

## 21. Managing Plant Diseases with Biofungicides (HortReport, November 2002)

Diseases in greenhouse vegetables and floriculture crops can be managed effectively with biological fungicides (biofungicides). A biofungicide is composed of beneficial microorganisms, such as specialized fungi and bacteria that attack and control plant pathogens and the diseases they cause (USDA). These specialized fungi and bacteria are microorganisms that normally inhabit most soils. Biofungicides can be a viable alternative to chemical fungicides and can be used as part of an integrated disease management program to reduce the risk of pathogens developing resistance to traditional chemical based fungicides.

An example of a widely used commercial biofungicide in the greenhouse industry is *Trichoderma harzianum* (TH) strain T-22 (Plantshield™). TH protects plant roots from pathogens such as *Pythium*, *Rhizoctonia*, *Fusarium*, *Sclerotinia*, and *Thielaviopsis*. TH will also suppress foliar diseases such as *Botrytis* and powdery mildew.

To optimize the effectiveness of TH or any other biofungicide, apply before the onset of disease development (preventative treatment) since they will not “cure” pre-existing pathogens. Early application of the biofungicide protects the roots against bad fungi, allowing for better development of root hairs. Always use biofungicides in conjunction with standard disease cultural controls including sanitation, and weekly scouting.

### How do biofungicides suppress diseases?

There are four mechanisms by which a biofungicide controls other microorganisms.

1. **Direct competition** – Before root infection can occur, pathogens must gain access to the zone closely associated with the root called the rhizosphere. A biofungicide “shields” the root by growing a defensive barrier around the roots, thus preventing the harmful fungi from attacking the root.
2. **Antibiosis** – the biofungicide produces a chemical compound such as an antibiotic or other toxin that kills the target organism.

3. **Predation or parasitism of the target organism** – the biofungicide attacks and feeds on the pathogen. For this mechanism to be effective, the biofungicide must be present in the rhizosphere at the same time or before the pathogen appears.
4. **Induced resistance to the host plant** – the biofungicide triggers the plant to turn on its own defense mechanisms.

### Biological fungicide products

Biofungicides, like chemical fungicides, must be registered by the EPA. Growers must read and follow the label to determine if the intended use has been approved. Always read the label. Here are a few examples of biofungicides used in the greenhouse industry.

#### AQ10™

- Biocontrol organism – *Ampelomyces quisqualis* isolate Q-10
- Target Pathogen – powdery mildew
- Crops – apples, cucurbits, grapes, ornamentals, and tomatoes
- Manufacturer – Ecogen, Inc.  
[www.agrobiologicals.com](http://www.agrobiologicals.com)

#### Companion™

- Biocontrol organism – *Bacillus subtilis* GB03 bacteria
- Target Pathogens – *Pythium*, *Rhizoctonia*, *Phytophthora*, and *Fusarium*
- Crops – bedding plants, foliage plants, and woody ornamentals
- Manufacturer – Growth Products,  
[www.growthproducts.com](http://www.growthproducts.com)

#### Mycostop™

- Biocontrol organism – *Streptomyces griseoviridis* strain K61
- Target Pathogens – *Fusarium* spp., *Alternaria brassicola*, *Phomopsis* spp., *Botrytis* spp., *Pythium* spp. and *Phytophthora* spp.

- Crops – field, ornamental and vegetable crops
- Manufacturer – Kemira Agro Oy
- Distributor – AgBio Development Inc.  
[www.agbio-inc.com](http://www.agbio-inc.com).

#### Plantshield™

- Biocontrol organism – *Trichoderma harzianum* strain T-22
- Target Pathogens – *Pythium* spp, *Rhizoctonia solani*, *Fusarium* spp, *Sclerotinia*, and *Thielaviopsis*
- Crops – trees, shrubs, transplants, ornamentals, cabbage, tomato, and cucumber
- Manufacturer – Bioworks, Inc.  
[www.bioworksbiocontrol.com](http://www.bioworksbiocontrol.com)

#### Soilgard™

- Biocontrol organism – *Gliocladium virens* GL -21
- Target Pathogens – *Rhizoctonia solani*, and *Pythium* spp.
- Crops – ornamental and food crops grown in greenhouses, nurseries, homes and interiorscapes.
- Manufacturer – Certis, Inc.  
[www.certisusa.com](http://www.certisusa.com)

A list of commercially available biological fungicide products can be found at this web site,  
[www.oardc.ohio-state.edu/apsbcc/productlist.htm](http://www.oardc.ohio-state.edu/apsbcc/productlist.htm).

#### Advantages of using biofungicides

- Reduces the use of chemical fungicides.
- In most cases are safer to use and have a lower reentry interval.
- Many products can be used by organic growers (listed by the Organic Materials Review Institute, OMRI,  
<http://www.omri.org>).
- In most cases, they are less phytotoxic.
- Many products can be used in rotation with chemicals (fungicides, insecticides, fertilizers, rooting compounds).

#### Disadvantages of using biofungicides

- Biofungicides do not eradicate the disease or “rescue” the host plant from infection.
- Biofungicides may have shorter shelf life than chemical controls.

Look for more of these biological fungicides to be developed and registered for the greenhouse industry. Recently, investigators at Penn State were awarded grant monies from the PA Dept of Agriculture research funds to study plant elicitors. These naturally occurring compounds activate the plant’s own defenses against a broad spectrum of insect, mite, and plant pathogen pests. Most of the research will be focused in greenhouse tomato production.