Effect of Botector® on Fruit Diseases

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What is Botector®?

• Manufactured by bio-ferm

• Yeast –like organism (fungus)
  – Two strains of *Aureobasidium pullulans*
    • DSM 14940 and DSM 14941

• Mode of Action (MoA) is competitive exclusion
  – Competes for nutrients and real estate
  – Labeled for control of botrytis, brown rot, anthracnose, and blossom blight on stone fruit, strawberries, berries, and grapes
  – Labeled for control of post-harvest diseases on pome fruit when applied pre-harvest
  – Activity is mostly against fungi
Fruit Colonization by *Aureobasidium pullulans*
# Botector® Labeled Crops and Diseases

<table>
<thead>
<tr>
<th>Crop</th>
<th>Disease</th>
<th>Rate oz/acre</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>GRAPE:</strong></td>
<td>Botrytis</td>
<td>5-10</td>
<td>1-8 applications</td>
</tr>
<tr>
<td>American bunch grapes (Table Grapes, Wine Grapes and Raisin Grapes), Muscadine grape and Vinifera grape, Raisin</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>BERRIES:</strong></td>
<td>Botrytis</td>
<td>5-10</td>
<td>As needed at 5-7 day intervals</td>
</tr>
<tr>
<td>Strawberry, Raspberry, Blueberry, Blackberry, Huckleberry, Red and Black currant, Loganberry</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>STONE FRUIT:</strong></td>
<td>Blossom Blight</td>
<td>10</td>
<td>1-10 applications</td>
</tr>
<tr>
<td>Apricot, Cherry (including sweet and tart), Nectarine, Peach, Plum (including Chickasaw, Damson and Japanese), Plumcot, Prune (fresh), Almond</td>
<td>Brown Rot</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>POME FRUIT:</strong></td>
<td>Storage Diseases</td>
<td>10</td>
<td>1-6 applications</td>
</tr>
<tr>
<td>Apple, Crabapple, Loquat, Mayhaw, Pear, Oriental pear, Quince</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Botector® Application Restrictions

• Zero hour PHI (Pre-Harvest Interval)
  – Can be applied up to day of harvest

• Four (4) hour REI (Re-entry Interval)
  – Unless PPE is used (coveralls, chemical resistant gloves, shoes and socks)

• 25 foot buffer around lakes, streams, and other groundwater areas
<table>
<thead>
<tr>
<th>Active Compound</th>
<th>Compatibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper hydroxide</td>
<td>Yes</td>
</tr>
<tr>
<td>Copper sulfate</td>
<td>Yes</td>
</tr>
<tr>
<td>Bordeaux mix</td>
<td>Maybe (probably a function of composition)</td>
</tr>
<tr>
<td>Copper oxychloride</td>
<td>Yes</td>
</tr>
<tr>
<td>Copper chloride</td>
<td>Yes</td>
</tr>
<tr>
<td>Copper soap</td>
<td>No</td>
</tr>
<tr>
<td>Sulfur, elemental</td>
<td>No</td>
</tr>
</tbody>
</table>

- There are some inconsistencies in these, it often depends on the formulation inerts
- Bordeaux mix has lime at variable levels and therefore different compatibility results
# Botector®
## Compatible Fungicides/Antibiotics

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Commodity</th>
<th>Diseases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vangard WG</td>
<td>Pome, berries, grapes, caneberries, strawberry</td>
<td>Scab, powdery mildew, and others</td>
</tr>
<tr>
<td>Elite 45 DF</td>
<td>Pome, grape, stone fruit</td>
<td>Scab, rust, powdery mildew, others</td>
</tr>
<tr>
<td>Scala 400 SC</td>
<td>Pome, stone fruit, grape</td>
<td>Scab, and others</td>
</tr>
<tr>
<td>Luna Privilege</td>
<td>Apple, cherry, strawberry, wine grapes</td>
<td>Scab, powdery mildew, and others</td>
</tr>
<tr>
<td>Quintec</td>
<td>Grape, cherry, stone fruit, strawberry</td>
<td>Powdery mildew only</td>
</tr>
</tbody>
</table>

- Inclusion in this list does not imply endorsement of the product
- It is better, if at all possible, to apply any fungicide sequentially
- Do not assume other biological products are compatible, many are not
STRAWBERRY TRIALS
Effect of Botector® on Botrytis Fruit Rot on Strawberries

Hillsboro, OR, 2011

Botector® was applied on 5/18, 5/24, 5/30, 6/6, 6/13, and 6/20 at a rate of 14oz/Acre per application. Rain events occurred on 5/21, 5/25, 5/30, 6/13, 6/18.
Effect of Botector® on Botrytis Fruit Rot on Strawberries

Hillsboro, OR, 2011

Control

Botector®
Botector® for the Control of Botrytis and Rhizopus in Strawberries var. Camarosa

Trial at Commercial Organic Farm, San Diego County, CA, 2013

- Applications of 6 oz/Acre at 2/28, 3/7, 3/14, 3/22, and 3/28
- Harvested on 4/11 and held at >70 F and 100% RH for 3 days
Botector® on Camarosa Strawberries
Post 3 Days @ 70° F and 100% RH

- Commercial Organic Farm, CA, 2013
- Botector® applications of 6 oz/Acre at 2/28, 3/7, 3/14, 3/22, and 3/28
- Harvested on 4/11 and held at >70 F and 100% RH for 3 days
Botector®
Botrytis Control on Strawberry

University Trial, CA 2012

Spray Schedule: 6/8, 6/22, 7/6, and 7/20;
GPA: 150; PSI: 120
Botector® on Strawberry
Control of Anthracnose Fruit Rot

University Trial, MI, 2011

Spray Schedule: Bloom (5/27), Bloom-Small Green Fruit (6/4), Green Fruit (6/10), 2 d pre-harvest 1 (6/18), 2 d pre-harvest 2 (6/25). Evaluated after 6 days @ 72 F and 100% RH.

Chemical Standard: Captec 4L, Topsin M, and Kocide 3000-Apps. 1, 2; Cabrio EG-App 3; Switch 62.5-Apps. 4,5
Botector® on Strawberry
Reduction of Phomopsis Leaf Blight

University Trial, MI, 2011

Spray Schedule: Bloom (5/27), Bloom-Small Green Fruit (6/4), Green Fruit (6/10), 2 d pre-harvest 1 (6/18), 2 d pre-harvest 2 (6/25). Evaluated after 6 days @ 72 F and 100% RH.

Chemical Standard: Captec 4L, Topsis M, and Kocide 3000-Apps. 1, 2; Cabrio EG-App 3; Switch 62.5-Apps. 4, 5.
Botector® on Strawberry var. Jewel Increases Marketable Fruit

University Trial, MI, 2011

Spray Schedule: Bloom (5/27), Bloom-Small Green Fruit (6/4), Green Fruit (6/10), 2 d pre-harvest 1 (6/18), 2 d pre-harvest 2 (6/25). Evaluated after 6 days @ 72 F and 100% RH

Chemical Standard: Captec 4L, Topsin M, and Kocide 3000-Apps. 1, 2; Cabrio EG-App 3; Switch 62.5-Apps. 4, 5.
GRAPE TRIALS
Botector® was applied 5 times at Bloom (14 Jul), Bunch Close (4 Aug), Veraison (15 Sep), Pre-harvest (29 Sep) and Pre-harvest (13 Oct). Chemical Standard was 4 applications.
Effect of Botector® on Botrytis Cluster Rot in Wine Grapes

Michigan State University, 2011

Spray dates: 1 = 9 May (dormant), 2 = 14 Jun (bloom), 3 = 29 Jun (pea-sized clusters), 4 = 18 Jul (bunch closure), 5 = 8 Aug (veraison).
Botector® on Wine Grapes

University Trial, New York, 2012

Botrytis on Vignoles Wine Grape

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Percent Incidence</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>61.3 A</td>
<td></td>
</tr>
<tr>
<td>Luna Tranquility &amp; Flint 50 WG, 12 fl oz &amp; 3 oz, 1, 3 &amp; 2, 4</td>
<td>41.3 B, C, D</td>
<td>B, C, D</td>
</tr>
<tr>
<td>Rovral 4 SC, 16 fl oz, 1-4</td>
<td>36.3 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Elevate 50 WG, 1 lb, 1-2</td>
<td>36.3 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Luna Experience, 8 fl oz, 1-4</td>
<td>36.3 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Elevate 50 WG, 1 lb, 2-3</td>
<td>35 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Elevate 50 WG, 1 lb, 1-3</td>
<td>35 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Pristine 38 WG, 23 oz, 1-4</td>
<td>35 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Luna Experience &amp; Flint 50 WG, 8 fl oz &amp; 3 oz, 1, 3 &amp; 2, 4</td>
<td>35 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Botector, 5 oz, 1-4</td>
<td>32.5 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Botector, 15 oz, 1-4</td>
<td>31.3 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Botector, 10 oz, 1-4</td>
<td>30 B, C, D, E</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Rovral 4 SC, 32 fl oz, 1-4</td>
<td>25 D, E</td>
<td>D, E</td>
</tr>
<tr>
<td>Elevate 50 WG, 1 lb, 1-4</td>
<td>25 D, E</td>
<td>D, E</td>
</tr>
</tbody>
</table>

Timing 1: Late Bloom; 2: Bunch Closure; 3: Veraison; 4: + 2 Weeks
App 1 @ 50 GPA, Apps 2-4 @ 100 GPA
### University Trial, New York, 2012

#### Botrytis on Vignoles Wine Grape

<table>
<thead>
<tr>
<th>Product Description</th>
<th>Percent Severity (% Cluster Infected)</th>
<th>Letters</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>12.1</td>
<td>A</td>
</tr>
<tr>
<td>Luna Tranquility &amp; Flint 50 WG, 12 fl oz &amp; 3 oz, 1,3 &amp; 2,4</td>
<td>5.8</td>
<td>B, C, D, E, F</td>
</tr>
<tr>
<td>Rovral 4 SC, 16 fl oz, 1-4</td>
<td>5.1</td>
<td>B, C, D, E, F, G</td>
</tr>
<tr>
<td>Elevate 50 WG, 1 lb, 1-2</td>
<td>5.7</td>
<td>A, B, C</td>
</tr>
<tr>
<td>Luna Experience, 8 fl oz, 1-4</td>
<td>5.9</td>
<td>B, C, D, E, F</td>
</tr>
<tr>
<td>Elevate 50 WG, 1 lb, 2-3</td>
<td>6.2</td>
<td>B, C, D, E, F</td>
</tr>
<tr>
<td>Elevate 50 WG, 1 lb, 1-3</td>
<td>3.9</td>
<td>B, C, D, E, F, G</td>
</tr>
<tr>
<td>Pristine 38 WG, 23 oz, 1-4</td>
<td>5.6</td>
<td>B, C, D, E, F</td>
</tr>
<tr>
<td>Luna Experience &amp; Flint 50 WG, 8 fl oz &amp; 3 oz, 1,3 &amp; 2,4</td>
<td>6.8</td>
<td>B, C, D, E</td>
</tr>
<tr>
<td>Botector, 5 oz, 1-4</td>
<td>4.4</td>
<td>B, C, D, E, F, G</td>
</tr>
<tr>
<td>Botector, 15 oz, 1-4</td>
<td>4.3</td>
<td>B, C, D, E, F, G</td>
</tr>
<tr>
<td>Botector, 10 oz, 1-4</td>
<td>4.1</td>
<td>B, C, D, E, F, G</td>
</tr>
<tr>
<td>Rovral 4 SC, 32 fl oz, 1-4</td>
<td>3.4</td>
<td>E, F, G</td>
</tr>
<tr>
<td>Elevate 50 WG, 1 lb, 1-4</td>
<td>2.2</td>
<td>G</td>
</tr>
</tbody>
</table>

**Timing** 1: Late Bloom; 2: Bunch Closure; 3: Veraison; 4: + 2 Weeks

App 1 @ 50 GPA, Apps 2-4 @ 100 GPA
Botector® for Botrytis Control
Fiesta Raisin Grapes

Fresno, CA Grower Trial, 2013

- Three Botector® applications between 80% cap fall and berry softening
- Percent incidence is the percent clusters with *any* disease, >99% confidence of statistical significance
- Percent severity is percent clusters with 50% or more of the cluster affected
- Evaluation date: **July 17, 2013**
Botector® for Botrytis Control
Fiesta Raisin Grapes

Fresno, CA Grower Trial, 2013

- Three Botector® applications between 80% cap fall and berry softening
- Percent incidence is the percent clusters with *any* disease, >99% confidence of statistical significance
- Percent severity is average percent of cluster with symptoms
- Evaluation date: September 11, 2013
Botector® for Botrytis Control

Commercial Trial, Fredonia, NY, 2013

Reisling Grapes

- Botector applied at 10 oz/acre 3 days after respective conventional application
- Application Timings: 80% cap fall, pre-bunch closure, veraison, and ripening

P(T<=t) two-tail (Incidence) = 0.048106803
(>95% confidence it is statistically significant)

P(T<=t) two-tail (Severity) = 0.085026515
(>91% confidence it is statistically significant)
Botector® Control of Botrytis in ‘Fiesta’ Raisin Grapes

Control

Treated
Botector® Control of Botrytis in ‘Fiesta’ Raisin Grapes

Control

Treated
STONE FRUIT TRIALS
Botector® for Monilinia Control
‘Santa Rosa’ Plums

Commercial Research Trial, CA, 2013

- Rovral @ 48 fl oz/Acre
- Rovral applied at 70% bloom and 50% petal fall
- Botector@10 oz/Acre
- Botector applied at 70% and 100% bloom and 50% and >60% petal fall
- +98% confidence Botector has significantly less disease than the control
Advantages of Using Botector®

- Shown to be safe for use around bees and beneficial insects.
- Excellent IPM and resistance management partner for both organic and conventional programs.
- Unique mode of action eliminates chance of resistance development.
- Naturally occurring yeast is exempt from MRL’s making it an ideal product to use when pesticide residues are a concern.
- No visible residues left from the compound after application.
- Does not affect fermentation or wine quality.
- Zero (0) Day Pre-Harvest Interval
- Proven efficacy
Thank You

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