Apple PGR’s for Michigan 2019

Philip Schwallier
District Hort Agent
Clarksville Research Center

Thanks to:
Michigan Apple Research Committee
Michigan State Horticulture Society
Tree Fruit Commission
Valent BioSciences, Valent USA
AmVac
BASF
Apogee and Actigard

Philip Schwallier
District Hort Agent
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Thanks to:
Michigan Apple Research Committee
Michigan State Horticulture Society
Tree Fruit Commission
Valent BioSciences, Valent USA
AmVac
BASF
Tall Spindle
Spy 2009
4th leaf
Apogee

• Vegetative Growth Control

• Apogee (Prohexadione-calcium)
  – Inhibits production of gibberellic acid (GA).
  – Locally systemic.
  – Apply early (King Bloom Petal Fall)
  – Not compatible with hard water, Ca, B.
  – Better spray coverage, reduce pruning
  – Fewer insect/disease problems

• Fire Blight Suppression

• Reduces Pruning

• Enhances Red Color???

• Return Bloom??
Apogée
Apogee Trial
Shoot Growth

Apogee  Typical Growth Control 40%

Control

Full Bloom  June  July
NW Mich. Apogee Trial 2008
**Timing Apogee Applications**

<table>
<thead>
<tr>
<th>1st</th>
<th>Full Seasonal Application</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>1st</td>
<td>2nd</td>
</tr>
<tr>
<td></td>
<td>Split Application</td>
</tr>
<tr>
<td></td>
<td>Optional</td>
</tr>
<tr>
<td>1st</td>
<td>2nd</td>
</tr>
<tr>
<td></td>
<td>3rd</td>
</tr>
<tr>
<td></td>
<td>4th</td>
</tr>
</tbody>
</table>

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |

**KBPF**

*May 10  *May 24  *Jun 7  *Jun 21

*These dates are typical timing dates for the Grand Rapids, Michigan area.*
Apogee
Fireblight

- Fireblight Suppression
- Will suppress FB canker growth and FB infections on shoots
- Key factor is apply early and high rates (get the shoots under control early)
Fireblight Shoot Blight
Super Spindle 2007
Fire Blight Tree Death

Apogee
UTC
Untreated

Apogee

From Dr. George Sundin, Michigan State University
Apogee for High Densities

- To control vegetative areas of trees
- Apogee is locally systemic
- 3-4 oz/acre every 2 weeks

<table>
<thead>
<tr>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>Aug</th>
<th>Sept</th>
<th>Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td>Green Tip</td>
<td>Bloom &amp; Fruit Set</td>
<td>Shoot Growth</td>
<td>Fruit Growth</td>
<td>Pre-Harvest</td>
<td>Harvest</td>
<td></td>
</tr>
</tbody>
</table>

Optional
Gingergold Growth Habit
Apogee Trial

Apogee
UTC
Honeycrisp Trial 2003

Harvest

Apogee

UTC
Apogee

- Nit vs rate needed
- Vigor vs rate needed
- Vigor or low cropload or high N will need additional Apogee

- Effect on Red Color
  - Inconsistent, no effect.
Apogee and Return Bloom
Apogee Super Spindle 2003
Return Bloom

<table>
<thead>
<tr>
<th></th>
<th>Flower Clusters/Tree</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mac UTC</td>
<td></td>
</tr>
<tr>
<td>Mac Apogee</td>
<td>b</td>
</tr>
<tr>
<td>Cortland UTC</td>
<td>a</td>
</tr>
<tr>
<td>Cortland Apogee</td>
<td>a</td>
</tr>
<tr>
<td>Gala UTC</td>
<td>a</td>
</tr>
<tr>
<td>Gala Apogee</td>
<td>a</td>
</tr>
<tr>
<td>Trial Apogee</td>
<td>b</td>
</tr>
</tbody>
</table>
Apogee Trial
Cortland

Apogee
UTC
Orchard Factors to Adjust Program

<table>
<thead>
<tr>
<th>Factors</th>
<th>Recommended Apogee Rate Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heavy Pruning (Vigor)</td>
<td>Add 1 oz/acre/spray</td>
</tr>
<tr>
<td>Nitrogen Fertilizer</td>
<td>Move Apogee Season Program to the Next Higher Level</td>
</tr>
<tr>
<td>Low Cropload</td>
<td></td>
</tr>
<tr>
<td>Questionable Coverage</td>
<td></td>
</tr>
<tr>
<td>Fireblight Concerns</td>
<td></td>
</tr>
<tr>
<td>Varieties</td>
<td>See Variety Guide</td>
</tr>
</tbody>
</table>
## Apogee Rates & Timing

### oz/Acre

<table>
<thead>
<tr>
<th>Tree Size</th>
<th>1&lt;sup&gt;st&lt;/sup&gt;</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt;</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt;</th>
<th>4&lt;sup&gt;th&lt;/sup&gt; *Optional</th>
<th>Seasonal Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Small</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;200 TRV</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4*</td>
<td>17 oz</td>
</tr>
<tr>
<td><strong>Medium</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;200 to 300 TRV</td>
<td>6</td>
<td>5</td>
<td>5</td>
<td>5*</td>
<td>21 oz</td>
</tr>
<tr>
<td><strong>Large</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;300 TRV</td>
<td>7</td>
<td>6</td>
<td>6</td>
<td>6*</td>
<td>25 oz</td>
</tr>
<tr>
<td><strong>Timing</strong></td>
<td>King Bloom PF</td>
<td>2 weeks after KB PF</td>
<td>2 weeks later</td>
<td>3 weeks later</td>
<td></td>
</tr>
</tbody>
</table>

*Optional
## Variety Consideration

<table>
<thead>
<tr>
<th>Sensitivity to Apogee</th>
<th>Variety</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Sensitive</td>
<td>Gingergold, Gala, Cortland, Rome, Paulared</td>
<td>Consider reducing rates of later sprays (spray 3 and 4).</td>
</tr>
<tr>
<td>Sensitive</td>
<td>Golden Delicious, Fuji, Spartan, N. Spy, Jonamac</td>
<td></td>
</tr>
<tr>
<td>Less Sensitive</td>
<td>Jonathan, Idared, McIntosh, Empire*, Golden Supreme, Jonagold</td>
<td>Consider using additional 1 oz/acre/spray.</td>
</tr>
<tr>
<td>Special</td>
<td>Red Delicious, Spur Mac</td>
<td>Spur type, Use 4+3+2 for medium size trees.</td>
</tr>
</tbody>
</table>

* Not recommended on Empire, Stayman.
Apogee
Conclusions

- Reduces shoot growth
- Significantly reduces pruning
- Suppresses FB.
- Apogee increases return bloom and fruit set (some varieties).
- Varieties differences
- Some fruit Ca benefits
- Increase thinning
2016 PGR Detail Trial

Prohexadione-Ca and Bitter Pit

45 Day BP Inc.

Contr ol

PF

3-Spray (PF)

Pin k

3-Spray (Pink )

57.8% BP

44.4% BP

25.6% BP

Avg = 0.4289

UDL

LDL

α = 0.05

JMP Analysis of Means of Proportions
2017 PGR Detail Trial

Prohexadione-Ca and Bitter Pit

53 Day BP Inc.

14.1% BP

8.4% BP

4.7% BP

JMP Analysis of Means of Proportions
Investigate strategies that might favor the movement of calcium into fruits.

2016 & 2017 PGR Detail Trial Results

1. Prohex 6 oz/A at pink significantly reduces bitter pit incidence.

2. Prohex when used at the conventional timing significantly increases bitter pit incidence.
Thanks to:
Michigan Apple Research Committee
Michigan State Hort Society
Valent USA
Valent BioSciences
International Fruit Tree Association
Supporting Growers
BASF
Amvac
Fine Ag Chemical
Actigard and SAR

- Acibenzolar-S-methyl
- Activates **systemic acquired resistance (SAR)** in the plant

1. pathogen attack
2. pathogen recognition
3. plant response at site of attack
4. SAR signaling through plant
5. defense activated in plant for future attack

From Sundin Lab
2014 Actigard test on ‘McIntosh’

- FireLine, 1.5 lb, 20-50%, 100% bloom, PF
- actigard, 2 oz + FireLine, 1.5 lb, 20-50%, 100% bloom
- Actigard, 2 oz, 20-50% bloom
- FireLine, 1.5 lb, 100% bloom
- Actigard, 2 oz, PF

(control)
Actigard Sparta Weather 2017

Temperature (°F)

Precip (mm)

Frost

Spray

# Actigard/Apogee Trial 2017

## Table 1. Actigard and Apogee Treatments, Rates and Dates.

<table>
<thead>
<tr>
<th>#</th>
<th>Treatment</th>
<th>Apps</th>
<th>Rate (ppm)</th>
<th>Total Seasonal Rate</th>
<th>5/3 Pink</th>
<th>5/17 Petal Fall</th>
<th>5/31 10 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>UTC</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Actigard 1 oz 3x</td>
<td>3</td>
<td>1 oz</td>
<td>3 oz</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>3</td>
<td>Actigard 2 oz 2x</td>
<td>2</td>
<td>2 oz</td>
<td>4 oz</td>
<td>✅</td>
<td>✅</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Actigard 1 + Apogee 1 3x</td>
<td>3</td>
<td>1+1</td>
<td>3 oz + 3 oz</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>5</td>
<td>Actigard 2 + Apogee 2 2x</td>
<td>2</td>
<td>2+2</td>
<td>4 oz + 4 oz</td>
<td>✅</td>
<td>✅</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Apogee 1 oz 3x</td>
<td>3</td>
<td>1 oz</td>
<td>3 oz</td>
<td>✅</td>
<td>✅</td>
<td>✅</td>
</tr>
<tr>
<td>7</td>
<td>Apogee 2 oz 2x</td>
<td>2</td>
<td>2 oz</td>
<td>4 oz</td>
<td>✅</td>
<td>✅</td>
<td></td>
</tr>
</tbody>
</table>

All Apogee treatments included Choice and LI700 as additives.
Thanks to those supporting this work:
- Michigan State Horticultural Society
- Michigan Apple Research Committee
- Cornell University
- Cooperating Growers

**Actigard/Apogee Trial 2017**

**Actigard/Apogee Trial Shoot Growth**

- Sprays: Pink, PF, 10 mm

- Dates: 5/3/17, 5/10/17, 5/17/17, 5/24/17, 5/31/17, 6/7/17, 6/14/17, 6/21/17, 6/28/17, 7/5/17, 7/12/17, 7/19/17

- Treatments: UTC, Act 1 oz, Act 2 oz, Act1+Apo1, Act2+Apo2, Apo 1 oz, Apo 2 oz

Legend:
- Act 2 oz
- Apo 2 oz
- Combo’s
MSU Fruit School 2019

Philip Schwallier

Clarksville Research Center
Michigan State University

Thank you!