

# Using Biological Fungicides in an Integrated Disease Management Program

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**M**any growers are including bio fungicides in their disease management program. In recent years, several products have become commercially available including: Mycostop (dried spores and mycelium of the fungus *Streptomyces griseoviridis*); SoilGard (*Gliocladium virens*); and RootShield (*Trichoderma harizianum*). In addition, the Connecticut based Earthgro company produces a growing mix inoculated with the beneficial fungus *Trichoderma hamatum* and the bacterium *Flavobacterium balustinum*. In general, more products are available for use against soilborne diseases compared to foliar diseases. The nutrient rich soil environment tends to be more favorable to natural biocontrol agents. There are fewer changes in temperature and moisture in the soil compared to the above ground environment. However, some natural biocontrol

agents for foliar diseases may become available in the near future.

Some advantages of biofungicides include: 1) they are considered safe to humans, animals, plants and the environment; 2) they are generally reduced risk pesticides with lower re-entry intervals compared to chemical fungicides and 3) due to their more diverse mode of action, it is less likely for biofungicides to develop resistance than with chemical fungicides.

Biofungicides contain living organisms, so growers need to be aware of their mode of action and how to most effectively use biofungicides to manage plant diseases. Biofungicides can work in a number of ways including 1) hyperparasitism (the direct parasitism of the pathogen by the biological control agent); 2) antibiosis (the production of compounds and secondary metabolites that inhibit the growth of pathogens) and 3) competition for nutrients and ecological niches in the environment. Some beneficial fungi have more than one mode of action, for example, competition and hyperparasitism.

In this article, I will focus on discussing the beneficial fungus, *Trichoderma*. Its primary mode of action is competition, as the fungus colonizes the host's roots feeding on root exudes and carbohydrates. This living microbe needs soil temperatures above 50°F and adequate soil moisture to survive and reproduce. It may last in the soil for up to 3 to 4 months. For long term crops such as perennials, two applications in the spring and fall may be needed. RootShield can be stored below 80°F for up to 6 to 12 months.

*Trichoderma* fungi are naturally found in many different types of agricultural soils and in decaying wood. RootShield contains a specific strain of the fungus, *T. harizianum* Rifai KRL-AG2. This strain is much more effective than the naturally-occurring *Trichoderma* because of its ability to colonize actively growing root tips.

RootShield is available as a drench or in granular form for growers mixing their own media. The drench formulation may be applied through an injector system, but due to the inert clay carrier, it is important to keep the solution well agitated. RootShield is labeled for use against *Pythium*, *Rhizoctonia* and *Fusarium* on greenhouse and nursery ornamental crops. It is also labeled for cabbage, tomatoes and cucumbers and the manufacturer hopes to include more vegetables on the label in the near future (pending EPA approval).

RootShield is a protectant fungicide and needs to create a protective barrier before root disease starts. Due to its mode of action, colonizing and protecting young root tips from pathogen attack, it is a protectant and not a curative fungicide. If you see signs of *Pythium*, *Rhizoctonia* or *Fusarium*, you need to treat with a chemical

fungicide before applying RootShield. Because it is effective against soilborne diseases, *Trichoderma* will not control the stem and web blight phase of *Rhizoctonia*.

The manufacturer states that it is best to avoid the application of chemical fungicides for at least one week before and after a RootShield application. RootShield is compatible with Terrazole, Rubigan, Aliette, Chipco 26019, Dithane, Terraclor, Cleary's 3336 and Ornalin. Incompatible fungicides can inhibit this beneficial fungus, so contact the manufacturer (BioWorks) for more information.

RootShield is best used in conjunction with a regular monitoring program where root health and crop quality is evaluated. It should be used in an integrated disease management program consisting of proper cultural practices and sanitation, and close monitoring of plant health.

*Trichoderma* has also been shown to increase plant growth shortening production time. Researchers have shown an increase in growth in a wide range of bedding plants including alyssum, marigolds, peppers, periwinkle, petunia and geranium. Increased root growth can also benefit vegetable transplants transplanted in the field and increase plant yields. In the field, sweet corn varieties that have poor stress tolerance at planting also show an increase in growth. It is thought that this increase in growth may occur in two different ways. First, *Trichoderma* fungi may antagonize minor soil borne pathogens that stunt but do not kill roots. Secondly, *Trichoderma* fungi may produce a growth-stimulating factor.

Researchers have investigated the control of soil borne pathogens since the 1930s. However, because of the complexity of the soil environment, much more work needs to be done. Research results need to be interpreted with caution because the researchers inoculate the test plants with pathogens providing a higher degree of disease pressure than a grower would normally encounter in a commercial greenhouse. Some products may work more effectively in combination. Keep records of your crop size, flowering date and root health to evaluate the effectiveness of biofungicides in your greenhouse operation.

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