

Beneficial Nematodes

Soil-Dwelling Predator

Description

Entomopathogenic nematodes are extraordinarily lethal to many insect pests yet safe for plants, animals, and people. No special safety equipment or re-entry restrictions are necessary. Nematodes are fast working and can kill insect pests within 24–48 hours. Dozens of different soil dwelling insect pests are susceptible to infection.

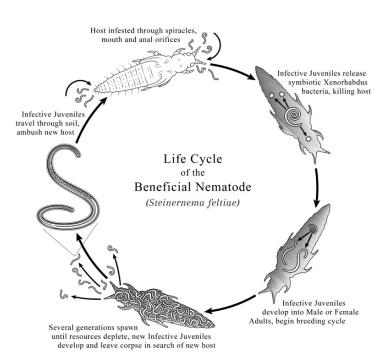
Target Pests

Pests vary depending on species of nematode. Generally, Fungus Gnats (*Bradysia*), Shorefly (*Scatella*), Cutworm (*Agrotis*), Weevils (*Otiorhynchus*), Leafminers (*Liriomyza*), Western Flower Thrips (*Frankliniella*) as well as many other soil dwelling pests.



Life Cycle

A complete life cycle takes 12 to 15 days at room temperature. 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 temperature if needed.



The nematodes enter the insect pest through body openings. Once inside they reproduce and release a symbiotic bacterium which is toxic to the host. The pests are killed within a few days and a second generation of infective juvenile nematodes exit the host and begin the cycle again.

Quality Control for Viability

Always check nematode viability before application if there has been a delay in shipment or a temperature compromise. Use a black background and a 10x magnification hand lens or field microscope to observe the nematodes. Once at room temperature, 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 which will be curvy or 'S' shaped. Cold or dead nematodes will be straight like a pin and not moving.



Use in Biological Control

Entomopathogenic nematodes are supplied as infective juveniles, which are usually applied as a soil drench. Not all nematodes are alike. They specialize in which pests they attack and kill and are effective at different temperatures. The common pests listed below are just a small sampling of what these nematodes will attack.

- **Greenhouse Blend** targets fungus gnats, shore flies and western flower thrips pupae. Contains a mix of *Steinernema carpocapsae* and *Steinernema feltiae*. *S. carpocapsae* is relatively sedentary and tends to remain near the soil surface to 'ambush' its hosts, whereas *S. feltiae* will search more actively through the substrate.
- **Lawn and Garden Blend** targets fleas, crane fly, grubs and weevils. Contains a mix of *Steinernema carpocapsae* and *Heterorhabditis bacteriophora*.
- **3-Way Blend** is best for broad coverage and contains *Steinernema carpocapsae*, *Steinernema feltiae* and *Heterorhabditis bacteriophora*.
- *Heterorhabditis bacteriophora* (*Hb*), targets Beetle Grubs lepidopterous and coleopterous insect larvae, root and black vine weevils. Works best in soil temperatures above 70°F.
- **Steinernema carpocapsae** (Sc), targets shoreflies, billbugs, cutworms, webworms, armyworms, wood-borers and other lepidopterous larvae. Works best between 72°F and 82°F. Sc is an 'ambush' forager, standing on its tail in an upright position near the soil surface and attaching to passing hosts, even capable of jumping.
- **Steinernema feltiae** (*Sf*), targets fungus gnat larvae and western flower thrips pupae, as well as other insects in the Diptera order. They work in cooler weather and can survive and infect in temperatures as low is 50°F.
- **Steinernema kraussei** (Sk) targets vine weevil larvae and is effective at lower temperatures from 40°F to 86°F.

Application Rates

Beneficial Nematodes are available in two forms.

- Sponges that are pre-inoculated with infective juveniles in quantities of 1 mil, 6 mil, and 24 mil of either single species or blends. Generally, in a Greenhouse setting, apply beneficial nematodes at a rate of 1 million per 1,000 sq. ft. This brand has a completely unique application rate as the bacterial level is much higher because they are produced *in vivo* in waxworms.
- Trays that contain 50 million or 250 million. Release every 2-3 weeks at a rate of 50 mil/1100 ft2 or every 4-6 weeks at a rate of 50 mil/550 ft2. Use 30-50 gal/1000ft2. For applications onto soil or growing media.

Instructions for Use

High volume, low-pressure sprayers work best, as well as a watering cans, injectors or conventional spray equipment. Backpack sprayers are not preferred. Remember that water is the CARRIER, the vehicle to get the nematodes where you want them. Plug trays can also be dipped into a nematode



solution. Boom irrigation and watering tunnels also work if they do not exceed 200 psi. Remove all intake injectors, openings smaller than .5 mm and all filters less than 50 mesh or finer.

Do not mix nematodes in a concentrated fertilizer solution. Nematodes can, however, be mixed in a reservoir with a fertilizer solution, although this is not preferred. Volume of water used depends on size of the container and the depth the target pest is in the substrate. Room temperature water is best $(65^{\circ}-75^{\circ} F)$.

Keep the nematode stock tank stirred and/or aerated. If you cannot aerate the solution, periodically stir it to keep the nematodes suspended. This prevents them from dropping to the bottom.

For Best Results

- Where Nematodes are being used to control Fungus Gnats and Shoreflies, it is best to use in conjunction with the predatory mite *Stratiolaelaps scimitus*. The use of both will effectively provide control for not only soil-dwelling pests, but also those that pupate in the soil such as Western Flower Thrips.
- Apply in the evening or at dusk or on a cloudy, overcast day.
- For best results, apply nematodes immediately after receiving them. If you must store the nematodes, keep unopened packages for two to three weeks in a refrigerator at 38-42°F. Avoid placing them in a small refrigerator where they may freeze.
- Treat as soon as possible (2 to 3 days) after sticking cuttings, planting plugs, or starting seeds. Injectors are placed directly on the planting line. Some growers apply the nematodes to the media directly before sticking cuttings or dip plugs in solution prior to transplanting.
- 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. Nematodes should be a similar temperature to the application water.
- Water the growing media before and soon after application but avoid over watering so they aren't washed out of the container.
- Repeated applications are often needed. Reapply in 2 to 4 weeks under moderate to heavy infestations. For longer term crops, apply at the beginning and at mid-crop.
- Nematodes are compatible with several different pesticides; however, they are generally not compatible with organophosphates, carbamates, nematicides, and hydrogen dioxide.

Some content courtesy of UMass Extension Greenhouse Crops and Floriculture Program.