FAQ's Nematodes

KOPPERT
BIOLOGICAL SYSTEMS

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1. Nematodes in general

What are nematodes?

Nematodes are microscopically small (0.6 to 1 mm), unsegmented worms that occur naturally in the soil throughout the world.

Are there different types of nematodes?

Yes, there are entomopathogenic nematodes (insect parasitic), plant pathogenic nematodes, and saprophytic nematodes. The entomopathogenic nematodes are natural enemies of a lot of insects.

Are all nematode species harmless?

No. Plant pathogenic nematodes cause harm to plants. However, entomopathogenic nematodes are 100% safe for plants, animals and humans. This is because only insects can be host to this group of nematodes. By far the most nematodes belong to the group of saprophytes. These nematodes are harmless and live of dead organic matter to provide a rich soil life.

How do entomopathogenic nematodes work?

Nematodes are actively looking for a host or using an ambush strategy to reach their host. Once in contact with a host, they try to penetrate it through a body opening. In the host, the nematodes release a bacterium that can kill the host very quickly. This bacterium also causes the host to be converted into food for the nematodes. This food enables the nematodes to complete their life cycle.

Are there different types of entomopathogenic nematodes?

Yes. The most common entomopathogenic nematodes belong to the families Heterorhabditis or Steinernema. In addition, there are a number of other families and species, but they are found in much smaller quantities.

Are the released bacteria harmful?

No. This group of bacteria is only harmful to insects and cannot survive outside an insect or in warm-blooded organisms.

Can entomopathogenic nematodes overwinter (temperate climate)?

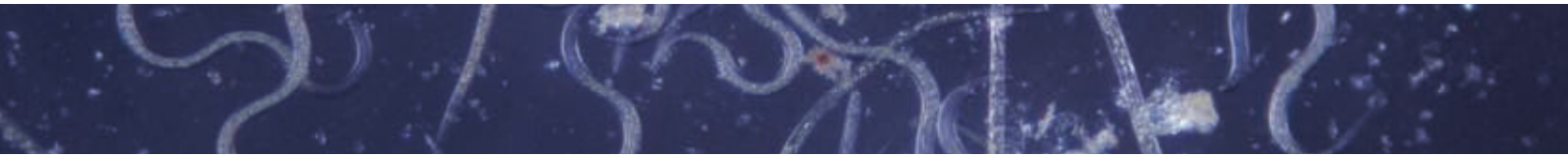
No. Nematodes cannot survive at very low temperatures and certainly not outside a host. Only if the nematode is in the host and the temperature is not too low is there a small chance that the nematodes can overwinter. However, this is never to the extent that enough nematodes are available in spring to be able to have a sufficiently controlling effect.

Do entomopathogenic nematodes work at all stages of the pest insect?

It depends. Some pests are susceptible to nematode infection in both larval and adult stages, some only during the larval stages (and some only as adults). As a general rule, nematodes have a preference for targeting young larvae, especially in the case of large insects.

Do entomopathogenic nematodes only work as a soil application?

Most are dedicated to soil pests but for several above ground pests foliar applications show good efficacy, provided the fields/greenhouses offer the optimal temperature and humidity conditions required. For instance, nematodes can be used against palm tree pests, caterpillars, thrips, Nesidiocoris, asparagus beetle, Tuta absoluta and several fruit moths and beetles….



2.1 Application

Which nematode should I use?

Please contact your advisor for the pest/target lists. This list is not exhaustive as we are routinely running bioassays to discover new targets.

How do I apply nematodes?

Nematodes should be applied with water. Once resuspended in water, the nematode suspension can be dispersed using spraying/irrigation systems most commonly used in agriculture and gardens: a watering can, backpack sprayer, Airblast sprayer or others. They can also be dispersed via drip irrigation systems with a preference for high pressure ones. Currently, only our Steinernema feltiae and Steinernema carpocapsae based nematode products can be applied with a Dosatron system. Remove filters if finer than 0.3 mm. If there is any doubt, remove all filters.

What pressure can be on the pump and the spray boom?

The pressure on the nozzle may not exceed 20 bar (190 psi), with conventional large volume nozzles.

Why should the soil be wet before/after treatment?

Nematodes are sensitive to drought. When they are introduced into a dry substrate/soil they will die. Also when the soil dries out very quickly after application. In addition, they use moisture in combination with soil particles to move. Dispersion is not possible without a water film.

How long after application should the substrate remain moist?

As long as the soil is not dry, the nematodes will survive and search for a host. It is therefore important to leave the soil moist for a few weeks after application of nematodes.

Can I apply nematodes to each substrate/soil?

No. In particular in clean rock wool slab they cannot maintain well and they will flush with the drain. (Pot) soil, on the other hand and if not too dry, is always good.
Heavy clay soil are also not optimum for nematodes. In this case, repeated applications is needed.

What are the optimal conditions for foliar applications?

Nematodes can also be used against several foliar pests (f.e. caterpillars, thrips). Their efficacy will be strictly connected to survival time on the leaves. To ensure the best results, we therefore recommend to use the nematodes when:

- Relative humidity is high (>75%); early mornings or evenings
- Solar radiation is low; early mornings or evenings
- Temperature is ideally within 15°C – 25°C (59-77°F)
- An adjuvant is recommended (ask your local consultants for compatible adjuvants)

2.2 Application

What should be the temperature of the spray water?

Preferably around 20 – 25°C (68/77°F) but certainly not above 30°C (86°F). Above 35°C (95°F), nematodes will die quickly.

Be careful about recirculation pump that may quickly warm up the spray tank water above 30°C, especially in hot seasons.

How long can I save a solution?

Once nematodes are resuspended in water, the total volume of the suspension must be sprayed immediately. Therefore a suspension cannot be saved. If the suspension is not mixed, the nematodes will sink to the bottom and die of oxygen deficiency. Therefore, a suspension must always be kept in motion or aerated.

Which pH and EC values are safe?

pH values between 4-8 and EC values up to 5 are safe for nematodes.

With which pesticides/fungicides can I mix a nematode product?

Nematodes are quite insensitive to many types of pesticides and can thus be sprayed easily after a pesticide treatment or even sometimes tank-mixed. For a complete list of side effects, check the Koppert Side Effect List on: https://www.koppert.com/side-effects/ or download the app. Tank mix with foliar fertilisers must be avoided.

When can I expect effect? How fast do the nematodes work?

Under optimum conditions, a nematode can kill an insect in 24-48 hours. Under practical conditions, a nematode will first have to look for a host. The effect of treatment is thus strongly dependent on how quickly a nematode has found a host.

Is the effect visible?

Infected larvae will change color because of the growth of the bacteria and nematodes. In case of Heterorhabditis pink-reddish and Steinernema yellow-brownish. Under practical conditions, infected insect larvae will quickly become slimy and thus will no longer be found. In practice, the decrease of pest pressure is the only indication that the application has been effective.

How long do the nematodes work / can they survive after application?

Under the right conditions, nematodes can, depending on their energy reserves, stay alive in the soil for a few weeks and look for a host.

3. Regulatory

Do I need a spray license to apply nematodes? Do nematodes require a Phytosanitary registration?

Nematodes are considered as natural enemies in most countries, so for applying nematodes no license is required. They are therefore exempt of pesticide regulations. However, some countries may require local permits. Check with your local Koppert consultant and/or your local authorities if any doubt.

Are nematodes compatible with organic farming?

In many countries they are considered as natural enemies (macrooganisms) and can therefore be used in organic farming. Local registration requirements and retail demands can differ, so always check the local situation in your country.

Our nematode products Entonem and Capsanem are OMRI listed, meaning that this formulation has been reviewed by OMRI against the USA and Canadian organic standards. Scia-Rid and Capirel are submitted as well.

4. Packaging and formulation

What is the substance the nematodes are packed in?

In order for the nematodes to survive during transport and storage they need to be packed in a carrier material. This carrier material which can be called a “hydrogel” is based on hygroscopic molecules that are safe for the users and the crops.

Is the gel harmful for humans?

No, the gel is not harmful to humans.

Is the gel harmful for the environment?

No, the gel is not harmful to the environment, fish, micro-organisms and soil organisms. In addition the gel does not bioaccumulate in the biosphere.

5. Handling & Storage

How do I store the product?

The product must be stored in a ventilated refrigerator between 2-6°C (35-43 °F). Upon reception of the nematodes, generally shipped in cool boxes, it is highly recommended to remove them from the cool box as soon as possible and store them preferably unstacked, in a fridge or a ventilated cool room, between 2 to 6°C (35-43 °F). This will maximize the nematodes shelf life. Freezing will be lethal.

If impossible to remove them from the cool boxes, keep the cool boxes lid open upon reception.

How long can I keep the product?

Nematodes can be stored in a ventilated refrigerator until the expiry date. For long storage, it is recommended to avoid stacking up the packs in order to maintain a good oxygen level.

Are the nematodes dead after reaching the 'use by' date?

No. However, we can no longer guarantee that the indicated numbers of nematodes on the pack are still active. As a result, the efficacy can no longer be guaranteed. It does not mean that, i.e. 1 week after "use by "date, no effects are to be expected.