Alternatives to Nemacur

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(Editor's Note: This report to the FGCSA Research Committee is a brief summary of the field trials that Dr. Crow has been conducting the past two years in an effort to study the efficacy of alternative products since Nemacur is being phased out.

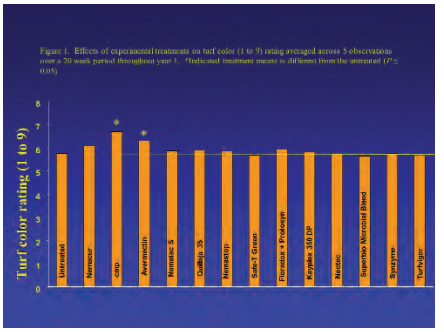
A recent field survey of golf courses in Florida found damaging levels of plant-parasitic nematodes on 87 percent of them. Fenamiphos, the active ingredient in Nemacur, has been the most commonly used nematode management product used by golf courses since the late 1970s. However, the manufacturer of Nemacur (Bayer) has agreed to a phase-out of all Nemacur products. The phase-out is a result of the recent review of organophosphate pesticides as mandated by the Food Quality Protection Act of 1996. This has created a great need for alternative nematode-management options. While there are a number of nematode products out there, the efficacy of many is questionable at best. We are planning on evaluating a number of commercially available and soon-to-be available products for nematode management. We hope to be able to offer turf managers a reasonable idea of what to expect when these products are used.

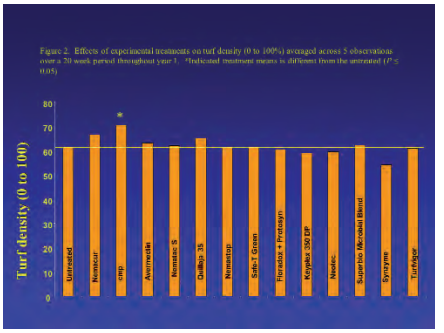
Materials and methods Year 1:

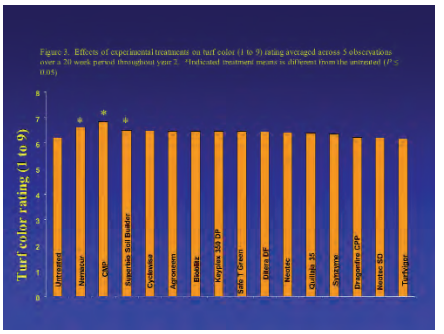
In 2002 we evaluated a number of products on Floradwarf bermudagrass for ability to cause decreases in nematode populations, decreases in nematode damage, or increases in tolerance to lance (*Hoplolaimus galeatus*) and stubby-root (*Trichodorus proximus*) nematodes.

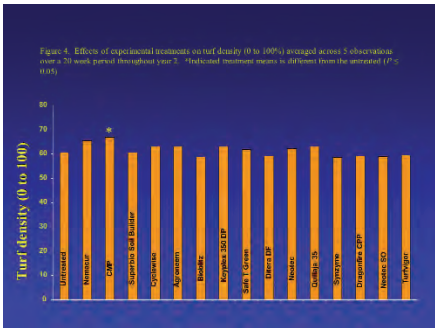
The products tested were avermectin (a miticide with nematicidal properties), Neotec (a plant-based product that claims to be nematode suppressive), Nemastop (a plant-based product that claims to be nematode suppressive) combined with Bac Pac Plus (a root biostimulant), Nematac S (a beneficial nematode), Quillaja 35 (a plant-based product that claims to be nematode suppressive), Safe T Green (a product that claims to be nematode suppressive), Floradox (a product that claims to stimulate plants' natural defenses) combined with Protosyne (a root stimulant), KeyPlex 350 DP (a product that claims to stimulate plants natural defenses), Superbio Microbial Blend (a root biostimulant), Synzyme (a root biostimulant), TurfVigor (a root stimulant), and CMP (a mustard bran product that may be a natural nematicide/fungicide applied at 12lb./1000 sq. ft.).

Each product was applied at the maximum labeled rate every four weeks. Turf was evaluated visually and nematode samples were collected 4 weeks after each treatment. The first treatments were applied April 23, 2002, and the final evaluations were made Aug. 27, 2002.









Turf was evaluated visually using several parameters. Turf color was measured on a scale of 1 to 9 with 9 being brilliant green and 1 being brown. Turf density was a measurement of the percentage of the ground covered by turf foliage. Population densities of lance and stubby-root nematodes were measured, as well as a total of both species. Nine 3/4-inch-diameter cores were taken 3 to 4 inches deep from each plot for nematode analysis. Nematodes were extracted from a 100 cc subsample of soil and counted.

Fourteen weeks after the initial treatment, two 1.5-inch-diameter cores were taken 6 inches deep for root analysis. Roots were extracted from the cores, stained, and scanned on a modified desktop scanner. The root lengths were measured from the digital images using GSRoot software package.

Nematode population densities and visual ratings for each treatment were compared to the untreated using the Contrast Procedure at each sampling date. For the visual parameters, the data for all sampling dates also were combined for season-long comparisons.

Materials and methods year 2

In 2003 a Tifway 419 bermudagrass site infested with damaging populations of sting nematode (*Belonolaimus longicaudatus*) was used. The site was located at The Villages, about an hour and a half South of Gainesville. Most of the protocols were identical to those in 2002, except some of the products were different and application frequency varied for some of the products.

In 2003 we evaluated many of the same products as in 2002: Neotec, Safe-T Green, Keyplex 350DP, TurVigor LN, Synzyme, Quillaja 35, and CMP. New entries in 2003 were NeoTec S.O., a plant-based product sold as a natural nematode treatment; Bioblitz, a plant-based product being developed as a natural nematode treatment, Dragonfire CPP, a plant-based product sold as a natural nematode treatment; Cyclewise Nema, a fungus product sold as a biological nematode treatment; AgroNeem, a plant-based product sold as a natural nematode treatment; Superbio Soil Builder, a biostimulant (replacing Superbio Microbial Blend used in 2002); and Ditera DF, a killed-microbial product sold as a nematicide.

Some of the products evaluated in 2002 were not included in 2003 because other sources of funding became available to do more intensive testing with those products. In 2003 most of the products were applied every four weeks except for Synzyme that was applied every two weeks, and Ditera DF that was applied weekly. The CMP used in 2003 was an improved formulation from that used in 2002 and was applied at a lower rate (10 lb. /1000 sq. ft.).

Results year 1

While some treatments had nematode population densities that were higher or lower than the untreated at one sampling date, there were no overall trends in nematode-population reduction. No treatments had significantly greater root lengths than the untreated controls.

Out of five individual observation dates, CMP improved ($P < 0.05$) turf color compared to untreated plots three times, avermectin two times, and Nemacur, Superbio Microbial Blend and Synzyme once each.

Out of five individual sampling dates, CMP improved ($P < 0.05$) turf density compared to untreated two times, Quillija 35 one time, and Synzyme improved density one time and decreased density two times. No other treatment had any observable effect on turf color or density at individual observation dates.

Average turf color throughout the 18 weeks was improved by CMP and avermectin (*Figure 1*). Average turf density throughout the study was improved only by CMP (*Figure 2*).

Results year 2

While some treatments had nematode population densities that were higher or lower than the untreated at one sampling date, there were no overall trends in nematode population reduction. Only Nemacur had greater root lengths ($P < 0.05$) than the untreated controls.

Out of the five individual observation dates, CMP improved turf color three times, and AgroNeem, Bioblitz, Cyclewise, Keyplex 350 DP, Nemacur, Neotec, Quillija 35, SafeTGreen, Neotec S.O., Superbio Soil Builder, and Synzyme improved turf color once each. Ditera DF had a negative affect on turf color once.

Out of the five individual observation dates, turf density was improved by AgroNeem, CMP, Cyclewise, Keyplex 350 DP, Nemacur, Neotec, Quillija 35, SafeTGreen, and Neotec S. O. once each. Bioblitz and Synzyme each had a positive effect at one observation and a negative effect on one observation. Average turf color throughout the study was improved by CMP, Superbio Soil Builder, and Nemacur (*Figure 3*).

Average turf density throughout the study was only improved by CMP (*Figure 4*.

Discussion

The results of this experiment are representative only of the conditions present at the test locations and the formulations and rates of materials used. With other conditions, improved formulations, or different application technologies or rates the results might be different from those reported here. In both years the high-performer was the mustard bran material.

This material is currently pending registration by EP A as a biopesticide. Upon contact with water, the mustard bran begins to release the nematicide allyl isothiocyanate (AITC). The AITC is then moved into the soil with irrigation water. The rates of mustard bran used in these experiments were below optimum for nematode control; this may be why nematode reductions were not observed. In other experiments using rates of 15 to 20 lb/l000 sq. ft., we have shown reductions in all three nematode species tested here (sting, lance, and stubby-root nematode). This material also contains about 5% nitrogen and has some fertilizer effects that may have contributed to the visual improvement.

However, in our other experiments with this material, we provide equivalent fertility rates to the untreated plots to account for this and still get treatment improvement compared to untreated. Our studies show that formulated mustard bran may be a useful tool on turfgrass with nematode infestations.