

## Appendix C

# Detecting and Avoiding Nematode Problems

Plant-parasitic nematodes are microscopic roundworms that live in soil and feed on roots or foliage of economically important plants. Nematode feeding can result in diseased plants with symptoms such as stunting, yellowing, wilting, yield reduction, root galling and the formation of root lesions. Although damage from plant parasitic nematodes costs Michigan vegetable growers millions of dollars annually, many of these losses are never correctly diagnosed. This appendix provides instructions for the nematode detection methods necessary to avoid or diagnose nematode problems.

A laboratory analysis of soil and root or shoot system tissue is usually necessary for diagnosis or long-term avoidance of plant-parasitic nematode problems. In Michigan, this service is provided by the Michigan State University Nematode Laboratory within Diagnostic Services. There are also private sector laboratories that provide nematode detection services. A \$25 fee is charged by MSU for analyzing each combined soil and root sample.

Samples for nematode analysis should be forwarded to:

Diagnostic Services  
101 CIPS  
Michigan State University  
East Lansing, MI 48824-1311

Samples taken directly to MSU should be delivered to Room 101 in the Center for Integrated Plant Systems (formerly the Pesticide Research Center). All samples must be submitted with a completed sample information form. These forms are available at county MSU Extension offices or can be downloaded from the Diagnostic Services web site at [www.pestid.msu.edu](http://www.pestid.msu.edu).

### Sample objective

The results from the samples are used to decide how to deal with nematode problems and how to avoid problems.

### Diagnosing problems

When plants exhibit symptoms such as stunting, yellowing, wilting, early-die, yield reduction, root-galling, root-lesions or plant mortality that cannot be attributed to other causes, take samples of appropriate soil, root system, or shoot systems, and submit them for nematode analysis.

### Avoiding nematode problems

Generally soil from Michigan agricultural sites should be analyzed for nematodes every 3-5 years at the minimum. If nematodes are a major limiting factor in the production of particular crops (e.g. northern root-knot nema-

toles on carrot), sites should be sampled every fall or spring prior to the growing of these crops. The test results are used to make decisions for avoiding nematode problems.

### When to sample

Generally, soil and root samples can be taken, submitted and reliably processed whenever the soil is not frozen. For the best possible results, however, do not take samples until 45 days after annual root growth, and not after the soil is frozen in late fall or winter. When considering fall soil fumigation, collect and submit samples between August and November. To determine if non-fumigant nematocide use is warranted, sample between March and May.

### How to sample

**Sampling instrument:** Take samples with a soil sampling tube, trowel, or narrow-bladed shovel at a 2-to 12-inch depth. Include as many feeder roots as possible.

Feeder roots or shoot tissue must always be included for samples submitted for best assessing the population densities of endoparasitic nematodes.

**Sample size:** Each sample should consist of a pint to a quart of soil taken from a larger sample composed of 10 or more subsamples. The number of samples needed depends on the size, history, and uniform soil texture of the area being investigated.

- Small area (less than 5,000 sq. ft.), take at least 10 subsamples (soil cores or borings).
- Medium area (5,000 sq. ft. to 1 acre), take at least 25 subsamples.
- Large area (1 to 80 acres), take at least 50 subsamples. In Michigan, no one sample should represent more than 80 acres, and each sample should be from an area of uniform soil texture.

The sampling pattern depends on the commodity and field history. Mix subsamples in a clean pail or a plastic bag and submit one pint to a quart for nematode analysis.

Subsamples from problem area: Plant-parasitic nematodes feed only on living tissues and are rarely found in dead roots. Therefore, take samples from the margin of the problem areas where the plants are still living.

**Sampling container:** A plastic bag can be used for nematode samples. Place samples in plastic bags as soon as possible. Nematodes will be killed if the sample is al-

lowed to dry, and it is important that nematodes are living when the sample arrives at the laboratory.

**Sample storage:** Soil and root samples should be regarded as perishable. Handle accordingly, and process as quickly as possible. Ideally, they should be stored at 10-15C (50-58F). Do not expose them to direct sunlight or store them in hot areas, such as the trunk of your car. Temperatures greater than 40C (100F) will kill nematodes.

### **How to submit samples**

Samples are usually submitted to the MSU Nematode Laboratory through the local extension office, accompanied by a completed form. The information required on the form is essential for diagnosing nematode problems and proper recommendations for nematode population management.

It generally takes two weeks from the time a sample is taken until the results are returned to the grower. The results may be returned through the local extension agent, a private consultant, or directly. The rapid root and soil assays used for mineral soils, however, are not always satisfactory for analysis of organic soils. In a few cases, a bioassay that requires a 45-day incubation period is used to analyze organic soils. When this procedure is recommended, the grower will be immediately notified of the delay and will receive the results within two months after the sample was received.

### **Results and recommendations**

The types and numbers of nematodes will be recorded on the assay form along with an indication of whether or not nematodes are a problem. If nematodes appear to be a problem, you will be occasionally referred to an appropriate extension bulletin for a recommendation. The recommendation should be discussed in detail with the local extension agent or private consultant.