

Nematode Management in Residential Lawns¹

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A well-maintained lawn can help beautify our environment, reduce water runoff and reduce water and air pollution. In 1991-92 there were 3.3 million acres of grass grown in home lawns in Florida, making home lawns the largest agricultural crop in the sunshine state. Just like any other crop, pest management is a key for growing healthy grass in a home lawn. Plant-parasitic nematodes are probably the least understood and most difficult to manage of the turfgrass pests in Florida (Figure 1).

What are Nematodes?

Nematodes are unsegmented roundworms, different from earthworms and other familiar worms that are segmented (annelids) or in some cases flattened and slimy (flatworms). Nematodes living in soil are very small and most can only be seen using a microscope (Figure 2). There are many kinds of nematodes found in the soil under any home lawn. Most of these are beneficial, feeding on bacteria, fungi, or other microscopic organisms. There are even nematodes that can be used as biological control organisms to help manage important turf insect pests. Unfortunately, there are also a group of nematodes that feed on plants, these are called plant-parasitic nematodes (Figure 1).

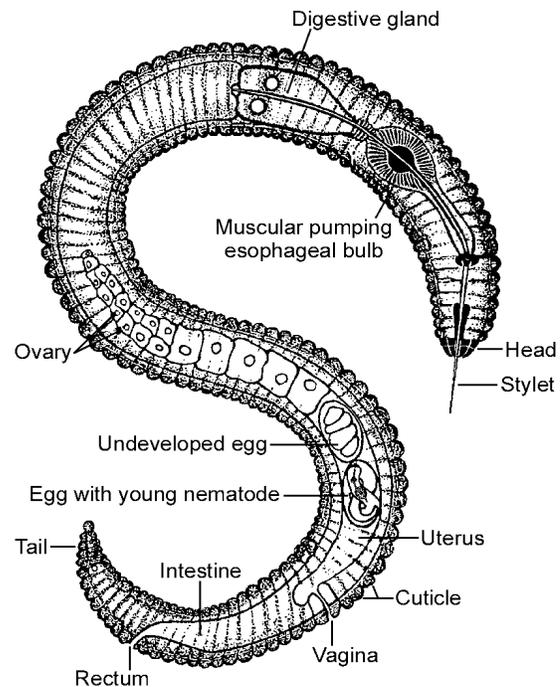


Figure 1. Diagram of a typical plant-parasitic nematode.

All plant-parasitic nematodes have a stylet or mouth-spear that is similar in structure and function to a hypodermic needle (Figure 3). The nematode uses the stylet to puncture plant cells, and then inject digestive juices and ingest plant fluids through it. All

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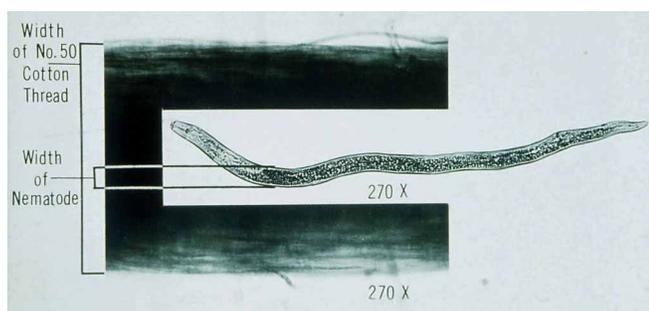


Figure 2. Size comparison of a typical plant-parasitic nematode to a cotton thread.

of the plant-parasitic nematodes that are important turfgrass pests feed on roots. Some plant-parasitic nematodes remain in the soil and feed by inserting only their stylet into the root, these are called ectoparasitic nematodes (Figure 4). Others, using their stylet to puncture an entry hole in the root, feed with their body inside the root tissue. These are called endoparasitic nematodes (Figure 5). Of the major nematodes that cause damage to turfgrasses in Florida, sting, awl, stubby-root, sheath, sheathoid, and ring nematodes are strictly ectoparasites, root-knot nematodes are strictly endoparasites, and lance nematodes feed both endo and ectoparasitically.



Figure 3. A typical plant-parasitic nematode stylet resembles a hypodermic needle.



Figure 4. An ectoparasitic nematode feeding by inserting its stylet into a root tip.



Figure 5. Endoparasitic nematodes burrowing within a root.

How Do Nematodes Damage Grass?

As plant-parasitic nematodes feed they damage the root system and reduce the ability of the grass to obtain water and nutrients from the soil. Roots may be abnormally short and appear darkened or rotten when damaged by plant-parasitic nematodes (Figure 6). Root galls or knots associated with certain nematode damage to other crops are usually not evident on grasses. When nematode population densities get high enough, or when environmental stresses such as high temperatures or drought occur, aboveground symptoms may become evident. Symptoms include yellowing, wilting, browning, thinning out, or death (Figure 7). Often weeds such as spurge, sedges, or Florida pusley become prominent as the grass thins out (Figures 8, 9, 10). Nematode damage usually occurs in irregularly shaped patches that may enlarge slowly over time (Figure 7). Be aware that similar conditions may be caused by other factors such as localized soil conditions, fungi, or insects.



Figure 6. Healthy grass roots (left) and dark, rotting grass roots damaged by nematodes.



Figure 7. Typical nematode symptoms on a lawn; irregular patches of declining grass.



Figure 8. Spurge, a weed often associated with turf declining from nematode injury.



Figure 9. Sedge, a weed often associated with turf declining from nematode injury.

How Do I Know if Nematodes are a Problem?

With any plant problem, having an accurate diagnosis is important to address the problem and to avoid wasting effort and unnecessary pesticide



Figure 10. Florida pusley, a weed often associated with turf declining from nematode injury.

applications. The only reliable way to determine if plant-parasitic nematodes are involved in a grass problem is by having a nematode assay conducted by a professional nematode diagnostic lab. The Florida Nematode Assay Lab is such a facility and will assay nematode samples for a cost that is currently \$20 for each sample from Florida and \$25 for each sample from outside of Florida. Nematode sample kits containing everything needed to collect and submit a sample, along with instructions, are available at your local county Cooperative Extension office.

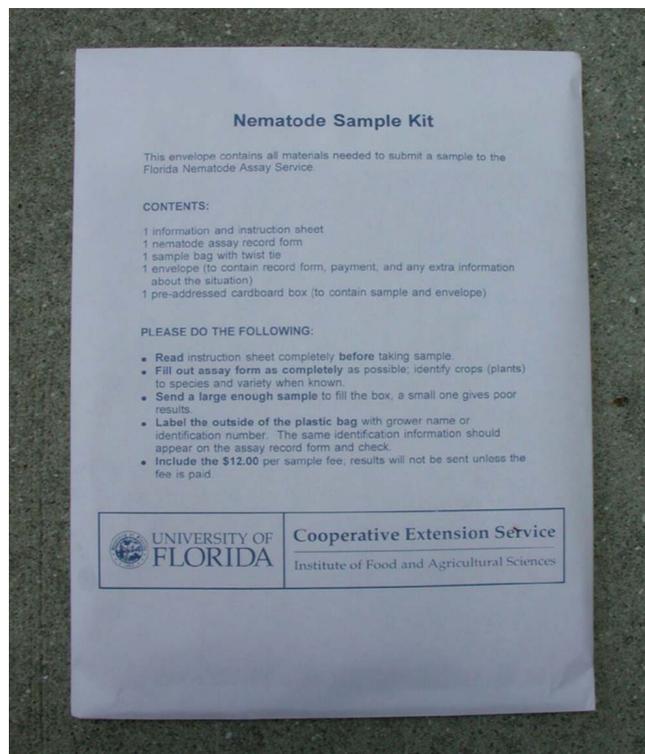


Figure 11. University of Florida Nematode Assay Kit.

Nematode analysis is a separate procedure and requires different sampling guidelines than those

required for soil analysis or plant disease samples. Be aware that when a plant disease sample is submitted to most labs a nematode analysis is not normally performed unless you specifically request it. Nematode analysis often requires separate payment and may even be sent to a separate address. Familiarize yourself with the procedures required by the lab where you intend to submit the sample. The accuracy of the diagnosis depends on the quality of the sample that you submit. If you are taking a sample for submission to another lab, or if you are submitting a sample to the University of Florida lab without using our sample kits, following the guidelines below will help insure an accurate diagnosis:

1) A sample must consist of multiple soil cores. Nematodes are not evenly distributed in soil, they congregate in “hot spots.” Nematode populations may be high at one spot and low just a few feet away. Collect soil from 20 locations in the lawn. Samples should be taken 3 inches deep. About a handful of soil from each location is adequate. Combine all the soil into a single plastic bag. The total volume of soil from the samples should be between 1 pint and a half gallon. Samples may be taken with a shovel, trowel or other device. If using a shovel you can put part of the soil from 20 shovel fulls into a bucket. Thoroughly mix the soil in the bucket then take out a pint for analysis.

2) If damage is evident then sample near the margin of the affected area (Figure 12). Nematode populations will decline in severely damaged areas because they have nothing left to eat. Therefore, populations tend to be highest near the edges of a declining area where the grass is still alive. If damage is occurring in a number of areas in one field take a few cores from the border of several affected areas to make the 20 cores.

When taking samples from turf that is not showing symptoms, or if sampling before planting, sample in a “zig-zag” pattern across the area (Figure 13).

3) Put the soil from each sampled area into a plastic bag and seal it. Nematodes require moisture to survive so drying the soil will kill them. This is different than submitting a sample for nutrient



Figure 12. Collect cores for a nematode sample from the edges of declining areas.

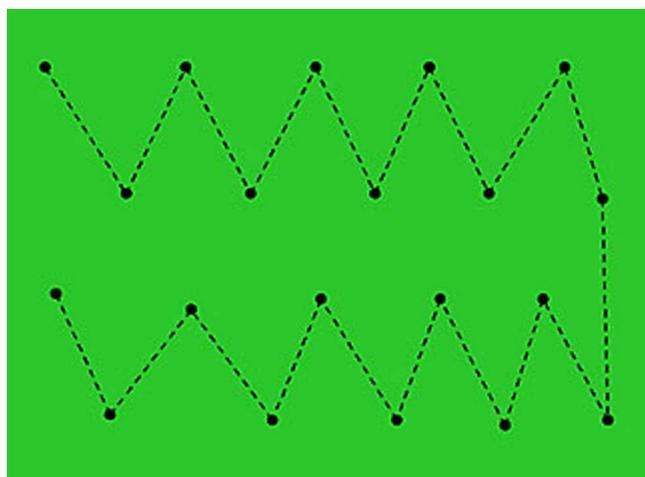


Figure 13. When sampling healthy appearing turf, collect cores in a zig-zag pattern across the area.

analysis where dry soil is preferred. Make sure that each bag is labeled with a permanent marker so that the diagnosis can be assigned to the correct area. If using a self-sealing bag seal it with tape also because the zippers often come open in transit.

4) Handle samples carefully. Do not expose samples to direct sunlight or heat. Nematodes are sensitive to high temperatures and UV light. Leaving samples on the dashboard or in the back of a pickup truck can kill them quickly and negatively affect the accuracy of the diagnosis. Keeping the nematode sample in a cooler is best.

The nematodes will be sandwiched between soil particles so rough handling will destroy them. For shipping and transport pack the samples well to minimized shifting.

5) Submit the sample right away. Next day delivery is best. One study found greatest nematode recovery from hand-delivered samples, the next highest from next-day delivery, and the lowest from regular postal delivery.

The staff at the Florida Nematode Assay Lab will make a determination on whether or not nematodes are a problem based on which nematodes are found and how many of them there are. Not all plant-parasitic nematodes are equal in their ability to harm grass. For example, one sting nematode can cause damage equal to hundreds of individuals of some other types of plant-parasitic nematodes. The number of each type of nematode in 100 cc of soil from the sample that you submit will be compared to established “thresholds” for these nematodes (Table 1). If nematode numbers are below the thresholds then a statement that "Nematodes are below levels believed to be damaging to crop indicated" will be stated on your results form. If nematode numbers exceed thresholds then a statement that "This crop is at high risk of damage caused by the nematodes indicated" or "This crop is at moderate risk of damage caused by the nematodes indicated. Damage may occur if nematode populations increase or if the crop is under stress conditions," will be made.

Be aware that different diagnostic labs may use different extraction techniques, use different quantities of soil, or use different thresholds. Because of this, samples submitted to separate labs may report different quantities of nematodes. Do not be alarmed by this, in most cases the different thresholds used are adjusted to account for the differences in methodology and local conditions. However, if you are using a lab in distant locations, your local conditions or regional variations in nematode aggressiveness may not be taken into account. Often your local labs will provide the most accurate assessments.

What Can I Do About Nematodes in My Lawn?

Because plant-parasitic nematodes live in soil or roots, the pesticides used to kill them tend to be very toxic and are water soluble. Because of health risks

and environmental concerns there are currently no toxic nematicides that are labeled for use on established home lawns. There are a number of products available for use on home lawns that are marketed as “organic,” “biological” or “non-toxic” that claim to be suppressive to plant parasitic nematodes. Be aware that in order to be labeled for home use these types of products need to be safe, but do not need to be proven effective. Nematologists at The University of Florida have tested many of these products for efficacy, generally with disappointing results.

Adding soil amendments can help the grass tolerate nematode damage or possibly suppress nematode population densities. Remember that anything that can be done to improve root health is good. Colloidal phosphate incorporated into fine sand has been shown to help bermudagrass withstand attack by certain nematodes. Organic materials such as composted municipal sludge or manures can also promote grass health, and at the same time may stimulate fungi that attack nematodes.

Some of the best practices for managing nematode damage in home lawns include avoiding other stresses on the grass. Grass that is given proper watering and fertilization can often withstand higher levels of nematode infestation than grass suffering from drought or nutrient deficiencies (see “Fertilizing your Florida Lawn,” a publication of the Florida Cooperative Extension Service available at you county Cooperative Extension Service office or on-line at <http://edis.ifas.ufl.edu/EP055>, and “Watering your Florida Lawn,” a publication of the Florida Cooperative Extension Service available at you county Cooperative Extension Service office or on-line at <http://edis.ifas.ufl.edu/LH025>). Over-fertilization should also be avoided, too much nitrogen can stimulate the production of succulent roots that are more susceptible to nematode damage. Grass that is mowed too low, or that is allowed to grow too tall between mowing, is also more prone to succumb to nematodes. Frequent mowing at moderate height is best (see “Mowing your Florida Lawn,” a publication of the Florida Cooperative Extension Service available at you county Cooperative Extension Service office or on-line at <http://edis.ifas.ufl.edu/LH028>). While minimizing

these stresses can help, even the best managed lawns can suffer from nematode damage from time to time.

If you are considering replanting your home lawn, and have had a history of nematode problems, choosing a different type of grass can sometimes help. Bahiagrass is generally more tolerant of plant-parasitic nematodes than are other common lawn grasses and is often a good choice, but even bahiagrass may suffer under extreme nematode pressure or drought conditions. Generally centipedegrass is the only common lawn grass damaged by ring nematodes. Therefore, if you have a centipedegrass lawn where ring nematodes have been problematic replanting with centipedegrass might be a poor choice.

Summary

At present, the best management strategies for nematodes in the home lawn are aimed at increasing the grass' ability to tolerate nematode damage. These strategies include avoiding stress, promoting root vigor, and choosing tolerant grasses. Researchers at the University of Florida are continually looking at new management options. Some of the options being investigated are testing of new "safer" products that are effective and can be used on home lawns, screening of turfgrass varieties looking for better resistance or tolerance to nematodes, and finding ways to use the nematodes' natural enemies to suppress them below damaging levels.

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For additional information regarding nematodes, nematode management, or help interpreting nematode assay results contact:

Dr. W. T. (Billy) Crow, Landscape Nematologist, Entomology and Nematology Dept., PO Box 110620, Gainesville, FL 32611, (352) 392-1901 ext. 138, FAX (352) 392-0190, Email: [wtcr@ufl.edu](mailto:wtc@ufl.edu).

For information on submitting samples to the Florida Nematode Assay Lab or to check on the status of a sample you submitted contact:

Mr. Frank Woods, Senior Biologist, Nematode Assay Lab, PO Box 110820, Gainesville, FL 32611, (352) 392-1994, FAX (352) 392-3438, Email: nemalab@ifas.ufl.edu.

Table 1. Risk Levels for Warm-Season Turfgrasses used by the University of Florida Nematode Assay Laboratory.

Nematode Species	Bermuda		Zoysia		Seashore paspalum		St. Augustine		Centipede	
	M	H	M	H	M	H	M	H	M	H
Root-knot (<i>Meloidogyne</i>)	80	300	80	300	80	300	80	300	80	300
Sting (<i>Belonolaimus</i>)	10	25	10	25	10	25	25	50	10	25
Lance (<i>Hoplolaimus</i>)	40	120	40	120	40	120	40	120	40	120
Stubby-root (<i>Paratrichodorus</i>)	150	300	150	300	150	300	40	120	150	300
Stubby-root (<i>Trichodorus</i>)	40	120	40	120	40	120	40	120	40	120
Spiral (<i>Helicotylendhus</i>)	700	1500	700	1500	700	1500	700	1500	700	1500
Spiral (<i>Peltamigratus</i>)	150	300	150	300	150	300	150	300	150	300
Ring (<i>Mesocriconema</i>)	500	1000	500	1000	500	1000	500	1000	150	300
Sheath (<i>Hemicycliophora</i>)	150	300	150	300	150	300	150	300	150	300
Sheathoid (<i>Hemicriconemoides</i>)	500	1000	500	1000	500	1000	500	1000	150	300
Awl (<i>Dolichodorus</i>)	10	25	10	25	10	25	10	25	10	25
Cyst (<i>Heterodera</i>)	---	---	---	---	---	---	10	40	---	---

Key:

--- = not believed to cause significant damage .
 M = Turf is considered at moderate risk of damage. Damage may become evident if the turf is placed under stress conditions.
 H = Turf is considered at high risk of damage. Root systems are likely damaged and turf quality may be declining.

* These risk levels are based upon numbers per 100 cc of soil extracted using a sugar-flotation with centrifugation method.
 ** While bahiagrass is a host for many of these nematodes, it is very tolerant to them and seldom is damaged. Therefore, no risk levels are given.
 *** Other nematodes such as dagger, lesion, stunt, etc. may damage turf in Florida, but damage from these is very rare so risk levels are not listed.
 **** These risk levels are based upon nematodes, grasses, and conditions in Florida only. They may not apply in other states.