ENY-055

UF UNIVERSITY of FLORIDA
IFAS Extension

Nematodes of Backyard Deciduous Fruit Trees in Florida[1]

Jimmy R. Rich, Robert A. Dunn, and Peter C. Andersen[2]

Fruit trees planted in Florida landscapes can appeal to the homeowner for many reasons, including fresh-tasting fruit of high quality and landscape beauty that adds to property value. If fruit plantings have so many wonderful attractions, why do we not see them in every yard? As for everything worth having, careful effort is needed to grow fruit successfully; every kind of plant has conditions most favorable for its growth and other situations in which it cannot thrive. Just as in real estate, the single most important key factor for success is location, location, location. Many EDIS publications [http://edis.ifas.ufl.edu/] provide important information about the needs of fruit crops you might want to grow. Consider that information carefully when choosing your dooryard fruit crop(s). Soil conditions, exposure to sunlight, climatic conditions, and pest risks all can affect which fruit crops will grow best for you.

Pests

What are pests, and where do nematodes fall among them? Many kinds of creatures great and small love the same fruits that we do. Pests are those that eat or otherwise damage plants we attempt to grow. Pests come in many forms and sizes, and may affect our fruit crops in many ways. Microscopic viruses, bacteria, fungi, and nematodes cause many kinds of diseases that may affect the health of the plant or destroy the fruit. Many mites, beetles, caterpillars, and other arthropods feed on the plants and/or the fruits themselves, or lay eggs in them, or carry some of those disease-causing microbes to them. Mice, birds, rabbits, deer, and even bears love most of the fruits we grow and can be very sneaky about getting to them.

Pest management is the term for the entire body of tricks (practices, products, etc.) that we use to reduce the effects of pests on what we wish to have. Knowing what methods are most useful against the common pests of the crop(s) you are growing in your area is very useful during the critical decision process about what to plant and how to care for it. The first decision may well be that only specific varieties of that crop should be planted there or that a different crop altogether would be a better choice for your location.

1. This document is fact sheet ENY-055 (NG0744, one of a series of the Department of Entomology and Nematology, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Publication Date: December 2006. Please visit the EDIS Website at **http://edis.ifas.ufl.edu**.

2. Jimmy R. Rich, professor, Entomology and Nematology Department, North Florida REC, Robert A. Dunn, retired professor, Entomology and Nematology Department, Peter C. Andersen, professor Horticultural Sciences, North Florida REC, University of Florida, Institute of Food and Agricultural Sciences, Quincy, FL 32351.

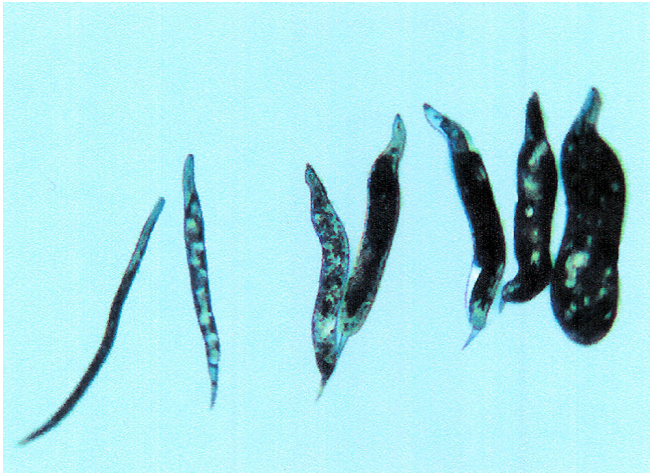

Figure 1. Root-knot nematodes moult five times and swell to egg-laying adults. Credits: John L. Capinera, University of Florida

What Do Nematodes Do To Fruit Crops?

Plant-parasitic nematodes are microscopic small worm-like animals that live in soil or plant tissues. They acquire nutrients from plant tissues by perforating the tissue cells with a hollow, needle-like feeding structure called stylet or spear. These pests damage fruit crops and other kinds of plants through several different effects of their feeding on plant root tissues. Different kinds of nematodes can be classified into one of three groups depending on how and where they feed on the plants:

- **Ectoparasitic nematodes** are those that always remain outside the plant root tissues, feeding on surface cells or those within reach of their probing stylets (spears) from outside. A few kinds of ectoparasitic nematodes can transmit important plant viruses to the tissues on which they feed.

- **Migratory endoparasitic** nematodes move through root tissues, feeding on and killing relatively tender cells as they go. They weaken roots by physical damage to tender tissues and their tunnels can dramatically reduce roots resistance to invasion by fungi and bacteria. The most common examples which affect fruits in north Florida are lesion nematodes.

- **Sedentary endoparasitic** nematodes penetrate young roots at or near the growing tip and establish permanent feeding sites there. They steal nutrients, disrupt water and mineral transport, and also provide excellent sites for other pathogens and pests to invade the root. Root-knot nematodes are the most common and damaging sedentary endoparasities affecting fruit trees in north Florida (Figure 1).

What kinds of Nematodes May Hurt Fruit Crops in Florida?

Many kinds of nematodes have been reported from in and around the roots of various fruit crops, but only a few are known to cause serious damage to most fruit crops, including root-knot, lesion, dagger, needle, ring, and stubby-root nematodes. Following are notes about a few of these:

1. **Root-knot nematodes** (many *Meloidogyne* species) have been known to parasitize various fruit crops for over a century. Root-knot nematodes are sedentary endoparasites whose feeding usually stimulates growth of galls or knots on roots (Figure 2). They disrupt normal formation and function of roots and allow easier entry into the roots for many fungi and bacteria which can cause disease or decay of the roots.

2. **Lesion nematodes** (many *Pratylenchus* species) are migratory endoparasites that feed on many kinds of woody plants, including most fruit crops. They are moderately important pests of many fruit crops.

3. **Ring nematodes** (several species of *Criconemoides* and related genera) are small, cigar-shaped animals that are strictly ectoparasitic, browsing on tender tissues of the surface of the root. They are of low importance to most crops but can contribute to serious decline or total failure of many peaches and nectarines planted on susceptible root stocks.

4. **Dagger nematodes** (several species of *Xiphinema* and closely-related genera) are relatively large ectoparasites which feed mostly at or very near root tips, sometimes causing stunting of root growth or club-like growth of root tips. They are more important to grapes, and perhaps to peaches and nectarines for their ability (unusual among nematodes) to store and transmit plant viruses that can cause diseases that

severely weaken and even kill the crops. The dagger nematodes most common in Florida fruit plantings (American dagger nematode, *Xiphinema americanum*) can store and transmit both tobacco ringspot virus and tomato ringspot virus, which can cause 'flat apple' condition of apples, reduce vigor and cause crumbly berries in bramble fruits and blueberries, and can weaken grapevines.

5. **Needle nematodes** (*Longidorus* species) are similar to dagger nematodes, but occur less commonly.

6. **Citrus nematodes** (*Tylenchulus semipenetrans*) are 'semi-endoparasites' whose females bodies protrude from the surface of the tender roots upon which they are feeding, but whose heads are buried fairly deeply in the root tissues. They are common on citrus and also infect persimmon and a few other fruit crops. Feeding by large numbers can weaken trees significantly.

For each kind of fruit crop, we can consider three **risk** levels of severity of nematode pests:

1. **Severe pests** whose simple presence poses a serious threat to the crop;

2. **Moderate pests** which may co-exist with the crop without causing serious injury under normal circumstances, but occasionally can cause serious stress and damage the crop severely.

3. **Limited pests** that may be associated with fruit crop roots even in fairly high numbers without causing any adverse effect but may, under very unusual circumstances, cause significant stress to the crop.

A few kinds of nematodes are severe pests more often than most and a few usually fall in the benign third class, but most are usually able to coexist with the fruit crop roots with low risk most of the time. From Table 1 it is evident that root-knot nematodes have been reported from more crops (and have been reported earlier and more often) than most other kinds of nematodes. Lesion nematodes may come in as a strong second.

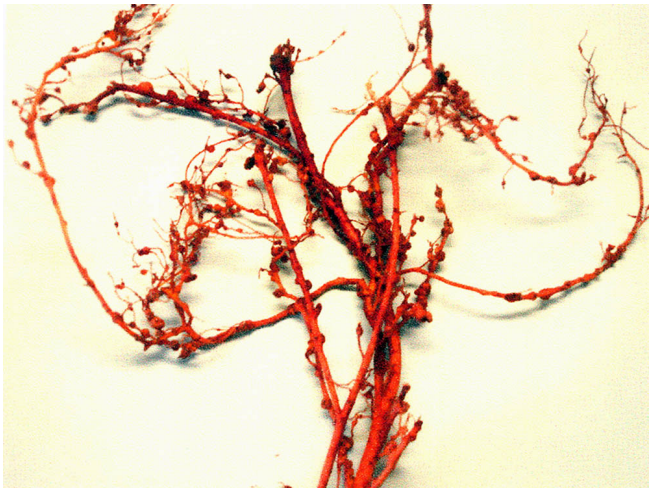

Figure 2. Fig roots showing galling (knots) caused by root-knot nematodes.

Diagnosis: How Can I Tell If Nematodes Are A Likely Problem?

If your fruit planting is still in the planning stage, knowing what nematodes are present may affect your planting decisions (what varieties and even what species of fruits would do best and worst with them?). It certainly may influence your site preparation.

There are three main ways to know about the kinds of nematodes that are at your planting site:

1. Laboratory analysis of soil and root samples can provide the most specific information about what kinds of nematodes are present, and can detect and quantify all kinds of plant-parasitic nematodes that may be present in the sample. See EDIS publication ENY-027 (SR011), *Nematode Assay Laboratory*, for detailed information about proper collection and submission of nematode samples.

2. Any known history of nematode problems on something grown there before gives important information about potential future problems. Nematodes that were present before are very likely to still be present.

3. One group of nematodes important to fruit crops causes recognizable symptoms on some plants that may be growing at the site. Root-knot nematodes normally cause galls, visible swollen growth, on roots of infected plants. Numbers and severity of galls on roots may be used to detect

and estimate severity of infestation of root-knot nematodes.

Management: What Can I Do About Them?

The simple presence of nematodes where you have fruits growing or hope to plant fruit does not mean disaster. Nearly every spoonful of soil has many nematodes in it. It is almost certain that some plant-parasitic nematodes occur around the roots of any plant growing in field soil. It is only when the balance shifts heavily in favor of the nematodes that they become serious pests. In most cases, an otherwise healthy plant will tolerate a few of one or several kinds of nematodes that can feed on its roots.

There are NO chemical pesticides to provide quick fixes either for nematode problems of existing dooryard fruit plantings or to get rid of nematode threats before planting. There are, however, many steps you can take to avoid or at least minimize nematode interference with your growing the fruit crops you want. While we will discuss each of those steps individually, your best chance of managing nematodes successfully will require combination of as many of these steps as possible into an integrated nematode management program. Some of these tactics may seem futile or even silly, but each can make a real contribution to suppression of nematode problems.

1. Pest exclusion is the most important strategy to prevent nematode problems. Avoid introducing nematodes that you dont have on your property by buying planting material certified to be free of nematode plant pests.

2. If you must plant where nematodes exist that are risk level 1 for your crop, consider soil replacement, i.e., dig out and remove all soil from a generous planting hole (at least 3 ft diameter X 1 ft deep) and replace it with soil free of nematodes and other pests. Soils or soil amendments high in organic matter can be added at this time. The crop roots eventually will grow out of the clean soil volume and there will be some movement of nematodes into the clean soil, but the plant will have a jump-start on them by having some time to grow nematode-free.

3. Do not plant a crop that is highly susceptible to one or more kinds of nematode present on your site. Related, but less drastic, may be choice of crop varieties or rootstocks that are least susceptible to specific nematodes at the site e.g., the widespread occurrence of root-knot nematodes in Florida calls for use of Nemaguard, Nemared or Floraguard rootstock for peaches and nectarines planted in such soils. Lovell rootstock, recommended for peaches to be grown to resist ring nematodes in sandy soils in some areas of the U.S., is not recommended in Florida, because it is extremely susceptible to root-knot nematodes.

4. Soil amendments are any organic materials that might be added to soil to improve its physical, chemical, or biological characteristics. Compost or raw manure, leaves or other organic products provide benefits for fruit tree growth and helps trees tolerate nematodes better.

5. Soil solarization involves covering soil to be treated with clear polyethylene for an extended period in the summer. Solarization of field planting sites in Florida may be disappointing because it rarely heats soil sufficiently at the recommended depth (5 - 6 inches is common) to provide adequate control for the entire root zone area (usually at least 1 ft). However, a limited volume of otherwise good topsoil or soil mix can be solarized by completely enclosing it in clear polyethylene film and keeping the soil depth at no more than 6 inches. It should be located where it will get full sun all day, and should be exposed 6 weeks or longer in June and July. This might be a good way to reduce nematodes and fungi as problems in soil or a soil mix to be used in soil replacement.

6. Biological control would be addition to the soil around fruit crop roots of microorganisms that are natural enemies of the nematode pests. Scientists know of many such organisms, but have had little success in producing effective products for sale for this purpose. Beware of products that claim such control.

Key Considerations in Managing Nematodes in Fruit Tree Plantings:

A. Purchase nematode-free planting stock from reputable dealers. Reject any whose roots have knots or galls.

B. Buy varieties with nematode resistant rootstocks when available; these are only available for peach, nectarine, and plum.

C. When planting, use copious quantities of organic matter. If nematodes are suspected, remove native soil and replace with nematode-free potting soil.

D. Water plants according to need; do not allow them to go through water stress.

E. Fertilize plants and follow good cultural practices, this allows plants to tolerate more nematodes.

F. Keep the area within the fruit tree drip line free of plants (ornamentals and weeds) which could serve as hosts to increase nematodes on fruit trees as well as compete with the fruit plants for water and nutrients.

Table 1. Fruit crops and nematodes most likely to affect them in North Florida dooryard plantings.

Nematode	Risk	Comments
Peach, Nectarine and Plum		
Root-knot	1	More serious in sandy soils; can severe stunt trees in short time if susceptible rootstocks are planted in infested sandy soils. Manage by pre-sampling to avoid planting into infested soils and select rootstocks that are most tolerant/resistant to root-knot nematodes.
Ring	2	More serious in sandy soils; one of many stress factors that contribute to "peach tree short life" syndrome in which trees often die in 3-7 years after planting. Pre-sample to avoid planting susceptible rootstocks into infested soils or select rootstocks that are most tolerant to ring nematodes.
Lesion	2	Root necrosis causes general weakening of the root system, especially if originally planted into soil with high lesion nematode populations.
Dagger	1	Direct damage from nematode feeding is relatively uncommon, but dagger nematodes can store and transmit plant viruses that can cause serious disease or death of trees.
Apples and Pears		
Lesion	2	Occasional damage
Root-knot	2	Occasional damage, expecially in very sandy soils
Dagger	2	Virus transmission is a greater risk than direct damage.
Blueberry		
Lesion	2	Can cause a non-specific decline, poor growth, and chlorosis (severe yellowing of foliage).

Table 1. Fruit crops and nematodes most likely to affect them in North Florida dooryard plantings.

Nematode	Risk	Comments
Dagger	2	Cause little direct damage but can transmit viruses (e.g., tomato ringspot and tobacco ringspot viruses) that can cause important diseases of blueberry, making dagger nematodes a serious risk at even very low population levels.
Blackberry		
Root-knot	2	Occasional problem, especially in sandy soils.
Lesion	2	Feeding causes death of root tissues which generally weakens roots and can lead to a general decline.
Dagger	1	Viruses transmitted by dagger nematodes among worst limitations in growing brambles in many areas of the U.S.
Kiwi		
Root-knot	1	Serious pest, can be a limiting factor in growing kiwi, especially in sandier soils.
Grape		
Dagger	1	Transmission of viruses that seriously weaken vines and kill them in some circumstances is much greater risk than direct damage from feeding.
Ring	3	Feeding by high populations can weaken vines.
Lesion	2	Can cause death of root tissues that may eventually cut off entire sections of root and seriously weaken vines
Citrus	2	Feeding by large numbers can weaken roots
Sting	2	Feeding at root tips can stunt root growth
Fig		
Root-knot	1	Figs infected with root-knot nematodes will eventually die. Life can be prolonged by cultural practices. This cannot be cured with any chemical treatment. New planting should be located as far as possible from old garden sites and agricultural land. Sample site for nematodes, and if root-knot nematodes are detected, do not plant figs there.
Lesion Ring Dagger	3	Although these and perhaps other nematodes can weaken trees, the tremendous sensitivity of figs to root-knot and the extremely widespread distribution of root-knot nematodes in North Florida renders all of the others trivial in importance.
Mulberry and Pomegranate		
Root-knot	1	Most species of root-knot nematodes can cause serious damage to mulberry, worse in sandier soils. Root-knot nematodes have been reported to be serious pests of pomegranate in most countries where it is grown.
Loquat		
A few kinds of nematodes have been reported associated with loquat, but there is little evidence of damage to it.		
Persimmon		
Citrus	2	Citrus nematode is addressed as a potentially important pest of persimmon in literature reports from many places where it is grown.