TURFGRASS TRENDS

PEST CONTROL

Some Nematodes at Root of All Evil

By William T. Crow

Yellow blotches on the greens. Weedy fairways. Poor transition. Decline during the summer. Grass on the athletic field tearing up during the big game. Large areas of (God forbid!) dying grass. All these are symptoms that can be caused by plant-parasitic nematodes.

While nematode problems are especially prevalent in the South, they can occur anywhere and are often misdiagnosed. Some of the questions that I'm frequently asked are: What are nematodes anyway? How do I know if nematodes are a problem? Where do they come from? What can I do about them?

Here are some answers to these common questions:

Raising mowing height, decreasing shade, increasing aeration and reducing traffic can improve nematode tolerance dramatically.

What are nematodes?

Nematodes are unsegmented roundworms that live in soil and water all over the earth. Most nematodes are beneficial, feeding on bacteria and fungi, some are even used as biological control agents on turfgrass insect pests like grubs and mole-crickets. However, there are also nematodes that feed on and damage plants; these are called plant-parasitic nematodes.

Several genera of plant-parasitic nematodes are pests of turfgrasses. Most of the plant-parasitic nematodes that damage turfgrasses feed on roots, although there is one species that feeds on the crown tissue of bentgrass and bluegrass in parts of California. The root-feeding nematodes can be grouped into ectoparasites that remain in the soil and feed on roots from the outside and endoparasites that enter into roots to feed and reproduce.

FIGURE 1

Roots fed upon by sting nematode (left) are abbreviated and stubby compared to healthy roots (right).

Some of the common ectoparasites that damage turfgrasses are sting, stunt, ring, stubby-root and spiral nematodes. Endoparasites that damage turf include root-knot, cyst and root-gall nematodes. Lance nematode is one of the most common plant-parasitic

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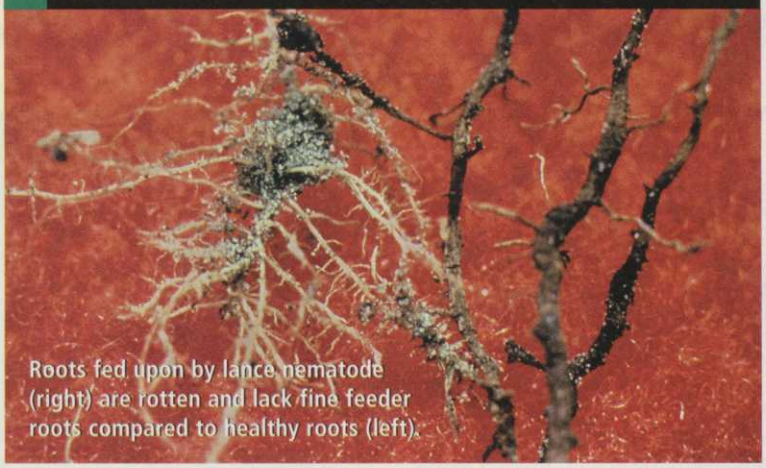
FIGURE 2



Roots fed upon by lance nematode (right) are rotten and lack fine feeder roots compared to healthy roots (left).

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nematodes on turf throughout the United States and can feed both as an endoparasite and an ectoparasite.

Ectoparasitic nematodes typically cause root tips to stop growing and develop an abbreviated or "stubby" appearance (Figure 1). Endoparasites may cause galls or swellings on roots, or rotting and lack of fine-root development (Figure 2). Heavy infestations can lead to an extremely shallow root system that may appear "cropped off" just below the soil surface. Nematode damage to the root system means that the grass cannot obtain the water and nutrients needed for adequate growth. Above-ground symptoms that may develop are yellowing, wilting and decline of the turf accompanied by proliferation of weeds. With severe infestation, death of the turf can occur (Figure 3).

One of the reasons that nematode problems are often misdiagnosed is that plant-parasitic nematodes are microscopic and cannot be seen with the naked eye. Also, the above-ground and below-ground symptoms of nematode damage often resemble those caused by fungal diseases, root-feeding insects or even herbicide damage. Therefore, if nematode problems are suspected, it is important to have a nematode assay conducted by a credible nematode diagnostic lab.

Usually nematode assays are a separate procedure and are not part of a standard plant disease diagnosis, and many plant disease labs cannot perform nematode assays. Fungi such as *Curvularia* and *Pythium* feed on damaged root tissue, so disease samples submitted from nematode-damaged roots often will show these or other fungi present. If the turf does not respond to fungicide treatments, it may be time to take a nematode assay. Nematode samples are collected and handled differently than disease samples, so make sure and contact the lab for instructions before submitting a sample.

Where do they come from?

Nematodes do not fly or migrate on their own from one area to another. A plant-parasitic nematode typically moves just a few inches during its lifetime.

The major ways that nematodes are spread are contaminated soil and planting material. Infested sod and sprigs can be a ready source of nematode inoculum to new areas. For example, sting nematode can only survive in sandy soil, but they can be found infesting sand-based putting greens in areas where the native soil is clay. These nematodes are brought in on sprigs grown in sandy areas and then do fine in the sandy greens.

Nematodes also can be moved in soil adhering to equipment. For this reason aerification equipment should be thoroughly cleaned before

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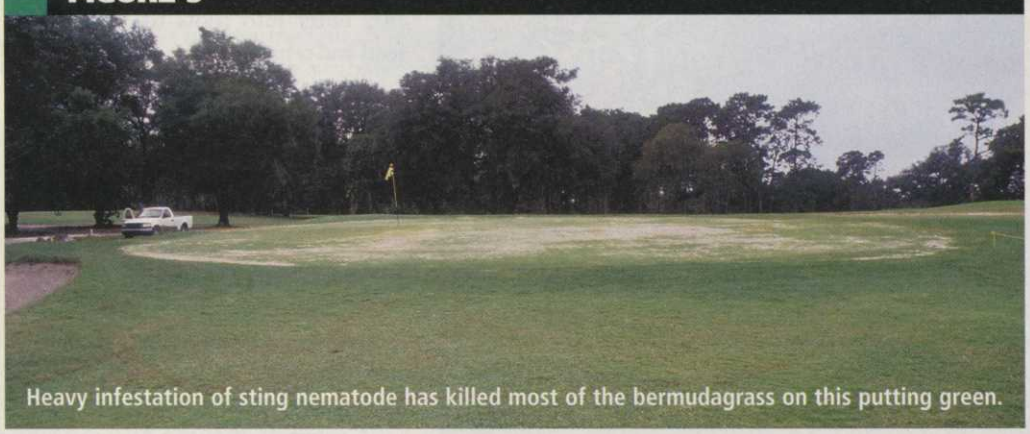
FIGURE 3



Heavy infestation of sting nematode has killed most of the bermudagrass on this putting green.

FIGURE 4

Slit-injection equipment applies soil fumigant on a putting green.

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being moved between locations, and areas with known nematode infestations on a given golf course should be aerified last.

Plant-parasitic nematodes also can occur naturally in an area and then become a problem after turf is planted.

In Florida we have golf courses constructed on sandy locations that used to be orange groves. The sting nematodes that formerly infested these orange groves now are enjoying the new food source provided to them ... bermudagrass. Sometimes nematode populations will exist at low numbers for many years until conditions become favorable for population development and the nematode populations build to damaging numbers. During construction and reconstruction, areas may be fumigated with methyl bromide to kill off the old grass and any soil borne pests like nematodes.

Be aware the fumigation seldom kills 100 percent of the nematodes, and the few survivors can reproduce and still be a problem later.

How to manage problems?

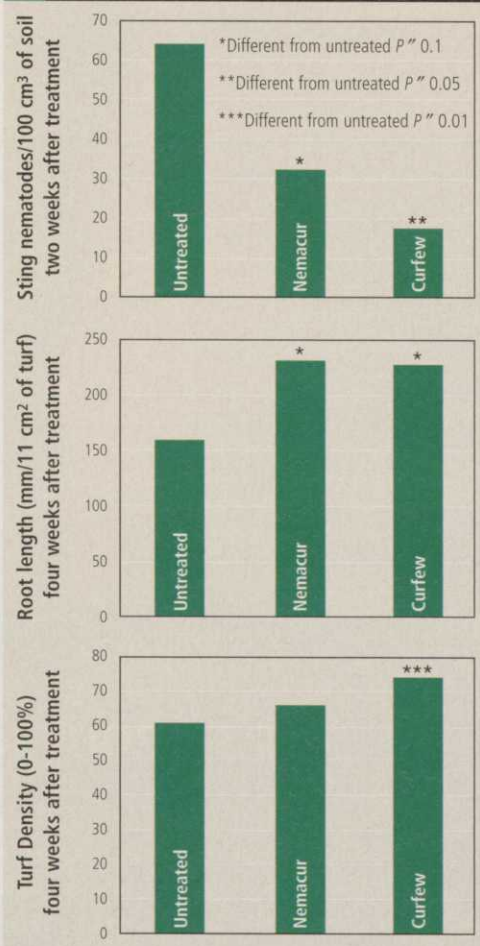
Often nematodes are one of many factors affecting the overall health of turf. In some cases, reducing or eliminating other stresses can help the turf tolerate the negative impacts of the nematodes.

Raising mowing height can improve nematode tolerance dramatically. Decreasing shade, increasing aeration and reducing traffic are other examples of cultural practices that can help improve nematode tolerance in turf.

Nemacur has been the most effective and commonly used nematicide on turfgrasses for the past 25 or 30 years. Because Nemacur is a systemic, it is effective against both ectoparasitic and endoparasitic nematodes. Nemacur causes paralysis of nematodes and prevents them from feeding for a period of time, allowing the turf to put out new roots. Usually there is not a big reduction in nematode numbers after a Nemacur application (sometimes numbers in soil may even increase), so the effectiveness of the application should rather be gauged by the turf response. When the Nemacur is working, turf health should improve. Repeat applications of Nemacur over time have been shown to build up soil microbes that "eat" the active ingredient (fenamiphos) and reduce its efficacy. This has become a common occurrence on golf courses in Florida, where Nemacur has been used extensively over the years.

Due to environmental concerns, Nemacur

FIGURE 12



Results from research trial showing effects of Nemacur and Curfew on numbers of sting nematode in soil, root length and turf density.

will no longer be manufactured after May 2007. Additionally, as of May 2005, Nemacur use is now prohibited on certain soil types. See the Bayer Procentral Web site *www.bayerprocentral.com* to find out if Nemacur can be used at your location.

Curfew Soil Fumigant is presently labeled for nematode control on turfgrasses in Florida, Georgia, North Carolina, South Carolina, Alabama and Mississippi. Additional states may be added later pending state approval and sufficient demand. Curfew Soil Fumigant is slit-injected as a liquid 5 inches to 6 inches deep and then disperses through the soil as a gas, killing nematodes on contact. Because of the specialized injection equipment required (Figure 4) and toxic nature of Curfew, it is only applied by Dow AgroSciences-approved custom applicators. Our research at the University of Florida has shown Curfew to be very effective against plant-parasitic nematodes, particularly ectoparasitic species and also some other turfgrass pests such as mole-crickets. For information regarding use and availability of Curfew Soil Fumigant in your area, contact your Dow AgroSciences representative.

Research conducted by researchers in Ohio and Virginia indicates that application of entomopathogenic nematodes (the nematodes used to control insects) may help suppress plant-parasitic nematodes on turf. However, a body of research conducted in Florida found that this tactic was not effective in that state. While research results are inconsistent, this might be something that turfgrass managers attempting a pesticide-alternative approach might want to consider. However, it would not hurt to have a back-up plan in case the results are not as good as desired.

There are numerous products being marketed as "nematicide alternatives" for use on turfgrasses at this time. Many of these are botanical or microbial in origin.

Be aware that many of these products have not been evaluated in objective field trials, or have been evaluated and found to be ineffective. Some turfgrass managers with large budgets prefer to try many of these to see what kind of results they get. I'm glad they are able to do this, because I get a lot of great ideas from these guys. However, for those of you on a shoestring budget, I encourage you to ask for the results from independent field testing before making an expensive purchase. It is very important that the comparisons in these trials be made to untreated control plots and not just use before-and-after nematode counts from treated plots.

Before-and-after counts can be very misleading as nematode populations can go up and down naturally over the course of a few months.

Presently we are working with some new botanical and microbial products that show potential as nematode management tactics on turf (Figure 5).

Additionally, some of the chemical companies are seeking new nematicides that will be effective but safer than some of the older nematicides. We also are attempting to identify nematode-resistant and -tolerant turfgrass cultivars. Hopefully these efforts will bear fruit in new nematode management strategies in the near future.

FIGURE 5

To see additional figures and photographs with this story, please visit:

www.turfgrasstrends.com

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REFERENCES

Anonymous. 2002. "Fenamiphos: Notice of receipt of request to voluntarily cancel all product registrations." *Federal Register* 67(188):61098-61099.

Crow, WT. 2005. "Alternatives to fenamiphos for management of plant-parasitic nematodes on bermudagrass." *Journal of Nematology* (in press).

Crow, WT. 2005. "Plant-parasitic nematodes on golf course turf." *Outlooks on Pest Management* 16(1):277-282.

Crow WT, Lickfeldt DW, Unruh JB. 2005. "Management of sting nematode (*Belonolaimus longicaudatus*) on bermudagrass putting greens with 1,3-dichloropropene." *International Turfgrass Society Research Journal* 10:734-741.

Crow WT, Porazinska DL, Giblin-Davis RM, Grewal PS. 2005. "Entomopathogenic nematodes are not an alternative to fenamiphos for management of plant-parasitic nematodes on golf courses in Florida." *Journal of Nematology* (in press).