

# Nematology Plant Protection Pointer

Florida's important tourist and real estate industries demand particularly high standard of quality for turfgrass. Therefore, a substantial turf care industry has become established here. Nematode damage to turf is probably more important here than in most parts of the country. Our mostly sandy soils and long growing season favor development of very high populations of nematodes, and also create conditions in which grasses are often more susceptible or sensitive to moderate stress. This report discusses the kinds of nematodes that can injure turf in Florida, how to diagnose nematode injury to turf, and nematode control measures available to professional turf workers. Nematology Plant Protection Pointer #16, "Nematodes in Home Lawns in Florida," provides information for homeowners who are concerned about turf nematode problems.

## TURFGRASS NEMATODES

Nematodes which are important turf pests in Florida are briefly described below. Table 1 presents the numbers of each kind of nematode expected to cause approximately comparable damage.

Sting nematode (*Belonolaimus longicaudatus*) - damages all grasses commonly grown in Florida; generally found only in very sandy soils.

Lance nematodes (*Hoplolaimus galeatus* and other

species) - widely distributed, attacking all grasses commonly grown in Florida, but especially damaging to and most frequently associated with St. Augustinegrass.

Ring nematodes (*Criconemoides* species) - widely distributed, they can live on most turfgrasses but are presently considered to be a major pest only to centipedegrass.

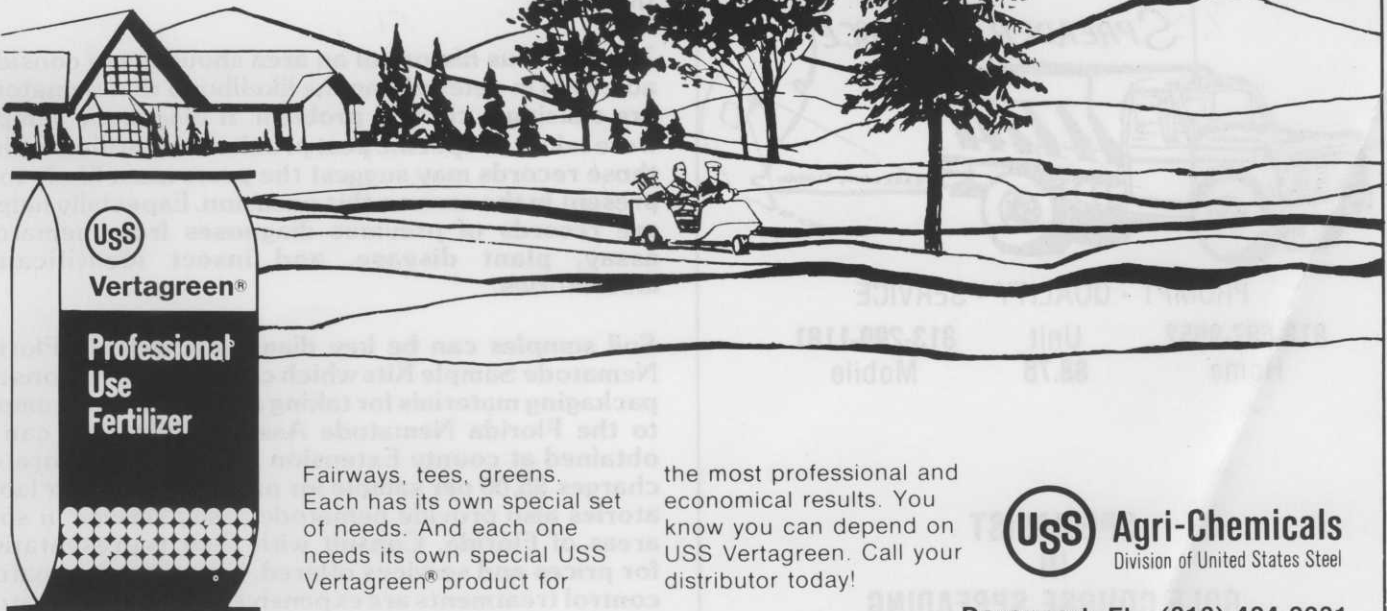
Root-knot nematodes (*Meloidogyne* species) - widely distributed, found most frequently in St. Augustinegrass, zoysiagrass, and bermudagrass; assumed to be injurious at high population densities, but the effects of root-knot nematodes on turf grasses are poorly known.

Stubby-root nematodes (species of *Trichodorous* and related genera) - occur in most soil types throughout the state and cause damage similar to that of sting nematodes.

Spiral nematodes (*Helicotylenchus* species) - frequently found on all grasses, but apparently do not cause serious damage in most circumstances.

Awl nematode (*Dolichodorus heterocephalus*) - very damaging to turfgrass in wet locations such as low land near lakes, ponds and canals. (continued on page 42)

## USS Vertagreen®... A product for all reasons



Fairways, tees, greens. Each has its own special set of needs. And each one needs its own special USS Vertagreen® product for

the most professional and economical results. You know you can depend on USS Vertagreen. Call your distributor today!

**USS** Agri-Chemicals  
Division of United States Steel

Davenport, FL (813) 424-2231

# ATLANTIC

## SULPHUR COATED UREA

For That Deep Long Lasting Green  
Without Excessive Growth  
ATLANTIC SULPHUR COATED UREA  
Is the Answer!

Ask Your Atlantic Representative for the  
Formulations Available

**ATLANTIC Fertilizer & Chemical Co.**  
Homestead, Florida

In Dade 247-8800 All others 1-800-432-3413

FERTILIZER - LIME - DOLOMITE



PROMPT - QUALITY - SERVICE

813-687-9652  
Home

Unit  
88.76

813-299-1181  
Mobile

**SPECIALIST  
IN  
GOLF COURSE SPREADING**

(continued from page 41)

St. Augustinegrass cyst nematode (*Heterodera leuceilyma*) - normally attacks only St. Augustinegrass; most commonly found on the lower east coast and central Florida, but has spread with sod to locations throughout the state; may be severely damaging to St. Augustinegrass when present in high numbers. Cyst nematodes are especially difficult to control with nematicides.

Many other kinds of nematodes may cause damage to turf when present in high numbers or when turf is stressed by other pests, pathogens, or environmental conditions. Among the genera which may be occasional turf pests are lesion (*Pratylenchus* species), sheath (*Hemicycliophora* species), stunt (*Tylenchorhynchus* species), sheathoid (*Hemicriconemoides* species), and dagger (*Xiphinema* species) nematodes.

**DIAGNOSIS OF NEMATODE DAMAGE TO TURF**  
*Above-ground symptoms* commonly associated with nematode injury to turf include wilting under moderate moisture stress, slow recovery of wilted areas after rain or irrigation, and "melting out" or gradual decline. Grassy and broad-leaved weeds commonly become more predominant in nematode-affected turf than in relatively healthy turf nearby; among weeds that occur frequently in nematode-damaged turf are spotted spurge and Florida pusley. There are no above-ground symptoms which are directly diagnostic for nematode injury; most symptoms commonly associated with nematodes are the same as might be caused by other kinds of root stress, such as fungal pathogens, some insects, chemical spills, compaction of soil, lack of adequate water supply, and flooding or saturation of the soil for extended periods of time.

*Roots* injured by nematodes are usually dark and short, with few lateral or "feeder" roots. Root tips may be swollen, and there is often excessive root rot. The most common symptom is a very short root system which does not hold soil together as well as does a healthy root system when a core or plug is lifted from the sod.

*The previous history* of an area should be of considerable help in determining the likelihood that nematodes are causing a current problem. If diagnostic samples were taken or specific pest problems identified earlier, those records may suggest the pests most likely to be present in the area on this occasion. Especially helpful are records of previous diagnoses from nematode assay, plant disease, and insect identification laboratories.

*Soil samples* can be key diagnostic aids. In Florida, Nematode Sample Kits which contain instructions and packaging materials for taking and submitting samples to the Florida Nematode Assay Laboratory can be obtained at county Extension offices; this laboratory charges \$5.00 per sample for processing. Other laboratories also provide nematode assay service in some areas of Florida. Consult with their representatives for prices and services offered. Since most nematode control treatments are expensive, adequate nematode samples should be processed to establish the need for treatment before it is initiated.

(continued on page 43)

## CONTROL

At present, the most practical way to reduce unacceptably high nematode populations in turf is to apply an appropriate nematicide. Crop rotation, varietal resistance, biological controls, and other means that are used against other pests or nematodes in other crops are rarely practical for turf nematode control. Turf professionals should study the turf nematicides available (Table 1) so that the most appropriate material can be chosen for each situation without expecting unrealistic control from it. There are both fumigant and non-fumigant "contact" chemicals registered as turf nematicides in Florida. The nematicide chosen for a specific problem must be *legally registered* for the situation, *effective* against the pest problems and the most *economical* of the acceptable products.

Soil fumigants are chemicals which are applied as gasses or volatile liquids which vaporize and spread through the soil pores as gasses. Physical conditions in the soil determine how well a fumigant can spread. A loose, open-pored soil permits more rapid and uniform diffusion of fumigant vapors than a compacted or cloddy soil. Soil with a moderate moisture level is best; vapor diffusion is inhibited by water-filled pores, while fumes may escape too rapidly and nematodes may be less susceptible to nematicides in very dry soils. Soil temperature must be within the range specified on the label of the product (usually 50°-80°F). Fumigants may vaporize poorly and will move more slowly in cold soils, and evaporate from hot soils too quickly to get adequate control.

Several non-fumigant "contact" nematicides may be applied to turf in certain situations. These products are all organophosphate insecticide-nematicides which are usually applied to the soil surface in granular formulations. The active ingredients are dissolved from the granules and carried into the soil profile by irrigation or rain water: Too little will fail to get the nematicide into the root zone, but too much may leach it too deep to be useful before control is achieved.

*Before planting new turf or during renovation, treatment of soil with a multi-purpose fumigant is often desirable to promote rapid and uniform establishment of new turf. Many products are registered for this use; only a few examples are discussed here. They should reduce nematodes and some insects, soil-borne fungi, and weeds.*

Several liquid soil fumigants which contain significant levels of chloropicrin or other tear gases can be injected into the soil with tractor-mounted equipment. For maximum effectiveness, soil treated with these products should be covered with a plastic tarp for one to several days. Terr-O-Cide 54-45®, Vorlex®, and Telone C-17® are among these multi-purpose liquid fumigants. Vapam® is a liquid product that can be applied either as a drench in water or injected by chisels; the area treated with this product should also be covered after treatment for maximum benefit from its use.

Methyl bromide/chloropicrin mixtures such as Dowfume MC-33® and Terr-O-Gas 67® must be injected by chisels and the soil covered immediately with a plastic

(continued on page 44)

*Golf Course  
Grassing,  
Renovation,  
Fumigation -*

*Unconditionally  
Guaranteed.*

 **STAN CRUSE  
ASSOCIATES**

FLORIDA STATE CERTIFIED GRASSES

(813) 722-4547  
Rt 1, Box 402x  
Palmetto, FL 33561

# OUR GAME IS IMPROVING YOUR TURF



## FERTILIZERS-CHEMICALS-FUMIGANTS

### See your Superior Golf Course Specialist

LAMAR "SUNNY" SMITH  
Mobile: 305/832-0451  
Unit 636

ED HAITHCOCK  
Mobile: 305/581-6123  
Unit 2425


DARRYL REJKO  
305/746-0667  
305/747-3541

PLANTS IN TAMPA AND FT. PIERCE

Du Cor      Du Cor      Du Cor

**Du Cor**  
**TURF AND LAWN**  
**MAINTENANCE PRODUCTS**

Home of:  
 DOWN 'N THRU SOIL PENETRANT  
 EMERGENCY GREEN  
 TEAM WORK  
 LIME AID



**Du Cor Chemical**  
 Corporation  
 P.O. Box 13298 · Orlando, Florida 32809  
 Phone (305) 859-4390

Du Cor      Du Cor      Du Cor

(continued from page 43)

tarp. These products must be handled as gasses with special metering devices, and are usually custom-applied. This is the most expensive but perhaps one of the most effective treatments available to reduce many kinds of soil-borne pests before turf is planted.

Several methyl bromide products, such as Dowfume MC-2<sup>®</sup> and Brom-O-Gas<sup>®</sup>, are available in small cans (1 lb. or 1½ lb. per can) for application to small areas. At the rate of 1 lb./50 sq. ft., excellent control of most soil-borne pests may be obtained with these products. Areas treated with these products must be covered with a plastic tarp for the chemical to stay in the ground long enough to be effective.

*Nematicides for established commercial turf.* There are both fumigants and organophosphate "granular" nematicides registered for use on established commercial turf, such as golf courses, sod farms, and cemeteries, in Florida. Physical treatments which will improve penetration of water into the soil, such as aeration, close mowing, vertical mowing, or mechanical thatch removal should be done before application of these products; soil should be moist but not saturated at the time of application. Follow application with ¼ to ½ inch of water as directed by the label of the product being used.

Nemacur<sup>®</sup>, Dasanit<sup>®</sup>, Mocap<sup>®</sup>, and Scotts Pro-Turf Nematicide/Insecticide<sup>®</sup> are organophosphate pesticides registered for application to commercial turf as granular formulations. These products are generally applied by the turf manager or his crew. Gravity or

"drop-type" granule spreaders are preferred over centrifugal types for accurate application and safety to non-target plants and animals. Centrifugal spreaders are more hazardous because they increase exposure of the applicator and bystanders to easily inhaled "fines" (dust) of the pesticide. These products vary in their efficacy against different kinds of nematodes (Table 1) and most are quite expensive.

Liquid (EC) formulations of Dasanit and Mocap may also be applied to commercial turf. However, Mocap EC may seriously burn foliage, so test the application on a limited basis before treating the entire area. These liquid formulations are restricted pesticides because they contain high concentrations of active ingredients.

Soilbrom 90<sup>®</sup>, a soil fumigant whose active ingredient is ethylene dibromide, may be injected into established commercial bermudagrass through chisels no more than 12 inches apart, 3 to 5 inches deep. This treatment is usually done by custom applicators. The low label rate (3.5 gal/acre) of Soilbrom 90 usually provides excellent nematode control with a minimum risk of phytotoxicity (chemical injury to turf). There is some risk of phytotoxicity if the high label rate (4.5 gal/acre) is applied to wet, cold, or compacted soils.

Soilbrom 90 EC<sup>®</sup> is an emulsifiable formulation of Soilbrom which can form a stable uniform mixture with water. It may be applied to established bermudagrass by chisel injection or by hydro-injection. It may also be applied to residential and ornamental turf of bahia, bermuda, centipede, St. Augustine and zoysia grasses, by hydro-injection. Application to residential turf is limited to licensed professional applicators.

Hydro-injection consists of shooting a water/nematicide emulsion of the product through needle-jet orifices directly into the turf at sufficient pressure to force it several inches deep into the soil. Although placement of fumigant may not be as deep or uniform as by chisel injection, hydro-injection is much less likely to damage underground roots, pipes, wires, etc. which are common in lawns. Application of Soilbrom 90 EC by hydro-injection should be followed immediately by 0.5-1.0 inch of water (irrigation or rain).

For hydro-injection, the label specifies mixing 0.75-1.0 gallons of Soilbrom 90 EC in 300 gallons of water to treat 10,000 sq ft of turf. This corresponds to applying 3.3-4.4 gallons of product per acre. In most instances, the lowest rate will be satisfactory. Among the turf species for which this treatment is registered, zoysia-grass was the only one on which visible injury was seen during preliminary testing. To minimize chance of phytotoxicity, use the lowest concentration of Soilbrom and carefully avoid spilling the mixture or allowing the application equipment to drain on desirable turf.

Soilbrom and Soilbrom 90 EC are relatively inexpensive nematicides with good activity against most turf nematodes. However, stubby-root nematodes often recover from treatment with these fumigants more rapidly than do other kinds of nematodes, so that repeated use of the fumigants may permit stubby-root nematodes to become predominant at a site where they

(continued on page 45)

(continued from page 44)

were barely detectable at first. If this situation develops, alternate treatment with an organophosphate product may correct the balance of nematode species.

**Residential turf.** Three products, Sarolex<sup>®</sup>, Mocap 10 G, and Soilbrom 90 EC, may be legally applied to established residential lawns and turf around condominiums or other areas exposes to the general public in Florida.

The use of Soilbrom 90 EC for residential turf has been discussed above.

Sarolex is a special formulation of the insecticide, diazinon, normally applied as a drench. The product itself is relatively expensive, but is the only one which gives the homeowner the option to buy and apply it with readily available equipment. However, it has limited efficacy: it is most active against sting nematodes, but is only slightly effective against ring nematodes and probably provides little or no control of most other kinds of nematodes.

Mocap 10G may be applied to home lawns in Florida only by certified commercial applicators. It is most effective against sting nematodes, and moderately (perhaps slowly) effective for control of ring, stubby-root, and several other ecto-parasitic nematodes. Poor control of endo-parasites such as lance and root-knot nematodes should be expected. Apply carefully *only to turf*: Mocap may be phytotoxic to some ornamental plants under some conditions. The label requires that only drop-type or gravity spreaders be used to avoid getting Mocap on non-target areas. Chinese elms are among the ornamentals most likely to be injured by Mocap if it is applied too close to the base of the tree, or if the tree is under stress at the time of application. Do not apply Mocap within the "dripline" or area covered by the branches, to avoid excessive root injury. Immediately following application of Mocap 10G to turf, apply 1/2 inch of water to wash the active ingredient into the soil where it can be effective, to reduce the

★ ★ **EXTRA** ★ ★  
Milorganite ... America's Foremost Naturally Organic Fertilizer

**Milorganite<sup>®</sup>**  
**is the**  
**greatest**  
**bargain**  
**in**  
**fertilizer**  
**today!**



Milorganite is loaded with dollar value materials completely lacking in other fertilizers sold for turf and ornamentals.

**PHIL HENDERSON**  
**VANGUARD**  
**INVESTMENT**  
**COMPANY**  
P.O. BOX 380396  
MIAMI, FL 33138  
(305) 751-3459

(Dealer Listing)

noticeable garlic-like odor, and to avoid hazard to people, pets and wildlife. Note that only Mocap 10% Granular Nematicide-Insecticide is registered for use on home lawns. Mocap EC and other manufacturers' products which contain ethoprop are not registered for use on residential turf.

TABLE 1. Approximate levels of common turf nematodes that may justify nematicide application to turfgrasses in Florida, and expected relative effectiveness of registered nematicides for their control.

Kind of Nematode	Nematodes 100 cc soil	Comparative effectiveness of nematicides				
		Nemacur	Dasanit	Mocap	Sarolex	Soilbrom 90, Soilbrom 90 EC
Sting	10	G*	G	G	M	G
Stubby-Root	40	G	M	M	P	M
Awl	10	G	G	G	P	G
Spiral	300	G	G	G	P	G
Ring	150**	G	M	M	P	G
Sheath	80?	G	?	M	P	G
Lance	40	G	P	P	P	G?
Root-knot	80	M	P	P	P	M

\* G = Good      M = Moderate      P = Poor

\*\*Threshold for centipedegrass is about 150 ring nematodes/100cc soil; other turfgrasses can apparently tolerate much higher without serious injury.