

Biopesticides for Managing Diseases of Carrot 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 carrots. The active ingredient follows product name. Most products are labeled for managing multiple diseases on many crops. The diseases of carrots 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 (aka crown rot and crater rot; *Rhizoctonia solani*), Alternaria leaf blight and powdery mildew (*Erysiphe* spp.). 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 bacterial leaf blight (*Xanthomonas campestris*), white mold (*Sclerotinia sclerotiorum*), 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 bacterial leaf blight (*Xanthomonas campestris*), early blight (aka Alternaria leaf blight; *Alternaria* spp.), powdery mildew (*Erysiphe* spp.) and white mold (*Sclerotinia sclerotiorum*), 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 *Xanthomonas* spp., *Alternaria dauci*, *Pythium irregulare*, *Rhizoctonia solani*

and white mold (*Sclerotinia sclerotiorum*). OMRI listed. Exempt from EPA registration. Brandt Consolidated, Inc.

Carb-O-Nator. 85% potassium bicarbonate. Labeled for leaf blight (*Alternaria*) and powdery mildew (*Erysiphe*). OMRI listed. EPA Reg. No. 70051-117. Certis USA, LLC.

Cinnerate. 60% cinnamon oil. Labeled for powdery mildew. 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 (aka *Alternaria* leaf blight; *Alternaria* spp.) and root rot (*Pythium* spp. or *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 bacterial leaf blight (*Xanthomonas campestris*), powdery mildew (*Erysiphe* spp.) and white mold (*Sclerotinia sclerotiorum*). See instructions below for “Soil application” against the following diseases: cavity spot (*Pythium* spp.), damping off, seedling blights, and root or crown diseases caused by *Pythium*, *Fusarium*, *Phytophthora*, or *Rhizoctonia* spp. OMRI-listed. EPA Reg No. 70051-107 and 108, respectively. Certis USA, LLC.

EcoSwing Botanical Fungicide. 82% Extract of *Swinglea glutinosa*. Labeled for powdery mildew (*Erysiphaceae* spp.). OMRI-listed. EPA Reg. No. 10163-357. Gowan Co.

ECOWORKS EC. 70% cold pressed neem oil. Labeled generally for blight, powdery mildew, leaf spot, etc. 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 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 powdery mildew, 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 powdery mildew, and soil treatment for *Pythium* damping off and cavity spot. OMRI listed. EPA Reg. No. 91197-3-92488. AgBiome Innovations Inc.

Kaligreen. 82% potassium bicarbonate. Labeled only for powdery mildew. OMRI-listed. EPA Reg. No. 11581-2. Arysta LifeScience North America LLC.

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 *Alternaria* leaf blight (*Alternaria dauci*). 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.

Mildew Cure (formerly GC-3 Organic fungicide). 30% cottonseed oil, 30% corn oil, 23% garlic extract. Labeled only for powdery mildew. OMRI-listed. Exempt from EPA registration. JH Biotech, Inc.

MilStop. 85% potassium bicarbonate. Broadly labeled including Alternaria blight and powdery mildew. 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 blight (*Alternaria dauci*), Cercospora leaf blight (*Cercospora carotae*) and powdery mildew (*Erysiphe polygoni*). OMRI-listed. EPA Reg No. 68173-4-70051. Certis USA, LLC.

OxiDate 2. 27% hydrogen dioxide and 2% peroxyacetic acid. Labeled for Alternaria, early blight, late blight, leaf blight, powdery mildew and Rhizoctonia, and root rots caused by *Fusarium*, *Pythium*, and *Rhizoctonia*. OMRI-listed. EPA Reg. No. 70299-12. BioSafe Systems, LLC.

PerCarb. 85% Sodium carbonate peroxyhydrate. Labeled for Alternaria leaf blight, bacterial leaf blight, early blight, late blight, powdery mildew and white mold. OMRI-listed. EPA Reg. No. 70299-15. BioSafe Systems, LLC.

Prestop. 93% *Gliocladium catenulatum* strain J1446. Labeled broadly for seed-borne and soil-borne diseases (such as damping-off and root/stem rot caused by *Phytophthora*, *Pythium*, *Rhizoctonia*, and *Sclerotinia*) and foliar diseases caused by pathogens such as *Alternaria*, as well as suppression of powdery mildew. 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.

Promax. 3.5% Thyme oil. Protective and curative soil fungicide and nematicide for control of soil-borne diseases and plant parasitic nematodes, including root-knot and lesion, on a broad range of crops. OMRI-listed. Exempt from EPA registration. Bio Huma Netics, Inc.

Regalia. 5% Extract of *Reynoutria sachalinensis*. Boosts the plant's natural defense mechanisms against certain fungal and bacterial diseases. Labeled for bacterial leaf blight (*Xanthomonas campestris*), leaf spot (*Cercospora* spp), powdery mildew (*Erysiphe polygoni*), *Pythium* and

Rhizoctonia. 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*, *Phytophthora*, *Pythium*, 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.), bacterial leaf blight (*Xanthomonas* spp.), leaf spot (*Cercospora* spp.), powdery mildew (*Erysiphe* spp.) and white mold (*Sclerotinia sclerotiorum*), 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 bacterial leaf spot (*Xanthomonas campestris* pv. *carotae*) and 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 bacterial leaf spot (*Xanthomonas campestris* pv. *carotae*), white mold (*Sclerotinia sclerotiorum*), cavity spot (*Pythium* spp.), *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. Labeled generally for fungal diseases in field including powdery mildew. OMRI-listed. EPA Reg. No. 82100-1. PQ Corporation.

Sonata. 1.38% *Bacillus pumilus* strain QST 2808. Labeled for powdery mildew (*Erysiphe* spp.). 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 early blight, late blight and powdery mildew. OMRI-listed. Exempt from EPA registration. KeyPlex.

Stargus. *Bacillus amyloliquefacinens* strain F727. Labeled for Alternaria leaf blight (*Alternaria* spp.), bacterial spot (*Xanthomonas* spp.), powdery mildew, *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. Labeled generally for control of soil-borne plant pathogens such as those caused by *Fusarium* (root rot), *Phytophthora* (blights, rots), *Pythium* (root rot), and *Rhizoctonia* (blight and stem rot). It 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.

Theia. 100% *Bacillus subtilis* strain AFS032321. Labeled for seed treatment and soil application (greenhouse and field) for soil-borne fungal diseases caused by *Fusarium*, *Rhizoctonia*, *Pythium* (cavity spot), and *Phytophthora*; and also for foliar application for bacterial leaf spot/blight, powdery mildew, and white mold. OMRI-listed. EPA Reg. No. 94713-2-92488. AgBiome Innovations 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 bacterial leaf blight (*Xanthomonas* spp.), powdery mildew (*Erysiphe* spp.), 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 Alternaria, early blight, leaf blight, leaf spot and powdery mildew. OMRI-listed. EPA Reg. No. 70051-2. Certis USA, LLC.

Zonix biofungicide. 8.5% Rhamnolipid Biosurfactant. Labeled for powdery mildew. 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>:

M-Pede. 49% Potassium salts of fatty acids. Labeled for powdery mildew and several insects and mites. OMRI-listed. EPA Reg. No. 10163-324. Gowan Co.

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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