

Biopesticides for Managing Diseases of Beet Organically

Margaret Tuttle McGrath

Plant Pathology & Plant-Microbe Biology, Cornell University

Long Island Horticultural Research & Extension Center

3059 Sound Avenue, Riverhead, NY 11901; mtm3@cornell.edu

More information at: <http://livegpath.cals.cornell.edu/organic/organic-management-of-vegetable-diseases/>

Following is a list of some biopesticides labeled for disease control in beets. The active ingredient follows product name. Most products are labeled for managing multiple diseases on many crops. The diseases of beets that are specified on these labels and occur in the northeastern U.S. are included. Some products are labeled broadly (general label) with separate lists for crops and target diseases and pathogens. Products listed with OMRI (Organic Materials Review Institute) are NOP compliant. Check state registration: each product may not be registered in all states. Also, always check with your certifier before purchasing any product. 'No Ag Label' indicates an agricultural label was not found for product. This list does not include the few conventional biopesticides (e.g. phosphorous acid fungicides) that are not permitted in organic production.

Actinovate AG. 0.0371% *Streptomyces lydicus* strain WYEC 108. Labeled for Rhizoctonia canker (*Rhizoctonia solani*) and Alternaria leaf spot. For best results with applications to foliage, label indicates to use a non-ionic spreader-sticker. OMRI-listed. EPA Reg. No. 73314-1. Monsanto BioAg.

Amplitude. 96.4% *Bacillus amyloliquefaciens* strain F727 cells and spent fermentation media. Labeled for white mold and also as soil treatment in furrow for root pathogens (*Fusarium*, *Phytophthora*, *Pythium*, *Rhizoctonia*, and *Verticillium*). OMRI-listed. EPA Reg. No. 84059-28. ProFarm Group (Formerly Marrone Bio Innovations, Inc).

Aviv. 0.08% *Bacillus subtilis* strain IAB/BS03. Labeled for early blight (*Alternaria* spp.), white mold (*Sclerotinia sclerotiorum*) and common scab (*Streptomyces scabies*), and also as soil treatment for root pathogens (*Fusarium*, *Phytophthora*, and *Rhizoctonia*). Replaces Prevont. OMRI-listed. EPA Reg. No. 91473-1-86182. Seipasa S.A.

BioST Nematicide 100. 95% heat-killed *Burkholderia* spp. strain A396 cells and spent fermentation media. Labeled for several nematodes including root-knot. OMRI listed. EPA Reg. No. 84059-14-42750. Albaugh, LLC.

Bio-Tam. 2% *Trichoderma asperellum* strain ICC 012 and 2% *Trichoderma gamsii* strain ICC 080. These beneficial fungi have different modes of action and are active over different temperature ranges (starting at 45°F) and environmental conditions. Labeled for application to soil for diseases caused by *Fusarium*, *Phytophthora*, *Pythium*, *Rhizoctonia*, and *Sclerotinia*. General label. OMRI-listed. EPA Reg. No. 80289-9-69592. Isagro USA; distributed by Bayer CropScience.

Brandt Organics Aleo. 78% garlic oil. Labeled generally for bacterial and fungal pathogens and diseases including *Pseudomonas* spp., *Pythium irregulare*, *Rhizoctonia solani* and white mold (*Sclerotinia sclerotiorum*). OMRI listed. Exempt from EPA registration. Brandt Consolidated, Inc.

Cinnerate. 60% cinnamon oil. Labeled for use on beets but no labeled diseases affect beets in the northeast. OMRI-listed. Exempt from EPA registration. Seipasa S.A.

Companion. 0.03% *Bacillus subtilis* strain GB03. Broadly labeled for foliar and soil-borne diseases, including early blight (*Alternaria* spp.) and root rot (*Pythium* spp. and *Rhizoctonia solani*). EPA Reg. No. 71065-3. Growth Products, Ltd.

Double Nickel 55 LC and WDG. *Bacillus amyloliquefacinens* strain D747, 98.8% and 25%, respectively. Labeled for white mold (*Sclerotinia sclerotiorum*), cavity spot (*Pythium* spp.), damping off, seedling blights, and root or crown diseases caused by *Pythium*, *Fusarium*, and *Rhizoctonia* spp. OMRI-listed. EPA Reg No. 70051-107 and 108, respectively. Certis USA, LLC.

ECOWORKS EC. 70% cold pressed neem oil. Labeled generally for diseases including leaf spot and also several insects and mites. OMRI-listed. EPA Reg. No. 89152-4. ECOSTADT Technologies LLC.

GreenFurrow BacStop. Clove 7.5%, Rosemary 3.5%, Peppermint Oil 3.2%, Cottonseed Oil 3.2%, Thyme 3.0%, Garlic 3.0%, Cinnamon 2.0%. Broadly labeled primarily for bacterial diseases and also common scab, early blight and late blight. Recommended used with GreenFurrow EF400 for these and some other diseases. Exempt from EPA registration. Mar Vista Resources.

GreenFurrow EF 400. Clove 5.6%, Rosemary 7.1%, Peppermint Oil 11.3%, Cottonseed Oil 10.5%. Broadly labeled including early blight, late blight and white mold (*Sclerotinia*). Exempt from EPA registration. Mar Vista Resources.

Howler. 50% *Pseudomonas chlororaphis* strain AFS009. Labeled for foliar spray for *Alternaria* leaf spot and *Rhizoctonia* stem canker and crown rot, and soil treatment for *Pythium* damping off. OMRI listed. EPA Reg. No. 91197-3-92488. AgBiome Innovations Inc.

KeyPlex 350 OR. 0.063% yeast extract hydrolysate from *Saccharomyces cerevisiae*. Combination of defensive proteins (alpha-keto acids) and secondary and micronutrients. Elicits systemic acquired resistance in plants against fungal and bacterial pathogens. Labeled for general disease control in vegetables. EPA approval for organic production. EPA Reg. No. 73512-4. KeyPlex.

LifeGard WG. 40% *Bacillus mycoides* isolate J. Biological Plant Activator. Labeled for *Cercospora* leaf spot (*Cercospora beticola*). OMRI-listed. EPA Reg No. 70051-119. Certis USA, LLC.

Majestene. 94.5% heat-killed *Burkholderia* spp. strain A396 cells and spent fermentation media. Bionematicide for root-knot, lesion, and other parasitic nematodes. Controls by contact and ingestion. OMRI-listed. EPA Reg. No. 84059-14. ProFarm Group (Formerly Marrone Bio Innovations, Inc).

MeloCon WG. 6% *Paecilomyces lilacinus* strain PL251. This soil fungus parasitizes many types of plant parasitic nematodes, including root knot and root lesion, without adverse impact on beneficial nematodes. OMRI-listed. EPA Reg No. 72444-2. Certis USA, LLC.

MilStop. 85% potassium bicarbonate. Broadly labeled including *Alternaria* blight, *Cercospora* leaf spot and scab. OMRI-listed. EPA Reg. No. 70870-1-68539. BioWorks, Inc.

Mycostop. 35% *Streptomyces griseoviridis* strain K61. Can be incorporated in potting mix, applied as a seed treatment, used as a transplant dip, and applied to soil as a spray, drench, or through drip irrigation. Labeled generally for use on vegetables and some other specified crops for seed and root rots caused by *Fusarium*, *Pythium*, *Phytophthora* and *Rhizoctonia*. OMRI listed. EPA Reg No. 64137-5. Lallemand Plant Care.

Organocide. 5% sesame oil. Labeled generally for use on vegetables for fungal diseases and insects. OMRI-listed. Exempt from EPA registration. No Ag Label. Organic Laboratories, Inc.

OSO. 5% Polyoxin D zinc salt. Labeled for *Alternaria* leaf spot (*Alternaria* spp.). OMRI-listed. EPA Reg No. 68173-4-70051. Certis USA, LLC.

OxiDate 2. 27% hydrogen dioxide and 2% peroxyacetic acid. Labeled for bacterial leaf spot, early blight, leaf spot, and root rot caused by *Rhizoctonia*. OMRI-listed. EPA Reg. No. 70299-12. BioSafe Systems, LLC.

PerCarb. 85% Sodium carbonate peroxyhydrate. Labeled for *Alternaria* leaf spot, bacterial leaf spot, leaf spot and white mold. OMRI-listed. EPA Reg. No. 70299-15. BioSafe Systems, LLC.

Prestop. 93% *Gliocladium catenulatum* strain J1446. Broadly labeled for seed-borne and soil-borne diseases (such as those caused by *Phytophthora*, *Pythium*, *Rhizoctonia*, and *Sclerotinia*) and foliar diseases caused by pathogens such as *Alternaria*. Can be incorporated in potting mix, applied to soil and to foliage. OMRI-listed. EPA Reg. No. 64137-13. Lallemand Plant Care.

Prevont. Renamed AVIV.

Regalia. 5% Extract of *Reynoutria sachalinensis*. Boosts the plant's natural defense mechanisms against certain fungal and bacterial diseases. Labeled for leaf spot (*Cercospora* spp.), *Pythium* spp. and *Rhizoctonia* spp. OMRI-listed. EPA Reg. No. 84059-2. ProFarm Group (Formerly Marrone Bio Innovations, Inc).

RootShield WP and Granules (formerly T-22 HC and PlantShield HC). 1.15% *Trichoderma harzianum* Rifai strain KRL-AG2. Protects plant roots against fungal pathogens such as *Fusarium*, *Pythium*, *Phytophthora*, and *Rhizoctonia*. The biocontrol fungus accomplishes this by growing on roots and releasing enzymes that dissolve the cell wall of many fungal pathogens, which it consumes. OMRI-listed. EPA Reg. No. 68539-3 and -7 for Granules and WP formulations, respectively. BioWorks, Inc.

RootShield Plus WP. 1.15% *Trichoderma harzianum* Rifai strain T-22 and 0.61% *Trichoderma virens* strain G-41. See previous product. OMRI-listed. EPA Reg. No. 68539-9. BioWorks, Inc.

Serenade ASO. 1.34% *Bacillus subtilis* strain QST 713. Replaced Serenade Soil. This bacterium colonizes roots and produces compounds that affect pathogens directly and triggers metabolic pathways to activate the plant's natural defenses and modulate growth. Labeled for foliar application targeting *Alternaria* leaf blight (*Alternaria* spp.), leaf spot (*Cercospora* spp.), white mold (*Sclerotinia sclerotiorum*) and common scab (*Streptomyces scabies*), and applied to soil for *Fusarium*, *Pythium*, and *Rhizoctonia*. OMRI-listed. EPA Reg. No. 264-1152. Bayer CropScience.

Serenade Opti. 26.2% *Bacillus subtilis* strain QST 713. Labeled for white mold (*Sclerotinia sclerotiorum*). OMRI-listed. EPA Reg. No. 264-1160. New formulation. Previous product names and formulations: Serenade, Serenade Max, Serenade Optimum. Bayer CropScience.

Serifel. 9.9% *Bacillus amyloliquefacinens* strain MBI 600. Labeled for white mold (*Sclerotinia sclerotiorum*), *Pythium* damping off (*Pythium* spp.) and *Rhizoctonia* damping off (*Rhizoctonia solani*). OMRI-listed. EPA Reg No. 71840-18. BASF Corporation.

Sil-Matrix. 29% Potassium silicate. Generally labeled for fungal diseases in field and greenhouse production. Labeled for use on beets but no labeled diseases affect beets in the northeast. OMRI-listed. EPA Reg. No. 82100-1. PQ Corporation.

Sonata. 1.38% *Bacillus pumilus* strain QST 2808. Labeled for use on beets but no labeled diseases affect beets in the northeast. OMRI-listed. EPA Reg. No. 264-1153. Bayer CropScience.

Sporan EC². 16% rosemary oil, 10% clove oil, 10% thyme oil, 2% peppermint oil. Labeled for bacterial spot, early blight and black root rot. OMRI-listed. Exempt from EPA registration. KeyPlex.

Stargus. *Bacillus amyloliquefacinens* strain F727. Labeled for early blight (*Alternaria* spp.) Cercospora leaf spot (*Cercospora beticola*), Pythium root and damping off, Rhizoctonia root rot (*Rhizoctonia solani*), and Sclerotinia white mold (*Sclerotinia sclerotiorum*). OMRI-listed. EPA Reg. No. 084059-28. ProFarm Group (Formerly Marrone Bio Innovations, Inc).

Taegro 2. 13% *Bacillus subtilis* var. *amyloliquefaciens* strain FZB24. Labeled for suppression of seedling diseases caused by the soil-borne pathogens *Phytophthora*, *Pythium*, and *Rhizoctonia*. OMRI-listed. EPA Reg. No. 70127-12. Novozymes Biologicals, Ind.

Tenet WP. Same as Bio-Tam. OMRI-listed. EPA Reg. No. 80289-9. Isagro USA; distributed by SipcamAdvan.

TerraClean 5. 27% hydrogen dioxide and 5% peroxyacetic acid. Generally labeled for application to soil for control of soil-borne plant diseases such as those caused by *Fusarium* (root rot), *Phytophthora* (blights, rots), *Pythium*, and *Rhizoctonia*. Beet is not one of the listed crops, but the list is preceded by 'including but not limited to'. TerraClean 5 penetrates soil to kill and suppress pathogens, and it releases vast amounts of oxygen that stimulates root development, nutrient uptake, and thus plant growth. OMRI-listed. EPA Reg. No. 70299-13. BioSafe Systems, Inc.

Thyme Guard. 23% thyme oil extract. Broadly labeled for diseases caused by fungi, bacteria, viruses, and nematodes; no crops or diseases specified. Exempt from EPA registration. Determined to be NOP compliant by Washington State Dept of Ag. Agro Research International.

Timorex Act. 12.5% tea tree oil. Labeled for common scab (*Streptomyces scabies*), white mold (*Sclerotinia sclerotiorum*), and damping off, seedling blights, and root or crown diseases caused by *Phytophthora*, *Pythium*, and *Rhizoctonia*. OMRI-listed. EPA Reg. No. 86182-3-88783. Summit Agro USA, LLC.

Trilogy. 70% clarified hydrophobic extract of neem oil. Labeled generally for several insects and diseases. Specified diseases include early blight, leaf spot and scab. OMRI-listed. EPA Reg. No. 70051-2. Certis USA, LLC.

Zonix biofungicide. 8.5% Rhamnolipid Biosurfactant. Labeled for use on beets but no labeled diseases affect beets in the northeast. OMRI-listed. EPA Reg. No. 72431-1. PropTera, LLC.

Below is an organic fungicide with active ingredient considered to be biocompatible, but the ingredient has not been reviewed by EPA or is not naturally occurring substance and thus is not in the US EPA biopesticide active ingredient list at <https://www.epa.gov/ingredients-used-pesticide-products/biopesticide-active-ingredients>:

Organic JMS Stylet-oil. 97.1% paraffinic oil. Labeled for several insect pests, viruses vectored by aphids, and some fungal diseases in several crops including *Alternaria* leaf spot. OMRI-listed. EPA Reg. No. 65564-1. JMS Flower Farms, Inc.

Please Note: The specific directions on fungicide labels must be adhered to -- they supersede these recommendations, if there is a conflict. If you are farming organically, before purchase make sure product is registered in your state and approved by your certifier. Any reference to commercial products, trade or brand names is for information only; no endorsement is intended.

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