Aphid Modeling: And Management of Potato virus Y

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Wisconsin Seed Potato Improvement Association, Inc.

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### PVY Strain identification from 2004-06

**State analyzed**
- **WI**: 163

**Total plants tested from PHT**
- **2009 crop**: 53
- **2010 crop**: 3
- **2011 crop**: 82
- **2012 crop**: 112
- **2013 crop**: 91

**Number of PVY positives**
- **2009 crop**: 45
- **2010 crop**: 3
- **2011 crop**: 65
- **2012 crop**: 108
- **2013 crop**: 87

**Number of PVYO**
- **2009 crop**: 30
- **2010 crop**: 67%
- **2011 crop**: 3
- **2012 crop**: 54%
- **2013 crop**: 32%

**Number of PVYN:O**
- **2009 crop**: 12
- **2010 crop**: 27%
- **2011 crop**: 0
- **2012 crop**: 38%
- **2013 crop**: 56%

**Number of PVYN:TN**
- **2009 crop**: 1
- **2010 crop**: 2%
- **2011 crop**: 0
- **2012 crop**: 5
- **2013 crop**: 10%

**Number of PVY NTN**
- **2009 crop**: 1
- **2010 crop**: 2%
- **2011 crop**: 5
- **2012 crop**: 8%
- **2013 crop**: 7

**Mixture of strains**
- **2009 crop**: 2
- **2010 crop**: 4%
- **2011 crop**: 0
- **2012 crop**: 0%
- **2013 crop**: 2

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**No data**
- **2009 crop**: 6
- **2010 crop**: 2
- **2011 crop**: 0
- **2012 crop**: 1
- **2013 crop**: 2
Russet Burbank

\[ y = -1.1741x + 5001.3 \]

\[ y = -1.1741x + 440.39 \]

Market Yield vs. EOS % PVY graph.
Russet Norkotah

\[ y = -1.1687x + 534.89 \]

\[ y = -1.1687x + 505.36 \]

\[ y = 1.0806x + 371.81 \]
Impacts on Marketable Yield

The marginal impact of a 1 percent level of PVY infection:

- **Russet Norkotah**
  - 1.169 cwt/acre (based on 2010 and 2012)

- **Russet Burbank**
  - 1.174 cwt/acre

*Note that in both cases these results are statistically significant.*
Dollar Impacts of PVY

Russet Burbank – Fresh Market
Each percent PVY infection = $5.13 to $18.06 per acre loss.
With a 10% level of infection you could expect to lose $115.93 per acre

Russet Burbank – Processing Market
Each percent PVY infection = $4.26 to $14.08 per acre loss.
With a 10% level of infection you could expect to lose $91.69 per acre
Dollar Impacts of PVY

Russet Norkotah – Fresh Market
Each percent PVY infection = $7.24 to $17.30 per acre loss.
With a 10% level of infection you could expect to lose $122.74 per acre

Russet Norkotah – Processing Market
Each percent PVY infection = $5.22 to $13.08 per acre loss.
With a 10% level of infection you could expect to lose $91.47 per acre
Modeling Aphid Phenology: Wisconsin GAMM’s (2005-11)
2013 Seasonal Dispersal of PVY Aphid-Vectors: Rhinelander WI
2013 Seasonal Dispersal of PVY Aphid-Vectors: Antigo WI
# Products Evaluated for Managing Aphid Transmission of PVY in Wisconsin, 2013-14

<table>
<thead>
<tr>
<th>Trt No.</th>
<th>Program</th>
<th>Form Conc Unit</th>
<th>Form Type</th>
<th>Rate Unit</th>
<th>Start Date</th>
<th>Appl Freq</th>
<th>Yield (cwt/ac)</th>
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<td>Movento 2 LB/GAL</td>
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<td>Movento 2 LB/GAL</td>
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<td>3.3 fl oz/a</td>
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<td>Fulfill 50 %AW/W</td>
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<td>5.5 oz wt/a</td>
<td>NA</td>
<td>NA</td>
<td>316.5</td>
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</table>

P=0.0723
LSD=54.32
PVY Foliar Protectant Trial, 2013-14
Winter Grow-Out Results

Mean Proportion of PVY-Infected Plants

Oil Compound (Concentration)

- UTC
- Stylet Oil (1.5)
- Stylet Oil (75)
- Aphoil (2)
- Aphoil (4)
- Aphoil (2) + Actigard (0.75oz)
- Aphoil (2) + Actigard (1oz)
- Aphoil (2) + Exirel (13.5)
- Aphoil (2) + Exirel (17)
- Aphoil (2) + Exirel (20.5)
- Stylet Oil (.75) + Actigard (0.75oz)
- Stylet Oil (.75) + Actigard (1oz)
- Stylet Oil (.75) + Movento (5)
- Stylet Oil (.75) + Fulfill (3.7)
- Stylet Oil (.75) + Fulfill (13.7)
- Stylet Oil (15.3) + Fulfill (15.3)

P = 0.0014

5% mosaic ‘Certified’
Current Season Management of PVY/seed Potato - Application Thresholds

- Early grain aphid migrations (mid-June)
- Colonizing aphids and mass flights (late July – early August)

Need to protect potato crop from PVY for nearly 8-10 weeks

At-plant systemic

Weekly oil

Weekly oil

Weekly oil

2X

Potato Crop

Vine Kill

Crop Protection Schedule:

- 15-Mar
- 14-Apr
- 14-May
- 13-Jun
- 13-Jul
- 12-Aug
- 11-Sep
- 11-Oct

- Corn leaf aphid
- Soybean aphid
- Spotted alfalfa aphid
- Bird-cherry oat aphid
## Aphid Management: Potato / PVY

<table>
<thead>
<tr>
<th>Mode of Action Class (Group)</th>
<th>Active Ingredient</th>
<th>Trade Names</th>
<th>Application / Delivery</th>
<th>Registration Status</th>
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<tbody>
<tr>
<td>Nicotinic acetylcholine receptor (nAChR) agonists (4A &amp; 4C)</td>
<td>imidacloprid</td>
<td>Admire Pro®, Gaucho®, Provado®</td>
<td>IF, ST, F, SD</td>
<td>Registered</td>
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<td></td>
<td>thiamethoxam</td>
<td>Platinum®, Cruiser®, Actara®</td>
<td>IF, ST, F, SD</td>
<td>Registered</td>
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<td></td>
<td>clothianadin</td>
<td>Belay®</td>
<td>IF, ST, F, SD</td>
<td>Registered</td>
</tr>
<tr>
<td></td>
<td>dinotefuran</td>
<td>Scorpion™</td>
<td>F</td>
<td>Registered</td>
</tr>
<tr>
<td></td>
<td>acetamiprid</td>
<td>Assail®</td>
<td>F</td>
<td>Registered</td>
</tr>
<tr>
<td></td>
<td>sulfoxaflor</td>
<td>Transform®</td>
<td>F</td>
<td>Registered (2012)</td>
</tr>
<tr>
<td>Selective Homopteran feeding blockers (9B &amp; 9C)</td>
<td>pymetrozine</td>
<td>Fulfill®</td>
<td>F</td>
<td>Registered</td>
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<tr>
<td></td>
<td>flonicamid</td>
<td>Beleaf®</td>
<td>F</td>
<td>Registered</td>
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<tr>
<td>Narrow-range mineral and paraffinic oils (UN)</td>
<td>petroleum oil</td>
<td>Aphoil™, JMS Stylet oil®</td>
<td>F</td>
<td>Registered</td>
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<tr>
<td>Terpene constituents (C. album) (UN)</td>
<td>terpene</td>
<td>Requiem®</td>
<td>F</td>
<td>Registered (2010)</td>
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<tr>
<td>Inhibitors of acetyl CoA carboxylase (23)</td>
<td>spirotetramat</td>
<td>Movento®</td>
<td>F</td>
<td>Registered (2011)</td>
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<tr>
<td>Ryanodine receptor modulators (28)</td>
<td>cyazypyr</td>
<td>Verimark™, Exirel™</td>
<td>IF, F</td>
<td>Not Registered</td>
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</table>

*a* Insecticide Resistance Action Committee (http://www.irac-online.org)

*b* Application types include: in-furrow (IF), seed treatment (ST), foliar (F) and side-dress (SD)

*c* Several generic formulations exist
Avoidance in Time – Cumulative Degree Days – Antigo, WI

- Planting
- Tuberization
- Vine Killing

CGDD\(_{40}\) = 3627
CGDD\(_{40}\) = 4086

35 days
CGDD\(_{40}\) = 3627
NASS CDL – Cropscape: [http://nassgeodatagmu.edu/CropScape/](http://nassgeodatagmu.edu/CropScape/)

- 110 agriculture related classes
- 2008-2012 full 48 coverage
Avoidance in Space – Langlade County Field units
Identified potato fields-2012
All crops 2012. acreage difference = corn or other
Distance to nearest forage-2012
Distance to nearest small grain-2012
Distance to nearest soybean-2012
Distance to nearest potato-2012
Distance to nearest potato 2006-2012

Distance to nearest potato (m)
- 0 - 175
- 176 - 754
- 755 - 1,334
- 1,335 - 1,914
- 1,915 - 2,494
- 2,495 - 3,074
- 3,075 - 3,654
- 3,655 - 4,234
- 4,235 - 4,814
Acknowledgements

- **USDA SCRI**

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  Alex Crockford, Kevin Bula, Rick Hafner

- **Wisconsin Potato and Vegetable Growers Association**

- **University of Illinois**
  Drs. David Voegtlin and Doris Lagos

- **University of Wisconsin**
  Agricultural Research Stations

- **Cooperating Industry Partners**