
IPM Fact Sheet Series**UMass Extension Fruit Team**
Fact Sheet #IPMG 002

Insect Pest-Suppressive Soils

Overview: Suppressive soils are described as soils in which disease severity remains low in plants, despite presence of a pathogen, susceptible host, and climatic conditions favorable for disease development. Suppressive soils have micro-organisms that do not allow pathogens to establish or cause severe disease. These soils can be enhanced by adding compost or other sources of carbon and energy.

Insect pest suppressive soils refers to soils with a diversity of microorganisms that help manage soil-dwelling pest population. When soil is maintained in ways that promote diversity, populations of entomopathogenic nematodes (EPN), entomopathogenic fungi (EPF), and bacteria/protozoa will affect soil dwelling pest populations. Maintaining the orchard floor to promote EPN and EPF populations that will help suppress pests.

In agricultural fields it has been shown that there is a relatively low concentration of EPN and parasitic nematodes (PN), but a relatively high concentration of EPF, neither in high enough concentrations to be effective against soil dwelling pests. Chemicals, strong UV light, and tillage are some reasons why their concentrations are so low. In fruit orchards one of the main reasons concentrations are so low is because of chemical use.

Important Soil Microorganisms:

Entomopathogenic nematodes cause death to insects by entering a host's body and producing bacteria that dissolve the host tissues. This allows the nematode to feed on the host and reproduce. The host eventually bursts, releasing infective juveniles (Figure 1).



Figure 1. Wax moth larvae that have been infected with entomopathogenic nematodes. Photo credit: Peggy Greb, USDA Agricultural Research Service, Bugwood.org

Entomopathogenic fungi attach to the outside of insects in the form of spores. As the spores germinate, they work their way inside the insect which eventually leads to death or serious disability of the insect. (Figure 2)



Figure 2 Grasshoppers that have been infected with entomopathogenic fungus. Stefan Jaronski - This image was released by the Agricultural Research Service, the research agency of the United States Department of Agriculture, with the ID k11446-1

Ways to promote EPNs and EPFs:

One way to ensure high enough concentrations of EPNs and EPFs would be to purchase and release them in the soil. Different EPN/EPF species effect different pests making it important to select the species for your specific pest needs. Beneficial organisms can be purchased through online vendors. Species and application rates may vary. Arbico Organics website is very easy to follow for the purchase of EPNs. They have different species and list what they control as well as how many are needed per acre or sq. ft.

After application, it is important to keep EPN/EPF species alive and thriving. This can be done through the avoidance of agrochemicals. Attract and kill methods are an effective way to limit the use of agrochemicals across an orchard. Limiting pruning actions and soil disturbances throughout the season will also promote EPN/EPF growth. Another way to promote their wellbeing is through the use of certain plants to help support alternative hosts. In orchards, legume species can be planted under fruit trees to promote *Sitona* weevils, which are hosts to EPN. Because these weevils mainly feed on the foliage of legume plants, they are not a threat to fruits, making them an ideal EPN host in orchards. Many pest insect larvae also make good hosts, like plum curculio which spends larval and pupal stages in soil under apple trees. An increase in host insects leads to a natural increase in concentrations of EPN. Although it is still being studied, populations of many nematode species are suspected to decline during the winter since they become dormant. It is unknown if reapplication would be needed every season for areas that experience winter.



Figure 1. *Sitona* weevil, a good host for entomopathogenic nematodes. Photo credit: Andrew Weeks, Cesar Australia

Suppressive soils, both for pathogens and pests, allow growers a chemical free and organic option for disease and pest control. With relatively low maintenance and products that are not harmful to people, pets, or crops this is a viable option.

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