Still Stinging

University of Florida research compares bermudagrass and seashore paspalum cultivars for their abilities to tolerate nematodes.

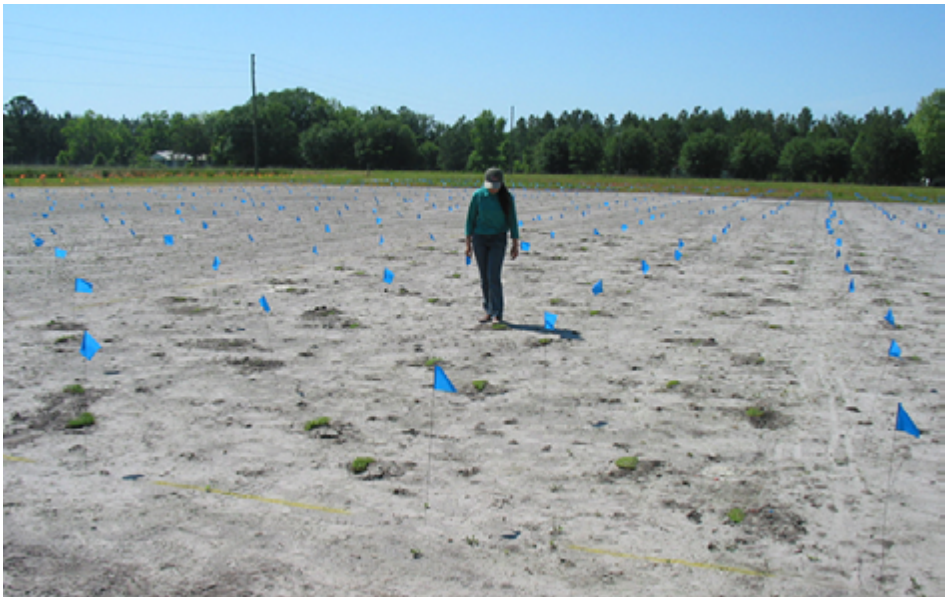
BY JEFF NUS, PH.D.

The crucial component of any turf pest control strategy is to use turfgrass cultivars that have the greatest genetic resistance to that pest. After all, if the turf is genetically resistant to certain diseases or insects, there is less dependency on fungicides and insecticides to keep the turf healthy. Can the same strategy be used for nematodes?

That is exactly what University of Florida scientists wanted to know. According to a 2005 field survey of Florida golf courses by Dr. William (Billy) Crow, associate professor of nematology at the University of Florida, 87% of those courses had potentially damaging levels of plant-parasitic nematodes (1). With the loss of Nemacur (fenamiphos) in 2007, questions regarding nematode resistance in turfgrass cultivars are more important than ever.

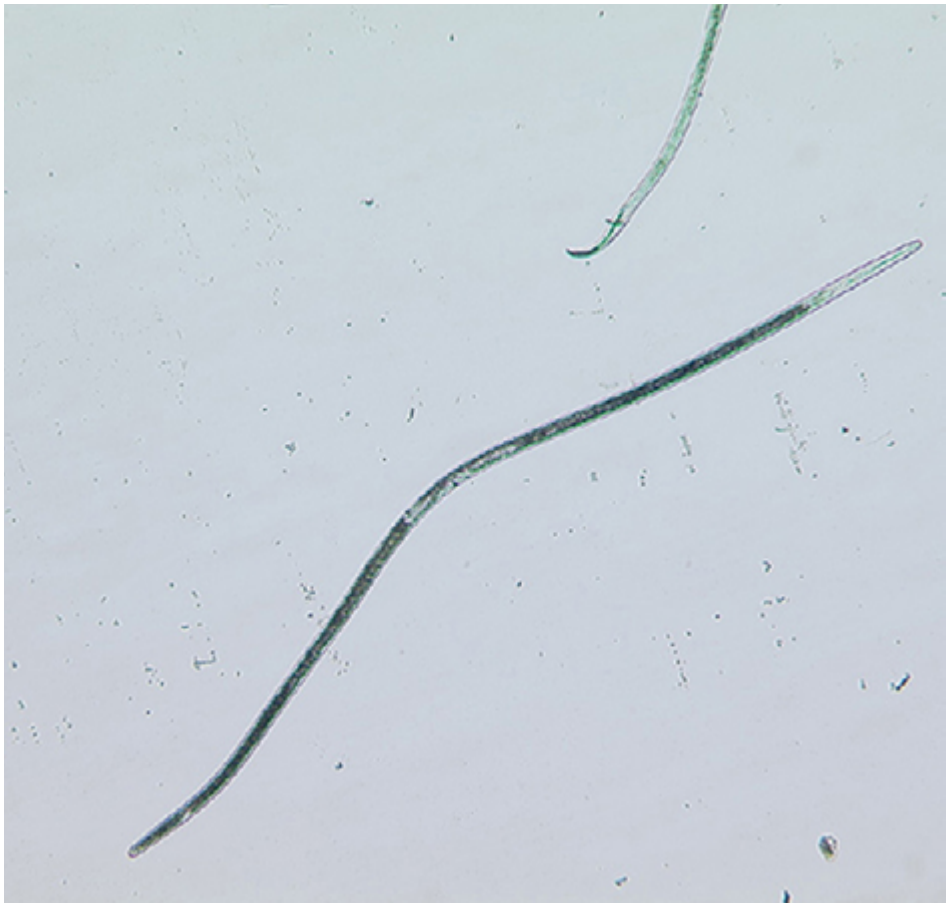
With funding from the USGA Turfgrass and Environmental Research Program, Dr. Crow and his colleagues, Dr. Kevin Kenworthy (assistant professor of plant breeding) and graduate student Wenjing Pang, initiated studies to evaluate bermudagrass and seashore paspalum cultivars for their abilities to resist nematode infestations (2, 3, 4, 5). "I am often asked by golf course superintendents if a particular cultivar is resistant or has fewer problems with nematodes than other cultivars," explains Dr. Crow. "I really wanted to have some research results to answer those types of questions. Use of plant resistance and tolerance is the most long-lasting and environmentally friendly method for controlling pests."

In May 2008 and April 2009 through 2010, two field studies were conducted. Nematode populations in each plot were recorded on the same day the plots were planted. Soil samples were collected every 90 days after planting,

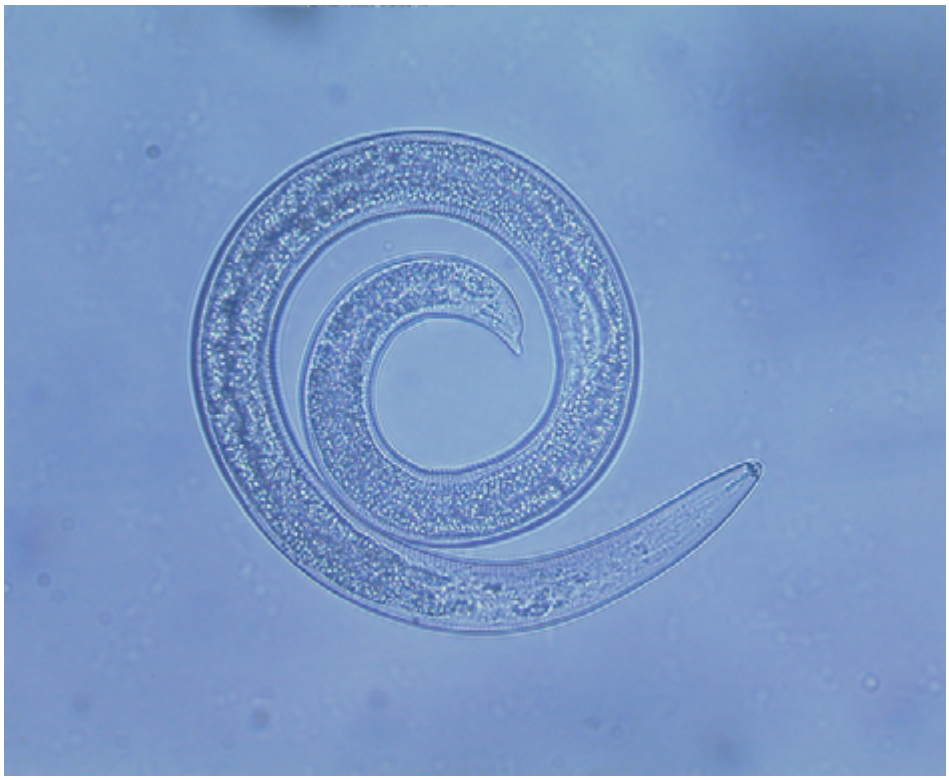


Plots of both bermudagrass and seashore paspalum were planted in 2008 at University of Florida turfgrass research plots. Nematode counts were taken from soil samples at the time of planting and every 90 days during the growing seasons of 2009 and 2010.

University of Florida graduate student Wenjing Pang takes soil samples of bermudagrass cultivars in an effort to compare them for their abilities to tolerate both sting and spiral nematodes without showing visual decline.



University of Florida field studies showed that sting nematodes (above) were much more prevalent in plots of bermudagrass cultivars (with the exception of TifSport), while spiral nematodes (below) were found in much higher numbers on seashore paspalum cultivars.



and turfgrass health was determined by evaluating root lengths and turf density every three months throughout the growing season (2, 3, 4, 5). Results of the studies showed that the change in sting nematode populations on bermudagrass plots depended on the cultivar. Populations of sting nematodes increased in Champion (37%) and Mini Verde (40%), but dropped in Tifgreen (4%), TifEagle (18%), Celebration (27%), Floradwarf (32%), Tifway (33%), and TifSport (93%). However, although TifSport bermudagrass appeared to be more effective at suppressing the reproduction of sting nematodes in the field, the population of spiral nematodes increased 123-fold in those same TifSport plots (2, 4).

The study revealed not only differences in nematode populations between bermudagrass cultivars, but also differences between bermudagrass and seashore paspalum. Seashore paspalum was a more desirable host to spiral nematodes than it was for sting nematodes. The population densities of spiral nematodes increased 177-, 106-, and 214-fold, while sting nematodes decreased by 69%, 96%, and 86%, respectively, in the seashore paspalum cultivars Aloha, SeaDwarf, and Sea Isle I within two years (3).

Although seashore paspalum is less affected by sting nematodes, it is more susceptible to damage by spiral nematodes. In other words, choosing seashore paspalum over bermudagrass is largely a tradeoff from sting to spiral nematodes. “Both species are damaged by sting nematode, but seashore paspalum has a more vigorous root system that makes it more tolerant than bermudagrass,” says Dr. Crow. “This is why you often see seashore paspalum contaminants outgrowing bermudagrass in sting nematode-infested areas. However, seashore paspalum is more susceptible to damage from spiral nematodes, which rarely damage bermudagrass.”

Do these results mean that the dominant species of nematode in a soil sample depends mostly on the turfgrass species (host) that is growing there? Dr. Crow cautions that it is much more complicated than that assumption. “Nematode species

composition and population density depends on lots of factors, including the content of sand, silt, clay, and organic matter that is present in the soil, depth to the water table, compaction, drainage, and presence or absence of natural enemies. The susceptibility of the host plant is one of the biggest factors involved, but not the only one," says Dr. Crow. "We look at the nematodes from thousands of turfgrass samples each year, so I often can pick up trends, such as seeing greater numbers of a certain type of nematode on a particular cultivar. This research gave me the opportunity to confirm some of these observations."

The results seem to suggest that where several nematode species are present, the presence of one nematode species may inhibit the population growth of other nematode species. If so, is there evidence that this is more than a competitive effect for susceptible hosts? "Yes, we noticed that as sting nematodes increased, spiral nematodes decreased, and vice versa. We have since confirmed this with greenhouse experiments. Interestingly, in our field experiments, spiral nematode numbers got highest on seashore paspalum, whereas sting nematode numbers got highest on bermudagrass, with the exception of TifSport," explained Dr. Crow. "I suspect that there is more going on than just competitive effects. This is something I hope to do further research on."

Dr. Crow is quick to emphasize that none of the tested bermudagrass or seashore paspalum cultivars were truly resistant. "Nematologists define a resistant plant as one that the nematode cannot reproduce on. Based on that, we did not identify any true resistance in commercial cultivars because the nematodes were able to reproduce on all of them. What we did identify was tolerance — cultivars that could deal with nematode feeding better than others," said Dr. Crow.

"Based on our results, for fairways and tee boxes infested with sting nematodes, switching from Tifway to Celebration or TifSport would likely reduce the amount of nematode damage. I know of golf courses in Florida that have made this switch and have been able to reduce greatly the frequency of nematicide applications. On greens, we found that all the ultradwarfs evaluated suffered more nematode damage than the dwarfs did. If sting nematodes are a major concern, this should be considered in the decision of what cultivar of bermudagrass to use."

Dr. Crow also notes that the visual damage by nematodes is more prevalent as more stress is placed on the turf and the golf course industry expands its use of ultradwarf bermudagrasses. "Nematode problems will likely increase if trends toward increased putting speed, lower mowing heights, and use of ultradwarf cultivars continue. This puts more stress on the turf and makes the turf less tolerant to nematodes. Similarly, the increased use of ultradwarf bermudagrasses in my region has increased nematode problems."

Although nematodes are extensive on Florida golf courses, Dr. Crow explains the damage to golf course turf is certainly not restricted to the sandy soils of the Sunshine State. "In general, the further north a course is located, the less likely nematode problems will develop, because there will be fewer generations of nematodes per year. On fairways and tees, nematodes will seldom be a problem outside of sandy areas adjacent to the Gulf and Atlantic coasts," says Dr. Crow. "However, sand-based greens are ideal habitat for most parasitic nematodes, wherever they are located. Sting nematodes are being spread by human activity and are now a problem on greens in Texas, Tennessee, Kansas, and California. In the United Kingdom, the root-knot nematode was not a problem until they started using sand-based construction."

In addition to using cultivars that are more tolerant of nematodes, other management practices can tip the scales toward or away from nematode damage. "In Florida, we have found that overseeding doubles the nematode populations on bermudagrass in the spring. Raising mowing heights and anything else that reduces turf stress will improve tolerance to nematodes," says Dr. Crow. "Good turf maintenance practices, like aerating, that promote root health and the use of soil amendments that increase the soil's nutrient-supplying and water-retention capabilities can help turf tolerate the negative effects of nematodes."

Dr. Crow emphasizes the effect that soil temperature has on nematode activity. Although nematode damage will most often be visible during hot, stressful months, nematode damage to turfgrass roots occurs mostly in the spring and fall, when nematodes are most active.

"The optimum soil temperature range for nematodes is 70-80°F. When it is cooler, their activity slows down and they are relatively dormant around 55°F. In warm coastal areas from South Carolina through Texas, it stays warm enough for these nematodes to stay active throughout most of the winter. High soil temperatures (over 90°F) will kill them, so they will move deeper in the soil where it is cooler during high summer temperatures. The root reductions caused by these nematodes generally occur during the spring or fall, while the above-ground damage may not be seen until the summer, when the turf is under the most stress. I recommend sampling early, while the turf is actively growing, and treating if needed at that time. Be proactive — it is much better to treat early and avoid nematode damage than to try to fix a problem."

Finally, Dr. Crow notes that there are new chemistries being developed for nematode control, however it is still important to have a multiple-control strategy. "I am currently working with several new active ingredients, some of which are promising. There is a strong possibility that there will be at least one new nematicide coming out in a couple of years, with more to follow."

Is development of resistance to nematicides something that superintendents should anticipate? "With older chemistries like fenamiphos (Nemacur) and 1, 3-dichloropropene (Curfew), this has not been documented as a problem. What does happen is that with repeated applications, populations of microbes build that rapidly break down the chemical so that it does not get a chance to work properly. This is called 'enhanced microbial degrada-

Tifway (left) and Celebration (right) bermudagrass showing differences in visual damage from sting nematode infestation.

tion' and was a very common problem with Nemacur," notes Dr. Crow.

"This could also become a problem with biopesticides and new chemicals, and it is something I will watch for. Many of the newer chemistries have more intricate modes of action, targeting specific pathways in the target pest. These tend to have more resistance problems than older chemistries, so chemical resistance could become more of a problem in the future. This is why it is critical to have multiple control strategies to rely on, including the right choice of turfgrass".

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