

# Biopesticides for Managing Diseases of Tomatoes 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 tomatoes. The active ingredient follows product name. Most products are labeled for managing multiple diseases on many crops. The diseases of tomatoes that are specified on these labels and occur in the northeastern U.S. are included. This information provides some indication about the breadth of activity of the product. 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 application to soil for Fusarium crown and root rot, Fusarium wilt, Pythium damping-off, and Verticillium wilt, and to foliage for anthracnose, bacterial speck, bacterial spot, early blight, gray mold, and late blight. For best results with applications to foliage, label indicates to use a spreader-sticker. OMRI listed. EPA Reg. No. 73314-20. Novozymes.

**AgriPhage.** < 1% Bacteriophage active against *Xanthomonas campestris* pv. *vesicatoria* and *Pseudomonas syringae* pv. *tomato*. Labeled for bacterial spot and bacterial speck. NOP compliant, not reviewed. EPA Reg. No. 67986-1-70051. OmniLytics; distributed by Certis USA.

**AgriPhage-CMM.** < 1% Bacteriophage active against *Clavibacter michiganensis* subsp. *michiganensis*. Labeled for bacterial canker. NOP compliant, not reviewed. EPA Reg. No. 67986-6-70051. OmniLytics; distributed by Certis USA, LLC.

**Aviv.** 0.08% *Bacillus subtilis* strain IAB/BS03. Labeled for bacterial spot, bacterial speck, early blight, gray mold, late blight, powdery mildew, and also as soil treatment for root pathogens (*Fusarium*, *Phytophthora*, *Rhizoctonia*, and *Verticillium*) in tomato. 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 pathogens that attack roots and crown tissue: *Fusarium*, *Phytophthora*, *Rhizoctonia*, *Pythium*, *Sclerotinia*, and *Verticillium*. General label. OMRI-listed. EPA Reg. No. 80289-9-67690. Manufactured by Isagro USA; distributed by SePRO Corporation.

**Brandt Organics Aleo.** 78% garlic oil. Labeled generally for bacterial and fungal diseases including bacterial speck, gray mold, late blight, Pythium damping off and white mold. OMRI listed. Exempt from EPA registration. Brandt Consolidated, Inc.

**Carb-O-Nator.** 85% potassium bicarbonate. Labeled for anthracnose, early blight, gray mold, and powdery mildew. OMRI listed. EPA Reg. No. 70051-117. Certis USA, LLC.

**Cease.** 1.34% *Bacillus subtilis* strain QST 713. Broadly labeled for use on greenhouse vegetables. Labeled for bacterial spot, bacterial speck, early blight, gray mold, late blight, and powdery mildew in tomato. OMRI listed. EPA Reg. No. 69592-19-68539. BioWorks, Inc.

**Cinnerate.** 60% cinnamon oil. Labeled broadly for diseases such as powdery mildew, Botrytis gray mold, and leaf mold. OMRI listed. Exempt from EPA registration. Seipasa S.A.

**Companion Biological Fungicide Wettable Powder.** 0.15% *Bacillus amyloliquefacinens* strain ENV503. Labeled for bacterial leaf spot, buckeye fruit rot, early blight, gray mold, late blight, Septoria leaf spot, root rot caused by *Pythium*, Fusarium wilt, and blight caused by *Sclerotinia* (white mold), and root rot and crown rot caused by *Pythium* and *Rhizoctonia* in tomato. OMRI listed. EPA Reg. No. 87645-4-94485. Plant Health Intermediate, Inc.

**DiTera DF Biological Nematicide.** 90% *Myrothecium verrucaria* strain AARC-0255 fermentation solids and solubles. Labeled for several nematodes including root-knot. OMRI listed. EPA Reg. No. 73049-67. Valent BioSciences LLC.

**Double Nickel 55 LC and WDG.** *Bacillus amyloliquefacinens* strain D747, 98.8% and 25%, respectively. Broadly labeled for foliar and soil-borne diseases, including bacterial spot, bacterial speck, damping off, early blight, gray mold, late blight, powdery mildew, and root rot and crown rot caused by *Fusarium*, *Pythium*, *Phytophthora*, *Rhizoctonia*, and *Verticillium* in tomato. OMRI listed. EPA Reg No. 70051-107 and 108, respectively. Certis USA, LLC.

**EcoSwing Botanical Fungicide.** 82% extract of *Swinglea glutinosa*. Labeled for Alternaria leaf spot (aka early blight) and powdery mildew. OMRI listed. EPA Reg. No. 10163-357. Gowan Co.

**ECOWORKS EC.** 70% cold pressed neem oil. Labeled generally for powdery mildew, leaf spot, Botrytis, anthracnose, etc. and also several insects and mites. OMRI listed. EPA Reg. No. 89152-4. ECOSTADT Technologies LLC.

**FungOUT.** 1.07% citric acid. Labeled for bacterial canker and powdery mildew in field and greenhouse crops. OMRI listed. Exempt from EPA registration. AEF Global Inc.

**GreenFurrow BacStop.** 7.5% clove, 3.5% rosemary, 3.2% peppermint oil, 3.2% cottonseed oil, 3.0% thyme, 3.0% garlic, 2.0% cinnamon. Labeled for bacterial leaf spot, bacterial canker, bacterial wilt, early blight and late blight. Exempt from EPA registration. Mar Vista Resources.

**GreenFurrow EF 400.** 5.6% clove, 7.1% rosemary, 11.3% peppermint oil, 10.5% cottonseed oil. Labeled diseases of vegetable crops that occur in tomato include anthracnose, early blight, late blight, powdery mildew, and white mold. Exempt from EPA registration. Mar Vista Resources.

**Howler.** 50% *Pseudomonas chlororaphis* strain AFS009. Labeled for foliar spray for diseases caused by *Botrytis* (gray mold) and *Colletotrichum* (anthracnose) and soil treatment for *Fusarium*, *Phytophthora*, *Pythium*, *Rhizoctonia*, and *Sclerotinia*. 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*. Contains 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.

**LALSTOP G46 WG.** 93% *Gliocladium catenulatum* Strain J1446. Labeled generally for seed-borne and soil-borne diseases caused by several pathogens including *Fusarium*, *Phytophthora*, *Pythium*, *Rhizoctonia*, *Sclerotinia*, and *Verticillium*, and foliar diseases caused by several pathogens including *Alternaria* (some species cause early blight\*), *Botrytis* (gray mold\*), and

also anthracnose and powdery mildew. \*These diseases are not specified on label. OMRI listed. EPA Reg. No. 64137-13. Lallemand Specialties Inc.

**LifeGard WG.** 40% *Bacillus mycoides* isolate J. Biological Plant Activator. Labeled for bacterial spot, bacterial speck, early blight, gray mold, and late blight. 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. Labeled diseases of agricultural crops that occur in tomato include anthracnose, *Alternaria* (early blight), *Botrytis* (gray mold), powdery mildew, and Septoria leaf spot. OMRI listed. EPA Reg. No. 70870-1-68539. BioWorks, Inc.

**Minuet.** 9.89% *Bacillus subtilis* strain QST 713. Labeled for application to soil for *Fusarium*, *Phytophthora*, *Pythium*, *Rhizoctonia*, and *Verticillium*. OMRI listed. EPA Reg No. 264-1202. Bayer CropScience.

**Mycostop.** 35% *Streptomyces griseoviridis* strain K61. Labeled for foliar spray to suppress *Botrytis*. Labeled for seed and root rots caused by *Pythium*, *Phytophthora* and *Rhizoctonia*. 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 for anthracnose, bacterial spot and early blight in greenhouse tomato. OMRI listed. EPA Reg No. 64137-5. Lallemand Plant Care.

**Organocide.** 5% sesame oil. Labeled broadly for several fungal diseases and insects. OMRI listed. Exempt from EPA registration. No Ag Label. Organic Laboratories, Inc.

**OSO.** 5% polyoxin D zinc salt. Labeled for anthracnose, early blight, gray mold, late blight, leaf mold, and powdery mildew. OMRI listed. EPA Reg No. 68173-4-70051. Certis USA, LLC.

**OxiDate 2.** 27% hydrogen dioxide and 2% peroxyacetic acid. Labeled for anthracnose, bacterial speck, bacterial spot, early blight, gray mold, late blight, leaf (Cladosporium) mold, powdery mildew, 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 anthracnose, bacterial spot, bacterial speck, early blight, and late blight. 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*, *Sclerotinia*, and *Verticillium*) and foliar diseases (including those caused by *Alternaria*, *Colletotrichum*, *Botrytis*, and *Fusarium* plus 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.

**Problad Verde.** 20% Banda de *Lupinus albus* doce (BLAD). Labeled for gray mold and powdery mildew. OMRI listed. EPA Reg. No. 84876-2. CEV, S.A.

**Procidic.** 3.5% citric acid. Labeled for gray mold and post-harvest diseases. Previously marketed as Citrex. Procidic was reviewed and determined to be NOP compliant by Washington State Dept of Ag. Exempt from EPA registration. Greenspire Global, Inc.

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

**Rango.** 70% cold pressed neem oil. Generally labeled for anthracnose, early blight, late blight, powdery mildew, and foliar diseases caused by fungal pathogens such as *Alternaria* and *Botrytis*, and for soil applications for nematodes and soil-borne fungal pathogens including *Fusarium*, *Pythium*, and *Rhizoctonia solani* (label has separate lists of crops and diseases). OMRI listed. EPA Reg. No. 88760-10. Terramera, Inc.

**Regalia.** 5% extract of *Reynoutria sachalinensis*. Boosts the plant's natural defense mechanisms against certain fungal and bacterial diseases. Labeled for bacterial speck, bacterial spot, early blight, gray mold, late blight, Phytophthora blight, and powdery mildew, and damping-off and root rot caused by *Fusarium*, *Pythium*, and *Rhizoctonia*. OMRI listed. EPA Reg. No. 84059-2. ProFarm Group (Formerly Marrone Bio Innovations, Inc).

**Romeo.** 94.1% cerevisane (cell walls of *Saccharomyces cerevisiae* strain LAS117). Labeled for Botrytis gray mold, late blight and powdery mildew. OMRI listed. EPA Reg. No. 91810-2. Lesaffre Yeast Corporation

**RootShield Granules, AG, and WP.** 1.15% *Trichoderma harzianum* Rifai strain KRL-AG2. Apply to transplant roots, soil (greenhouse or field), or seed (RootShield AG). The biocontrol fungus grows on roots protecting them against fungal pathogens such as *Rhizoctonia*, *Pythium*, and *Fusarium*. OMRI listed. EPA Reg. No. 68539-3, -4 and -7 for Granules, AG, 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 anthracnose, bacterial canker, bacterial speck, bacterial spot, buckeye fruit rot, early blight, gray mold, late blight, and powdery mildew in tomato, and applied to soil for *Fusarium*, *Phytophthora*, *Pythium*, *Rhizoctonia*, Southern blight, and *Verticillium*. OMRI listed. EPA Reg. No. 264-1152. Bayer CropScience.

**Serenade Opti.** 26.2% *Bacillus subtilis* strain QST 713. Labeled for anthracnose, bacterial speck, bacterial spot, buckeye fruit rot, early blight, gray mold, and late blight in tomato. OMRI listed. EPA Reg. No. 264-1160. New formulation. Previous product names and formulations: Serenade, Serenade Max, Serenade Optimum. Bayer CropScience.

**Serifel NG.** 11% *Bacillus amyloliquefacinens* strain MBI 600. Labeled for use on greenhouse crops applied to soil for root rot pathogens (*Fusarium*, *Pythium*, and *Rhizoctonia*) and as foliar spray for gray mold and powdery mildew. Replaces Subtilex NG. OMRI listed. EPA Reg No. 71840-8. BASF Corporation.

**Serifel.** 9.9% *Bacillus amyloliquefacinens* strain MBI 600. Broadly labeled for foliar diseases, including anthracnose, bacterial spot and speck (supplemental label), buckeye rot, early blight, gray mold, late blight, and powdery mildew. OMRI listed. EPA Reg No. 71840-18. BASF Corporation.

**Sil-Matrix.** 29% potassium silicate. Generally labeled for fungal diseases in field and greenhouse production. OMRI listed. EPA Reg. No. 82100-1. PQ Corporation.

**SoilGard.** 12% *Gliocladium virens* strain GL-21. Labeled for soil application in greenhouse and field for damping-off and root rot caused by *Fusarium*, *Pythium*, *Rhizoctonia*, *Sclerotinia*, and *Phytophthora capsici* plus Fusarium crown rot. OMRI listed. EPA Reg. No. 70051-3. Certis USA, LLC.

**Sonata.** 1.38% *Bacillus pumilus* strain QST 2808. Labeled for early blight, late blight, and powdery mildew in field and greenhouse tomato. OMRI listed. EPA Reg. No. 264-1153. Bayer CropScience.

**Sporan EC<sup>2</sup>.** 16% rosemary oil, 10% clove oil, 10% thyme oil, 2% peppermint oil. Labeled for bacterial spot, early blight, gray mold, late blight, and powdery mildew in tomato. OMRI listed. Exempt from EPA registration. KeyPlex.

**Stargus.** *Bacillus amyloliquefacinens* strain F727. Labeled for bacterial leaf spot, gray mold, late blight, Phytophthora blight, and root rot pathogens (*Fusarium*, *Phytophthora*, *Pythium*, *Rhizoctonia*, and *Verticillium*). 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 bacterial speck and spot, early blight, late blight, powdery mildew, and seedling diseases caused by the soil-borne pathogens *Fusarium*, *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 SipcamaAdvan.

**TerraClean 5.** 27% hydrogen dioxide and 5% peroxyacetic acid. Generally labeled for control of soil-borne plant diseases such as those caused by *Fusarium* (root rot), *Phytophthora* (blights, rots), *Pythium*, and *Rhizoctonia*; crops not specified on label. 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.

**TerraNeem EC.** 84.9% cold pressed neem oil. Generally labeled for anthracnose, late blight, powdery mildew, and foliar diseases caused by fungal pathogens such as *Alternaria* and *Botrytis*, and for soil applications for nematodes and soil-borne fungal pathogens including *Fusarium*, *Pythium*, and *Rhizoctonia solani* (label has separate lists of crops and diseases). OMRI listed. EPA Reg. No. 88760-5. Terramera, 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*, and *Phytophthora*; and also for foliar application for anthracnose, bacterial speck, bacterial spot, buckeye fruit rot, early blight, gray mold, and powdery mildew. OMRI-listed. EPA Reg. No. 94713-2-92488. AgBiome Innovations Inc.

**Thymox Control.** 27% thyme oil. Proprietary nano emulsion technology. Broadly labeled for fungal diseases such as powdery mildew and grey mold, and bacterial diseases; crops not specified. OMRI listed. Exempt from EPA registration. Kemin Industries, Inc. Manufactured by Laboratoire M2.

**Thyme Guard.** 23% thyme oil extract. Broadly labeled for diseases like Botrytis gray mold, late blight, powdery mildew and others caused by fungi, bacteria, viruses, and nematodes; crops not 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 anthracnose, bacterial diseases (speck, spot, canker), early blight, gray mold, late blight, leaf mold, powdery mildew, and applied to soil for damping-off, crown and root rot caused by *Fusarium*, *Pythium*, *Rhizoctonia*, *Sclerotinia*, *Phytophthora*, or *Verticillium*. OMRI listed. EPA Reg. No. 86182-3-88783. Summit Agro USA, LLC.

**Triathlon BA.** 98.85% *Bacillus amyloliquefaciens* strain D747. Labeled for controlling gray mold and suppressing bacterial speck and spot (label states to tank mix or rotate with copper-based fungicides to improve control), early blight, late blight, powdery mildew, and applied to soil for suppressing damping off, seedling blights, and root or crown diseases caused by *Pythium*, *Rhizoctonia*, *Fusarium*, *Phytophthora*, or *Verticillium* spp. OMRI listed. EPA Reg. No. 70051-107-59807. OHP, Inc.

**Trilogy.** 70% clarified hydrophobic extract of neem oil. Labeled generally for several insects and diseases. Labeled diseases that occur in tomato include anthracnose, early blight, *Botrytis* (gray mold), and powdery mildew (label has separate lists of crops and diseases). OMRI listed. EPA Reg. No. 70051-2. Certis USA, LLC.

**Zonix biofungicide.** 8.5% rhamnolipid biosurfactant. Kills zoospores, which is one spore type produced by Oomycete pathogens which cause diseases such as late blight. OMRI listed. EPA Reg. No. 72431-1. PropTera, LLC.

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

**DES-X insecticidal soap.** 47% potassium salts of fatty acids. Labeled for powdery mildew and several insects and mites. OMRI listed. EPA Reg. No. 67702-22-70051. Certis USA, LLC.

**KOPA insecticidal soap.** 47% potassium salts of fatty acids. Labeled for powdery mildew and several insects and mites. OMRI listed. EPA Reg. No. 67702-11-59807. OHP, Inc.

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

**Organic JMS Stylet-oil.** 97.1% paraffinic oil. Labeled for several insect pests, viruses vectored by aphids, and powdery mildew. OMRI listed. EPA Reg. No. 65564-1. JMS Flower Farms, Inc.

**TriTek.** 80% mineral oil. Labeled for several insect pests and powdery mildew. OMRI listed. EPA Reg. No. 48813-1. Previously named Saf-T-Side. Brandt Consolidated, 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.*

Up-dated 12-21-22.