

Biofungicides and Chemicals for Managing Diseases in Organic Vegetable Production

Prepared by

Roger Francis, Clemson University Agriculture Extension Agent
and Dr. Anthony Keinath, Clemson University Plant Pathologist

What is a biofungicide? Biofungicides are microorganisms (microbial pesticides) and naturally occurring substances that control diseases (biochemical pesticides) that are approved for organic production.

Biofungicides are widely used by organic vegetable growers to control selected foliar and soilborne diseases of vegetable crops (see Table 1). Biofungicides can be applied as a stand-alone treatment to control a target disease, provided the application is made before the disease starts. However, a better practice is to combine a biofungicide with cultural practices, which will probably result in better disease management.

In an organic vegetable production system, growers should adopt and implement integrated pest management (IPM) practices such as field scouting for disease incidence, disease symptom identification, crop rotation, and field sanitation. These practices will help the grower to make good decisions that will improve disease management on their farm.

Finding suitable biofungicides and chemicals for use in organic vegetable production is sometimes difficult and frustrating for growers. Agro-chemicals used in an organic production system must be approved by the Organic Material Review Institute (OMRI) or by the National Organic Program (NOP). Table 1 is a list of biofungicides that are approved by the Environmental Protection Agency (EPA) and are listed by OMRI for use in organic production.

Table1. List of biofungicides (biologicals) used to control selected vegetable crop diseases.

Product	Active Ingredient	Disease	REI	PHI	Treatment Site	OMRI	Company
Ballad	<i>Bacillus pumilus</i>	Several (Foliar)	4-hr	0 day	Foliar	Approve	AgraQuest
Bio-Save	<i>Pseudomonas syringe</i>	Post-harvest	N/A	N/A	Irish and sweet potatoes in storage	N/A	Jet Harvest Solutions
Contans	<i>Coniothyrium minitans</i>	White Mold	4-hr	N/A	Soil applied	Approve	Advan LLC
Kodiak ¹	<i>Bacillus subtilis</i>	<i>Pythium, Rhizoctonia, Fusarium</i>	N/A	N/A	Seed treatment, beans only	Approve	Gustafson, LLC
Mycostop ²	<i>Streptomyces griseoviridis</i>	Several	4-hr	0	Greenhouse; Soil applied	Approve	Ag-Bio, Inc
PlantShield HC	<i>Trichoderma harzianum</i>	Root diseases	N/A	N/A	Soil applied	Approve	Bioworks, Inc
Regalia	Plant extract	Powdery mildew	1day	1 day	Foliar	Approve	Marrone BioInnovations
RootShield Granules, RootShield WP	<i>Trichoderma harzianum</i>	<i>Pythium, Rhizoctonia, Fusarium</i>	N/A	N/A	Soil applied	Approve	Bioworks, Inc
Serenade	<i>Bacillus subtilis</i>	Powdery mildew, other foliar diseases	4-hr	0	Foliar	Approve	AgraQuest
Sonata	<i>Bacillus pumilus</i>	Downy and powdery mildew, rust	4-hr	0	Foliar	Approve	AgraQuest
T22-HC	<i>Trichoderma harzianum</i>	<i>Pythium, Rhizoctonia, Fusarium</i>	N/A	N/A	Soil applied	Approve	BioWorks, Inc
Surround	Kaolin	Powdery mildew	0	0	Foliar	Approve	Englehard
Trilogy	Neem Oil	Powdery mildew	4hr	0	Foliar	Approve	Certis USA, LLC
Actinovate AG	<i>Streptomyces lydicus</i>	<i>Fusarium, Rhizoctonia, Pythium, Phytophthora</i>	0	0	Soil applied Foliar	Approve	Natural Industries
SoilGard	<i>Gliocladium virens</i>	Damping off	0	N/A	Greenhouse-transplants, soil applied	Approve	Certis, LLC

Source: Products for Managing Diseases in Organic Vegetables; McGrath. M., Cornell Univ. LIHREC, Riverhead, NY

Company web site or product label

¹ Only Concentrate is OMRI approve

² Works best under cool temperature

Chemicals

Organic chemicals are approved for use in organic production systems. There is a wide range of products that fall under this classification that are OMRI approved. Organic growers should apply the same principles of disease management in an organic production system as in a conventional production system. Growers should adopt and implement an IPM program, practice rotating chemicals, scout their fields weekly, and identify disease symptoms to select the proper chemical. These practices will help to reduce the development of resistance, reduce production costs, and improve farm earnings. Table 2 is a list of some of the chemicals that are currently available for use in organic production cropping systems.

Table 2. Chemical control products for organic plant disease management.

Product Name	Active Ingredient	Disease	REI	PHI	OMRI	Company
Champion	Copper hydroxide	Various	1 day	1day	Approve	NuFarm Americas Inc.
JMS Stylet-Oil	Parafinic Oil	Powdery mildew	0	0	Approve	JMS Flower Farm
Nordox ®	Copper oxide	Various	1 day	1 day	Approve	AgBio, Inc
Oxidate	Hydrogen peroxide	Various	0	0	Approve	Biosafe Systems
Sulfur	Sulfur	Powdery mildew	1 day	0	Approve	various

Source: Products for Managing Diseases in Organic Vegetables; McGarth. M., Cornell Uni. LIHREC, Riverhead, NY
Product label
® Restricted use

The biofungicides and chemicals listed in both tables have not been tested for efficacy under local environmental conditions. Although only the main diseases are listed in the tables above, the label for each chemical might list several other diseases, pathogens and plant pests the product will control. Growers should note that powdery mildew is the main foliar disease listed for control by these organic chemicals. Therefore, precautionary measures should be taken to prevent the development of fungicide resistance in powdery mildew.

Some of the chemicals listed are oil-based and care must be taken when applying these chemicals to prevent plant injury. To prevent injury, oil-based chemicals should not be applied when daytime temperature is high. These chemicals should be applied during the cooler part of the day.

Growers should read and follow label instructions of the biofungicides and organic chemicals used.

This fact sheet might be more appropriate for large organic growers since the products listed are only available in large quantities. Growers should also note that the list of products provided is not final; new products may be added while some might be removed.

Clemson University Cooperative Extension Service offers its programs to people of all ages, regardless of race, color, sex, religion, national origin, disability, political beliefs, sexual orientation, marital or family status and is an equal opportunity employer.
Clemson University Cooperating with U.S. Department of Agriculture and South Carolina Counties.