Organic Pest Management in Strawberries and Caneberries: Available Materials from Biosafe Systems

Presented by:
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BioSafe Systems

- Established in 1996
- Based in East Hartford, CT
- Environmentally Responsible Plant Pest Control Products
- Domestic & International Sales
Markets

Agriculture
Aquatics
Animal Health
Home & Garden
Home & Ranch
Greenhouse / Nursery
Post Harvest/Food Safety
Sanitation
Turf
Integrated Pest Management (IPM)

IPM – Integration of methods for successful management of pests.

Features of IPM Methods:

• Effective
• Economical
• Environmentally Safe

IPM Methods:
- Physical
- Chemical
- Biological
- Cultural
When chemical methods have to be employed, there is growing interest in use of organic/Biorational based chemsitries in Strawberry and Caneberry Pest management.

Features of Organic/Biorational based Pest control Products—

• Natural (Not synthetic) in origin
• Non-residual in nature
• Can be safely integrated with other methods in the IPM program
• Safe to workers and environment
BioSafe Systems Product Line

- **Peroxycompounds**: (Bactericide/Fungicide)
  - OxiDate 2.0 - Organic Bactericide/Fungicide
  - TerraClean 5.0 - Organic Soil Bactericide/Fungicide

- **Azadirachtin**: (Botanical Insecticide)
  - AzaGuard - Organic Insect Growth Regulator/Insecticide

- **Ammonium Nonanoate**: (Herbicide)
  - AXXE - Organic Herbicide
What are Peroxycompounds (POC)?

Hydrogen Peroxide (H₂O₂):
• Powerful Oxidizer
• 2H₂O₂ = 2H₂O (water) + O₂ (oxygen)
• Oxidation Potential: - 1.8

Peracetic Acid (PAA):
• Produced by mixing H₂O₂ and Acetic Acid
• More stable than H₂O₂
• During degradation, releases OH (hydroxyl radicals) – Very powerful oxidizers

(OP~2.8) H₂O₂ = OH + OH
Mode of Action

• Forms free hydroxyl radicals which oxidize thiol groups in enzymes and proteins of the target cell.
  • Leads to increased cell permeability and collapse.
  • Risk for fungicide resistance – Not present/unidentified.
BioSafe Systems POC’s

27.0% H2O2 + 2.0% PAA

- OxiDate 2.0
- Foliar Bactericide/Fungicide
- OMRI Approved

27.0% H2O2 + 5.0% PAA

- TerraClean 5.0
- Soil Bactericide/Fungicide
- OMRI Approved
OxiDate 2.0

Broad Spectrum Bactericide/Fungicide

Use in curative and preventative programs to ensure complete disease control. Approved for use on over 150 varieties of fruits, vegetables and nuts.

- EPA Registered
- Zero-Hour REI (Four-Hour in CA) & Zero-Days to Harvest
- Exempt from Pesticide Residue
- No Mutational Resistance
- OMRI Listed for Organic Production
# OxiDate 2.0-Application Program

<table>
<thead>
<tr>
<th>Application Type</th>
<th>Rate (per application)</th>
<th>Spray Interval and volume</th>
<th>Application Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curative</td>
<td>1.0% v/v (1:100)</td>
<td>5-7 days; 30-100 GPA</td>
<td>At early signs of disease</td>
</tr>
<tr>
<td>Preventative</td>
<td>0.50-0.25% v/v (1:200-1:400)</td>
<td>5-7 days; 30-100 GPA</td>
<td>When weather conditions are congenial for disease development</td>
</tr>
<tr>
<td>Tank-mix/Rotation with Conventional/Biologicals</td>
<td>0.5-1.0% v/v (1:200-1:100)</td>
<td>7-14 days; 30-100 GPA</td>
<td>When disease pressure is high and/or for diseases that require residual chemistries</td>
</tr>
</tbody>
</table>
OxiDate 2.0

*Broad Spectrum Bactericide/Fungicide*

Evaluation of OxiDate 2.0 for Control of Powdery Mildew in Strawberries, 2012

**Researcher:** UCCE, CA  
**Crop:** Strawberry  
**Disease:** Powdery Mildew (*Sphaerotheca macularis*)  
**Trial Location:** Santa Maria, CA
OxiDate 2.0
Powdery Mildew in Strawberry, 2012

2 Treatments:

Trt # 1-
1:100 OxiDate 2.0 + 0.125% yucca surfactant as a stand alone.

Trt # 2-
1:200 OxiDate 2.0 + Procure (6.0 fl. oz) followed by
1:200 OxiDate 2.0 + Pristine (18.5 fl. oz)

Applications:

• Spray interval- 7-13 days
• Total # of applications- 5 (May 23-June 27, 2012)
• Spray Volume: 100 GPA

8 other treatments Included
OxiDate 2.0 and Strawberry Average Yield

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Weight in grams from ~20 plants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>616.66</td>
</tr>
<tr>
<td>Pristine-23</td>
<td>823.98</td>
</tr>
<tr>
<td>Switch</td>
<td>700.09</td>
</tr>
<tr>
<td>OxiDate 2.0</td>
<td>657.25</td>
</tr>
<tr>
<td>OxiDate 2.0 + Procure/Pristine</td>
<td>721.73</td>
</tr>
</tbody>
</table>

Uninfected vs Infected
Evaluation of OxiDate 2.0 for Control of Botrytis Fruit in Annual Strawberry, 2012

**Researchers:** Univ. of Florida, Wimauma, FL
**Crop:** Strawberry
**Diseases:** Botrytis Fruit Rot; (*Botrytis cinerea*); Strawberry Leak; (*Rhizopus* and *Mucor* spp)
**Trial Location:** Research Site, Wimauma, FL
OxiDate 2.0
Botrytis Fruit Rot in Strawberry, 2012

Treatment:

1:100 OxiDate 2.0 + 0.125% non-ionic surfactant (Kinetic).

Applications:

- Spray interval: 7-28 days
- Total # of applications: 5
- Spray Volume: 100 GPA

20 other treatments included
OxiDate 2.0 and Botrytis Fruit Rot
Pre-Harvest Botrytis Incidence

- OxiDate 2.0:
  - 20 Harvests: 4.7%
  - 6 Harvests: 6.2%

- Non-Treated Control:
  - 20 Harvests: 8.6%
  - 6 Harvests: 13.8%
OxiDate 2.0 and Botrytis Fruit Rot
Post-Harvest Botrytis Fruit Rot and Rhizopus
Leak Incidence

![Graph showing the comparison of disease incidence between OxiDate 2.0 and Non-Treated Control. The graph compares the % Disease Incidence with blue bars representing Botrytis Fruit Rot and red bars representing Rhizopus Rot (Leak). The OxiDate 2.0 has lower disease incidence compared to the Non-Treated Control.](image-url)
OxiDate 2.0 and Botrytis Fruit Rot
Total Marketable Yield

<table>
<thead>
<tr>
<th></th>
<th>Non-Treated Control</th>
<th>OxiDate 2.0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (Lbs/A)</td>
<td>15154</td>
<td>18488</td>
</tr>
</tbody>
</table>

Yield (Lbs/A)
TerraClean 5.0

Broad Spectrum Bactericide/Fungicide

Penetrates soil and control pathogens such as *Pythium*, *Phytophthora*, *Fusarium*, *Verticillium* and *Rhizoctonia* on contact.

- EPA Registered
- Zero-Hour REI
- Easily Apply through drip tape for control of soil borne pathogens
- Apply at planting and during growing season to treat root zone
- Oxygenates root zone
# TerraClean 5.0-Application Program

<table>
<thead>
<tr>
<th>Application Type</th>
<th>Rate (per application)</th>
<th>Application Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drip</td>
<td>1.0-2.0 Gal/A</td>
<td>At planting/transplanting followed by application post-plant at 1-2 week interval up to 6-8 applications as needed</td>
</tr>
</tbody>
</table>
TerraClean 5.0

Broad Spectrum Bactericide/Fungicide

Evaluation of TerraClean 5.0 for control of Phytophthora Crown Rot in Strawberries, 2010-11

**Researcher:** Univ. of Florida, Wimauma, FL.
**Crop:** Strawberry (*Fragaria x ananassa*) var. ‘Florida Radiance’
**Disease:** Crown Rot (*Phytophthora cactorum*)
**Trial Location:** University of Florida, GCREC
TerraClean 5.0
Phytophthora Crown Rot in Strawberry, 2011

Treatments and Application

TerraClean 5.0 @1.0 and 2.0 Gal/A
# of applications-3

First application as post-planting drip at 14 DAP using 2 Gal/A followed by two applications at 38 and 52 DAP using 1 gal/A
TerraClean 5.0
*Phytophthora* Crown Rot in Strawberry, 2011
TerraClean 5.0
Phytophthora Crown Rot in Strawberry, 2011

- Ridomil G-1 Pint-2 aps: 8370
- Presidio-4 floz-2 aps: 6570
- TerraClean 5.0: 5940
- B. subtilis based Biological: 4570
- UNC: 3340

Yield, lb/A
TerraClean 5.0

Broad Spectrum Bactericide/Fungicide

Evaluation of TerraClean 5.0 for Charcoal Rot Control in Strawberries, 2012

Researcher: Univ. of Florida, Wimauma, FL.
Crop: Strawberry (Fragaria x ananassa) var. ‘Strawberry Festival’
Disease: Charcoal Rot (Macrophomina phaseolina)
Trial Location: University of Florida, GCREC
Treatments and Application

1. Trt.1: TerraClean 5.0- 2 Gal/A (1 Application) followed by TerraClean 5.0- 1 Gal/A (5 Applications)

2. Trt.2: TerraClean 5.0- 1-2 Gal/A + B. subtilis based Biological Fungicide- 4.0 qt/A (6 applications)


Products injected into drip irrigation in the last 25% of total water applied
AzaGuard

• Botanical Insecticide/Nematicide

• 3.0% Azadirachtin EC Formulation

• OMRI Approved

• Effective on a Variety of Insect Pests

• Indoor and Outdoor Uses (Field and Packing Houses)

• Environmentally Safe
## AzaGuard

### Insect Pests

<table>
<thead>
<tr>
<th>Aphids</th>
<th>Beetles</th>
<th>Worms (Bud, Cut, Army)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fungus Gnats</td>
<td>Leaf Hoppers</td>
<td>Leaf Miners</td>
</tr>
<tr>
<td>Lepidopterans</td>
<td>Loopers</td>
<td>Mushroom flies</td>
</tr>
<tr>
<td>Saw Flies</td>
<td>Thrips</td>
<td>Whiteflies</td>
</tr>
</tbody>
</table>

### Nematodes

<table>
<thead>
<tr>
<th>Root-Knot</th>
<th>Dagger</th>
<th>Golden</th>
</tr>
</thead>
</table>

And more…
Azadirachtin-Mode of Action

• First Isolated in 1968

• Considered most bioactive ingredient in Neem

• Acts mainly as an insect growth regulator, anti-feedant and ovi-position (egg-laying) deterrent properties
AzaGuard
Botanical Insecticide/Nematicide

AzaGuard for Lygus Bug Control in Strawberries, 2012

**Researcher:** UCCE, CA  
**Crop:** Strawberries  
**Insect Pest:** Lygus Bugs (*Lygus hesperus*)  
**Trial Location:** Commercial Farm
AzaGuard
Lygus Bug Control in Strawberries, 2012

Treatments and Application

AzaGuard- 8.0 and 16.0 fl.oz per 100 gallons

Applications once a week
Total 3 applications
Spray to run off

2 other insecticide formulations evaluated in the trial
AzaGuard
Lygus Bug Control in Strawberries, 2012

![Graph showing the control of Lygus bugs with different treatments over time.

- **Untreated**
- **Acetamiprid**
- **Aza 8 fl oz**
- **Aza 16 fl oz**
- **Novaluron+Bifenthrin**

The x-axis represents different stages of treatment: 0 DAT, I-6 DAT, II-5DAT, III-5DAT. The y-axis represents the number of insects per 20 plant. The graph illustrates the effectiveness of each treatment over time, with darker bars indicating higher control levels.}
IR-4 Trial with AzaGuard for Western Flower Thrip Control, 2012

**Researcher:** Michigan State University  
**Crop:** Marigold; *Tagetes patula* L. ‘Yellow Bonanza’  
**Insect Pest:** Western Flower Thrips; *Frankliniella occidentalis* (Pergande)  
**Trial Location:** Commercial Greenhouse
AzaGuard
Western Flower Thrips Control, 2012

Treatments and Application

- AzaGuard- 16.0 fl.oz per 100 gallons
- Applications once a week
  Total 4 applications (06/06/12-06/26/12)
  Spray on foliage to run off

- 8 other insecticide formulations evaluated in the trial
AzaGuard on Western Flower Thrips Control, 2012

Mean # of All Thrips (Adults and Immatures)

- Untreated
- AzaGuard

Dates:
- 6/12/2012
- 6/19/2012
- 6/26/2012
- 7/11/2012

Values:
- Untreated:
  - 6/12/2012: 5.13
  - 6/19/2012: 2.13
  - 6/26/2012: 1.88
  - 7/11/2012: 1.13
- AzaGuard:
  - 6/12/2012: 7.25
  - 6/19/2012: 1.88
  - 6/26/2012: 1.13
  - 7/11/2012: 1
New Biorational Herbicide from BiosafeSystems

(OMRI Approved for use in Non-Food Crops)
- Non-selective herbicide for Ag., commercial and residential use
- A.I. Ammonium Nonanoate- 40.0% (35% Pelargonic Acid)
- A contact spray control or burn down of annual and perennial weeds and grasses, moss and liverworts.
- Mode of Action: Disrupts plant tissue through cell wall penetration, resulting in cease of plant growth and brown necrosis.
- Non-volatile and water soluble
Application Rates- 3.0%-15.0% v/v
6.0%-10.0% v/v commonly used
Spray Volume- 30-125 Gallons per Acre
45-75 GPA commonly used

Use method- Vegetative burn down, directed and shielded spray, pre-emergence spray and dormant/post-harvest sprays.

Broad number of crop and non-crop groups.
No aquatic applications

Rate and spray volume depend on weed species, height, leaf shape and weed density.
Axxe Weed Control, USDA-ARS-2011-12

% Total Weed Control

<table>
<thead>
<tr>
<th></th>
<th>Axxe 1.5</th>
<th>Axxe 3.0</th>
<th>Axxe 5.0</th>
<th>Axxe 10.0</th>
<th>Weed-check</th>
<th>Weed-check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 DAT</td>
<td>25.0</td>
<td>21.25</td>
<td>81.25</td>
<td>92.50</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>14 DAT</td>
<td>0.08</td>
<td>12.25</td>
<td>59.50</td>
<td>83.25</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
% Grass Weed Control

<table>
<thead>
<tr>
<th></th>
<th>AXXE1.5</th>
<th>AXXE3.0</th>
<th>AXXE5.0</th>
<th>AXXE10.0</th>
<th>Weedy-Check</th>
<th>Weedy-Check</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 DAT</td>
<td>2.50</td>
<td>20.00</td>
<td>73.75</td>
<td>88.75</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>14 DAT</td>
<td>0.50</td>
<td>11.00</td>
<td>58.25</td>
<td>80.75</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>
Thank You
From BioSafe Systems, LLC

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