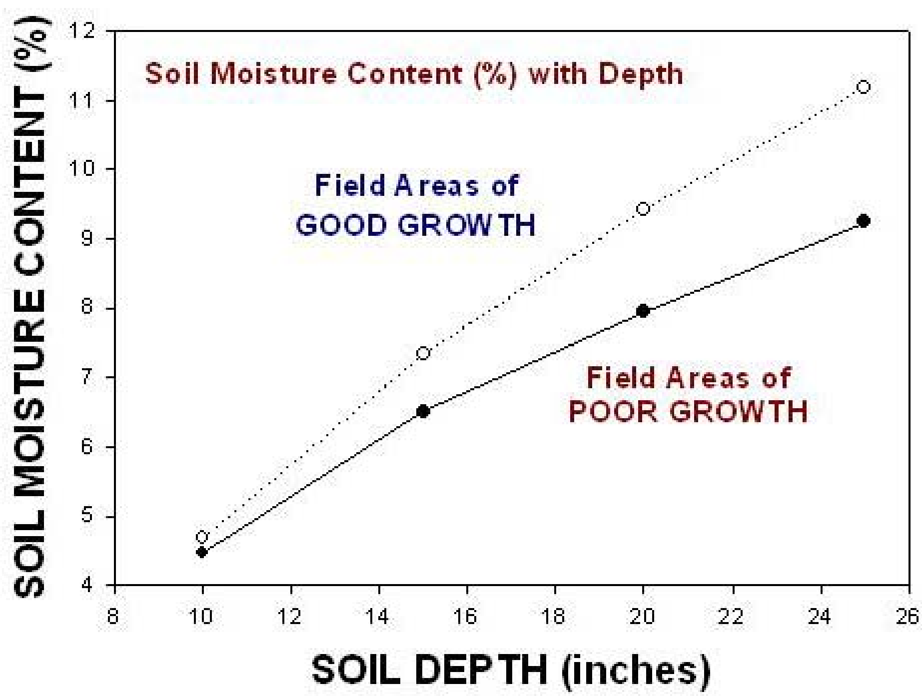


Fig. 3. Percentage of silt and clay recovered from soil samples at four depths obtained from two fields exhibiting good growth, and areas where plants were stunted by the sting nematode, *Belonolaimus longicaudatus*.

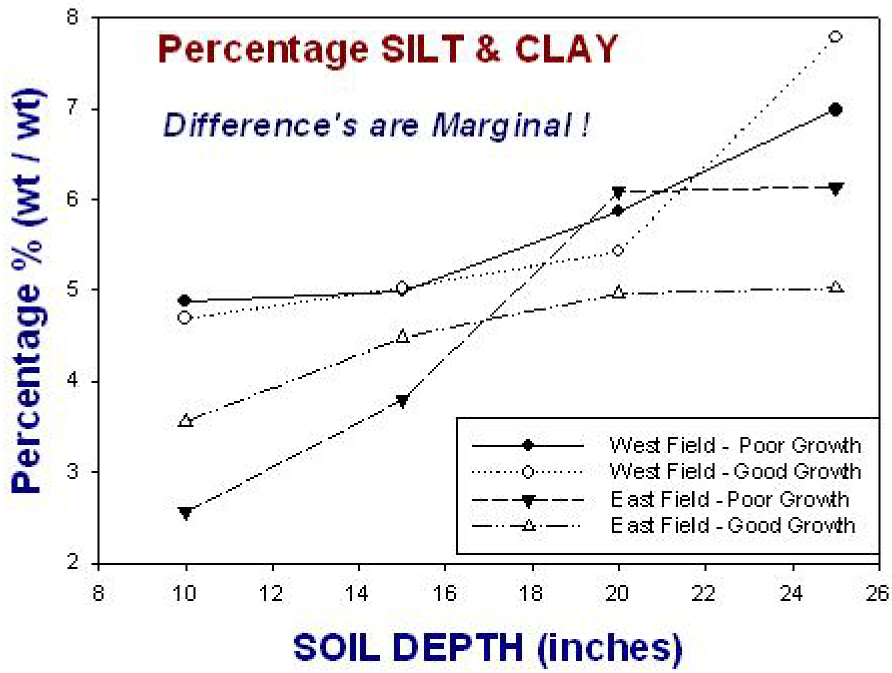
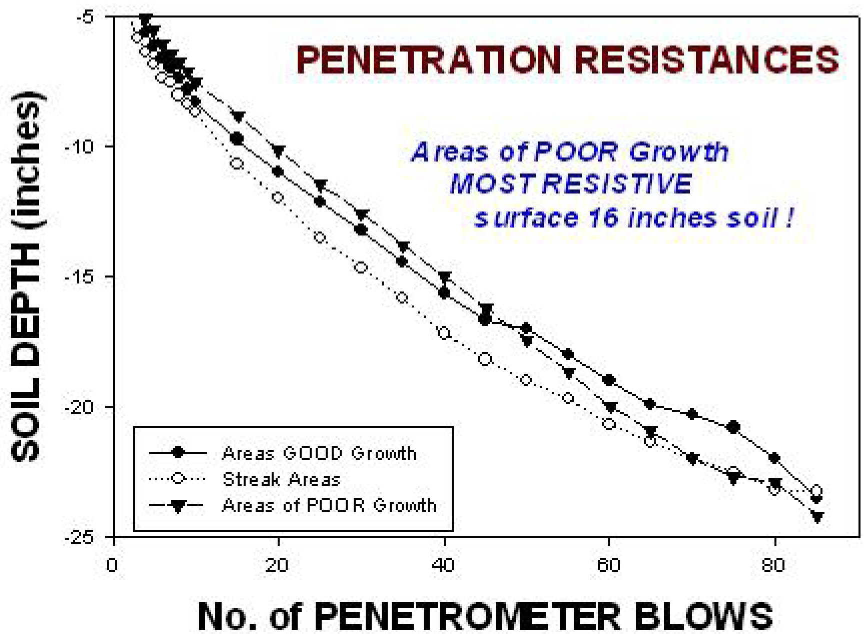


Fig. 4. Spatial distribution of soil compaction as indicated by cone penetrometer resistance with depth obtained from field areas exhibiting good growth, and areas where plants were stunted by the sting nematode, *Belonolaimus longicaudatus*.


PENETRATION RESISTANCES
Areas of POOR Growth
MOST RESISTIVE
surface 16 inches soil !
SOIL DEPTH (inches)
No. of PENETROMETER BLOWS
Areas GOOD Growth
Streak Areas
Areas of POOR Growth
-5
-10
-15
-20
-25
0
20
40
60
80