Interpretation: Deciding on the need for management?

In some cases, the scoring for root-lesion nematode can be difficult to interpret due to the potential interactions with other fungal pathogens and root-rotting soil organisms. However even in such cases, this bioassay can still be used to detect the presence or absence of the root-lesion nematode in the target soil sample.

A soil population of 100 *P. penetrans*/ 100 cc soil is damaging to onion and several other vegetable crops, especially when they are stressed from biotic and/or abiotic factors. Results of soil bioassays conducted under greenhouse conditions have suggested that this same density of lesion nematode permits the observation of approximately 15 (range of 10 to 20 lesions) diagnositic lesions on the taproot of the soybean bioassay plant. Observing less or more of the diagnositic lesions on the taproot will suggest < 100 or > 100 *P. penetrans*/ 100 cc soil. It is advised that management options be implemented when 100 or more *P. penetrans*/ 100 cc soil are predicted. Research efforts are in progress to further improve the predicitability of soil infestation levels of lesion nematode and to relate the observed lesion number to specific crop damage thresholds.

Summary

Soil bioassay with soybean is an effective protocol in predicting the soil infestation level of the lesion nematode. The diagnostic lesion produced on the tap root can be visually observed and counted after only 2 to 3 weeks.

Bioassaying your soil using soybean to detect root-lesion nematode infestation levels is only as accurate as the thoroughness of the sampling procedure and the number of composite soil samples collected. Therefore, the more soil samples collected per field the greater the understanding of the root-lesion nematode distribution within the field and the accuracy of the infestation level. The bioassay is an additional tool for managing the root-lesion nematode on an as-needed basis and it will contribute to reducing nematode damage and ultimately increasing profitability.

Fig. 1. Examples of soybean bioassay plants grown and maintained by a grower outside an onion storage facility (left) and in cone tubes in a research greenhouse (right).

PLEASE NOTE that this research is ongoing and that this protocol is continually being improved to increase its user friendliness.

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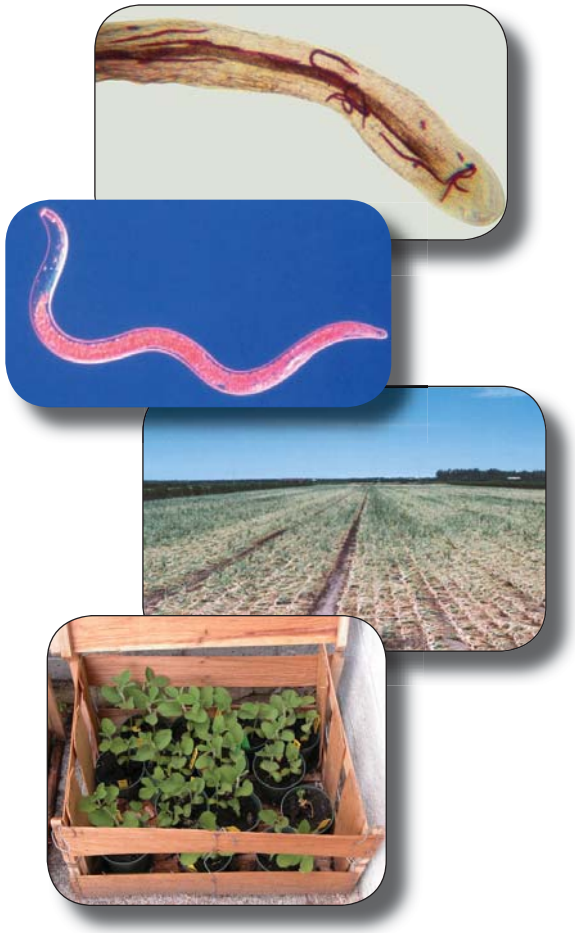
A Soil Bioassay for the Visual Assessment of Soil Infestations of Lesion Nematode



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Introduction

Root-lesion nematodes (primarily, *Pratylenchus penetrans*) are major pathogens of vegetables in New York and the Northeast impacting both the quality and quantity of marketable yield. They are migratory endoparasites, indicating that they can be found in roots or in the soil surrounding the roots. Juvenile and adult stages can infect plant roots, causing considerable destruction of the cortical tissue. However, depending on the plant host, visible lesions may or may not develop at the site of infection on the root. Onion root infections can lead to delayed maturity and reduced bulb size while on potato and other crops infection can result in uneven and poor plant growth and reduced yield. Interactions with other pathogens can also increase root disease severity and yield losses. An example is the potato early dying disease complex caused by the interaction of the lesion nematode and the plant-pathogenic fungus *Verticillium dahliae*.

Effective management of lesion nematodes is best accomplished by practicing IPM principles and strategies. Initial soil infestation densities of lesion nematodes at planting will determine the severity of infestation and yield losses, if any. Thus, the need to monitor soil populations of these nematodes in order to manage them on an as-needed basis and to also select appropriate and effective managment option(s). Soil and/or root samples can be collected and sent to nematode diagnositic laboratories for analysis at a cost of $25 to $40/ sample, which can be costly since at least four or more samples are recommended per production unit. Thus, a simple and visual on-farm soil bioassay was developed for assessing the level of lesion nematode infestation. This brochure describes how to set-up and evaluate lesion nematode infestations using this bioassay.

Materials

The following materials will be needed to conduct the bioassay:

- Pails and plastic bags for collecting soil samples
- Permanent marker for labeling
- Trowel/ shovel
- Pots/ containers
- Soybean seed
- Greenhouse bench/ table space with light
- Watering can/ bottle

Protocol

Soil sampling. A minimum of four composite soil samples should be collected per field (a sample/ 2-3 acres or smaller is preferred). The more composite samples collected per field the more accurate the assessment of the nematode population and distribution within the field. Each composite sample should be approx. 1-2 liters in volume and consist of 15 to 20 sub-samples collected following an X or V patter across the sampling area.

Sample storage. Maintain samples in cool location out of direct sunlight. Ideally, samples are bioassayed soon after being collected but samples can be placed in cold storage about 40F for several months, if needed. Thus, it is possible to sample in the fall and conduct the bioassays in early spring.

Soybean. In a study conducted to identify suitable bioassay hosts for the lesion nematodes, diagnositic lesions resulting from the penetration and feeding activities of these nematodes were observed on cultivars of soybean, lima bean and cowpea. Soybeans are better suited for small containers and the seeds are readily available. All the soybean cultivars evaluated in greenhouse tests were found to be susceptible (good hosts) to *P. penetrans*. In addition, incorporation of soybean residues into soil infested with *P. penetrans* four weeks before planting did not reduce the number of lesion nematodes that penetrated and reproduced on a susceptible crop such as snap beans. To-date, soybean cultivar 'SG1405 RR' has been used in the evaluation of this protocol.

Bioassay set-up. After the composite soil samples are collected, each soil sample is thoroughly mixed, and then an appropriate portion is placed in two 10-cm pots or other suitable container with drainage holes and planted with 2 to 3 soybean seeds. Maintain the plants in a greenhouse or on a workbench under lights, watering daily or as needed for 2 to 3 weeks. Fertilize once a week with a solution of a complete fertilizer, if needed.

Bioassay take-down. After 2-3 weeks, the plants are carefully removed and the roots washed free of soil under running tap water, then examined for the diagnostic root lesions that developed on the main root.

Estimating root-lesion severity

The number of the lesions developed on the soybean roots is a reflection of the lesion nematode infestation level in the soil. It can be roughly estimated by counting the total number of elongated chocolate to dark brown lesions observed on the main taproot (the side roots may be removed prior to counting). A hand lense and supplemental light may improve lesion visability and thus a more accurate evaluation.