

Using Insect-Parasitic Nematodes to Manage White Grub

White Grubs can be an extremely damaging pest on home lawns. When populations become high, action must be taken to reduce pest numbers. One option available to home owners is application of insect parasitic nematodes. This is a form of biological control, using a beneficial organism to reduce numbers of a pest organism. To be successful with biological controls, home owners must educate themselves. They must choose the correct biological control agent, give them the environment that they need to survive, and release or apply them at the appropriate time. When using biological controls, home owners must be patient; while synthetic pesticides show immediate results, biological controls require time.

WHAT IS A NEMATODE?

Nematodes are microscopic unsegmented worms that are among the most common organisms on earth. Some species are known to seriously damage plants or parasitize animals however insect-parasitic nematodes only kill insects and are safe to use on home lawns. Insect-parasitic nematodes complete part of their life cycle inside insects. When they find a suitable insect host, they enter through natural body openings or pierce the body wall. Then they release bacteria into the insect, killing it within several days. The nematode then feeds on the bacteria and on the dead insect and reproduces inside of it. Thousands of nematodes can be produced from one parasitized insect. Nematodes typically kill their hosts 2 or 3 days after invading the body cavity. Nematodes develop from an egg, through 4 juvenile stages into an adult. Only the 3rd juvenile stage (infective juvenile) is able to parasitize an insect. This is the stage that is marketed for pest management.

Two genera of nematodes are currently being sold to manage insect pests, often in products containing a mixture of both. Their host-finding strategies are very different, thus they are effective against different pests. *Steinernema* are ambush predators which sit at or near the soil surface, waiting for a suitable insect host to move close to it. They are most effective against mobile insects like cutworms or sod web worms.

Heterorhabditis are cruiser predators; they actively move short distances through the soil seeking prey and are most effective against more sedentary insects like white grubs.

STORING, HANDLING AND APPLYING INSECT-PARASITIC NEMATODES

Nematodes must be given the correct environmental conditions before, during and after application to be effective biological control agents. **Moisture** is the most critical factor. Nematodes are able to move only short distances on their own. They move in the film of water that occurs on soil particles and in pore spaces in the soil. If the soil is saturated with water, nematodes will drown, however, they will also desiccate in a dry environment. Pre-treatment irrigation is necessary to create a moist environment for the nematodes and encourages root feeding insects to move into the root zone where nematodes will be more likely to encounter them. Nematodes move better in sandy soils, where pore spaces are larger than in more compact clay soils.

Nematodes are susceptible to extreme **temperature**. Temperatures above 32 to 35° C kill many species of *Steinernema*, and temperatures below 13°C inactivate most species of *Heterorhabditis*. Nematodes function best at temperatures between 13 and 25°C and should be applied only when the soil temperature falls within that range. Nematodes should never be left where temperatures are too high (e.g. in a hot car following purchase).

Nematodes are damaged by exposure to **ultraviolet light**. They should be applied early in the morning, at dusk or on an overcast day to minimize their exposure. Following application, the treated area should be irrigated (25 to 50 mm) to wash the nematodes off of the foliage and into the soil. An extensive thatch layer may prevent nematode penetration into the root zone.

Nematodes may be purchased in several formulations: in gels, on dry granules, on clay, on vermiculite and in water-filled sponges. They are mixed with water and applied to the surface of the grass or soil. Always follow directions on the package, but remember that if a mixture of *Steinernema* and *Heterorhabditis* is being applied, only half of the nematodes will be effective against white grub, and the rate of application should be adjusted. Hose-end sprayers, watering cans and small pressure sprayers (e.g. backpack sprayers) are all effective for application. Do not apply at high pressures (> 73 psi (5 bar)) and remove any screens or filters smaller than 0.5 mm. When applying nematodes, agitate the mixture often, as nematodes are heavier than water and will sink to the bottom of the spray tank. Nematodes should be used as soon as possible after purchase and often have a 'use by' date on the package. They cannot be stored after they have been diluted in water.

Note: Fertilizers should be avoided roughly 2 weeks prior to and 2 weeks after nematode application as they are adversely affected by high nitrogen levels.

TIMING OF APPLICATION

The pest that you are trying to control must be present and susceptible to infection when nematodes are applied. All species of white grub are present in the soil in the late summer and early fall (August-September) and this is when most damage to turf roots occurs. This is the ideal time for application of nematodes. Recent research in British Columbia suggests that later instar white grub (i.e., those present in spring) are resistant to infection by nematodes.

For more information on using insect parasitic nematodes, refer to the following web sites:

<http://www.ext.colostate.edu/pubs/insect/05573.html>

http://www.oardc.ohio-state.edu/nematodes/using_insect_parasitic_nematodes.htm

<http://www.oardc.ohio-state.edu/nematodes/biologyecology.htm>

<http://www.ento.psu.edu/extension/factsheets/nematode.htm>