Field Evaluation of Entomogenous Nematodes for Grub Control

Insect pathogenic nematodes may offer a biological control alternative to conventional insecticides when applied in an inundative release program.

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There has been great interest in the possibility of using entomogenous (insect parasitic) nematodes to control scarab grubs in turfgrass. Insect pathogenic nematodes may offer a biological control alternative to conventional insecticides when applied in an inundative release program.

Nematodes may be applied through conventional spray equipment, and irrigation requirements are similar to those needed for effective control with chemical insecticides.

Two species of nematodes have shown promise for controlling Japanese beetle grubs in turfgrass, *Steinernema glaseri* and *Heterorhabditis bacteriophora*. *S. Glaseri* was originally described from infected Japanese beetle grubs collected in New Jersey and has the advantage of superior production and storage properties when compared with *H. bacteriophora*. An advantage of *H. bacteriophora* is that their ineffective stage has a tooth that allows them to enter through the grub's body wall while *S. glaseri* must enter through an existing body cavity, usually the grub's mouth. *H. bacteriophora* also appears to be a superior grub hunter allowing it to find and infect grubs in the soil. Other commercially available nematodes have been shown to be less effective at controlling scarab grubs in turf.

Field Studies

Long-term studies that focus on the feasibility of using commercially available entomogenous nematodes to reduce scarab grub infestations in turfgrass and ornamental plantings were addressed during 1991 with funds from New York State Integrated Pest Management Program and the New York State turfgrass industry. Field studies were initiated on three golf course fairways with Japanese grub populations that were significantly above the accepted economic threshold. Four commercially available nematodes were applied to turfgrass at the recommended rate of 1 billion nema per acre according to standard procedures. *Heterorhabditis bacteriophora* was also applied at one half and one quarter the recommended rate to determine any rate response. Bendiocarb was applied at the recommended rate as an insecticide standard for this study. Results of the study were determined by direct counts of live grubs four weeks after application of control agents.

The first question one must ask is whether entomogenous nematodes reduce grub populations below standard action thresholds? Predictable results are essential if nematodes are to be used in the field. Our results indicate that all four nematode species tested performed about as well or as poorly at each application site. Results of our field study indicated that *Steinernema glaseri* (Biosys, Palo Alto, CA) and *Heterorhabditis bacteriophora* (Bioenterprises, Glenorchy, Australia) both at 1 billion nema per acre reduced grub populations to or below the economic threshold on all three fairways. For biological control agents to be included in management programs the product must perform consistently. Grub counts ranged from 19 to 46 grubs per square foot in the check plots and were reduced to 13 to 3 grubs per square foot in the nematode treated plots. Bendiocarb treatments were statistically indistinguishable from the nematode treated plots with respect to grub counts. Non-significant reductions were also observed with the other nematodes tested. These results mirror past studies with these nematodes and suggest that under suitable conditions both nematode species have the potential to reduce high populations of Japanese beetle grubs below economic thresholds.

Dose Effect

A second important question that must be addressed in the field is whether there is increased grub mortality with increased application rates of nematodes. Since alternative control tactics tend to be more expensive than traditional insecticide treatments for controlling grubs, commercial applicators often reduce suggested application rates of nematodes to levels competitive with traditional insecticides. There appears to be some justification for this practice. Laboratory and field studies suggest minimal dose response when applying nematodes for grub control.

In contrast, studies this year with *Heterorhabditis bacteriophora* indicated a significant dose effect. Grubs were reduced by 70% when nematodes were applied at the recommended rate of 1 billion nema per acre, by 43% at the half rate of 0.5 billion nema per acre and by 36% at the quarter rate of 0.25 billion nema per acre. Only the recommended rate reduced grub populations below economic thresholds. While additional data is required, it is my view that nematode applications should be coupled with grub mapping to reduce application costs while maintaining sufficient nematode numbers to reduce grub populations.

Results reported here should be considered preliminary and a first step in a long range project conducted over several years. Studies such as those described above must be replicated over time and in several additional geographic regions to insure predictable results.

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