Crop Protection Product Update(s)
BioSafe Systems

IR-4 Food Use/Integrated Solutions/Biopesticide Workshop
Sept. 19-21, 2018

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Entomologist & Technical Representative-US and Mexico
• A family-owned manufacturer of biodegradable and reduced risk crop protection products.
• Headquartered in East Hartford, CT, USA
• Biochemical (Peracetic Acid Based) and Microbial based Biopesticides for organic and conventional Agriculture and Horticulture markets.
• Products registered in US, Canada and Mexico.
Crop Protection Product Update(s)
Active Ingredient: *Gliocladium catenulatum* strain J1446.....93.0%

Contains a minimum of $1 \times 10^9$ CFU/g

Formulation Type: Wettable Granule (WG)

- Originally registered with EPA in 1998 as “PrimaStop” Wettable Powder formulation.
- Later marketed as “PreStop”
- Pending registration in California.
**Gliocladium catenulatum Strain J1446**

- Naturally occurring Saprophytic Fungus
- J1446 strain isolated from a field soil in Finland
- Optimal growth conditions for the fungus:
  - Temperature of 25-28°C;
  - pH of 5-6, with a range of pH 3-8.2.
- Non-Toxic. The risk to non-target organisms, including fish, birds, and insects, is expected to be minimal. Not harmful to beneficial insects, nematodes or pollinators
Modes of Action

*Antagonistic against many fungal pathogens*

- Hyperparasitism
- Enzyme activity on fungal structures-Chitinases and $\beta-1,3$-glucanenzymes
- Colonization of root and foliar surfaces
- Competition for nutrients and space
- Induced Resistance
PVent (WG) controls seed-borne and soil-borne plant diseases such as damping-off, root and stem rot, and wilt caused by *Alternaria, Bipolaris, Botrytis, Cladosporium, Colletotrichum, Fusarium, Mycosphaerella, Penicillium, Phytophthora, Plasmodiophora, Plicaria, Pyrenoachaeta, Pythium, Rhizoctonia, Sclerotinia and Verticillium*, certain storage diseases caused by *Helminthosporium* and *Rhizoctonia*, and foliar diseases like grapevine trunk diseases (several pathogens) as well as diseases caused by *Alternaria, Anthracnose (Colletotrichum) Bipolaris, Botrytis, Cladosporium, Didymella, Fusarium, Monilinia, Mycosphaerella, Penicillium and Sclerotinia* on greenhouse or field grown vegetables, herbs, ornamentals, berries, cereals, legumes, pome and stone fruits, nut trees, tree and forest seedlings and turf. PVent (WG) also suppresses powdery mildew symptoms on these greenhouse or field grown crops.
Strawberry Charcoal Rot (UFL-2017)

<table>
<thead>
<tr>
<th>Treatment</th>
<th>% Disease Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Inoculated Control</td>
<td>6.3</td>
</tr>
<tr>
<td>Inoculated Control</td>
<td>41.3</td>
</tr>
<tr>
<td>P-Vent (0.067 oz/Gal; 1.2 Lbs/A)</td>
<td>10.1</td>
</tr>
<tr>
<td>Rhyme-7.0 Fl.oz/A</td>
<td>27.5</td>
</tr>
<tr>
<td>Topsin 4.5 FL-20 fl.oz/A</td>
<td>27.9</td>
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Efficacy on Pathogens Causing Root Diseases

Damping Off
(Pythium and Rhizoctonia)
6 weeks after sowing

Control  J-1446 (10g/m2) as a Drench
Efficacy on Pathogens Causing Stem/Foliar Diseases

Gummy Stem Blight of Cucumber
*(Didymella/Mycosphaerella)*
Sprays at 6 and 53 days after planting

Botrytis on Tomatoes *(Botrytis cinerea)*
2019 IR-4 Biopesticide Study Request(s)

- Study requests to develop and support additional data for registration in California.

- Soilborne Diseases (Landscapes and Orchards)
- Rhizoctonia and Charcoal Rot (Strawberry)
- Botrytis (Strawberry and Raspberry)
- Botrytis (GH Tomato)
- Fusarium Wilt (Basil)
- Botrytis (Herbs)
- Phytophthora (Cucurbits, Vegetables, Peppers)
- Fungi-Post-Harvest (Sweet Potato)
- Damping Off (Hemp)
- Pythium Cavity Spot (Carrots)
- Root Rot (Ginseng)
- Southern Blight (Tomato and Pepper)
- Timber Rot (Tomato)
- Verticillium Wilt (Egg Plant)
- Fusarium Root Rot (Green Beans)
US EPA Registered Broad Spectrum Plant Bactericide/Fungicide
Labeled for control of major foliar diseases on field grown crops, tree crops, berries, small fruits, vine crops and greenhouse vegetable crops.

EPA Registration No. 70299-15
Registration Pending in CA

Active Ingredient: Sodium Carbonate Peroxyhydrate*: 85.00%
Inert Ingredients**: 15.0%

*Contains 27.60% Hydrogen Peroxide by weight

**Includes <10% Calcium Carbonate as a Calcium Source for the Plants and a Silicate based material as a stabilizer
MODE OF ACTION

✓ Hydrogen Peroxide works by oxidizing Bacterial/Fungal cells/spores with which they come into contact. Damage to cellular macromolecules including lipids, proteins and nucleic acids occur upon oxidation by hydrogen peroxide.

✓ The sodium carbonate also play a role in inhibiting development of fungal mycelium and spores through changes in pH and osmotic pressure of the microbial cells.
<table>
<thead>
<tr>
<th>Crops</th>
<th>Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Berries</td>
<td>a. Powdery Mildew</td>
</tr>
<tr>
<td>b. Bulb Vegetables</td>
<td>b. Downy Mildew</td>
</tr>
<tr>
<td>c. Citrus</td>
<td>c. Bacterial Leaf Spots/Blights</td>
</tr>
<tr>
<td>d. Cole Crops</td>
<td>d. Fungal Leaf Spots/Blights</td>
</tr>
<tr>
<td>e. Cucurbits</td>
<td>e. Rust</td>
</tr>
<tr>
<td>f. Fruiting Vegetables</td>
<td>f. Scab</td>
</tr>
<tr>
<td>g. Grapes</td>
<td></td>
</tr>
<tr>
<td>h. Herbs/Spices</td>
<td></td>
</tr>
<tr>
<td>i. Leafy Vegetables</td>
<td></td>
</tr>
<tr>
<td>j. Pome Fruits</td>
<td></td>
</tr>
<tr>
<td>k. Root &amp; Tuber Vegetables</td>
<td></td>
</tr>
<tr>
<td>l. Tree Nuts</td>
<td></td>
</tr>
<tr>
<td>m. Stone Fruits</td>
<td></td>
</tr>
</tbody>
</table>
Grape PM (UC, Davis-2017)

% Mean Incidence vs % Mean Severity

- Untreated Control
- PerCarb-3.0 Lbs/100 Gallons
- OxiPhos-5 Quarts/A
- Regalia-4 Quarts/A
- Sonata + Sulfur DF+Sylcoat

Letters indicate significant differences in treatments.
Tomato Bacterial Spot, UFL, 2015

13 foliar sprays (17 Sep-01 Dec, 2015)
4-10 day spray schedule
Spray Volume: 90 GPA
2019 IR-4 Biopesticide Study Request(s)

- Study requests to develop and support additional data for registration in California.
- Powdery Mildew and Scab (Apples)
- Powdery Mildew and Black Rot (Grapes)
- Bacterial Leaf Spot/Angular Leaf Spot (Cucurbit and Pepper)
- Botrytis, Bacterial Spot and Speck (GH Tomato)
- Botrytis (Herbs)
- Cercospora and Cladosporium Leaf Spots (Leafy Greens)
US EPA Registered Pre-Plant Soil Treatment for Control of Soil Borne Plant Pathogens

Labeled to suppress and control soilborne plant pathogens and their associated diseases such as Fusarium, Phytophthora, Pythium, Rhizoctonia, Ralstonia solanacearum, Sclerotinia sclerotiorum, Sclerotium rolfsii, Thielaviopsis and Verticillium

EPA Registration No. 70299-18

Not Registered in CA

Active Ingredients:
Hydrogen Peroxide: 18.50%
Peroxyacetic Acid: 12.00%
Pre-Plant Soil Treatment Program

- DIRECT INJECT APPLICATION,
- DRIP OR SPRINKLER IRRIGATION SYSTEMS
- DIRECT SOIL DRENCH

Pre-wet soil preferably with a surfactant. Inject TerraStart directly into the water of the drip system at a 1:265 – 1:132 dilution rate (3.8 to 7.6 gallons of TerraStart per 1000 gallons of water; equivalent to 500 – 1,000 ppm of peroxycetic acid).

- Depending on soil type, approx. 3,000 to 6,000 gallons of finished TerraStart solution per treated acre to treat top 6-10 inches of soil bed.

- Applications should be made at a minimum of 48 hours prior to planting/transplanting to allow any residual TerraStart to dissipate in the soil.
Pre-Plant Soil Treatment Program

**AS A DIRECT INJECT APPLICATION THROUGH DRIP OR SPRINKLER IRRIGATION SYSTEMS OR AS A DIRECT SOIL DRENCH**

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Total Number of Gallons of TerraStart Concentrate/Treated-Acre</th>
<th>Gallons of Water to be used with TerraStart per Treated Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1:132</td>
<td>1:265</td>
</tr>
<tr>
<td>Light (Sandy/Loam)</td>
<td>23.0</td>
<td>11.5</td>
</tr>
<tr>
<td>Medium (Loam)</td>
<td>34.0</td>
<td>17.0</td>
</tr>
<tr>
<td>Heavy (Loam/Clay)</td>
<td>45.5</td>
<td>22.5</td>
</tr>
</tbody>
</table>
TerraStart on Phytophthora Root Rot Control in Citrus Seedlings (TAMU, TX-2018)

• T1-Untreated-Uninoculated
• T2-Untreated-Inoculated
• T3-Ridomil Gold
• T5-TerraStart as a Soil Drench at 1:132 strength post-inoculation and prior to planting
2019 IR-4 Biopesticide Study Request(s)

- Study requests to develop and support additional data for registration in California.
- Nematodes, *Rhizoctonia* and Charcoal Rot (Strawberry)
- Soilborne Diseases (Landscapes and Orchards)
- *Phytophthora* (Cucurbits and Fruiting Vegetables)
- Root Rot (Ginseng)
- Verticillium Wilt (Eggplant)
- Fusarium Root Rot (Green Beans)
Biological Mycoinsecticide

Active Ingredient: *Beauveria bassiana* strain-ANT-03

Formulation Type: Wettable Powder (WP)

Contains a minimum of $1.0 \times 10^{10}$ viable conidia/g gram

EPA Registration #: 89600-2

Pending Registration in California
**Beauveria bassiana**

- An entomopathogenic fungus belonging to order Hypocreales
- Occurs naturally in the soils throughout the world
- Can attack both larval and adult stages

**Mode of Action**

- Adhesion to the cuticle
- Germination (infection) via enzymatic activity and mechanical pressure
- Penetration of the fungus into the insect
- Multiplication and sporulation
- Infection via contact and ingestion
  - Pathogenicity for all development stages including eggs, nymphs and diapausing insects
Labeled Application Rates and Methods

1.0-3.0 Lbs/Acre for most crops*
Conventional ground apps: At least 50 Gallons of solution/A. Ensure thorough coverage of plant foliage but not to run off.
Spray Interval: 5-7 days as needed
Pre-Harvest Interval (PHI): 0 (Zero) Days
Can be applied by air (Field Crops).

(*Refer Label for Appropriate Crop Specific Rates)
BioCeres® WP

Insect Pests Labeled

✓ Aphids
✓ Bud Weevil
✓ European Corn Borer
✓ Plant Bugs
✓ Thrips
✓ Whiteflies
✓ Spotted Wing Drosophila
✓ Striped Cucumber Beetle
BioCeres® WP

Efficacy Studies
Two applications of BioCeres GR, rate 20 g/m², early fall on the presence of Chafer white grubs of Turfgrass-2015 (n=4 for both control and treated conditions).

Treatments: 1 – untreated control; 2, 3, 4 – BioCeres WP at 8, 12 and 16 g/L; 5 – BioCeres GR at 20g/m²
Study requests to develop and support additional data for registration in California.

- BMSB, SWD and White Fly (Q-Biotype)-All crops
- Apple Maggot and Codling Moth-Apple
- Asian Ambrosia Beetle (Avocado)
- ACP (Citrus)
- Berry Borer (Coffee)
- Cabbage Aphid (Brassicas)
- Striped Cucumber Beetle (Cucurbits, Vegetables)
- Colorado Potato Beetle (Potato)
- Potato Leaf Hopper (Potato)
- Chilli Thrips (All Crops)
- Varroa Mite (Honey Bee)
- Bagrada Bug and Cabbage Looper (Brassica)
- Corn Root Worm (Corn)
- Squash Bugs (Cucurbits)
- Flea Beetles (Eggplant)
- Pepper Weevil (GH Pepper)
- Wireworms (Potato)
Thank You
From BioSafe Systems, LLC

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