



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

### **Introduction**

Greenhouse growers that are interested in using biological controls are encouraged to begin by using beneficial nematodes. There are several advantages to their use. 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. The target audience of this fact sheet are commercial greenhouse growers.

### **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 nematodes are sensitive to ultra-violet light and desiccation that would affect them on the foliage. *Steinernema feltiae* is commonly used for fungus gnat larvae, and pupae of western flower thrips and onion thrips found 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. 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 srench against fungus gnat larvae. Preventative applications to moist soils work best. 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)

- Water the growing media the day before application. (Nematodes need moisture for movement).
- 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 so need extra care while in stock and tank solutions. Adequate aeration of the nematode suspension during application is important. Use a small battery-powered submersible pump to keep the solution agitated and to keep the nematodes 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. Keep water temperatures below 95 F in the summer. The longer the nematodes 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).
- Apply in the 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/ peroxyacetic. 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](#).

### **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. Living nematodes move and are curved as show in the picture below.

- Collect spray water with an empty nematode tray. Collect and filter this water through a coffee filter, to concentrate the nematodes, into a spot on the filter. Cut out this spot, rinse it with water into a small clear container over a dark background and then check the nematodes with a hand lens or microscope.



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

### 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* is not effective against all thrips species for example, *Echinothrips americanus* (Poinsettia thrips) which does not pupate in the soil. Chilli thrips are so small that it is hard for the nematodes to enter their bodies.

Growers often combine media applications of beneficial nematodes with predatory mites (*Neoseilus cucumeris* and/or *Amblyseius swirskii*) on the foliage as part of their biological control program for thrips management because it targets two life stages of the thrips and results in better control.

### Storing nematodes

Several formulations are available and storage time depends upon the species and formulation (i.e., 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.

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

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## References

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