ALTERNATIVES FOR NEMACUR?

Turfgrass Manager's Goal is Vigorous Healthy Turf, Not Dead Nematodes

By Joel Jackson and Billy Crow

Unless you have had your head stuck in the sand for the past year, you should be aware that the Environmental Protection Agency is in the final stages of reviewing the registration of the organophosphate nematicide fenamiphos (Nemacur). In fact by the time you read this, the decision probably will have been made.

Over the past year, the Bayer Corporation, the FGCSA, the state of Florida and the U. S. EPA have been conducting numerous conference calls to discuss the importance of the product, the risks and benefits and just how the product is used on today's golf courses. It seems inevitable, regardless of the real-world data, that EPA is leaning heavily to a three- to five-year phase-out of the product. Curfew is another synthetic nematicide on the market, but so far only slit injection for fairways is workable. Research continues on less disruptive ways to apply it to greens.

In the late stages of the discussions, a chemical company, Parkway sent an email to the EPA stating that their organically-based product Neo-Tec might be considered as an alternative product. In fact Parkway recommends a combination of applications of a "conventional nematicide" with its product, especially if you have high nematode populations.

Parkway reports that 150-200 courses in Florida have purchased and tried the product. I have had one reliable source confirm he is getting satisfactory results using Neo-Tec.

I have also had recent reports from two highly respected Central Florida superintendents reporting positive results in reducing nematode problems using another organic product called Synzyme distributed by the Howard Fertilizer and Chemical Company.

Every time someone uses an organic product; we always ask "Where's the university research?" A couple of years ago, UF nematologist Dr. Bob Dunn shot down a whole bunch of natural products.

With the testimonials by some pretty reliable superintendents, I asked UF/IFAS nematologist Billy Crow the same question that arose when the Neo-Tec issue surfaced in the Nemacur discussions.

"I wanted to pass on some more info regarding the Neo-Tec," he said. "I did one study with the product while I was in Texas, but it had a different name 'Sincocin.' In that test it did not perform well, but neither did Nemacur.

"The main thing I wanted to point out that, other than my one test - which was inconclusive - this product has never been evaluated for nematodes on turf! It has also never been evaluated on any other crop in the US.

"Joe Noling, another nematologist with UF will be testing it this year on tomatoes and I plan on doing the same for turf."

We may be in a situation with conventional nematicides, where you are going to have to try some of these products and put their claims to the test. If you do try one of the organic products how do you know what's happening?

Dr. Crow responds:

I agree that products that prevent problems are hard to quantify. If you use a product and don't get a problem does that mean that the product worked or would you not have had a problem anyway?

These types of products can have several ways of working, if they do work.

They can kill nematodes. If they do this you should be able to detect nematode reductions compared to untreated plots. You should also get a turf response if nematodes were causing damage.

They can change the nematodes behavior (as Neo-Tec claims) by preventing feeding, reproduction, etc. If the product works this way then you may or may not see a short-term nematode response as the nematodes will still be present in a soil sample even if the product works. However, you should see a turf response in comparison with untreated plots.

They can cause a turf response that has nothing to do with nematodes. For instance, if a product stimulates root development, the turf can become more tolerant of nematode damage and have a turf response even if nematodes are unaffected. This is a valid nematode-management approach, and I will be working with a couple of these products this year.

They can affect another organism. For instance; in some of my tests last year I included both Nemacur and Heritage plots for comparison. Interestingly, often both Nemacur and Heritage gave a visual turf response. This could be because both nematodes and fungi were causing damage so you get a response if you control either pest, or because the nematodes and certain fungi like take-all fungus can work together to cause damage in many instances. So, if you had a product that was primarily a fungicide you could get a visual turf response in some cases in areas with "nematode damage."

Turf performance has to be a major criterion for evaluating all of these products. The goal is to have healthy turf, not necessarily to kill nematodes. But, if you are preventing nematodes from feeding over a period of months there should be a reduction in populations over time because nematodes cannot reproduce without food.

My plan is to apply Neo-Tec and similar products monthly and then evaluate nematode populations, turf visual performance, and root production over a period of 6 months. If the products have any efficacy there should be both turf responses and nematode responses in comparison with untreated plots.

NEMATODE MANAGEMENT IN GOLF COURSE PUTTING GREENS USING 1,3-DICHLOROPROPENE

Help For Nematode Control Pending Registration Approval by EPA

J. Bryan Unruh and Robert A. Kinloch

Plant parasitic nematodes have long been known to adversely affect plant health. However, only since the early 1950s have nematodes been known to negatively affect turfgrass health (Dunn, 1999). Today, nematodes cause significant injury to both cool- and warm-season turfgrasses by puncturing and feeding on turfgrass roots. By debilitating the root system, nematodes weaken the turf and additional nutrients and water

Figure 5*. Nematode damage on a green at Fort Walton Golf Club. Photo by J. Bryan Unruh, Ph.D.*

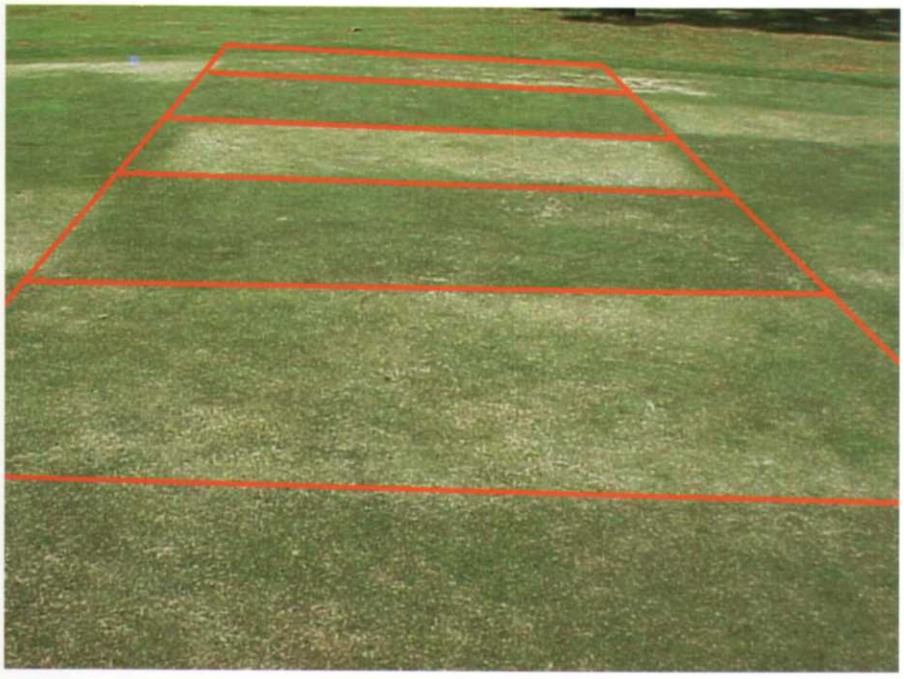

Figure 7*. 1,3-D test plots on the same green above, 19 days after application. Photo by J. Bryan Unruh, Ph.D.*

are often required to counter this destructive activity. Additionally, weakened turf also favors pest infestation, especially troublesome weeds, which necessitates herbicide applications.

Nematode Control

Several decades ago, many fumigant and non-fumigant nematicides provided effective control of nematodes. In 1977 however, environmental and health safety issues brought about restrictions on DBCP (1,2-dibromo-3-chloropropane) and since this time, many other nematicides have been removed from the marketplace (Dunn, 1999).

Today, control of nematodes has been relegated to only one synthetic pesticide, fenamiphos, and this material is available only to the golf course and sod industries. At present, there are no synthetic nematicides available for the landscape and athletic turf markets.

Although numerous products claim nematode control, these materials have proved largely ineffective in university-conducted research (Dunn, 1999, Giblin-Davis, 2000; 2001).

1,3-dichloropropene (1,3-D), a soil fumigant, was developed in 1943 and was the first effective and inexpensive nematicide for general field use (Noling, 1996). In turf, 1,3-D was first tested for nematode control in bermudagrass turf in 1953 (Heald and Perry, 1969) and over the years, researchers and practitioners have noted exceptional control of nematodes and some soil-borne insects with this soil fumigant (Noling and Becker, 1994).

More recently, researchers have been evaluating 1,3-D for its usefulness in controlling nematodes and soil-borne insects in established turf situations (Unruh and Lickfeldt, 2002). Specifically, 1,3-D was applied at rates up to 10 gallons per acre through a coulter-shank injection machine into established bermudagrass fairways and driving ranges. Although surface disruption was minimal and recovery was quick, concern over using this application equipment on putting greens is noteworthy.

High-Pressure Subsurface Injection Technology

High-Pressure subsurface injection technology has made a dramatic impact on turfgrass management (Perrault, 1998). This equipment allows greater control of pesticide application - most notably, precision placement. Furthermore, research conducted in Georgia showed that subsurface injec-

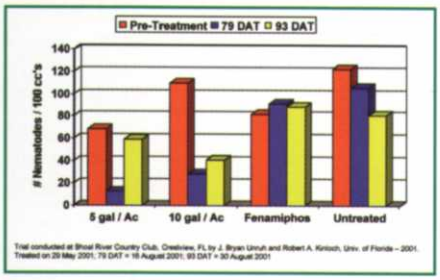

Figure 1. Control of Lance Nematodes with 1,3-Dichloropropene Soil Fumigant

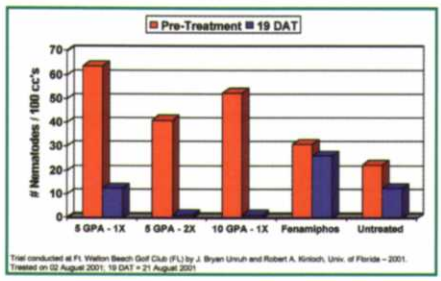

Fig. 2. Control of Lance Nematodes with 1,3-Dichloropropene Soil Fumigant

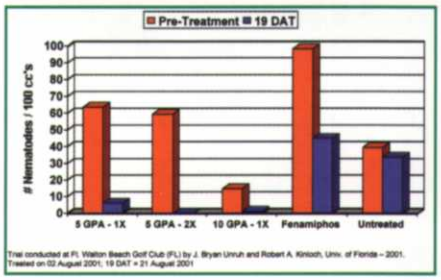

Fig. 3. Control of Lance Nematodes with 1,3-Dichloropropene Soil Fumigant

Today, control of nematodes has been relegated to only one synthetic pesticide, fenamiphos, and this material is available only to the golf course and sod industries. At present, there are no synthetic nematicides available for the landscape and athletic turf markets. Although numerous products claim nematode control, these materials have proved largely ineffective in university-conducted research.

tion of pesticides might reduce - by as much as 75 percent - the potential for pesticides to enter surface water (Perrault, 1998).

Aided by technological advances and a greater understanding of how better to use this equipment, researchers are now employing this technology in the battle against nematodes. In cooperation with Dow AgroSciences, we tested the efficacy of subsurface injection of 1,3-D using the Cushman Envirojet 160. This machine uses high-pressure pulses of water to carry the fumigant into the soil where the nematodes reside.

Research Projects

Trials were conducted during the summer of 2001 to determine the turfgrass tolerance to subsurface injection of 1,3-D and to determine the efficacy of 1,3-D for nematode control in Florida. In all the studies, applications were made using a Cushman Envirojet 160 subsurface high-pressure injection machine. 1,3-D was injected to a depth of 6 inches and the injection nozzles were spaced 4 inches apart. The operating speed of the equipment was fixed at 1.4 MPH to ensure that a 4-inch by 4-inch injection spacing resulted. The machine was calibrated to deliver 500 GPA at 2600 PSI. Tests were conducted on actual golf course Tifdwarf bermudagrass putting greens maintained at 0.156 inch.

Shoal River Country Club

Methods. A trial was conducted at

Shoal River Country Club, Crestview, in the summer of 2001 to determine whether 1,3-D would provide effective nematode control and to evaluate the turfgrass tolerance to 1,3-D when injected into a bermudagrass putting green under high pressure.

On May 29, 1,3-D was applied at 5 and 10 gallons per acre using the equipment described above. As a comparative treatment, fenamiphos 10G was applied as a surface broadcast at 100 pounds per acre. Plot size was 10 feet X 40 feet with four replications (greens No. 1, 6, 18, and the practice green were used; one green equaled one replication).

Results. Nematode assays taken 79 days after treatment (DAT) showed that 1,3-D applied at 5 and 10 GPA provided 69 and 74 percent control of Lance nematodes (*Hoplolaimus geleatus*), respectively (*Fig. 1*). Post treatment nematode counts from plots treated with fenamiphos actually showed an increase in nematode numbers (*Fig. 1*).

Although few Sting nematodes (*Belonolaimus longicaudatus*) were present, both rates of 1,3-D provided 100 percent control of this nematode (data not presented). By 93 DAT, nematode populations in plots treated with 5 GPA had recovered to within 70 percent of the pretreatment values. Conversely, nematode counts in plots treated with 10 GPA had only rebounded by 30 percent. Fenamiphos provided no control of either nematode species in this study.

Objectionable turfgrass injury was observed in plots receiving 10 GPA 1,3-D.

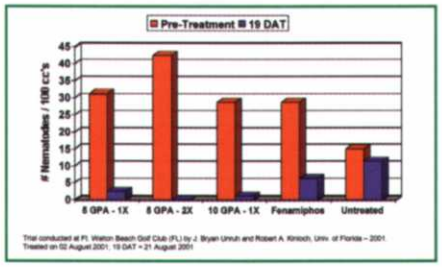

Fig. 4. Control of Sting Nematodes with 1,3-Dichloropropene Soil Fumigant

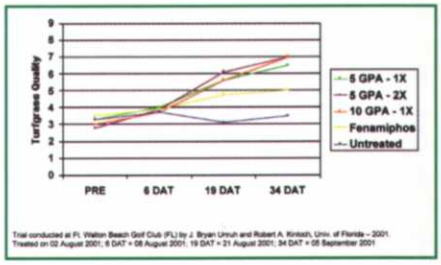

Fig. 6. Turfgrass Quality as Affected by 1,3-Dichloropropene Soil Fumigant Application

However, injury subsided within three weeks. Although nematode levels were high on these putting greens - exceeding the recommended treatment threshold - turfgrass quality was not adversely affected and post-treatment quality ratings did not show a significant improvement in turf quality (data not presented).

Bottom line. 1,3-D applied at 5 and 10 GPA provided good control of Lance and Sting nematodes. By three months after treatment, nematode counts had rebounded in plots treated at the 5 GPA rate. Under the conditions in which this trial was conducted, turfgrass injury was observed at the 10 GPA rate.

Ft. Walton Beach Golf Club

Methods. Two studies were conducted at Ft. Walton Beach Golf Club in the summer of 2001 to determine whether 1,3-D would provide effective nematode control when high-pressure injected into a bermudagrass putting green. On Aug. 2, 1,3-D was applied at 5 and 10 gallons per acre using the equipment described above.

Other researchers had noted that two passes, each injecting 5 GPA (total application rate of 10 GPA), did not cause the same level of injury as a single pass at 10 GPA (personal communication, Dr. Billy Crow). Therefore, this additional treatment regime (5 GPA 2X) was added to the trials.

As a comparative treatment, fenamiphos 10G was applied as a surface broadcast at 100 pounds per acre. Two separate putting greens were used, and plot size in both trials was 5' X 10' with four replications.

Results. In the trial conducted on practice green no. 10, 1,3-D applied at 5 GPA, 5 GPA 2X, and 10 GPA, provided exceptional control of lance nematodes (*Fig. 2*). Fenamiphos provide a slight level of nematode control compared to the pre-treatment counts. As noted previously in other trials, turfgrass injury was objectionable at the 10 GPA rate, but was not objectionable at the 5 GPA and 5 GPA 2X rates (data not presented).

In the trial conducted on the north practice green, all rates of 1,3-D provided 90-100 percent control of lance and sting nematodes (*Figs. 3 and 4*). Fenamiphos gave 55 and 78 percent control of lance and sting nematodes, respectively.

Of particular interest in this trial was the initial turf density - averaging only 40 percent turf coverage at the time of application (*Fig. 5*). *Figure 6* shows the dramatic improvement of turf quality achieved with the application of 1,3-D. By 19 DAT, turf in fumigant-treated plots was at, or near, an acceptable quality level and by 34 DAT, regardless of rate, had improved from a pre-treatment value of 3.5 to a post-treatment level of 6.5 to 7.0. *Figure 7* reveals photographically, the difference in turf quality observed at 19 DAT. Similar turfgrass injury results were observed in this trial.

Bottom line. Results from this study showed that 1,3-D can control lance and sting nematodes, and when used at 5 GPA or 5 GPA - 2X, will not produce objectionable turfgrass injury.

Conclusions

Results from the trials discussed here show that 1,3-D will provide a valuable nematode management tool to golf course superintendents should it receive a registration from the Environmental Protection Agency. With this tool, turfgrass managers will be better able to manage their turf and do so with fewer inputs of pesticides, nutrients, and water.

Acknowledgments

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