

## BENEFICIAL USES OF ENTOMOGENOUS NEMATODES IN AGRICULTURE

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Due to the recent progress in mass production, the entomogenous nematodes, *Steinernema* and *Heterorhabditis* based products are commercially available for insect control. Wide interest in these nematodes reflects their impressive attributes for biological control, particularly the broad spectrum of activity against many species of insect pests in many different orders and the ability to kill the insect host within 24-48 hours.

What makes these nematodes so attractive as alternative control agents is that they do not harm the environment and are safe to non target organisms. Numerous publications have described these attributes in detail. Presently the Environmental Protection Agency does not require the registration of entomogenous nematode based products under the Federal Insecticide Fungicide and Rodenticide Act.

Many factors affect our ability to place quantities of nematodes on or in close proximity to the target host to produce optimal results at the lowest possible cost. Application methods and timing are crucial for success; however, without proper consideration to a reliable and stable formulation, successful application of entomogenous nematodes is not very probable. Substantial improvement in formulation stability has been obtained by immobilizing or partially desiccating the nematodes on specific carriers. Apparently, these carriers reduce nematode metabolism, improving their tolerance to temperature. The storage period for such formulations is related to the oxygen and/or moisture requirements for the nematodes.

As with chemical pesticides, selection and use of application equipment are of utmost importance and deserve major emphasis when considering nematode application. Fortunately nematodes can normally be applied through conventional application or irrigation systems if nozzle diameters are at least one micron in size or larger and system pressures do not exceed 300 pounds per square inch. In spite of these limitations, nematode products have been introduced successfully in markets where safety and/or the use of restricted insecticides is an issue.

In recent years, efforts made to narrow the efficacy gap between chemical pesticides and nematodes have been successful in various market segments. Research efforts towards adopting a quality control procedure, selection of suitable target environments and target insects for nematodes, selecting effective nematode strains and dosages, proper timing of application, and selecting appropriate methods of application or delivery to increase the probability of successful insect-nematode interaction have been instrumental in commercializing these entomogenous nematodes.

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