



Beneficial Nematodes

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Beneficial nematodes are microscopic worm-like organisms found naturally in soil. There are many species--good, bad and in-between. Good nematodes kill pests in soil. They work best when soil stays moist, killing in about 48 hours by releasing unique bacteria inside pest larva, hence they are called infective parasitic nematodes. Several species are available commercially in various size packages and formulations and will attack a broad host range. The following descriptions indicate which nematode species is best for different systems and pests.

Heterorhabditis bacteriophora (also Nemasys G) can be used in lawn and field conditions in soils at 55° F to 86° F against:

- cucumber, flea, scarab and Japanese beetle, strawberry root and black vine weevil, chafer, white grub, corn root worm, billbug, Colorado potato beetle, Oriental and Japanese beetle
- highly motile, and "cruising" in search of host, thus valuable when the pest is more dispersed
- more potent, because they have a "tooth" to rupture and enter the insect's skin
- twice as good against white grubs compared to *S. carpocapse*

Heterorhabditis megidis (Nemasys H) is applied April-June and Aug-Nov for black vine weevil when soils are 55° F to 86° F. Seasonally available.

Steinernema carpocapse (also Millenium) are used in lawn, garden and orchard soils at 55° F to 90° F at 1 billion per acre (less for caterpillars; more for cranberry girdler, mint pests and weevils):

- fleas, codling moth, navel orangeworm, peach tree borer, mint root borer, cranberry girdler, cutworm, armyworm, leafminer, sod web worm, mole cricket, banana moth, other caterpillar pests, termite, bluegrass weevil
- *S. carpocapse* wait to ambush a passing host, latch on and crawl through body openings
- *S. carpocapse* is the preferred species when hosts are mobile

Steinernema feltiae (also Nemasys) are used in media at 50° F to 86° F or as a foliar against:

- fungus gnat, shore fly, mushroom gnats, fruit

fly, Western flower thrips, leafminer

- biocontrol inhibition of some plant parasitic nematodes, particularly root-knot nematodes
- house flies need 5-10 million nematodes per 25 sq. ft. of manure pile.

For high levels of fungus gnats, *Steinernema* move through rockwool, peat, sawdust or soil growing media without difficulty. They will not reproduce or stay in the growing media and must be reapplied if reinfestation occurs. Follow these steps:

- Apply nematodes when yellow sticky traps average over 50-75 fungus gnat adults/trap, weekly, or while fungus gnat populations appear to be increasing.
- If root diseases are a problem in the crop, apply nematodes sooner to reduce the risk of disease transmission by fungus gnat larvae.
- Three applications 7-10 days apart are usually required. Follow product label for rates.
- Calculate based on actual growing area (i.e., containers or beds) not greenhouse area.

Steinernema kraussei (also Nemasys L) are applied June-Sept in turf at 41° F to 86° F against Japanese beetle, European chafer, Masked chafer, Oriental beetle, and black vine weevil. 250 million will treat 5500 square feet.

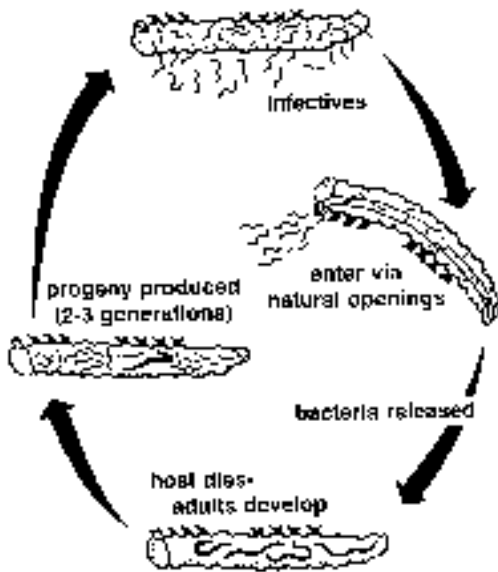
Steinernema riobrave (BioVector) are used at soil temperatures of 50° F to 86° F or as a foliar:

- In citrus against citrus weevil, blue green weevil, borers at 20-40,000 per square foot, 0.5 to 1 billion per acre for fuller rose beetle.
- In turf for mole crickets (or use *Steinernema scapterisci*, Nematac S).
- black vine weevil and strawberry weevil at 3 billion per acre.
- competes with root knot and sting nematodes.

Quantity guidelines

Beneficial nematodes supplied by Rincon-Vitova are used at around 1 million per 60 ft² and 1 billion per acre, but product labels vary. Release every three to six weeks until infestation subsides. The warmer and more regular the watering system, the lower the required rate. With lower rates, control declines. For example, using *H. bacteriophora* against Japanese beetle grubs, after three weeks,

a billion per acre achieved 85-90% control while half that much resulted in half the control.



Steinernema life cycle

From: "Steinernematid and Heterorhabditid Nematodes", Southern Cooperative Series Bulletin 331, AK Ag. Exp. Stn., Fayetteville, AK 72701

Spot treatments effective for many pests

For control of fleas, applications should be made to areas the pet frequents, such as feeding and watering sites, beds, or shaded areas. When treating tree pests, treat the drip line area, about one-fifth of the total acreage. For tree bark pests, nematode solutions are injected into borer holes.

When and how to apply

Soil temperature should be greater than 45° F to apply all species and warmer for some. At that temperature they will live but not grow very well. When soil reaches 60° F all species will grow and parasitize insects. Late evening or night is ideal and never when the ground is hot and dry. Water dry soils before applying. The best conditions are cloudy, cool weather in spring or late summer while soil temperatures are between 60° F and 85° F. When using a sprayer, use a course nozzle, remove screens and pressures can be set up to 300 psi. The mixture can also be distributed through an irrigation system.

How it comes

Our 10, 25 and 50 million units come as a moist powder sealed in a small Ziploc bag. We also carry a 7 million unit in vermiculite.

Our larger bulk units come as water dispersible polyacrylamide gel in trays. Our bulk OMRI listed nematodes for organic production are packed in trays of diatomaceous earth (DE).

Directions for mixing

Place powder, gel or DE in water and let it sit for five minutes. Then stir nematodes and carrier into a suspension in the water so you can sprinkle or spray them on the ground. The suspended nematodes survive about three to four hours depending on temperature and oxygen in the water, so mix only what you will apply today. They will eventually drown in the water.

To illustrate in the case of a small backyard, use a quart jar and a sprinkling can or hose-in sprayer. Mix a 10 million nematode pack in 3 cups of water in the jar. When fully suspended, pour 1 cup into the sprinkling can or sprayer jug. Fill the sprinkling can or sprayer jug with water. Spread or spray the contents over approximately 13 ft². Refill the sprinkling or spraying container with the second cup of suspended nematodes (swirl around before measuring), fill with water, and cover the next 13 ft². Finally pour the last cup of nematode suspension, dilute in the sprinkling can or sprayer jug, and cover the last 13 ft². The amount of water is not important so long as it allows you to spread the total pack of 10 million nematodes over 500 ft².

To mix half the quantity from a pack, use half and leave half in the plastic bag and return to refrigerator. There is a risk that the remainder will dry out, so push the air out, seal it tight, and don't store long once the package is opened.

For nematodes packed in vermiculite, sprinkle the carrier in the pots or soil surface, distributing 1 million nematodes over 50 ft² or from 1,000 to 60,000 per 6 inch pot and water it in. Black vine weevil in strawberries, for example, is controlled using 10,000 to 20,000 nematodes per pot.

Agitate solution and keep soil moist

Agitate the water in the container while applying. Keep the soil moist with light watering afterward to help the nematodes move into the soil. Avoid over-watering plants for one week after applying nematodes as they may be washed out of the media. To check viability, examine a drop of the suspension with a hand lens. Live nematodes will be curved and ideally moving in the water drop. If dead, they are straight.

Easy and safe

Nematodes are easy to use and don't harm beneficial organisms, such as earthworms. They don't pollute and are harmless to us and our pets. They are exempt from registration by EPA.