Guiding Apple Scab Management with RIMpro and Efficacy Trials with Revysol and SDHI fungicides

Srdjan G. Acimovic, Christopher L. Meredith

123rd Annual Vermont Tree Fruit Growers Association Meeting and Educational Program
14 Feb 2019
1. Apple Scab

(Venturia inaequalis)
Symptoms
Fruit Scab
For NY Growers We:

- Monitored pathogen maturation
- Delivery to RIMpro subscribers of scab & fire blight predictions with spray recs:
  - 19 E-mails (2017)
  - 22 E-mails (2018)
- Short blogs to Acimovic Lab subscribers:
  - 43 blogs (2017)
  - 44 blogs (2018)
- Published two articles in Fruit Quarterly
- Continue use & increase RIMpro base
Monitor Ascospore Release
- Ascospores vs. Conidia -
Cornell’s HVRL Extension & Outreach
- Apple scab biofixes, RIMpro -

- Ascospore maturity in leaf litter
  - Highland **29 Mar**
  - Rexford **7 Apr**
  - North Peru **11 Apr**
  - Maturation is predicted when RH > 70%
  - Speed and amount of maturation assumed proportional to the accumulated temperatures above 32°F.
  - 50-60 spores an economic threshold in tower
What is What?

Available at: http://blogs.cornell.edu/acimoviclab/extension-publications/
Year Differences in Scab Infections - 2016 -
Year Differences
- 2017 -

RIMpro-Venturia location: HighlandNEWA - 2017

- Ejected spores
- Infection value
- Germinating spores
- Primary stroma

- Biofix 26-March
- Immature spores
- Mature ascospores

Cornell University
Hudson Valley Research Laboratory
Two Years of Experience with RIMpro Apple Scab Prediction Model on Commercial Apple Farms in Eastern New York

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Keywords: Apple scab, prediction models, RIMpro, NEWA,

• You can omit 1-3 unnecessary fungicide sprays in 2017 & 2018
• 1 or 2 additional sprays necessary to control scab before scab season end
• $310,000 – $930,000 for 12,375 acres in east NY
### Monitor Ascospore Release
- Results, New York -

#### Table 1. Dates and abundance of first mature *Venturia inaequalis* ascopores detected in East New York during 2017 and 2018 using vacuum tower spore trap, with green tip dates and adjusted biofixes.

<table>
<thead>
<tr>
<th>Locations in East New York</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Date of ascospore detection and their number range</td>
<td>*RIMpro Biofix adjusted to ascospore number</td>
</tr>
<tr>
<td>Peru</td>
<td>11 April (50-127)</td>
<td>6 April</td>
</tr>
<tr>
<td>Rexford</td>
<td>7 April (25-30)</td>
<td>31 March</td>
</tr>
<tr>
<td>Highland</td>
<td>29 March (9-15)</td>
<td>26 March</td>
</tr>
</tbody>
</table>
Start of Primary Scab Season  
- Results, New York -

Table 2. Dates of green tip occurrence and apple scab infection periods in RIMpro and NEWA during 2017 and 2018 with dates when first apple scab symptoms were detected in unsprayed control plots in eastern NY. Dates with orange text color are infection periods reported in NEWA's model for which fungicide spray application/s were not needed as per RIMpro’s apple scab model.

<table>
<thead>
<tr>
<th>Locations in East New York</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RIMpro’s first weak apple scab infection (spray not needed)</td>
<td>RIMpro’s first apple scab infection (spray needed)</td>
</tr>
<tr>
<td>Peru – GT 2017: 16 April; GT 2018: 3 May</td>
<td>12 April</td>
<td>20 April</td>
</tr>
</tbody>
</table>
| Rexford – GT 2017: 6 April; GT 2018: 17 April | 17 April | 20 April | 26 March* 4 April* 6 April 12 April 15 April 20 April | 23 May | 25 April | 6 May | 29 March* 25 April 27 April 6 May | /*

Highland – GT 2017: 30 March; GT 2018: 7 April | 4 April | 20 April | 7 March* 25 March 30 March 4 April 6 April 19 April | 10 May | 17 April | 25 April | 2 April* 15 April 24 April | 11 May |
## End of Primary Scab Season
- Results, New York -

Table 3. Comparison of dates in RIMpro and NEWA apple scab models when primary apple scab season ended in 2017 and 2018 due to depletion of ascospores in leaf litter and of the dates when both models advise to continue spray coverage. Dates with blue text color are the apple scab infection periods reported in NEWA’s model that required fungicide spray protection as per NEWA’s recommendations to continue coverage for two weeks after ascospore discharge is completed. Dates with green text color are infection periods reported in NEWA that did not require fungicide spray protection according to NEWA but did according to RIMpro.

<table>
<thead>
<tr>
<th>Locations in East New York</th>
<th>2017</th>
<th>2018</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RIMpro</td>
<td>NEWA</td>
</tr>
<tr>
<td><strong>Primary scab season over date in</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peru</td>
<td>1 June</td>
<td>22 May</td>
</tr>
<tr>
<td></td>
<td>RIMpro</td>
<td>NEWA</td>
</tr>
<tr>
<td></td>
<td>25 May</td>
<td>29 May</td>
</tr>
<tr>
<td>Rexford</td>
<td>27 May</td>
<td>13 May</td>
</tr>
<tr>
<td></td>
<td>RIMpro</td>
<td>NEWA</td>
</tr>
<tr>
<td></td>
<td>18 May</td>
<td>22 May</td>
</tr>
<tr>
<td>Highland</td>
<td>15 May</td>
<td>6 May</td>
</tr>
<tr>
<td></td>
<td>RIMpro</td>
<td>NEWA</td>
</tr>
<tr>
<td></td>
<td>13 May</td>
<td>22 May</td>
</tr>
<tr>
<td></td>
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</tbody>
</table>
Savings

• 2017 & 2018: if RIMpro used 1-3 unnecessary sprays early in spring
• If $25/A for each fungicide spray, growers could save $310 K – 930K for the total of 12,375 A apples in eastern NY
• RIMpro allowed better protection from scab than NEWA by requiring 1 or 2 additional sprays necessary before primary scab season end
2018 Revysol Apple Scab Trial
- BASF, Bayer Crop Science -

Revysol® mefentrifluconazole (FRAC 3, DMI)

Spray dates from the protocols:

4/24/2018 – HIG (1.5 lb of Manzate-Pro stick applied)
5/1/2018 – TC
5/5/2018 – PK
5/7/2018 – Early BL
5/9/2018 – Mid BL
5/14/2018 – PF
5/25/2018 – 1C
6/6/2018 – 2C
6/26/2018 – 3C
7/16/2018 – 4C
7/23/2018 – 5C
8/4/2018 – 6C
Apple Scab Infections 2018
- Use Models to Time Sprays -
### 2018 Revysol Apple Scab Trial - Treatment Programs -

<table>
<thead>
<tr>
<th>Treatment Program</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Check - UTC (Unsprayed Control)</td>
<td></td>
</tr>
<tr>
<td>2- Check - Only cover sprays applied (no early spring scab sprays) (no primary scab fungicides applied) Followed by 4 cover sprays - 3 lbs Captan 80WG/acre</td>
<td>4 due to rain</td>
</tr>
<tr>
<td>3- Revysol @ 4.0 fl oz/acre &amp; LI-700 @ 16 fl oz/ 100 gal</td>
<td>A- Tight Cluster  B- Early Bloom  C- Mid-bloom  D- Petal Fall followed by 4 cover sprays - 3 lbs Captan 80WG/acre</td>
</tr>
<tr>
<td>4- Revysol @ 5.0 fl oz/acre &amp; LI-700 @ 16 fl oz/ 100 gal</td>
<td></td>
</tr>
<tr>
<td>5- Rhyme @ 6.5 fl oz/acre &amp; LI-700 @ 16 fl oz/ 100 gal</td>
<td></td>
</tr>
<tr>
<td>6- Rally 40W @ 5.0 oz/acre &amp; LI-700 @ 16 fl oz/ 100 gal</td>
<td></td>
</tr>
<tr>
<td>7- Inspire Super @ 12.0 fl oz/acre &amp; LI-700 @ 16 fl oz/ 100 gal</td>
<td></td>
</tr>
<tr>
<td>8- Sercadis @ 4.5 fl oz/acre &amp; Manzate Pro Stick 75WG @ 3 lbs/acre &amp; LI-700 @ 16 fl oz/ 100 gal</td>
<td></td>
</tr>
<tr>
<td>9- Revysol @ 5.0 fl oz/acre + Manzate Pro Stick 3 lb /A &amp; LI-700 @ 16 fl oz/ 100 gal</td>
<td></td>
</tr>
<tr>
<td>10- Inspire Super @ 12.0 fl oz/acre + Manzate Pro Stick @ 3 lb/A &amp; LI-700 @ 16 fl oz/ 100 gal</td>
<td></td>
</tr>
<tr>
<td>11 - Aprovia 5.5 oz/acre &amp; Manzate Pro-Stick 75WG @ 3 lbs/acre &amp; LI-700 @ 16 fl oz/ 100 gal</td>
<td></td>
</tr>
<tr>
<td>12- 1) Manzate Pro Stick 3 lb + Indar 6 fl oz @ TC, then Manzate Pro Stick 3 lb + Rally 5 oz/A @ PK 2) Luna Sensation 5 oz/a + 3 lb/a Manzate Pro Stick 3 lb/A @ Bloom, Petal Fall 3) Captan 2.5 lb + Flint Xtra 2FL/A (or captan + Topsin M 1 lb/ A or Sovran 4 oz/A), OR captan alone 3 lb/A @ other Covers (FC-onward)</td>
<td></td>
</tr>
<tr>
<td>13- 1) Manzate Pro Stick 3 lb/A + Indar 6 fl oz/A @ TC, then Manzate Pro Stick 3 lb/A + Rally 5 oz/A @ PK 2) Luna Tranquility 11.2 oz/a + 3 lb/a Manzate Pro Stick 3 lb/A @ Bloom, Petal Fall 3) Captan 2.5 lb + Flint Xtra 2FL/A (or captan + Topsin M 1 lb/ A or Sovran 4 oz/A) OR captan alone 3 lbs @ other Covers (FC-onward)</td>
<td></td>
</tr>
</tbody>
</table>

**Revysol®** mefentrifluconazole (FRAC 3, DMI)
2018 - The Year of Apple Scab
- 11-71% More Rain -
2018 Apple Scab Results (I)
- Jersey Mac -

SPUR LEAF SCAB %, 12 JULY 2018 (LSD, $P < 0.05$)

FRUIT SCAB %, 10 AUG 2018 (Jersey Mac)
2018 Apple Scab Results (II)
- Golden Delicious ‘Smoothee’ -

SPUR LEAF SCAB % 12 JULY 2018 7 (LSD, P<0.05)

FRUIT SCAB % 10 Aug 2018 (Tukey, P<0.05)
2018 Apple Scab Results (III) - Red Cort -

SPUR LEAF SCAB % 12 JULY 2018 (LSD, P<0.05)

FRUIT SCAB % 10 AUG 2018 (Tukey, P<0.05)
Red Cort Phenology
- 2018 -

- Red Cort preceded Jersey Mac and Golden Delicious in bud development
- 18 Apr GT:
  - 67% RedCort
  - 36% Jersey Mac
  - 28% Golden Delicious
- 27 Apr HIG:
  - RedCort - 73%
  - Jersey Mac - 52.9%
- 1.5 lb Mancozeb too low rate
  +
- Large green tissue in RedCort allowed infections of 24 and 27 April at HIG
### 2017 Apple Scab Trial – SDHI (FRAC 7)
- Jersey Mac, Red Cort, Smoothee -

<table>
<thead>
<tr>
<th>PRODUCT</th>
<th>GROWTH STAGE/S</th>
<th>RATE/A</th>
<th>/100 GAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Control</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>2. Manzate 3 lb</td>
<td>TC, PK, PF, FC</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>3. Merivon 4 fl oz</td>
<td>TC, PK, PF, FC</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>+ Manzate 3 lb</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ Wide Spread Max</td>
<td>-</td>
<td>6.00</td>
<td></td>
</tr>
<tr>
<td>4. Sercadil 3.5 fl oz</td>
<td>TC, PK, PF, FC</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>+ Manzate 3 lb</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ Wide Spread Max</td>
<td>-</td>
<td>6.00</td>
<td></td>
</tr>
<tr>
<td>5. Luna Sensation 4 fl oz</td>
<td>TC, PK, PF, FC</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>+ Manzate 3 lb</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Luna Tranquility 11.2 fl oz</td>
<td>TC, PK, PF, FC</td>
<td>11.2</td>
<td></td>
</tr>
<tr>
<td>+ Manzate 3 lb</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Manzate lb</td>
<td>1/2 INCH GREEN</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>+ Captain lb</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Manzate lb</td>
<td>TC</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>+ Captain lb</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fontelis fl oz</td>
<td>-</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>+ Manzate lb</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ LI 700 @ 0.25%</td>
<td>-</td>
<td>32.00</td>
<td></td>
</tr>
<tr>
<td>Inspire Super fl oz</td>
<td>BLOOM</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>+ Manzate lb</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fontelis fl oz</td>
<td>-</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>+ Manzate lb</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ LI 700 @ 0.25%</td>
<td>-</td>
<td>32.00</td>
<td></td>
</tr>
<tr>
<td>Manzate lb</td>
<td>FC</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>+ Captain lb</td>
<td>2.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Spray dates:
- 4/11/2017 – ½” GREEN
- 4/17/2017 – TC
- 4/27/2017 – PK
- 4/29/2017 – BLOOM
- 5/6/2017 – PF
- 5/12/2017 – FC
In Relation to Infection
Jersey Mac
- Leaf Scab % -

23 Jun 2017 (LSD, $P<0.05$)
Jersey Mac - Susceptible
- Fruit Scab % -

23 Jun 2017 (Tukey, P<0.05)

29 Aug 2017 (Tukey, P<0.05)
Red Cort – Medium Susceptible
- Leaf Scab % -

23 Jun 2017 (LSD, P<0.05)
Red Cort – Medium Susceptible
- Fruit Scab % -

23 Jun 2017 (Tukey, $P<0.05$)

29 Aug 2017 (Tukey, $P<0.05$)
Smoother - Scab Resistant
- Leaf Scab % -

23 Jun 2017 (LSD, P<0.05)
Conclusions

• Use RIMpro to save sprays
• Revysol very effective
• SDHI-s very effective
• LI-700 better than WS-Max on ‘Jersey Mac’ fruit
• Advantage: switched to Inspire Super
• LI-700: better fungicide penetration
  • Longer residual active through rain
  • Better 48 h kick-back
  • Better eradication of any incubating infections
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Jon Clements, UMass
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Seth, Mason & Mac Forrence
Forrence Orchards
Jay Toohil, Chazy Orchards
Randy Hart, Hart Apple Farm
Everett brothers, Everett Orchards
Jesse Mulbury, Northern Orchard
Kevin Bowman, Bowman Apples
Peter Ten Eyck, Indian Ladder Farms
Charles and Phil, M.G. Hurd & Sons
Robert & Doug Minard, W.G. Minard and Sons
Danny Albinder, Shawn Bixby Hudson River Fruit

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Jentsch Lab, Cornell’s HVRL
Dr. David Rosenberger
2017 Apogee Reduces Canker Formation

1. 1 x Apogee 6 oz (Pink bud)
2. 2 x Apogee 6 oz + Regulaid 32 fl oz (1-3", 14 days)
3. 1 x Apogee 12 oz (1-3")
4. 2 x Apogee 12 oz (1-3", 14 days)
5. 3 x Apogee 1-2-1 oz (1-3", 14 days, 14 days)
6. 3 x Apogee 2-1-2 oz (1-3", 14 days, 14 days)
7. 1 x Apogee 6 oz + Actigard 2 oz/A (1-3")
8. 2 x Apogee 6 oz + Actigard 2 oz/A (1-3", 14 days)
9. 2 x Apogee 6 oz + Actigard 2 oz/A + Regulaid 32 fl oz (1-3", 14 days)
10. 3 x Apogee 6 oz + Actigard 2 oz/A (1-3", 14 days, 14 days)
11. 3 x Bordeaux Mix 0.2-0.2-100
12. 3 x Badge X2 (0.2 lb of Cu/A)
13. Inoculated control
14. Uninoculated control

Dates:
- 8/13/2017
- 7/9/2017
- 6/8/2017

Fire blight canker percent (%)

Cornell University
Hudson Valley Research Laboratory
2018 Apogee Prevents Canker Formation

Dates:
- 9/17/2018
- 7/11/2018
- 6/18/2018

Fire blight canker percent (%)
Copper
- Fruit Russet -

Fruit russet incidence (%)
Biologicals & Regalia
- Fruit Russetting -

Fruit russet incidence (%)