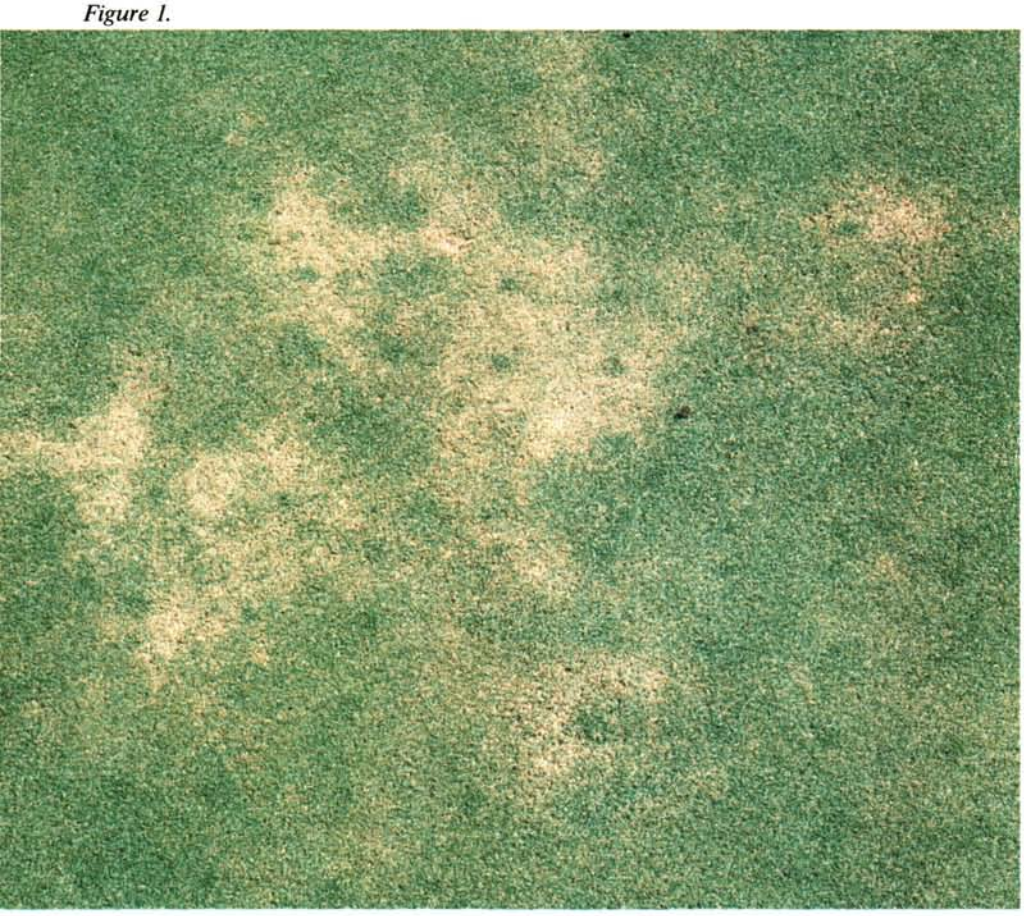
The Nematode Problem in New England

by DR. STANLEY R. SWIER
Extension Entomologist, University of New Hampshire, Durham, New Hampshire

PLANT-FEEDING nematodes have never been considered a problem in New England turf. We knew they existed, but the prevailing wisdom dictated that populations rarely reached damaging levels in the northern as compared to the southern United States. However, recent research is changing our thinking about these pests. Here's some background information on nematodes.

Nematodes are microscopic worm-like parasites from 1/70 to 1/10 of an inch long. They have two general types of habitat: Plant parasitic nematodes have a stylet that is used to pierce the cell and feed on its contents. Turf nematodes are mostly root feeders, and can occur in extremely large numbers. We have found several thousand per 100cc of soil, though nematode counts are often much higher in the South. Death of the turfgrass plant is rare, but nematode feeding can put a severe stress on turf. The extent of the damage will depend on the initial vigor of the plant and the population of nematodes.

Figure 1.



Turf stressed by nematodes has symptoms resembling those caused by other problems, such as fungal diseases, nutrient, or moisture problems. These symptoms include stunting, yellowing, poor vigor, malformed roots, poor root growth, and root galls. Not all symptoms will be expressed, depending on the population pressure and species of nematodes. *Figure 1* shows typical symptoms of nematode damage on a velvet bentgrass green in New Hampshire.

I became involved with nematodes in 1983, when a local golf course was having a severe problem on certain greens. We eventually ruled out every insect, environmental, cultural, or other disease problem. As our last effort, we took soil samples and had them diagnosed for parasitic nematodes by the Cornell Nematode Diagnostic Laboratory. As you might guess, the lab report showed high counts of nematodes. From then on, I was taking nematode counts on every stressed green where no other problem could be found. Commonly, nematode populations were high and apparently a significant factor in turf decline.

Drs. Rob Wick (plant pathologist) and Pat Vittum (entomologist), at the University of Massachusetts (Suburban Field Station, Waltham), also began extensive nematode sampling and reached similar conclusions. In 1985 we teamed up to coordinate our research efforts. Our research had three main objectives: 1) to survey golf course greens to determine which nematodes are present; 2) to determine seasonal population fluctuations; and 3) to determine how many nematodes of each genera it takes to cause damage (economic threshold).

In the population survey, 13 golf courses (three greens each) were sampled every two weeks from spring until fall. The golf courses represented a large geographic area, from Massachusetts to Maine. Each green was extensively

sampled, taking 20 cores per green per sample period. Core size varied from ⅜ to 1 inch, depending on soils. The small core would often plug up in heavy soils, making it necessary to use the larger core, but we tried to be as consistent as possible.

Figures 2 and *3* show a typical population trend for four genera of nematodes. Note that the populations tended to peak in mid-July, then decline. This population trend was fairly consistent, despite the geographic location. The genera of nematodes most commonly found in our survey were *Tylenchorhynchus* (stunt), *Hoplolaimus* (lance), *Helicotylenchus* (spiral), *Pratylenchus* (lesion), *Criconemella* (ring), and *Longidorus* (needle). Not all of these genera are equally pathogenic because it takes fewer needle nematodes to cause damage than it does ring nematodes. Just how many nematodes of each genera it takes to cause a problem is a difficult question. Remember the nematodes are merely one stress factor among a whole host of environmental and biological factors that can cause turf decline.

We know that healthy turf can often support a large population of nematodes and show no apparent ill effects. However, turf under heat or moisture stress cannot. It may show damage with lower nematode numbers. Therefore, there is often no relationship between nematode counts and symptoms. High counts in themselves mean little. Before nematodes can be implicated as a problem, you need to show significant population levels, damage symptoms, and no other insect, disease, environmental, or cultural factor as the primary cause. Much more research needs to be done to identify those biotic and abiotic factors that influence nematode populations and their ability to cause turf decline.

IN A PRELIMINARY STUDY, we found that nematodes went deeper than four inches, which was the sampling depth in our 1985 population survey. In 1986 we concentrated on a depth survey to characterize the rise and fall of nematodes in the soil profile. We sampled every two weeks to a depth of 30cm (about 12 inches) and divided each core into five-centimeter (about two-inch) increments. It was interesting to find that certain nematodes (*Longidorus*) were more evenly distributed throughout the depth profile than others.

Other nematode genera had a strong preference for the upper four inches of soil, where active root growth occurs. Overall, most nematodes will be found in this top four-inch zone. *Table 1* shows the distribution of nematodes for three greens, all sample dates combined. The courses were Bald Peak (Moultonboro, New Hampshire), Wentworth (Newcastle, New Hampshire), and Webb-hannet (Wells, Maine). Note that the majority of nematodes are in the top four inches (10cm) of soil. The green at Bald Peak had fewer nematodes at 0-5cm than at 5-10cm, because this green received no irrigation, and the top 5cm were extremely dry.

Since most nematodes are found in the upper four inches of soil, we do not recommend sampling any deeper. When sampling for nematodes, take at least 12 cores (one inch) in the area showing symptoms. You need to take some samples in healthy turf, in turf just beginning to show decline, and in the damaged area. If the samples are just pulled from the worst area, the nematode counts may be low because the grass is in poor condition. Since nematodes are obligate parasites, their populations decline when the grass dies.

Place the samples in a plastic bag, place vital information on an outside label (name, location, pesticide history, etc.), and send it as fast as possible to a recognized nematode diagnostic laboratory. It's usually best to mail samples early in the week to avoid samples sitting in a post office for the weekend. If you can't mail the samples immediately, store them out of the sun, in a cool

Figure 2

Concord, New Hampshire, 1985

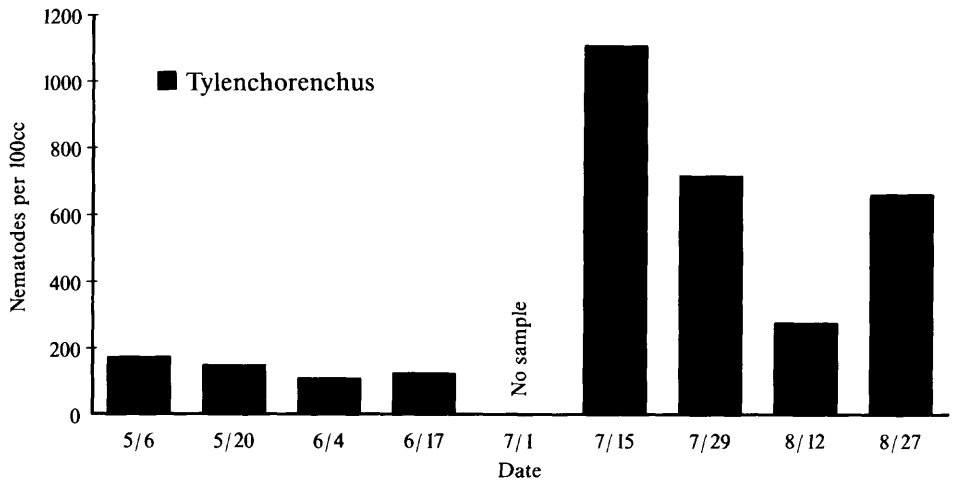
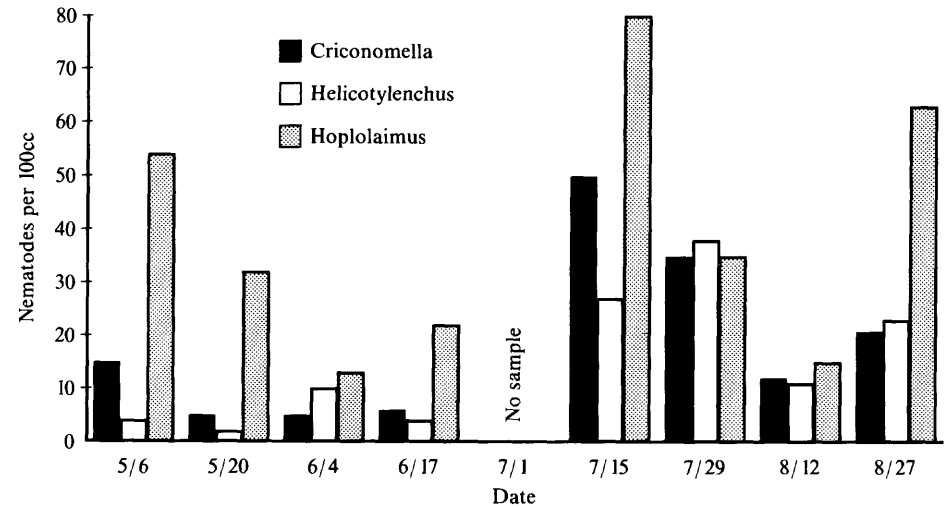


Figure 3

Concord, New Hampshire, 1985



place. It's good to keep them refrigerated, but don't let them freeze.

Before you chemically treat for a suspected nematode problem, be sure to get competent advice from your appropriate university researcher or extension specialist. You need to be sure that nematodes are to blame for your turf ills.

Since we need to treat nematodes in New England occasionally, I began some efficacy trials. The only registered material for bentgrass is Nemacur (fenamiphos) from Mobay Chemical Company. The 3EC formulation of Nemacur is not registered in New England, so my trials only included the 10G formulation. I wanted to determine the effectiveness of the low rate. If efficacious, the low rate would help reduce the pesticide load in the environment. *Table 2* shows the results of a trial at the Cocheco Country Club, in Dover, New Hampshire. The plots consisted of bentgrass greens; the treatments were replicated nine times. Treatment date was July 17, 1985. Plots were irrigated with ½ inch of water after application. The low rate performed as well as the high rate in controlling the three major genera of nematodes. However, *Helicotylenchus* and *Tylenchorhynchus* were more effectively controlled than *Criconemella*. Since overall control was 87 percent for both the low and high rate, there is no need to use the high rate in this area.

Nematicides are highly toxic pesticides. Their use dictates caution. They should not be used unless absolutely necessary, since we are concerned with possible harmful non-target effects associated with overuse. It is extremely important that you use the necessary safety aids such as a respirator, gloves, and glasses while mixing, loading, and applying nematicides. We also continually stress proper calibration of application equipment. I feel the application should be made about two weeks before the summer stress period (July). However, some superintendents have opted to apply nematicides before the busy golfing season, in May or early June, and have had good success.

We recommend closing the course for the day to allow safer application. If you cannot close the course for the day, try closing for two hours early in the evening, which still gives you enough time to treat 18 greens. One advantage of an evening application is that usually fewer birds will be feeding. Irrigation is necessary to increase the effectiveness of the nematicide and reduce the toxicity of granules remaining on the surface. Immediately irrigate the treatment with ½ inch of water, being sure not to allow puddling. Birds bathing or drinking from a puddle will be exposed to the nematicide. If these precautions are not followed and misuse occurs, our pesticide regulatory agencies will probably eliminate the use of nematicides on golf courses.

IN CONCLUSION, nematodes are a greater problem in New England putting greens than previously thought. However, they are not a problem on every course. Relatively few courses in our area will need chemical control. Nematodes are mostly a problem when the turf is under other biotic and abiotic stresses. Possibly, we are seeing more nematode stress today due to the trend toward lower mowing heights and sand topdressing. Lowering mower heights adds stress to the grass, and nematode populations tend to be greater in sand soils. Proper diagnosis by a qualified professional is necessary before nematodes can be implicated as the cause of turf decline.

Table 1

DEPTH PROFILE (All Dates Combined)

Depth (cm)	Percent of Nematodes		
	Bald Peak	Wentworth	Webbhannet
0-5	23.1	37.6	68.9
5-10	28.9	22.3	18.9
10-15	19.9	14.4	4.0
15-20	15.8	11.8	3.4
20-25	6.6	9.0	3.0
25-30	5.7	4.8	1.9

Table 2

Mean Number Nematodes per 100cc Soil, 8 Weeks Post-Treatment*

Formulation and pounds ai/acre	Total Nematodes		Helicotylenchus		Tylenchorhynchus		Criconemella	
	mean no.	% control	mean no.	% control	mean no.	% control	mean no.	% control
Nemacur 10G 10	212 a	87	61 a	92	80 a	88	75 a	62
Nemacur 10G 20	210 a	87	103 a	86	57 a	91	108 a	45
Check	1624 b		747 b		662 b		195 b	

*Means followed by the same letter are not significantly different (p = .05, DNMRT)