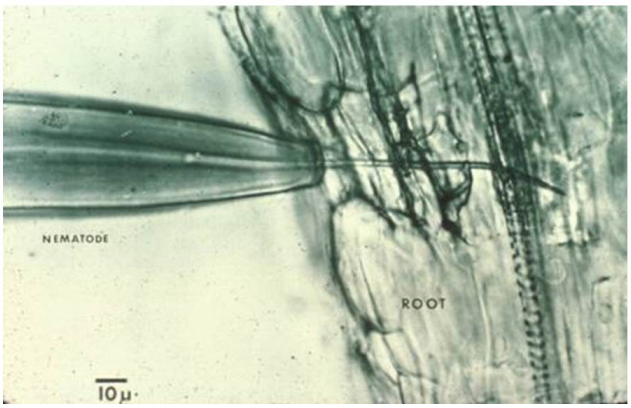
Preventing Nematode Problems in Deciduous Fruit Trees

Nematodes are economically important pathogens on fruit crops. They reduce tree vigor and crop yields by parasitizing tree roots; they predispose trees to disease, reduce winter hardiness, and transmit viruses.

Peach Stem Pitting and Apple Union Necrosis

Two of the most serious nematode problems in Pennsylvania are peach stem pitting and apple union necrosis and decline. Both diseases are caused by the tomato ringspot virus (ToRSV), transmitted by the dagger nematode (*Xiphinema spp.)*.

The only natural means of infection with ToRSV is by dagger nematode transmission. The nematode acquires ToRSV when it feeds on an infected plant and transmits the virus when it feeds on a healthy plant. In the absence of dagger nematodes the virus does not naturally spread to fruit trees. ToRSV can be transported over great distances in the seed of some weeds, such as dandelion. Dagger nematodes and ToRSV are both common in orchards of the Mid-Atlantic states.



Dagger Nematode (Xiphinema spp.). Photo courtesy N.C. State University.

Replant Problems and the Root-Lesion Nematode

Replanted fruit trees frequently have difficulty becoming reestablished, often because of interactions between nematodes and other soil microorganisms. The root-lesion nematode, *Pratylenchus penetrans*, is often the cause of the problem. It is perhaps the most widespread and best-known nematode pest of fruit trees. It damages roots through feeding and intracellular migration, which destroys tissue in the root cortex. Root damage caused by this nematode promotes infection by root-rotting microorganisms. The resulting damage is greater than that caused by the nematode alone.

Root-lesion nematodes migrate and seek new feeding sites when roots become crowded or decayed. Although root impairment results in a loss in vigor and yield of mature trees, the role of root-lesion nematodes in the development of replant problems is of greater economic importance.

Orchards affected by replant disease never reach their full production potential, and there are no remedial measures that can fully correct problems after the orchard is established. Depending on the extent of the problem, infested orchards force the grower to make tough economic decisions, such as whether to keep trees that are not highly profitable or to reestablish a new orchard at major expense and loss of several years' productivity. However, replant disease can be prevented by assessing the risk of problems with preplant nematode assays and by proper site preparation.

The symptoms of orchard replant disease include stunting, yellowing of leaves, discolored and necrotic feeder roots, and in severe cases tree death within the first few years after planting. Necrotic roots may or may not show obvious lesions. Typically, affected trees show a patchy distribution, and the severity of disease may be quite variable within the orchard.

Nematode management is based on rotating crops, using synthetic soil fumigants or nematicides, or incorporating green manure of rapeseed, which releases nematicidal chemicals.

Detection and Sampling for Plant-Parasitic Nematodes

Whenever nematode damage is suspected, and especially before planting young trees, an examination of both soil and roots is recommended. Soil and root samples must be adequate in size and collected in a manner that will make evaluation possible.

The nematode diagnostic service at the Fruit Research and Extension Center in Biglerville has been discontinued. Other university-affiliated labs that will accept out of state samples for nematode testing are listed below. Sample submission information, instructions, and fees can be found at the websites for each lab. Additional laboratories providing this service can be found on line by searching “Nematode Testing Services” or “Nematode Diagnostic Service.” Be sure to contact the facility prior to sending samples. Table 2-15 includes the list of plant-parasitic nematodes with treatment guidelines.

	Number/100cc 2	**Number/100cc 2**
Nematode	Peach	Apple
Lesion	60 – 80	40 – 60
Stunt	60 – 80	60 – 80
Spiral	40	40
Stubby Root	16	16
Dagger	Any – as virus vector 16+ for feeding injury	Any – as virus vector 16+ for feeding injury
Ring	24	30
Cyst	Not economic	Not economic
Sting	8 – 10	8 – 10
Lance	40 – 60	40 – 60
Root Knot	Any in new plantings	Not economic

Table 2 - 15. Plant - parasitic nematodes and their treatment guidelines. 1

1 Table adapted from the 2015 New Jersey Commercial Tree Fruit Production Guide.

2 Thresholds given are not based on experimental data, but rather on field experience and observations in commercial orchards.

Clemson Plant Problem Clinic and Nematode Assay Lab 511 Westinghouse Road Pendleton, SC 29670 Phone: 864-646-2133 Fax: 864-646-2178 Email: nemalab@clemson.edu

Rutgers Plant Diagnostic Laboratory and Nematode Detection Service Rutgers NJAES P.O. Box 550 Milltown, NJ 08850-0550 Phone: 732-932-9140 Fax: 732-932-1270

Suggestions for collecting nematode soil samples on orchard sites

1. If the soil in the area to be sampled is fairly uniform and is 2 acres or less in size, one composite sample will suffice. If the field is larger than 2 but less than 4 acres, divide the field into two blocks of approximately equal size and take composite samples from each block. Fields larger than 4 acres should be divided into blocks accordingly, each of which is not larger than 2 acres and has a uniform history and soil type. This is only a guideline. The smaller the area sampled, the more accurately the sample will represent the site.

2. In each site to be assayed, take a sample from each area that has a common cropping history and that will be planted with a single crop. For example, if a 2-acre field is to be planted with peaches next year and if half the field was in apples last season and the rest in woods, collect a sample from each area.

3. If the soil in the area to be sampled is variable, such as having a heavy clay soil in one portion and a sandy soil in another, take one composite sample from each soil type.

4. Preferably using a 1-by-12-inch sampling tube (or a trowel, small shovel, or similar tool if a sampling tube is unavailable), take at least 20 cores of soil from each sampling area. Samples should be taken to a depth of 8 to 12 inches in the root zone. Send only a single blended sample from the sampling area.

5. Feeder roots, found at varying depths, are usually most abundant at the dripline, directly below the outer leaf canopy. Soil samples should be taken from the same area where the roots are growing.

6. Do not sample from dead or nearly dead trees. Nematodes feed on live roots and may migrate away from dying plants. Therefore, when sampling problem areas, the samples should be taken from adjacent trees that either appear healthy or show early symptoms of stress.

Since nematodes are not uniformly distributed in a field, a carefully prescribed sampling procedure must be followed to obtain root and soil samples representative of the area surveyed. In addition, the samples must be properly handled and shipped to ensure that the nematodes remain alive until they are processed in the laboratory. If there has been a prolonged dry spell, or if the soil has been saturated with water for an extended period, wait until normal soil-moisture conditions return before sampling.

Handling samples

1. Make certain that all information requested is included on the nematode assay form that is requested by the Nematode Diagnostic Clinic you choose to use. This information is needed to identify the sample and to aid in interpreting assay data. If you collect more than one sample, you must assign a field number to each area sampled and place that number in the appropriate area of the form. Each plastic bag of soil should be sealed tightly.

2. Soil samples must remain cool until processed. Keep samples out of direct sunlight to avoid overheating. Samples may also be damaged by heat if they are stored in the trunk of a car, open bed of a pickup truck, or other hot location. Heat kills nematodes, and dead nematodes are unsuitable for identification. It is best to transport soil samples from the orchard in an ice-filled cooler and store them in the refrigerator until they are sent to a lab for processing. If the samples will be mailed to the lab, it is best to include a “blue ice pack” and wrap the sample with some type of insulation such as newspaper, bubble wrap, or Styrofoam to keep the sample in good condition.

Specific chemical recommendations for commercial growers are in the Penn State Tree Fruit Production Guide.

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