Environmental Institute for Golf

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Nematode and nitrogen management

Even when turf is stressed, judicious use of fertility and nematicide treatments can help maintain turf quality.

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The sting nematode (*Belonolaimus longicaudatus*) is considered the most damaging plant-parasitic nematode on bermudagrass turf in Florida. Sting nematode damage to bermudagrass root systems can decrease water and nutrient uptake and reduce plant growth, but nematode feeding alone rarely kills a plant. Typically, nematode feeding will predispose turf to other stresses such as drought, heat, malnutrition, arthropods, pathogens and weeds, which can reduce turf quality, color and density (3).

Recently the turf industry has perceived nematode management as a growing problem because the number of available effective nematicides that can be applied to established turf has been reduced. If nematode management is not effective, superintendents commonly increase water and nitrogen fertility levels, but the sting nematode can reduce the turfgrass root system and thereby minimize the positive effects of nitrogen fertility. This study describes the relationships among nematode management, nitrogen fertility and turf performance on golf course fairways.

KEY points

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- **The sting nematode** is a serious pest of turfgrass on golf courses in Florida.
- **Improvement in turf quality** was most pronounced when a slow-release nitrogen source was used rather than potassium nitrate.
- **A combination of fertility and nematicide treatments** improved turf performance only when a nematicide was used to control the sting nematode.
- **Turf quality** did not consistently increase in response to increasing nitrogen fertility with nematicide treatment.

Materials and methods

We conducted three field experiments in 2002 and 2003 in west-central Florida on golf course fairways infested with the sting nematode. The fairways were mature stands (15 to 20 years old) of Tifway 419 bermudagrass (*Cynodon* species) with histories of nematode damage over the last few years. The experiments compared the visual performance of untreated turf plots and plots treated with nematicide in response to increasing amounts of fertilizer. Each treatment combination was replicated four times. This allowed us to determine how effective the fertilizer was in promoting turf health if sting nematodes were not managed.

Nematicide treatments

The nematicide used was Curfew Soil Fumigant (1,3-dichloropropene) applied at 5 gallons/acre (46.76 liters/hectare) using commercial slit-injection equipment (1). The nematicide was applied during the first week of May each year. (Curfew is a restricted-use pesticide available only in Alabama, Florida, Georgia and South Carolina.)

Fertility treatments

Fertility treatments were potassium nitrate 14-0-46 (N-P_2O_5-K_2O) at levels of 0.5, 1.0, 1.5 and 2.0 pounds nitrogen/1,000 square feet/month (2.4, 4.9, 7.3 and 9.8 grams/square meter/month) (experiment 1) and at levels of 0, 0.75, 1.50 and 2.25 pounds nitrogen/1,000 square feet/month (0, 3.7, 7.3, 11 grams/square meter/month) (experiment 2), and a sulfur-coated blend of slow-release fertilizer 14-14-14 (N-P_2O_5-K_2O) at levels of 0, 0.75, 1.50 and 2.25 pounds nitrogen/1,000 square feet/month (0, 3.7, 7.3, and 11 grams/square meter/month) (experiment 3). In all three experiments, half of the monthly fertility rate was applied every two weeks.

Fertility treatments started either at the same time as nematicide treatment (experiment 1), two weeks before nematicide treatment (experiment 2) or four weeks before nematicide treatment (experiment 3), and continued at two-week intervals until the end of the study.

Cultural practices

Turf was mowed by the golf course staff to a height of 0.5 inch (12.7 millimeters), three times per week. Cultural practices such as aerification, slicing and vertical mowing were suspended during these experiments. During the first two experiments, turf was irrigated with 0.25 inch (6.35 millimeters) of water as needed. During experiment 3, turf was irrigated once a day with 0.25 inch of water until three weeks after nematicide

application when the irrigation system failed. Thereafter, turf was irrigated twice a day with 0.25 inch of water, except during the ninth week after nematicide treatment when the irrigation system failed again.

Evaluations

During experiment 1, nematode assays were conducted two weeks before and two weeks after nematicide treatment, and turf performance was evaluated visually at two, four, eight and 12 weeks after nematicide treatment. Turf color was evaluated on a 1-9 scale, where 1 = poor, 6.5 = acceptable and 9 = excellent. Turf density was evaluated on percent of live cover during experiments 2 and 3; turf performance was evaluated visually for overall quality on a 1-9 scale every two weeks, beginning with the first fertility treatment. Nematode populations were assayed at six weeks before nematicide treatments, at one day before nematicide treatments and at two-week intervals following nematicide treatment. Treatments were compared by using population counts of sting nematode and by rating visual turf performance.

Results

Nematicide treatments

In all three experiments, sting nematode populations were lower in nematicide-treated plots following nematicide application. In experiments 2 and 3, nematode populations were assayed repeatedly over time. In these experiments, observations made more than six weeks after nematicide application showed no difference in the number of sting nematodes between the nematicide-treated plots and plots that did not receive nematicide (Figures 1, 2) because nematode populations in the plots without nematicide showed a general decline over time. This may indicate that nematode populations naturally decline from March through August.

Further studies of sting nematode population dynamics may be warranted to determine when to apply nematicide treatments for a maximum benefit to turf stands in Florida. The general decline in the number of nematodes in untreated plots indicates that nematode populations often decline naturally, and before-and-after nematode counts are not the best way to measure nematicide efficacy. Rather, comparisons should be made between treated and untreated areas on the same dates.

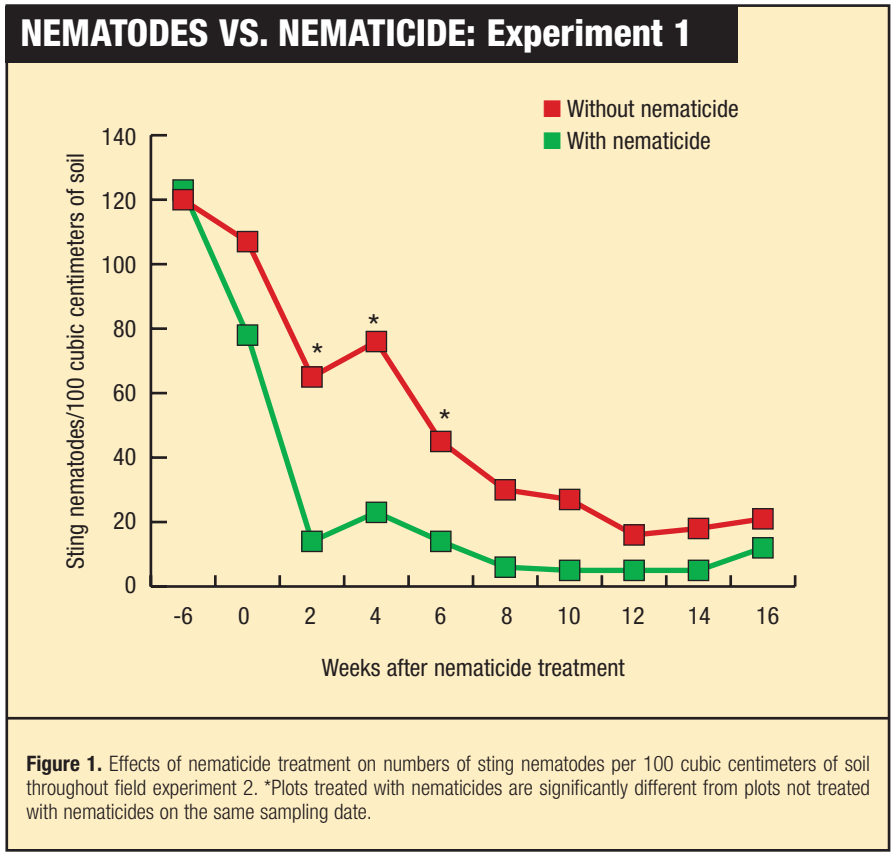

Figure 1. Effects of nematicide treatment on numbers of sting nematodes per 100 cubic centimeters of soil throughout field experiment 2. *Plots treated with nematicides are significantly different from plots not treated with nematicides on the same sampling date.

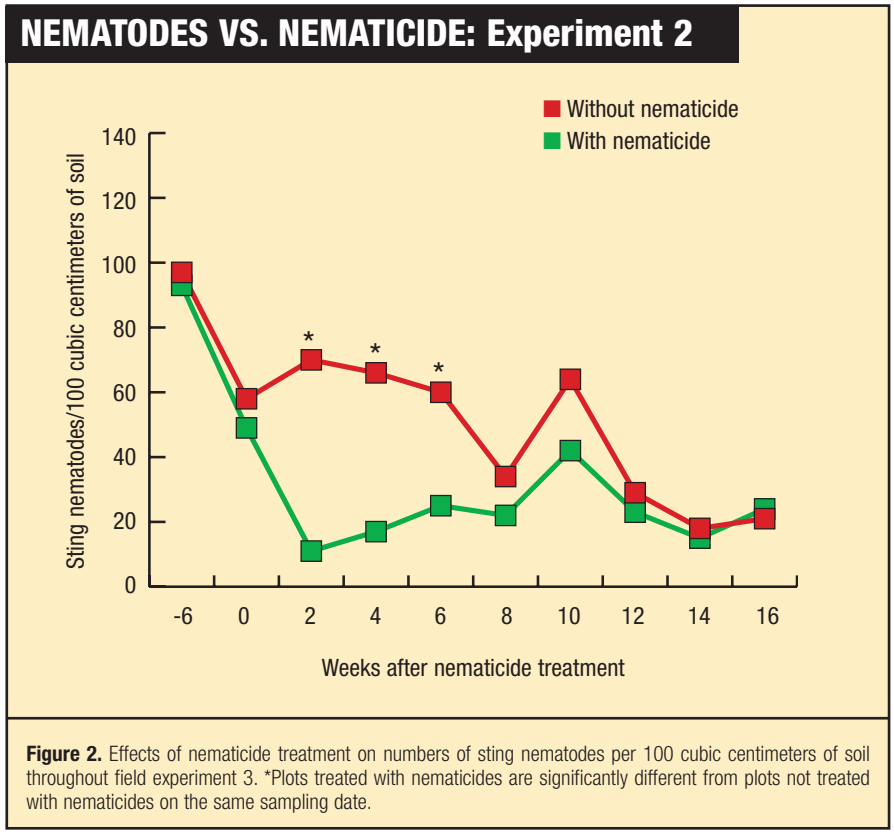

Figure 2. Effects of nematicide treatment on numbers of sting nematodes per 100 cubic centimeters of soil throughout field experiment 3. *Plots treated with nematicides are significantly different from plots not treated with nematicides on the same sampling date.

Turf performance

At some dates during all three experiments, turf performance improved in nematicide-treated plots that received the same level of nitrogen fertility.

In experiment 1, nematicide-treated plots showed improved turf color at all fertility levels two and 12 weeks after treatment and improved turf density eight weeks after nematicide treatment (Figures 3, 4).

Overall turf quality ratings were higher in nematicide-treated plots than in untreated plots at some nitrogen fertility levels at two, eight, 10 and 12 weeks after treatment in experiment 2 and at two, four, eight, 10, 12, 14 and 16 weeks after treatment in experiment 3 (Figures 5, 6).

Turf quality did not improve in response to fertility treatments in plots that were not treated with nematicide on any observation date during any of the three experiments. Improvement in turf quality was most pronounced in experiment 3 when a slow-release nitrogen source was used rather than potassium nitrate.

During experiment 3, visual differences between nematicide-treated and untreated plots were most pronounced following the irrigation failures. This situation illustrates that increased irrigation frequency and nitrogen fertility can maintain turf quality in the short term. However, if stresses such as drought, heat or improper mowing occur on turf stands suffering nematode infestations, turf quality can be reduced for an extended period of time (3).

Summary

In summary, management of the sting nematode can improve turf performance, especially when turf is stressed. Turf performance improved only when a nematicide was used to control sting nematodes. Positive turf responses to nitrogen fertility also occurred only when an effective nematicide was applied. However, these experiments did not demonstrate consistent increases in turf quality in response to increasing nitrogen fertility with nematicide treatment.

Golf courses in Florida use an estimated 35 million pounds (15,875,733 kilograms) of nitrogen annually (2). A recent field survey in four regions of Florida found damaging numbers of sting nematode on 60% of the golf courses surveyed. Using effective nematicides to manage sting nematodes

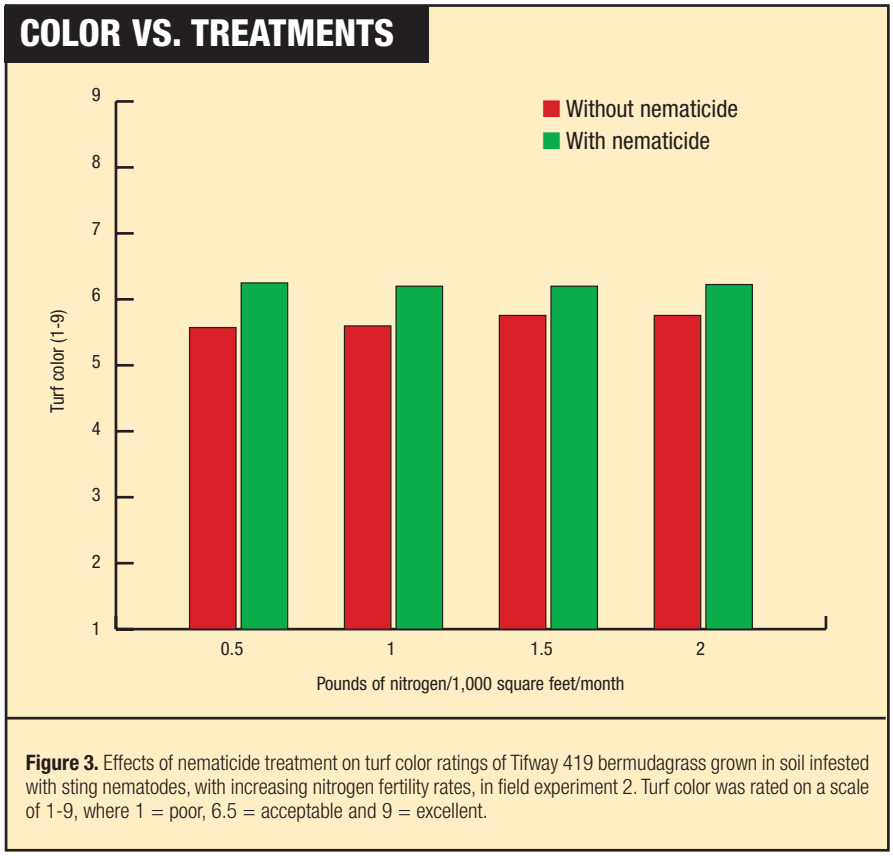

Figure 3. Effects of nematicide treatment on turf color ratings of Tifway 419 bermudagrass grown in soil infested with sting nematodes, with increasing nitrogen fertility rates, in field experiment 2. Turf color was rated on a scale of 1-9, where 1 = poor, 6.5 = acceptable and 9 = excellent.

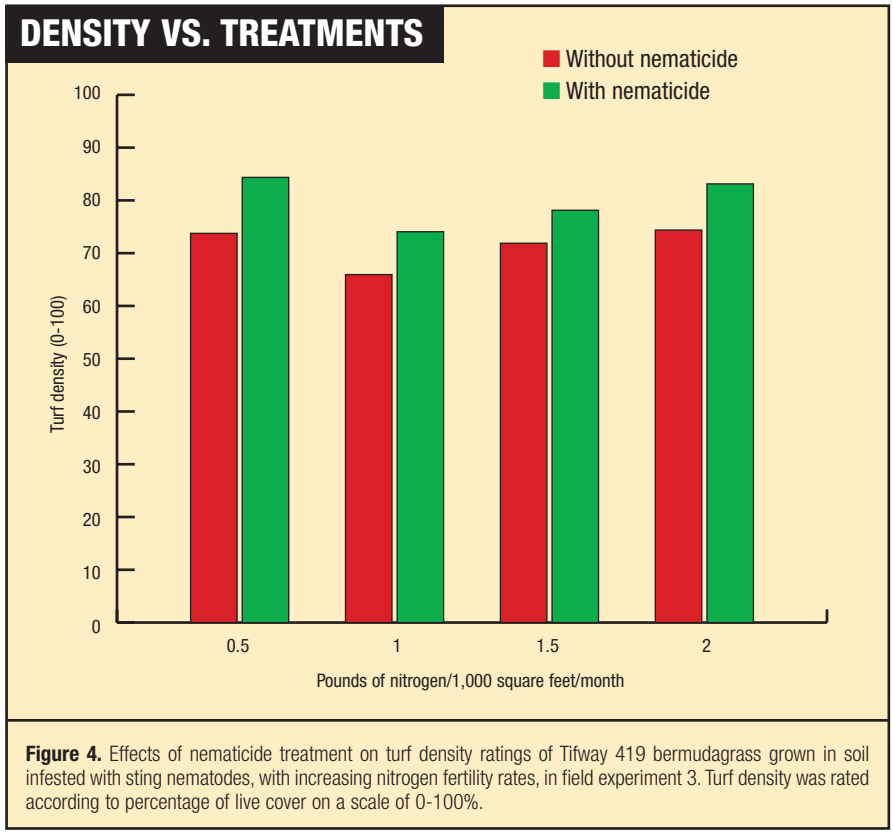

Figure 4. Effects of nematicide treatment on turf density ratings of Tifway 419 bermudagrass grown in soil infested with sting nematodes, with increasing nitrogen fertility rates, in field experiment 3. Turf density was rated according to percentage of live cover on a scale of 0-100%.

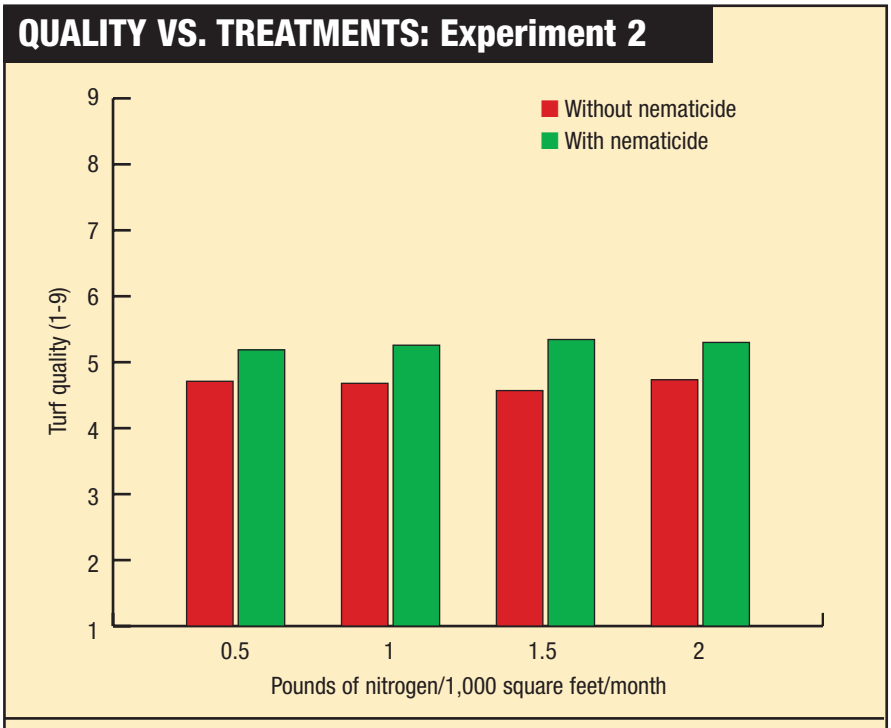

Figure 5. Effects of nematicide treatment on turf quality ratings (1-9 scale, where 6.5 was acceptable turf) of Tifway 419 bermudagrass grown in soil infested with sting nematodes, with increasing nitrogen fertility rates, in field experiment 2. Measurements are the average over 16 weeks.

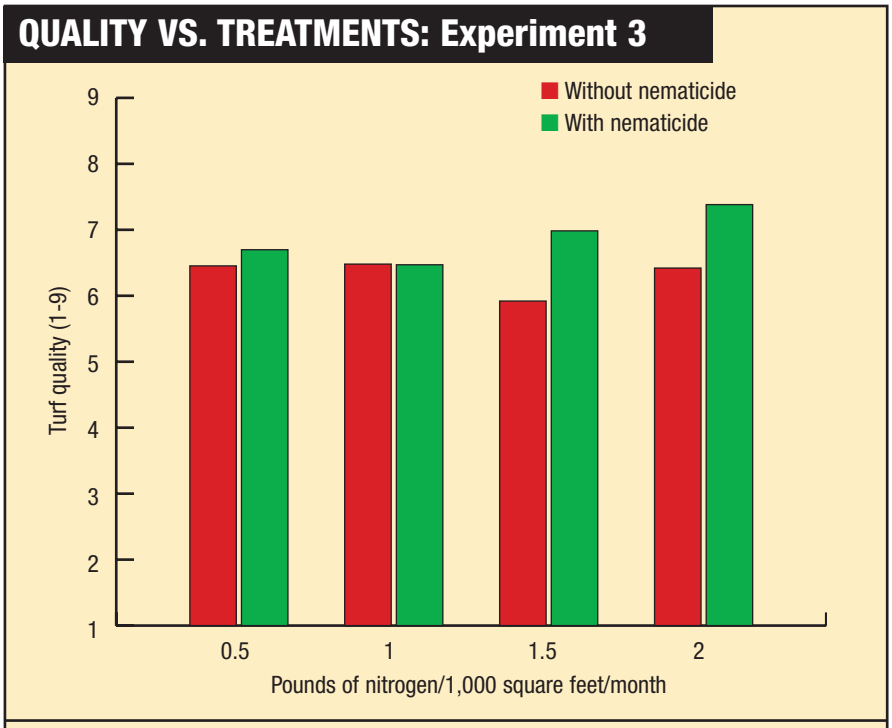

Figure 6. Effects of nematicide treatment on turf quality rating (1-9 scale, where 6.5 was acceptable turf) of Tifway 419 bermudagrass grown in soil infested with sting nematodes, with increasing nitrogen fertility rates in field experiment 3. These are the average measurements over 16 weeks.

should reduce waste of valuable fertilizer and potentially improve water quality by reducing the amounts of nitrates leaching into the aquifer. This emphasizes the importance of using nematode management strategies, including nematicides, on golf course turf.

Acknowledgments

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