

Biopesticides for Managing Diseases of Bulb Crops Organically

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Following is a list of some biopesticides labeled for disease control in bulb vegetables (garlic, green onion, bulb onion, leek, shallot, etc.). The active ingredient follows product name. Most products are labeled for managing multiple diseases on many crops. The diseases of bulb vegetables that are specified on these labels and occur in the northeastern U.S. are included below. 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 Fusarium basal rot, Botrytis leaf blight, and Botrytis neck rot. For best results with applications to foliage, label indicates to use a non-ionic spreader-sticker. OMRI-listed. EPA Reg. No. 73314-20. Novozymes.

Amplitude. 96.4% *Bacillus amyloliquefaciens* strain F727 cells and spent fermentation media. Labeled for Botrytis leaf blight, Botrytis neck rot, downy mildew, and also as soil treatment for root pathogens (*Fusarium*, *Pythium*, and *Rhizoctonia*). OMRI-listed. EPA Reg. No. 84059-28. ProFarm Group (Formerly Marrone Bio Innovations, Inc).

Aviv. 0.08% *Bacillus subtilis* strain IAB/BS03. Labeled for Botrytis leaf blight, Botrytis neck rot, downy mildew, purple blotch and Stemphylium leaf blight and also as soil treatment for root pathogens (*Fusarium*, *Pythium*, 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 pathogens that attack roots and crown tissue: *Fusarium*, *Phytophthora*, *Rhizoctonia*, *Pythium* 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. OMRI-listed. Exempt from EPA registration. Brandt Consolidated, Inc.

Carb-O-Nator. 85% potassium bicarbonate. Labeled for Botrytis leaf blight, Botrytis neck rot, downy mildew, purple blotch. OMRI-listed. EPA Reg. No. 70051-117. Certis USA, LLC.

Cease. 1.34% *Bacillus subtilis* strain QST 713. Labeled for use on greenhouse vegetables. Labeled for Botrytis leaf blight, Botrytis neck rot, downy mildew, and purple blotch. OMRI-listed. EPA Reg. No. 69592-19-68539. BioWorks, Inc.

Companion. 0.03% *Bacillus subtilis* strain GB03. Labeled for Botrytis leaf blight, Pythium root rot, blight caused by *Sclerotinia* (white mold), and bacterial soft rot. EPA Reg. No. 71065-3. Growth Products, Ltd.

Contans WG. 5.3% *Paraconiothyrium minitans* strain CON/M/91-08. Soil-applied product for *Sclerotinia sclerotiorum* (white mold pathogen). OMRI-listed. EPA Reg. No. 72444-1. SipcamAdvan.

Double Nickel 55 LC and WDG. *Bacillus amyloliquefacinens* strain D747, 98.8% and 25%, respectively. Labeled for Botrytis leaf blight, Botrytis neck rot, downy mildew, purple blotch and damping off and root rot caused by *Fusarium*, *Pythium*, *Phytophthora*, *Rhizoctonia*, and *Verticillium*. OMRI-listed. EPA Reg No. 70051-107 and 108, respectively. Certis USA, LLC.

EcoSwing Botanical Fungicide. 82% extract of *Swinglea glutinosa*. Labeled for use on bulb crops; no diseases or pathogens of bulb crops included in the general list of targeted pests. OMRI-listed. EPA Reg. No. 10163-357. Gowan Co.

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

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 anthracnose (onion smudge) which is not known to affect bulb crops in the northeast. 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 bulb crops include downy mildew and white mold. Exempt from EPA registration. Mar Vista Resources.

Howler. 50% *Pseudomonas chlororaphis* strain AFS009. Labeled for foliar spray 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 which does not affect bulb crops in the northeast. 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 soil-borne diseases caused by several pathogens including *Fusarium*, *Phytophthora*, *Pythium*, *Rhizoctonia*, *Sclerotinia*, and *Verticillium*, and foliar diseases caused by several pathogens. OMRI-listed. EPA Reg. No. 64137-13. Lallemand Specialties Inc./Lallemand Plant Care.

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.

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 for seed and root rots caused by *Pythium*, *Phytophthora* and *Rhizoctonia*. 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 Botrytis leaf blight, Botrytis neck rot, downy mildew, and purple blotch. OMRI-listed. EPA Reg No. 68173-4-70051. Certis USA, LLC.

OxiDate 2. 27% hydrogen dioxide and 2% peroxyacetic acid. Labeled for downy mildew. OMRI-listed. EPA Reg. No. 70299-12. BioSafe Systems, LLC.

PerCarb. 85% sodium carbonate peroxyhydrate. Labeled for bacterial leaf blight, Botrytis rot, and downy mildew. 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 (*Alternaria*, *Colletotrichum*, *Botrytis*, *Didymella*, 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.

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 downy 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 Botrytis leaf blight and neck rot, downy mildew, and purple blotch, and applied to soil for root rots caused by *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 and downy 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 as pre-plant dust (AG and WP formulations) or in-furrow (granules). 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. Labeled for foliar application for bacterial leaf blight caused by *Xanthomonas*, Botrytis leaf blight and neck rot, downy mildew, and purple blotch, and applied to soil for *Fusarium*, *Phytophthora*, *Pythium*, *Rhizoctonia*, *Verticillium*, and *Phoma* (pink root). OMRI-listed. EPA Reg. No. 264-1152. Bayer CropScience.

Serenade Opti. 26.2% *Bacillus subtilis* strain QST 713. Labeled for Botrytis leaf blight, Botrytis neck rot, and purple blotch. 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 amyloliquefaciens* strain MBI 600. Labeled for use on greenhouse crops applied to soil or growing media for root rot pathogens (*Fusarium*, *Pythium*, and *Rhizoctonia*) and as foliar spray for Botrytis leaf blight and Botrytis neck rot. Replaces Subtilex NG. OMRI-listed. EPA Reg No. 71840-8. BASF Corporation.

Serifel. 9.9% *Bacillus amyloliquefaciens* strain MBI 600. Labeled for Botrytis leaf blight, Botrytis neck rot, downy mildew, purple blotch and Stemphylium leaf blight. OMRI-listed. EPA Reg No. 71840-18. BASF 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*. OMRI-listed. EPA Reg. No. 70051-3. Certis USA, LLC.

Sonata. 1.38% *Bacillus pumilus* strain QST 2808. Labeled for downy mildew. 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 downy mildew and Botrytis neck rot. OMRI-listed. Exempt from EPA registration. KeyPlex.

Stargus. *Bacillus amyloliquefacinens* strain F727. Labeled for Botrytis leaf blight, Botrytis neck rot, and downy mildew. OMRI-listed. EPA Reg. No. 084059-28. ProFarm Group (Formerly Marrone Bio Innovations, Inc).

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 control of soil-borne plant diseases such as root rot caused by *Fusarium*, *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. Labeled generally for foliar diseases caused by fungal pathogens such as *Alternaria* (which include purple blotch in onion*) and *Botrytis* (leaf blight, neck rot, and flower blight*) and also downy mildew and for soil applications for nematodes and soil-borne fungal pathogens including *Fusarium* and *Pythium*. *Label does not include specific diseases caused by these fungi. 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 Botrytis leaf blight, Botrytis neck rot, downy mildew, purple blotch, and white rot. OMRI-listed. EPA Reg. No. 94713-2-92488. AgBiome Innovations Inc.

Thymox Control. 27% thyme oil. Proprietary nano emulsion technology. Broadly labeled for fungal and bacterial diseases; crops not specified. OMRI-listed. Exempt from EPA registration. Kemira Industries, Inc. Manufactured by Laboratoire M2.

Thyme Guard. 23% thyme oil extract. Broadly labeled for diseases 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 Botrytis leaf blight, Botrytis neck rot, downy mildew, purple blotch, and Stemphylium leaf blight, and applied to soil for damping-off and root and crown diseases 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 Botrytis leaf blight, Botrytis neck rot, downy mildew, purple blotch, 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, including *Botrytis*, downy mildew, and leaf blight (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 downy mildew. OMRI-listed. EPA Reg. No. 72431-1. PropTera, LLC.

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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