

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, 3.3 million acres of grass were grown as home lawns in Florida, making home lawns the largest acreage crop in the Sunshine State. For grass, just like any other crop, pest management is crucial for proper plant health. Plant-parasitic nematodes (Figure 1) are among the least understood and most difficult pests to manage on turfgrass in Florida.

What are Nematodes?

Nematodes are unsegmented roundworms, different from earthworms (<http://entnemdept.ufl.edu/creatures/MISC/MISC/Earthworm.htm>) and other, more familiar worms. Nematodes living in soil are very small, and most can only be seen with the aid of a microscope (Figure 2). Many kinds of nematodes live in the soil under any home lawn. Most of these soil nematodes are beneficial, feeding on bacteria, fungi, or other microscopic organisms found in soil (http://entnemdept.ufl.edu/creatures/nematode/soil_nematode.htm). In addition, some nematodes can be used as biological control organisms to help manage important turf insect pests (<http://edis.ifas.ufl.edu/in468>). Unfortunately, other nematodes are harmful to plants because they feed on plant tissues and cause plant damage.

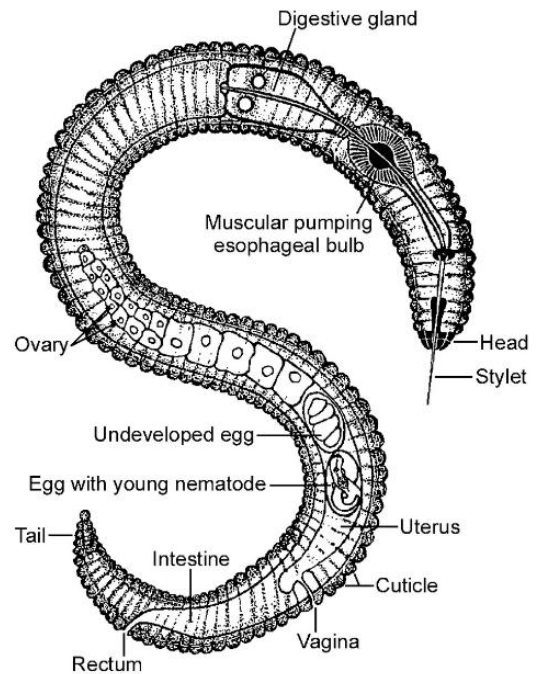


Figure 1. Diagram of a generic plant-parasitic nematode.

All plant-parasitic nematodes have a stylet or mouth-spear (Figure 3) that is similar in structure and function to a hypodermic needle. Plant-parasitic nematodes use their stylet to puncture plant cells, to inject digestive juices into them, and to ingest plant fluids. All of the plant-parasitic nematodes that are important turfgrass pests in Florida

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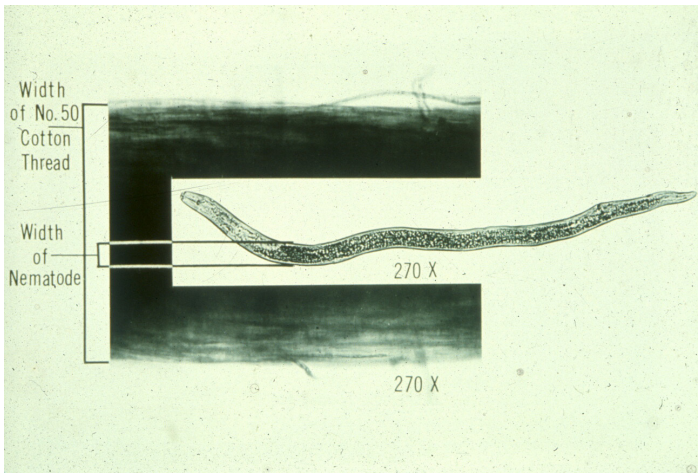


Figure 2. Size comparison of a plant-parasitic nematode to a piece of thread.



Figure 4. An ectoparasitic nematode feeding on a root tip.

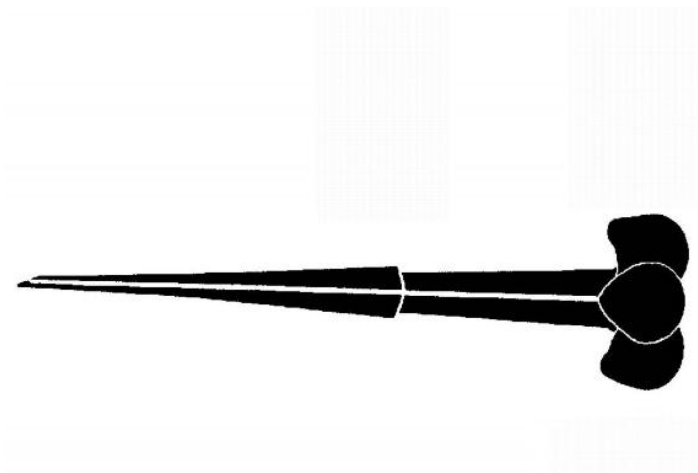


Figure 3. A nematode's stylet is like a hollow spear. Ectoparasitic nematodes, called ectoparasitic nematodes, remain in the soil and feed by inserting only their stylet into roots (Figure 4). Other plant-parasitic nematodes, called endoparasites, use their stylet to puncture an entry hole in the root and crawl inside the root tissue to feed (Figure 5). Among the major nematodes that cause damage to turfgrasses in Florida, sting, stubby-root, ring, and spiral nematodes are ectoparasites, while root-knot, lesion, and lance nematodes are endoparasites.

How Do Nematodes Damage Grass?

Plant-parasitic nematodes damage roots as they feed, reducing the ability of the grass to obtain water and nutrients from the soil. Roots damaged by nematodes may be abnormally short and stubby (Figure 6), or they may appear darkened or rotten (Figure 7). Root galls or knots associated with certain nematode damage to other crops are



Figure 5. Endoparasitic nematodes (stained red) inside a turfgrass root. 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. These symptoms include yellowing (Figure 8), wilting, browning, thinning (Figure 9), or plant death. Weeds such as spurge may increase as the grass cover thins (Figure 10). Nematode damage usually occurs in irregularly shaped patches that may enlarge slowly over time (Figure 11). Be aware that similar conditions may be caused by other factors such as localized soil conditions, fungi, or insects.

Which Kinds of Turfgrass Are Damaged by Nematodes?

All types of grasses are affected by nematodes to some extent. However, certain nematodes are more problematic



Figure 6. Roots damaged by ectoparasitic nematodes (left) and healthy roots (right).



Figure 7. Roots damaged by endoparasitic nematodes (right) and healthy roots (left).

on some grasses than others. The most common nematodes that damage each type of turfgrass used in Florida lawns are:

St. Augustinegrass - lance nematode (<http://edis.ifas.ufl.edu/in390>) and stubby-root nematode (<http://edis.ifas.ufl.edu/in617>).

Zoysia - sting nematode (<http://edis.ifas.ufl.edu/in395>), root-knot nematode, and lance nematode (<http://edis.ifas.ufl.edu/in390>).

Bermudagrass - sting nematode (<http://edis.ifas.ufl.edu/in395>) and lance nematode (<http://edis.ifas.ufl.edu/in390>).

Centipede – Ring nematode and sting nematode (<http://edis.ifas.ufl.edu/in395>).



Figure 8. Yellow patch of seashore paspalum caused by spiral nematodes.



Figure 9. Wilting, declining bermudagrass lawn damaged by sting nematode.

Seashore Paspalum – spiral nematode (<http://edis.ifas.ufl.edu/in973>) and sting nematode (<http://edis.ifas.ufl.edu/in395>).

Bahiagrass is the most nematode-tolerant turfgrass and rarely has nematode problems.

How Do I Find Out If Nematodes Are a Problem?

With any plant problem, an accurate diagnosis is important to address the problem and to avoid wasting effort and applying unnecessary pesticides. The most reliable way to determine whether plant-parasitic nematodes are involved in a turf problem is to have a nematode assay conducted by a professional nematode diagnostic lab. The Florida Nematode Assay Lab (<http://nematology.ifas.ufl.edu/assaylab/>) is the University of Florida nematode diagnostic facility.



Figure 10. Weeds proliferate in a nematode-damaged athletic field.



Figure 11. Nematode-damaged St. Augustine lawn declining in patches.

This lab will diagnose nematode samples for a cost that is currently \$20 for each sample from within Florida, and \$25 for each sample submitted from outside Florida.

Nematode analysis is a separate procedure from soil analysis or plant disease diagnosis and requires different sampling guidelines. Consequently, when a plant disease sample is submitted to most plant diagnostic labs, a nematode analysis is not normally performed unless it is specifically requested. Nematode analysis often requires separate payment and the samples may be sent to a different address from plant disease samples. Familiarize yourself with the procedures required by the lab where you intend to submit a sample.

The accuracy of the diagnosis depends on the quality of the sample that you submit. Following the guidelines below will help ensure that the lab's diagnosis is accurate:

1) Take soil from 10–15 locations to a depth of 3–4 inches and combine it to make a single sample. Nematodes are not evenly distributed in a lawn. Populations tend to clump into “hot spots” and may be high in one area and low just a few feet away. Sampling from numerous areas increases the chance of getting an accurate estimate of nematode numbers in the affected area(s). Combine the soil from the different locations into a single sample from each lawn. A total volume of about a pint of soil from each lawn is adequate.

2) Take samples from areas where the grass is sick, but not dead. If your lawn has patches of dead grass, sample near the margins of these areas where the grass is declining but not yet dead (Figure 12). Nematode numbers will decline in severely damaged areas because they have nothing left to eat. If damage occurs in a number of areas in one lawn, take a few cores from the border of several affected areas to make the sample. When taking samples from turf that does not show symptoms, or if you sample the ground before planting, sample in a “zig-zag” pattern across the area (Figure 13).

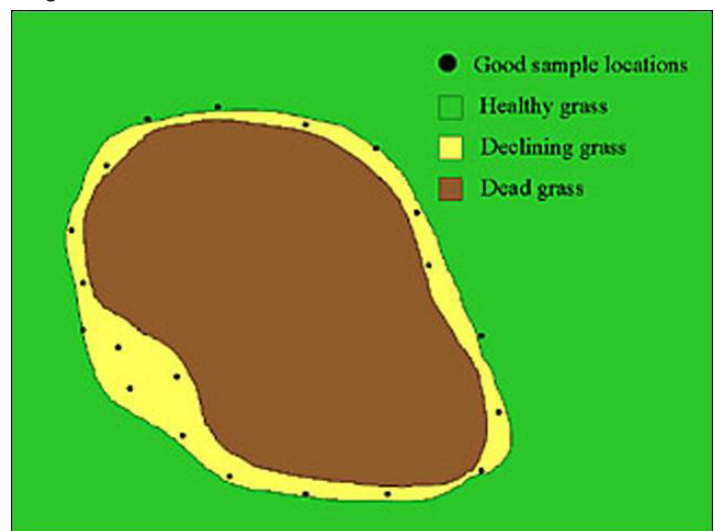


Figure 12. From symptomatic grass, collect cores for nematode sample from turf that is declining, but not dead.

3) Put the combined soil from each lawn into a plastic bag and seal it. Do not use paper bags.

4) Keep the samples out of sunlight and in an air-conditioned room until you ship them. Nematodes are sensitive to high temperatures and UV light. Leaving samples on the dashboard of your car or in the back of a pickup truck can kill them quickly and negatively affect accuracy of the diagnosis.

5) Submit the sample right away. Next day delivery is best to obtain accurate results and diagnosis.

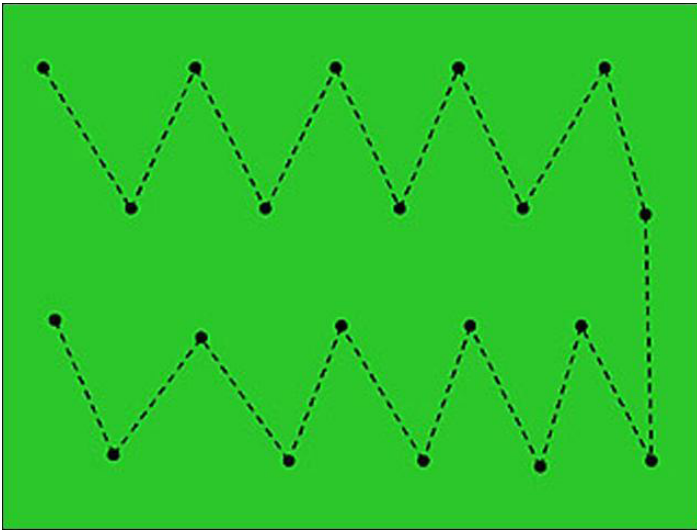


Figure 13. From non-symptomatic areas, collect cores for nematode samples in a zig-zag pattern across the lawn.

The staff at the Florida Nematode Assay Lab (<http://nematology.ifas.ufl.edu/assaylab/>) or other lab will make a determination on whether or not nematodes are a problem in your lawn based on what kinds of nematodes are found and how many of them are found. 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. Your lawn will then be identified as having low, moderate, or high risk of nematode damage based on these findings.

What Can I Do about Nematodes in My Lawn?

Many of the highly effective nematicides used in the past are no longer available because of their risks to humans and the environment. 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. However, for many of these there is no field effectiveness data conducted by credible scientists that indicates they work. Nematologists at the University of Florida have tested many of these products for effectiveness, generally with disappointing results. Two bionematicides that have shown some degree of effectiveness in University of Florida research trials are Nortica and MustGrow Invest.

MustGrow Invest: MustGrow Invest is a bionematicide derived from certain mustard plants grown in Canada. University of Florida research has shown that MustGrow Invest can reduce nematode pressure when it is used on

areas with an efficient irrigation system and good water infiltration. While it does not eliminate nematodes, it can reduce their numbers considerably. In addition to effects on nematodes, MustGrow Invest is a source of organic nitrogen and other plant nutrients. Since MustGrow Invest contains 5% N (nitrogen), and a single application supplies 0.75 to 1.0 lb of N/1000 ft², the combination of nematode and fertilizer effects from MustGrow has made it one of the most successful treatments evaluated in UF trials in recent years for improving turf health in areas infested with some of the most difficult-to-control nematodes. For turf, MustGrow Invest is applied topically using a fertilizer spreader at rates of 15 to 20 lb./1000 ft². The turf surface should be dry (no dew) at the time of application. After application, irrigate with 1/2 inch of water. MustGrow Invest works best when an efficient irrigation system capable of applying a large amount of water in a short amount of time is used. If puddling occurs, cease irrigation until the puddles drain and then begin irrigating again. Aerifying prior to application may improve effectiveness.

Nortica: The active ingredient in Nortica is the bacterium *Bacillus firmus* strain I-1582. This bacterium colonizes the root system of the turf and produces compounds that protect the root system from nematode feeding and damage. Nortica is a solid formulation that disperses in water and is sprayed onto the turf surface before being moved into the soil with irrigation. University of Florida research has shown this biological agent to be effective in protecting turfgrass roots from nematode damage when it is applied properly. However, to achieve good results timing is critical with this product. An application schedule map for Florida counties is available from Bayer Environmental Sciences at <http://www.backedbybayer.com/nortica>. The map should be consulted when scheduling applications. Since Nortica has more of a root-protecting mode of action than a nematode-killing one, it works better when it is used in the early season to prevent a nematode problem. It will not be as effective if you use it to “fix” an existing nematode problem.

Organic amendments such as compost, mulch, municipal sludge, and manure can help the grass tolerate nematode damage by improving plant health. Remember that anything that can be done to improve root health will help plants tolerate nematode damage. In addition, some organic amendments may stimulate soil microbes that can help suppress nematodes in some situations.

Some of the best practices for managing nematode damage in home lawns are targeted at 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. Following the guidelines presented in *Fertilization and Irrigation Needs for Florida Lawns and Landscapes* (<http://edis.ifas.ufl.edu/ep110>) should ensure a properly cared-for lawn.

If you are considering replanting your home lawn and have had a history of nematode problems, choosing a different type of grass may help. Bahiagrass is generally more tolerant of plant-parasitic nematodes than are other common lawn grasses and is often a good choice. Deed restrictions in some parts of Florida require that bermudagrass lawns be used. University of Florida research has shown 'Celebration' bermudagrass to be more tolerant to certain nematodes than some other bermudagrass cultivars, indicating that it might be a good choice in nematode-prone landscapes. In some cases, turf can be replaced with an alternative groundcover such as perennial peanut (<http://edis.ifas.ufl.edu/ep135>) that will not be damaged by the nematodes.

Summary

At present, the best management strategies for nematodes in the home lawn are aimed at increasing the ability of the grass 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 include 1) testing of new safer products that are effective and can be used on home lawns, 2) screening of turfgrass varieties to look for varieties with better resistance or tolerance to nematodes, and 3) finding ways to use the nematodes' natural enemies to suppress them below damaging levels. The University of Florida is committed to bringing you the most current information possible. Consequently, this document will be modified with each breaking development. The most current version of this document may be obtained at your county Cooperative Extension office, or found online at the University of Florida's Electronic Document Information System (EDIS) website at <http://edis.ifas.ufl.edu/ng039>.

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

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

Florida Nematode Assay Lab. Phone: (352) 392-1994.
Email: nemalab@ifas.ufl.edu. Website: <http://nematology.ifas.ufl.edu/assaylab/>