Industry Update Bayer CropScience

Luna

REASON

MOVENTO

Sivanto®

FLINT

SERENADE OPTIMUM

Alion
<table>
<thead>
<tr>
<th>Signal word</th>
<th>PPE</th>
<th>FRAC Chemical class</th>
<th>REI (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caution</td>
<td>Long-sleeved shirt Long pants Shoes plus socks Chem-resistant gloves</td>
<td>Group 7 (SDHI) Group 3 (DMI)</td>
<td>12 hrs (Except for cane tying, turning, or girdling on wine grape which is 5 days)</td>
</tr>
<tr>
<td>Caution</td>
<td>Same</td>
<td>Group 7 (SDHI) Group 9 (AP)</td>
<td>12 hrs</td>
</tr>
<tr>
<td>Crop</td>
<td>PHI (days)</td>
<td>Crop Safety</td>
<td>Adjuvants</td>
</tr>
<tr>
<td>--------------</td>
<td>------------</td>
<td>------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>Wine grape</td>
<td>14</td>
<td>Never seen on these crops</td>
<td>No restrictions Adjuvants improve disease control</td>
</tr>
<tr>
<td>Wine Grape</td>
<td>7</td>
<td>Never seen on these crops</td>
<td>No restrictions Adjuvants improve disease control</td>
</tr>
</tbody>
</table>
Fluopyram
Chemistry is close to Pristine, but different….and better.

Luna = fluopyram
pyridinylethylbenzamide (pyramide)

Carboxin
oxathiincarboxamide

Boscalid
pyridinecarboxamide

Bixafen
pyrazolecarboxamide

Succinate dehydrogenase inhibitor
Fluopyram - Molecular Structure

Fluopyram, a pyramide, has a different molecular shape compared to the carboxamides which may improve its ability to bind where structural mutations have resulted in resistance.
“This suggests very tight binding for fluopyram”

## Industry Update Bayer CropScience

### CARBOXAMIDE RESISTANCE

<table>
<thead>
<tr>
<th>Disease</th>
<th>Pathogen</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf spot of Pistachio and Almond</td>
<td><em>Alternaria alternata</em></td>
<td>USA – CA</td>
</tr>
<tr>
<td>Grey mold of Grape</td>
<td><em>Botrytis cinerea</em></td>
<td>France</td>
</tr>
<tr>
<td>Grey mold of Strawberry</td>
<td><em>Botrytis cinerea</em></td>
<td>Florida</td>
</tr>
<tr>
<td>Powdery mildew of Cucumber</td>
<td><em>Podosphaera xanthii</em></td>
<td>Japan</td>
</tr>
<tr>
<td>Corynespora leaf spot of Cucumber</td>
<td><em>Corynespora cassiicola</em></td>
<td>Japan</td>
</tr>
<tr>
<td>Gummy stem blight of Watermelon</td>
<td><em>Didymella bryoniae</em></td>
<td>USA - GA</td>
</tr>
<tr>
<td>Grey mold of Apples</td>
<td><em>Botrytis spp. (storage)</em></td>
<td>Washington</td>
</tr>
<tr>
<td>Early blight of Potato</td>
<td><em>Alternaria solani</em></td>
<td>Idaho</td>
</tr>
</tbody>
</table>

**Boscalid resistance detected**
Grape – Powdery Mildew

D. Gubler, Davis CA, 2009

% Disease Severity

Untreated: 97
Rally 5oz, Quintec 6.6: 37
Pristine 8oz 14d: 27
Adament, Quintec: 20
Inspire Super, Quintec: 14
Pristine, Vintage, Flint: 9.5
Adament, Luna Exp, Flint: 1
Luna Experience: 0.7

Grape – Powdery Mildew
• Good results Luna programs compared to competition
• Some weaker treatments not included in this graph
• Incidence ratings (% rotten clusters) similar

Table 1. Fungicide treatments evaluated for Botrytis bunch rot control.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Application Timing</th>
<th>Product Rate/Acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Untreated Control</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>2. Vangard 75 WG</td>
<td>B, PC, V</td>
<td>10 oz</td>
</tr>
<tr>
<td>3. Switch 62.5 WG</td>
<td>B, PC, V</td>
<td>14 oz</td>
</tr>
<tr>
<td>5. Inspire Super 338 EW</td>
<td>B, PC, V</td>
<td>20 fl oz</td>
</tr>
<tr>
<td>6. Pristine 38 WG</td>
<td>B, PC, V</td>
<td>23 oz</td>
</tr>
<tr>
<td>7. Elevate 50 WG</td>
<td>B, PC, V</td>
<td>1 lb</td>
</tr>
<tr>
<td>8. Luna Experience 400 SC</td>
<td>B, PC, V</td>
<td>8 fl oz</td>
</tr>
<tr>
<td>9. Luna Tranquility</td>
<td>B, PC, V</td>
<td>16 fl oz</td>
</tr>
<tr>
<td>10. Luna Tranquility</td>
<td>B, V</td>
<td>16 fl oz</td>
</tr>
<tr>
<td>Serenade Optimum</td>
<td>PC</td>
<td>1 lb</td>
</tr>
</tbody>
</table>

*B, PC, and V are full bloom, cluster pre-close, and veraison respectively.
## Wine Grape Fungicide MRLs in ppm

( as of January, 2014 - mrldatabase.com)

<table>
<thead>
<tr>
<th></th>
<th>Codex</th>
<th>Australia</th>
<th>Canada</th>
<th>Japan</th>
<th>Korea</th>
<th>Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Luna E (fluo/teb)</td>
<td>2/6</td>
<td>---</td>
<td>2/5</td>
<td>10/10</td>
<td>2/2</td>
<td>---</td>
</tr>
<tr>
<td>Luna T (fluo/pyrim)</td>
<td>2/4</td>
<td>---</td>
<td>2/2</td>
<td>10/10</td>
<td>2/5</td>
<td>---</td>
</tr>
<tr>
<td>Flint</td>
<td>3</td>
<td>0.5</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Scala</td>
<td>4</td>
<td>5</td>
<td>5</td>
<td>10</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>Pristine (bos/pyraclostrobin)</td>
<td>5/2</td>
<td>4/2</td>
<td>3.5/2</td>
<td>10/3</td>
<td>5/3</td>
<td>1/2</td>
</tr>
<tr>
<td>Vivando</td>
<td>---</td>
<td>4.5</td>
<td>4.5</td>
<td>---</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Mettle</td>
<td>---</td>
<td>0.5</td>
<td>---</td>
<td>0.5</td>
<td>2</td>
<td>0.5</td>
</tr>
<tr>
<td>InspireSuper (difenocon/cyprodinil)</td>
<td>0.1</td>
<td>4</td>
<td>4</td>
<td>0.5</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Vanguard</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Elevate</td>
<td>15</td>
<td>10</td>
<td>4</td>
<td>20</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Sovran</td>
<td>1</td>
<td>---</td>
<td>1</td>
<td>15</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Tebuconazole</td>
<td>6</td>
<td>2</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Quintec</td>
<td>2</td>
<td>0.6</td>
<td>0.5</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Viticure</td>
<td>---</td>
<td>0.5</td>
<td>2.5</td>
<td>2</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Rally</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Abound</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>10</td>
<td>3</td>
<td>2</td>
</tr>
</tbody>
</table>
Bayer CropScience intends to offer Luna on a wider range of fruit and vegetable crops in late 2015 pending additional registrations in:

*Stone fruit, Pome fruit, Strawberry, Leafy brassica vegetables, Fruiting vegetables, Brassica vegetables, Bulb vegetables, Carrots, Cucurbits, and others.*
MRL Update

Vegetable disease targets
Phytophthora and Pythium, Alternaria (Early blight, Purple blotch)
Downy mildew, White rust, Cavity spot and other Pythium
## REASON – MRLs (ppm)- 2013

<table>
<thead>
<tr>
<th>Product</th>
<th>EU</th>
<th>Mexico</th>
<th>Canada</th>
<th>Japan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lettuce, Head</td>
<td>2</td>
<td>60.0</td>
<td>60.0</td>
<td>20</td>
</tr>
<tr>
<td>Lettuce, Leaf</td>
<td>2</td>
<td>60.0</td>
<td>60.0</td>
<td>20</td>
</tr>
<tr>
<td>Broccoli, Cauliflower</td>
<td>0.02</td>
<td>5.0</td>
<td>5.0</td>
<td>5</td>
</tr>
<tr>
<td>Broccoli, Chinese</td>
<td>0.02</td>
<td>5.0</td>
<td>5.0</td>
<td>---</td>
</tr>
<tr>
<td>Cabbage</td>
<td>0.02</td>
<td>5.0</td>
<td>5.0</td>
<td>5</td>
</tr>
<tr>
<td>Bok Choy, collards, kale</td>
<td>0.02</td>
<td>5.0</td>
<td>55.0</td>
<td>---</td>
</tr>
<tr>
<td>Carrot</td>
<td>0.02</td>
<td>0.15</td>
<td>0.02</td>
<td>0.15</td>
</tr>
<tr>
<td>Celery</td>
<td>0.02</td>
<td>60.0</td>
<td>60.0</td>
<td>---</td>
</tr>
<tr>
<td>Peppers</td>
<td>0.02</td>
<td>1.0</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>Tomatoes</td>
<td>0.02</td>
<td>1.0</td>
<td>1.0</td>
<td>1</td>
</tr>
<tr>
<td>Spinach</td>
<td>0.02</td>
<td>60.0</td>
<td>60.0</td>
<td>---</td>
</tr>
<tr>
<td>Onions, Bulb</td>
<td>0.02</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Onions, Green</td>
<td>---</td>
<td>1.5</td>
<td>1.5</td>
<td>---</td>
</tr>
<tr>
<td>Cucumbers</td>
<td>0.02</td>
<td>0.15</td>
<td>0.15</td>
<td>0.3</td>
</tr>
<tr>
<td>Watermelon</td>
<td>0.02</td>
<td>0.15</td>
<td>0.15</td>
<td>0.15</td>
</tr>
</tbody>
</table>

1/ Changed in Aug. 2013. Was 15 ppm for head and 20 ppm for leaf lettuce
2/ Established in August 2013.
Label updates 2014
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Unique mode of action and symptoms in sucking pests

• A unique mode of action against several key target pests, Lipid Biosynthesis Inhibitor (LBI)
• Nymphs have incomplete molting, or dehydration and subsequent death
• Adult females accumulate nymphs and die
• Strong effects on fecundity, fertility, and survivability of progeny
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In plants two transport systems coexist - xylem (one-way) and phloem (two-way)

The active ingredient is absorbed into the leaf, readily hydrolyzed to spirotetramat-enol – which translocates.
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$^{14}$C autoradiograph of systemic movement and protection of new leaves...and roots?

Application sites

Systemic movement of spirotetramat into new leaves
Industry Update Bayer CropScience

Rootknot nematodes-cowpeas-
UCR, Phil Roberts
Industry Update Bayer CropScience

Nematodes-cowpeas-
UCR, Phil Roberts
Rootknot nematodes-cowpeas-
UCR, Phil Roberts, 2010- Juveniles (J3-4s) impacted

Movento Trial
Roots Stained 1 Week After Inoculation

Developmental Stages as Percent of Total Number

Inoculated with J2s

A-W = Water
A-D = Dynamic 0.25%
A-L = Movento-4 oz + Dynamic
A-H = Movento-6.25 oz + Dynamic

Bar Graph:
- A-W: 79.3 cd
- A-D: 85.0 bc
- A-L: 92.6 ab
- A-H: 96.2 a

Legend:
- J2
- J3 & J4
Nematodes-cowpeas-
UCR, Phil Roberts, 2011- Adults impacted

10 dai
Nematode numbers in each stage

Inoculated with J2s

Movento rates: 2.5, 4.0, 6.5 oz/acre equivalent
Rootknot nematodes-cowpeas-2011
UCR, Phil Roberts, Egg masses impacted

Inoculated with J2s

Movento II
20 dai

Movento rates: 2.5, 4.0, 6.5 oz/acre equivalent
Movento/rootknot nematode control
Conclusion – Phil Roberts, UCR-2011

• “For seedlings, these results suggest early season protection of annual host plants from nematode infection and damage could be achieved from Movento treatment at the seedling stage.”
Movento: New crops - 2014

• Additional crops
  – Tropical crops
    • Banana and Plantain
    • Coffee
    • Pineapple
    • Taro
  – Globe artichokes
  – Pomegranates
  – Watercress
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**Movento: new crops – 2014**

- Additional crops
  - Bulb Vegetables
    - Onions
  - Bushberry & low growing berry subgroup
    - Blueberries
    - Cranberries
    - Currants
Movento new crops: 2015

- 2014 submission: June, 2014 (registration 2Q, 2015)
  - Strawberries – aphids, whiteflies, mites
  - Cucurbits (no bloom restriction)
  - Sugar beets
  - Cotton
  - Carrots (IR-4)

(Updated March 27, 2014 – S. Maria meeting)
New Strawberry MRL for Canada
A New Insecticide from Bayer CropScience

Science For A Better Life

Registration Pending
Chemical class: **Butenolide**

- Bayer synthesized new compounds based on derivations of the natural alkaloid **Stemofoline**, identified in *Stemona japonica* (monocot group from Asia/Australia).

- This new class of compounds are called **Butenolides**, and
  - Act on the Nicotinic acetylcholine receptor (**nAChR**) agonist IRAC Group 4D
  - Show no cross resistance on imidaclorpid-resistant whiteflies.
  - These compounds have shown insecticidal activity
    - In foliar, soil, and seed applications.
    - No phytotoxic effects observed.
Product Overview

- Chemical class: **Butenolide**
- Core formulation: 200 SL
- Mode of action: Contact and ingestion activity
- Pest Spectrum: **Aphids, Leafhoppers, Whiteflies, Scales, Psyllids, Scirtothrips**
- Application Methods: Foliar and **Soil**
- REI: 4 hours, 12 hrs in CA
- PHI: Foliar - 0-14 days dependent on crop
  Soil – 21-45 days dependent on crop

Registration Pending
Submission (EPA & CDPR) : July 2012

Positioned as reduced risk 18 month PRIA review

Registration Expected : October 2014 –

Full Market Launch : 2015
  TNV, Vegetables, Grapes, Strawberries, Cotton, Alfalfa, Cereals

Tier II submission in 2015
  Stone fruit, greenhouse tomatoes and cucumbers, pomegranates, avocados, cactus, caneberries
# MRLs

<table>
<thead>
<tr>
<th>Crop</th>
<th>U.S.</th>
<th>CODEX</th>
<th>E.U.</th>
<th>Canada/Mex, Australia</th>
<th>Japan</th>
<th>Korea</th>
<th>Taiwan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Label</td>
<td>Q3 2014</td>
<td>Q3 2016</td>
<td>Q1 2016</td>
<td>Q3 2014</td>
<td>Q1 2016</td>
<td>2017 or 2016 if CODEX accepted</td>
<td>Q1 2016</td>
</tr>
</tbody>
</table>

Sivanto - MRL Establishment (anticipated, best estimates)

Registration Pending

Bayer CropScience
Biological Characteristics

- Activity via ingestion and contact
- Adult knockdown, nymph & egg control
- Rapid and strong feeding cessation effect – Disease transmission inhibition (CYSDV, HLB?, leafroll virus?)
- Xylem systemic from root uptake, translaminar / locally systemic from foliar applications
- Excellent residual control
- Excellent honey bee safety profile

Registration Pending
Soil App. - CYSDV - Melons - 68 DAT

SIVANTO

21 oz/A
14 oz/A
28 oz/A
UTC

10.12.2011
Sivanto:
Effects on honey bee foraging/brood

Studies indicate Sivanto has no adverse effects on mortality, foraging activity, brood development, hive vitality and overwintering.

<table>
<thead>
<tr>
<th>Test Substance</th>
<th>Study Type/Duration</th>
<th>Ecotox Endpoint (LD50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sivanto</td>
<td>Oral 48 h</td>
<td>3.2 ug Al/bee</td>
</tr>
<tr>
<td>Sivanto (technical)</td>
<td>Contact 48 h</td>
<td>&gt;200 ug Al/bee</td>
</tr>
<tr>
<td>Sivanto</td>
<td>Foliar residue @ 3,8, 25 h</td>
<td>No toxicity @ 205 g Al/ha</td>
</tr>
</tbody>
</table>

Note: Azole fungicides inhibit metabolism of Sivanto
Bayer Biologics
Not just for organic programs

- Rotational options (res mngt)
- 0-day PHI for all crops
- No MRL issues