New Tools for Blueberry Insect IPM Programs

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Fifty year anniversary of IPM

from Castle & Bentley, 2009. Pest Management Science
### Main activity and management periods of blueberry insect and mite pests

<table>
<thead>
<tr>
<th>Growth stage</th>
<th>pre-bloom</th>
<th>bloom</th>
<th>mid-season</th>
<th>pre-harvest</th>
<th>harvest</th>
<th>post-harvest</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degree days</td>
<td>100</td>
<td>300</td>
<td>400</td>
<td>700</td>
<td>1100</td>
<td>1300</td>
</tr>
</tbody>
</table>

Bars show period when scouting and management of the pest is most important. Blue = key pest.
Guthion phaseout update


Changes for 2010

• Guthion WP yearly max. at 1.5 pounds/ac.
• Aerial application of Guthion is now banned.

• Maximum single application of 1.5 pounds.

• 7 day REI and PHI, except in U-pick fields (30 or more days).

• 60 ft buffer zone to bodies of water, occupied dwellings, and recreational areas.
Cranberry fruitworm on fruit

Eggs

Larvae
Cranberry fruitworm life cycle

Period from first moths to first eggs can be used to predict time to start fruit protection
Insect phenology is based on temperature

Key events can be predicted most accurately using degree days, not the calendar.

Events happen on different dates, but at the same degree days each season.

Blue line = cool season

Red line = warm season

Growing degree days
GDD = ((max+min)/2)-threshold (50°F)

Growing degree days (base 50°F) from March 1
Using the degree day model to identify the start of CBFW flight

- Put traps out at the start of flowering
- One trap/10 ac in top of bushes, at edge of fields
- Check twice a week to identify first sustained catch of moths
- Count DD from day before sustained moth catch
- First eggs predicted 85 GDD later

<table>
<thead>
<tr>
<th>Trap check</th>
<th>Site 1</th>
<th>Site 2</th>
<th>Site 3</th>
<th>Site 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/3</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6/6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>6/9</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6/13</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>6/17</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>17</td>
</tr>
<tr>
<td>6/21</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>25</td>
</tr>
<tr>
<td>6/24</td>
<td>2</td>
<td>9</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>6/27</td>
<td>4</td>
<td>0</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>6/30</td>
<td>10</td>
<td>0</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>7/2</td>
<td>25</td>
<td>2</td>
<td>11</td>
<td>1</td>
</tr>
</tbody>
</table>

Gray boxes indicate date to start counting DD to predict start of egglaying.
For selective insecticide, correct timing improves control

Comparison of different timings of growth regulator Confirm to the broad-spectrum Guthion. All treatments reapplied 14 days later.

**Infested clusters/plot**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Infested clusters/plot</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td>a</td>
</tr>
<tr>
<td>Guthion 250 GDD</td>
<td>c</td>
</tr>
<tr>
<td>100 GDD</td>
<td>bc</td>
</tr>
<tr>
<td>200 GDD</td>
<td>abc</td>
</tr>
<tr>
<td>300 GDD</td>
<td>ab</td>
</tr>
</tbody>
</table>

GDD after biofix for Confirm at 16 oz/ac
Tracking degree days on your farm

**DIY:** max-min thermometer
\[
\frac{(\text{Max}+\text{Min}) - 50}{2} = \text{daily DD accumulation}
\]

Weather monitor:

**MSU Online Information:**
- Fruit CAT Alert
- Blueberry IPM Update
- Enviroweather

[www.enviroweather.msu.edu](http://www.enviroweather.msu.edu)
Using the cranberry fruitworm model
www.enviroweather.msu.edu

Free online service to access weather information from around Michigan

Weather forecasts, frost warnings

Pest development models for blueberry cranberry fruitworm blueberry maggot oblique-banded leafroller
Cherry fruitworm

• Also has 1 generation per year

• Slightly earlier than CBFW, and so can be missed if controls timed for the ‘major’ fruitworm.

• Use traps to monitor and identify CFW flight.

• CFW egglaying often ahead of CBFW egglaying.
# Fruitworm control, 2006

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Timing</th>
<th>% clusters infested 7/7/06</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untreated</td>
<td></td>
<td>21.5 a</td>
</tr>
<tr>
<td>Guthion 50WP, 1.5 lb</td>
<td>A,B,C</td>
<td>1.5 b</td>
</tr>
<tr>
<td>Assail 30SG, 5 oz</td>
<td>A,B,C</td>
<td>1.5 b</td>
</tr>
<tr>
<td>Avaunt 30 WG, 6 oz</td>
<td>A,B,C</td>
<td>0.5 b</td>
</tr>
<tr>
<td>Delegate 25 WG, 4.5 oz</td>
<td>A,B,C</td>
<td>1 b</td>
</tr>
</tbody>
</table>

Treatment timing: A = 6/7 (Petal Fall), B = 6/21, C = 7/6
Fruitworm control, 2008

Intrepid 12 oz
*Altacor 3 oz
*Belt 2 oz
Assail 5 oz
Imidan 1.33 lb
Mustang.. 4 oz
*Alverde 16 oz
Guthion 1 lb
Untreated

* Not yet labeled

All significantly different from the untreated
Not different from each other

Total Cluster Infestation, 7/7

% clusters infested
Fruitworm control trial, 2009

Trial at TNRC Rubel planting

Generally lower pressure from fruitworms during 2009

Treatments applied at:
- **Std timing:** 6-5 (PF), 6-19, 7-3
- **Model timing:** 5-27 (85 GDD), 6-10, 6-24

All insecticide treatments were active against CFW and CBFW

Broad-spectrum and reduced-risk insecticides performed very well against fruitworms
Cranberry fruitworm program in blueberry

1. Set traps at early bloom and check twice a week. Set biofix as the date of the trap check preceding sustained catch.
2. First egglaying starts around 85 GDD after biofix (base 50 °F). Intrepid at this timing reduces infestation during bloom.
3. Apply a second spray with excellent activity and long residual at 100% petal fall, once bees are removed. **This is a key spray!!**
4. If cranberry fruitworm is still active 7-14 days later, consider a follow-up spray to protect berries against hatching larvae. May overlap with the need for aphid or maggot control.

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- **Start of moth flight**
- **Early petal fall**
- **Insect growth regulator**
- **100% petal fall**
- **If further pest activity detected**
- **Duration of degree days, base 50 °F**

- **85**
- **~400**
### On-farm program comparison, 2009

<table>
<thead>
<tr>
<th>Timing</th>
<th>Confirm-Guthion</th>
<th>Confirm-Pyrethroid</th>
<th>Advanced IPM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bloom</td>
<td>Confirm 16 oz</td>
<td>Confirm 16 oz</td>
<td>Intrepid 8 oz 85 GDD</td>
</tr>
<tr>
<td>Petal fall</td>
<td>Guthion 1.25 lb</td>
<td>Asana 9.6 oz</td>
<td>Intrepid 8 oz 10-14 d later</td>
</tr>
<tr>
<td>7-10 days later</td>
<td>Guthion 1.25 lb</td>
<td><strong>Asana 9.6 oz or Mustang Max 4 oz</strong></td>
<td>Assail 5.3 oz 7-10 days later</td>
</tr>
</tbody>
</table>

**Infestation by cherry fruitworm/early CBFW**

- Confirm-Guthion
- Confirm-Pyrethroid
- Advanced IPM

**Infestation by CBFW**

- Confirm-Guthion
- Confirm-Pyrethroid
- Advanced IPM

No significant difference
Blueberry aphid

Aphids transmit viruses – shoestring virus in Michigan.
Natural enemies suppress populations.
Control is most important in shoestring susceptible cultivars.
Aphid control for virus control

• If an aphid-vectored virus detected, aphid control prevents further spread.

• Many broad spectrum insecticides will provide short-term control of aphids. Lannate is the most effective of these.

• Neonicotinoids (e.g. Provado, Assail, Actara) are systemic. They move into the leaves and stems, protecting the residue and directing it into the aphid.

• The neonicotinoid class is highly effective against aphids and may control other pests active at the same time.

Ratings of registered neonicotinoids for control of blueberry insect pests

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>REI (h)</th>
<th>PHI (d)</th>
<th>Aphids</th>
<th>CBFW</th>
<th>BBM</th>
<th>JB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actara 3-4 oz</td>
<td>12</td>
<td>3</td>
<td>****</td>
<td>*</td>
<td>**</td>
<td>**</td>
</tr>
<tr>
<td>Assail 2.5-3.5 oz</td>
<td>12</td>
<td>1</td>
<td>****</td>
<td>***</td>
<td>****</td>
<td>**</td>
</tr>
<tr>
<td>Provado 3-4 oz</td>
<td>12</td>
<td>3</td>
<td>****</td>
<td>*</td>
<td>***</td>
<td>**</td>
</tr>
<tr>
<td>Admire (soil) 16 oz</td>
<td>12</td>
<td>7</td>
<td>****</td>
<td></td>
<td></td>
<td>**** grubs</td>
</tr>
<tr>
<td>Platinum (soil) 5-12 oz</td>
<td>12</td>
<td>75</td>
<td>****</td>
<td></td>
<td></td>
<td>**** grubs</td>
</tr>
</tbody>
</table>

• For all foliar aphid sprays, be sure to cover the whole bush, including the lower branches.
Aphid control trials, 2009

Blueberry aphid control trial, 2009

Provado (registered) and Movento (not yet) provided rapid control of blueberry aphid.

Requiem had little activity on aphids.

Blueberry aphid populations in four Jersey blueberry fields, 2009

2009 grower-applied spray programs focused on fruitworm, with late June Assail application.

Van Buren 1 farm also applied Provado in late May, preventing aphid buildup.
Summary

Monitor and scout fields to identify pest hot spots

Consider varietal susceptibility to insects and viruses

Use monitoring and degree day models to optimize spray timings – enviroweather.msu.edu

Integrate new insecticide tools where they fit best

Intrepid for fruitworms and tussock moth during bloom
Assail, Avaunt, Asana, Mustang, or Delegate for fruitworms post bloom
Assail or Provado for aphids and maggot post bloom
Provado or Mustang for Japanese beetle
Online information delivery

www.blueberries.msu.edu

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ipmnews.msu.edu/fruit/

Integrated Pest Management Resources

Michigan Blueberry IPM Newsletter

Contact jenki132@msu.edu to subscribe
Thanks to...

Michigan blueberry grower cooperators
MDA-MSU Virus Task Force
TNRC and SWMREC staff
DuPont, Dow AgroSciences, Bayer CropScience, and UPI

Industry: MSU partnership

Information for Michigan blueberry growers

Michigan industry priorities

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