

Are You Sure Your Course is Nematode-free?

by Dr. William M. Powell, University of Georgia

In order to answer this question, you must understand what nematodes are, what symptoms they cause on grasses, and how the diseases they cause can be recognized. Moreover, if nematodes are a problem in your course, you need to know what can be done.

Nematodes are very tiny, usually microscopic worm-like creatures which grow in all kinds of habitats, from ocean waters to the bodies of man and animals and tissues of higher plants (fig. 1). These latter types, called plant parasitic nematodes, are the forms that frequently become major factors in the production and maintenance of healthy turf. Nematodes that feed on grasses usually do so on the roots and thereby damage the plants by removing cell contents and by destroying root tissue. However, these pests must have living grass tissue in order to survive and reproduce. Thus, they rarely are guilty of killing their host plants. They simply reduce vigor, which results in yellowing and stunting of grass in scattered patterns over the planting (fig. 2 & 3). More often than not, their symptoms make for increased expenditures in terms of additional fertilizer and water in order to maintain attractive turf.

The author has had the good fortune over the past several years to be rather closely associated with James B. Moncrief, Director of the Southern Region of the USGA Green Section. This Association has afforded the opportunity to obtain nematode samples from some 250

golf clubs from 13 Eastern and Southeastern states. Since 1960, we have processed nearly 1,300 samples from golf greens and fairways from these areas. Table 1 shows the results of nematode assays on samples drawn during the 11-year period from 1961 to the present.

Table 1. Kinds and relative numbers of nematodes found in soil samples from golf courses over an 11-year period.

Nematode	Number of Samples	Percent of Occurrence
Ring	1,040	81.8
Spiral	691	54.4
Lesion	467	36.7
Lance	357	28.1
Stubby-root	340	26.8
Sting	262	20.6
Dagger	203	16.0
Stunt	161	12.7
Root-knot	124	9.8
Sheath	81	6.4
None	36	2.8
Total	1,271	

Obviously, most of the samples contained more than one type of nematode. In fact, samples sometimes contained as many as 10 different species of plant parasitic nematodes.

From this table it is clear that there are several different kinds of nematodes that are capable of parasitizing turfgrass. Any one of these can cause significant damage in a given situation if the populations reach sufficiently

Figure 1. Low magnification view of lesion nematode.

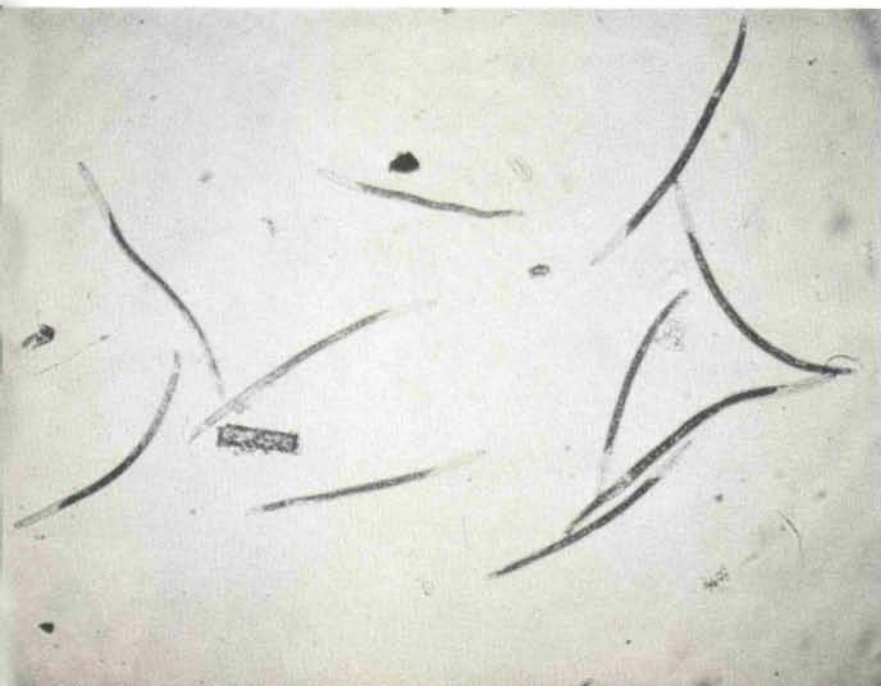


Figure 2. Typical symptoms



high levels. The ring nematode (*Criconemoides* spp.) is the type most frequently found in turf situations. This nematode is not as damaging as some of the others on an individual nematode basis, but it has a tremendous reproductive capability. Thus, it becomes a major problem because its populations tend to build up to very high levels and it is well adapted to a wide range of conditions. The lance nematode (*Hoplolaimus* spp.) is much more destructive than is the ring nematode. It is also widespread as a parasite on grasses and possesses a reasonably high reproductive rate. Lance nematode is probably the number one nematode threat to turf grasses in the Southeast.

The most devastating nematode on turf is the sting nematode (*Belonolaimus* spp.). This form is capable of destroying root systems of most turfgrasses (fig. 4). Fortunately, sting nematodes are limited somewhat by soil conditions in that they are able to survive best in the sandy soils and they can become problems on manufactured greens in areas where the natural soils are higher in clay content.

Root-knot nematodes (*Meloidogyne* spp.) are becoming increasingly important as parasites of turf grasses. This is the best known of all nematodes and is the primary pest of agronomic crops. This form causes swellings or galls on the roots of affected plants, hence the name root-knot nematode.

Lesion (*Pratylenchus* spp.) and stunt (*Tylenchorhynchus* spp.) nematodes are also important pests of various types of grasses. Populations of these types do not build up as rapidly as ring or root-knot nematodes, nor are they as damaging as lance or sting nematodes, but they are widely distributed and can be problems in many cases.

These six nematodes are probably the most economically important types. However, there are several additional forms that are damaging to grass in specific instances. Among these are stubby-root (*Trichodorus* spp.), dagger (*Xiphinema* spp.), sheath (*Hemicycliophora* spp.), awl (*Dolichodorus* spp.) and needle (*Longidorus* spp.) nematodes. Spiral (*Helicotylenchus* spp.) nematodes occur very frequently in association with grasses, but the damage done is very slight. Therefore, the spiral nematode is not considered as dangerous as most other forms.

Nematodes are damaging enough to grass when they are the only pests present in an area. Unfortunately, they are also well-known as factors in the so-called complex diseases. In this role, nematodes combine with fungi, bacteria, or even insects to intensify the amount of damage done to the plants. This means that population levels of nematodes that would probably be insignificant in themselves, become extremely damaging when other pathogens are present in the same area.

What can be done if nematodes are a problem, or if they become a problem on a particular golf course? The old axiom that prevention is easier than a cure is as true in this type disease as with any other, perhaps even more than with most others. Nematodes are spread from one area to another primarily on infected planting material or accompanying soil. Thus it is of primary importance to obtain planting stock from nurseries that realize the necessity of producing nematode-free turf. This is, of course, not an important consideration when seeded grasses are used.

It is equally important to make certain that nematodes are not a problem in an area where a new course is being developed or where renova-

of nematode damage.

Figure 3. Portion of fairway showing difference in nematocide treated strips vs. non-treated strips.





Figure 4. Roots of St. Augustine grass badly damaged by sting nematode.

tion is in progress. This can be done by taking soil samples from areas to be planted and having them assayed by some agency equipped to handle such samples. If plant parasitic nematodes are present, then these areas should be treated with a nematicide or a general purpose pesticide before grass is planted. Materials such as the D-D compounds, ethylene dibromide and Telone are suitable for use as preplant nematicides. Methyl bromide fumigants also are highly effective nematicides and give additional benefit through the control of fungi, insects and most weeds.

Control of nematode problems on existing turf is a more difficult problem. Again, samples should be drawn from suspect areas and assayed by competent personnel to determine if a nematode problem exists. Basically, there are two types of nematicides presently used to control nematodes on living turfgrass, and it should be emphasized that both give only temporary relief of the problem. One type is essentially a contact material that is applied on the surface and then drenched into the root zone with irrigation water. In using this type material, the effectiveness of the treatment is dependent on how well the material is distributed in the soil since such materials have very limited vapor action. Compounds such as Dasnit, Diazinon Mocap, and VC-13 are all used in this procedure.

The second type utilizes a volatile fumigant that is injected into the soil near the roots. With such materials, the vapor action is much greater than with contact materials although mechanical disturbance to the turf is greater. The dibromochloro-propane compounds (DBCP, Nemagon, Fumazone) are used in this type of

treatment. Fortunately, application equipment has been developed by several commercial operators which can inject these materials in turf areas with minimum disturbance to the grass. In fact, custom operators are available for the application of all the types of operations mentioned here.

Several factors need emphasis in summarizing our knowledge of nematode problems on golf courses. Plant parasitic nematodes are present in a high percentage of our golf courses and they are damaging the grass in these areas. Research has shown that proper site preparation and the use of nematode-free planting material gives much more satisfactory results than attempts to eliminate these pests after the grass is established. Finally, procedures are available that will reduce nematode populations on established grass. These procedures are beneficial through reduction in production costs as well as allowing for the maintenance of playable turf surfaces.

THE AUTHOR

William M. Powell is a native of Halifax, Va. He received his B.S. degree in agronomy from Virginia Polytechnical Institute, and his M.S. and Ph.D. in plant pathology from North Carolina State University. Powell joined the faculty of the department of plant pathology at the University of Georgia in 1960, and since then he has engaged in teaching and research in that capacity until the present time. His teaching responsibilities include both nematology and general plant pathology while his research has dealt primarily with nematode diseases of fruit and nut trees, ornamentals and turf.