Beneficial Nematodes: An Easy Way to Begin Using Biological Controls in the Greenhouse

Growers that are interested in using biological controls are encouraged to begin by using beneficial nematodes. Unlike many traditional pesticides, there is no re-entry interval (REI) or postharvest interval (PHI), and no personal protective equipment is needed during their application. Beneficial nematodes are also compatible with many other biological control agents. There is almost no risk that the target pest will develop resistance to their use. In many different field studies, no adverse effects have been shown against non-target organisms. However, beneficial nematodes are living organisms, so there are several precautions you need to follow for their successful use.

What are beneficial nematodes?

Nematodes are small, (0.5 mm), colorless, cylindrical roundworms that occur naturally in soils throughout the world. Species that kill insects are known as entomopathogenic nematodes. These insect-killing nematodes have been primarily used against soil dwelling pests because they are sensitive to ultra-violet light and desiccation. *Steinernema feltiae* is commonly used for fungus gnat larvae and western flower thrips and onion thrips pupae in the growing media. *Steinernema carpocapsae* is used for the suppression of shore fly larvae.

Nematode Life Cycle

The life cycle of nematodes includes an egg stage, four larval stages and adults. The third larval stage is the infective form of the nematode (IJ). The juvenile nematodes enter the insect host through body openings. They multiply within the host and release a symbiotic bacterium whose toxin kills the target pest. The larvae are killed in one to two days by blood poisoning. Nematodes feed and reproduce, emerging as infective juveniles to search for new hosts to infect.

How to use beneficial nematodes

Steinernema feltiae is used as a soil drench or sprench against fungus gnat larvae. Preventative applications to moist soils work best but they can also be used as a curative treatment with moderate numbers of fungus gnat larvae. Repeat applications every two weeks or as recommended by your supplier. Apply nematodes with a sprayer or injector (remove screens and filters)

- If using an injector, set the dilution to 1:100. Remove all filters or screens (50 mesh or finer) in any spray lines so that the nematodes can pass through undamaged.
- If using a sprayer, spray pressure should be kept below 300 psi.
- Remove nematodes from refrigerator and let them warm up for 30 minutes to avoid heat shock.
- Although nematodes are applied in water, they are not aquatic animals and therefore they need extra care while in stock and tank solutions, so adequate aeration of the nematode suspension during application is important. Use a small battery powered submersible pump to keep the solution agitated. The small

pump will also keep them from settling on the bottom. Dramm manufactures an aeration bucket specific for using the nematodes with a fertilizer injector.

- Keep the suspension in the spray tank cool and apply as soon as possible after mixing. This is especially important during the warmer months.
- Keep water temperatures below 95 F in the summer. The longer they are held before spraying and the warmer the tank water, the more quickly their energy reserves are used up. Weaker nematodes are less robust during and after application, and less able to search for and infect a susceptible host.
- Nematodes can be applied through an irrigation system, however, there is better distribution with boom sprayers than with drip or sprinkler systems.
- For use against fungus gnat larvae, treat as soon as possible (2 to 3 days) after sticking cuttings, planting plugs, or starting seeds. Some growers apply the nematodes to the media directly before sticking cuttings to ensure that nematodes reach the media. Apply as a media drench or sprench to target the fungus gnat larvae.
- Media temperatures should be above 50° F but avoid applying when soil temperatures are above 80°F. Optimum media temperatures are between 60-70°F. (Use a soil thermometer to monitor temperatures).
- Cornell researchers found that *S. feltiae* can't tolerate temperatures of 95F for longer than 4 hours in the spray tank or growing media.
- Water the growing media the day before application. (Nematodes need moisture for movement).
- Apply in the evening or at dusk or on a cloudy, overcast day.
- Repeated applications are often needed. Make the first application at planting and then repeat every two weeks or as recommended by your supplier.

How to tell if the nematodes are working against fungus gnats

The symbiotic bacteria break down the host insect's cuticle. The infected fungus gnat larvae rapidly disappear, so they may be difficult to locate. Infected fungus gnat larvae are often opaque-white to light yellow in color. Use potato disks to monitor for fungus gnat larvae.

Check nematode viability before and after application

- Let nematodes come to room temperature for about 30 minutes.
- Place a small amount of the product in a small, clear container or petri dish. Add 1 or 2 drops of room temperature water; wait a few minutes and look for actively moving nematodes. Use a dark-black background and a hand lens or field microscope to see the small (0.6 mm) nematodes. Dead nematodes will be straight and still.
- Collect spray water with an empty nematode tray. Collect and filter this water through a coffee filter, to concentrate the nematodes, and then cut out this spot and use this water to check for the nematodes against a dark background.

Figure 1: Checking viability of nematodes before and after application. Photos by L. Pundt

- Apply in the early morning, evening or at dusk or on a cloudy, overcast day.
- Nematodes are compatible with many different pesticides. However, they are generally not compatible with organophosphates, carbamates, and hydrogen dioxide. Do not apply with fertilizer water. For more detailed information on pesticide compatibility: consult with your supplier or see *the BASF Nemasys Beneficial Nematodes Chemical Compatibility Guide.*

Thrips

In the late 1990s in the U.K., it was reported that cut flower chrysanthemum growers who applied nematodes weekly as a foliar spray, noted a reduction in their western flower thrips populations. More recent research (in Canada, the U.K. and Germany), showed that soil dwelling stages of western flower thrips (especially the pupal stages) were susceptible to several species of nematodes, and particularly to *Steinernema feltiae*. During the weekly sprays, a significant number of nematodes reached the growing media via runoff from the foliar sprays. However, S. feltiae do not work against all thrips species. *Echinothrips americanus (*Poinsettia thrips) does not pupate in the soil but on plant leaves. Chilli thrips are so small that it is hard for them to enter their bodies.

Growers often combine beneficial nematodes with predatory mites (*Neoseilus cucumeris* and/or *Amblyseius swirskii*) as part of their biological control program for thrips management.

Storing nematodes

Several formulations are available and storage time depends upon the species and formulation. They may be available as hydrogels, powders, on sponges or in trays or bags.

If you must store the nematodes, store them in a refrigerator at a constant 40° F. Avoid storing them in a refrigerator that is opened frequently. It is best to purchase a dedicated refrigerator just for storing your nematodes, so you can provide temperatures that are more constant.

Avoid placing them in a small refrigerator where they may freeze and die! Check the expiration date on the package for the length of time they can be stored. Let the nematodes sit at room temperature for about 30 minutes before mixing them in the tank solution to avoid drastic changes in temperature.

As with any biological control measure, beneficial, entomopathogenic nematodes are most effectively used preventively in conjunction with good cultural practices.

By Leanne Pundt, UConn Extension, 2011. latest revision 2024

References

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