Multiple Strategies to Control Bitter Pit in Honeycrisp

**Principle Researchers**
Dan Donahue & Anna Wallis
CCE Eastern NY Commercial Horticulture Program

**Collaborators**
Dr. Chris Watkins
Dr. Lailiang Cheng
Dr. Gemma Reig
Jim Eve
Objectives

1. **Orchard Survey**
   Survey ENY orchards to determine if relationships exist between certain horticultural, nutritional, and micro-climate parameters and the expression of Bitter Pit in Honeycrisp.

2. **Prediction Tool – apple peel nutrient analysis**
   Evaluate the value of pre-harvest apple peel analysis as a Bitter Pit prediction tool.

3. **Foliar Calcium Efficacy Trial**
   Evaluate commercially available sprayable calcium formulations for Bitter Pit mitigation.

4. **Competition for Ca, How to Tip the Balance?**
   Evaluate strategies deployable during the cell mitosis phase of fruit development to mitigate the expression of Bitter Pit.
Soil Water Status Monitoring - HC BP Survey

- 35 blocks
  - 19 Hudson Valley
  - 16 Champlain Valley
- Six contiguous trees
- Variables
  - Horticultural
  - Nutritional
  - Micro-climate
  - Fruit quality and BP
September 19, 2017: Empty Irrigation Pond
Have Irrigation? Selected observations across 35 ENY Honeycrisp Blocks in 2016

Irrigation status was not a statistically significant factor for the parameters below:

<table>
<thead>
<tr>
<th>Irrigation Status</th>
<th>Blocks Sampled</th>
<th>Fruit Size (gm)</th>
<th>Fruit Load (#/CM² TCSA)</th>
<th>Bitter Pit @ Harvest (% Incidence)</th>
<th>Bitter Pit @ 60 days (% Incidence)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>23</td>
<td>222</td>
<td>2.6</td>
<td>13.8</td>
<td>29.1</td>
</tr>
<tr>
<td>Y</td>
<td>12</td>
<td>215</td>
<td>3.1</td>
<td>13.3</td>
<td>23.1</td>
</tr>
</tbody>
</table>
Irrigation Scheduling Considerations

- Many (most?) growers do not have an unlimited supply of irrigation water.
- 2016 in ENY was a dry year, but not officially a drought.
- 2016 in WNY suffered a serious drought, it could happen here as well.
- Use the NEWA irrigation model to assist in efficiently scheduling your irrigation.
- Excess water is not necessarily better, or needed to produce a quality crop.
Bitter pit in Honeycrisp on G-41 vs M9-337: Field observations from an orchard visit.

Dan Donahue

Extension Associate
CCE Eastern NY Commercial Horticulture Program
Cornell Cooperative Extension
Hudson Valley Research Laboratory
Highland, New York
Bitter pit in Honeycrisp on G-41 vs M9-337

HC / G-41

HC / M9-337
## Bitter pit in Honeycrisp on G-41 vs M9-337

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>Chi Sq /AMP</th>
<th>% BP Incidence</th>
</tr>
</thead>
<tbody>
<tr>
<td>M9-337 lower</td>
<td>n=144</td>
<td>59.7</td>
</tr>
<tr>
<td>G-41 upper</td>
<td>n=171</td>
<td>81.9</td>
</tr>
</tbody>
</table>

JMP Contingency Analysis of Means by Treatment, w/Chi-Square and Analysis of Means by Proportion
## Bitter Pit in Honeycrisp on G-41 vs M9-337

<table>
<thead>
<tr>
<th>Rootstock</th>
<th>t-Test</th>
<th>#/CM² SA</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>M9-337</td>
<td>A</td>
<td>0.8</td>
<td>0.28</td>
</tr>
<tr>
<td>G-41</td>
<td>B</td>
<td>2.3</td>
<td>0.27</td>
</tr>
</tbody>
</table>

Average # BP Spots/CM² SA

JMP LSM/Student's t-Test  \( p = 0.05 \)
Read all the details of the study in the upcoming Spring 2017 issue of the New York Fruit Quarterly
Apple Orchard Decline in the Hudson Valley
ARDP Black Stem Borer Biology and Impact

Black Stem Borer Hudson Valley

- Claverack
- Linlithgo
- Highland
- Milton 1
- Milton 2
- Hudson
- Milton 3
- Clintondale
ARDP Apple orchard latent virus study: Preliminary results
Color Rating Zestar! Trees

0

1

2

3
Apple Tree Decline: Bark Injury
Possible Causes of, or Contributors to, Apple Tree Decline

Black Stem Borer & Associated Pathogens
  Dogwood Borer
  Phytophthora
Secondary Wood Decay Fungi
  Fire Blight
Nutrient Imbalances
Rootstock/Scion Incompatibilities
  Winter Injury
  Drought Stress
Latent virus Infections
Herbicide Injury
A new insect pest or pathogen?
Summer Internship Available for 2017

Located at the Hudson Valley Laboratory in Highland, NY

Position supervisors are Dan Donahue and Dr. Kerik Cox

Project is to work on our Apple Orchard Decline Survey

The successful candidate must be current Cornell undergraduate, have a driver’s license and reliable transportation, and some biology coursework.

Salary is $4,000 for the period June 1 – August 18, 2017
NYS DEC Special Permit Training for 2017

• The newly published Federal Pesticide Applicator Certification Regulations, among other changes, eliminate Special Permit Training Programs.

• It may be 5 years before NYSDEC can fully implement the changes.

• Until then, SPT will continue, relatively unchanged, for 2017 and very likely, 2018.

• The new regulations will require some form of annual training for non-certified applicators to legally apply FRUP’s while under DIRECT supervision.

• Direct Supervision in NYS means: “my voice to your ear” (no electronic assistance allowed)

• A solution in a change in NYS regulations to allow a broader definition of “Direct Supervision”. The Tree Fruit industry has about two years to get this done.
Pesticide Applicator Exam Coaching for 2017

- SPT is specifically intended for farm employees who cannot read English.
- NYSDEC officials monitor our trainings across the state, and suspect that some of our students can read English well enough to sit for the Private Applicator Certification Exam.

**Pesticide Applicator Pre-Exam Coaching Sessions**
CCE ENYCHP Agriculture Specialists will be offering a training to review core concepts and commodity specific items in preparation for the exam.

**PRE-REGISTRATION is REQUIRED by Friday, March 10th**

**Workshop cost is: $50.00 per person**
(Additional costs for manuals and exam)

**Hudson Valley Pre-Exam Coaching Sessions**
Hudson Valley Research Lab, 3357 US 9W, Highland, NY

*Training Classes: Monday 3/20 & Wednesday 3/22, 9AM-12Noon*

*Exam: Friday 3/24, 9AM-1PM*

*Registration:* http://enych.cce.cornell.edu/event.php?id=686
Fall Weed Control Efficacy Studies

2014 – 2015 in the Hudson Valley
6’ X 20’ plots with 3 replicates, cultivar Honeycrisp
Application Date: 12-November, 2014
Application made at 59°F, 0.21” rain within 48 hours, with a 5-day total of 1.04” at an average temperature of 37°F

2015 – 2016 in the Champlain Valley
9’x4’ plots with 3 replicated, cultivar NY-1
Application made on 28-October, 2015.
Application made at 40°F, 1.02” rain within 24hrs, and a 5-day total of 1.12” at an average temperature of 43°F
Table 1. HVRL Fall 2014 Weed Control in Honeycrisp, Summer 2015 Evaluations

<table>
<thead>
<tr>
<th>Material #1*</th>
<th>Rate</th>
<th>Material #2</th>
<th>Rate</th>
<th>Material #3</th>
<th>Rate</th>
<th>25-May</th>
<th>8-Jun</th>
<th>29-Jun</th>
<th>2-Oct</th>
<th>Weed Species Breakthrough</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>60</td>
<td>90</td>
<td>100</td>
<td>100</td>
<td>see full list</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>3.5 pts/A</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>27</td>
<td>70</td>
<td>100</td>
<td>100</td>
<td>LQ, PS, CT</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>3.5 pts/A</td>
<td>Matrix 25 DF</td>
<td>4 oz/A</td>
<td>na</td>
<td>na</td>
<td>3</td>
<td>17</td>
<td>87</td>
<td>97</td>
<td>LQ, PS, CT, BG</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>3.5 pts/A</td>
<td>Alion 1.67</td>
<td>6 oz/A</td>
<td>na</td>
<td>na</td>
<td>0</td>
<td>0</td>
<td>13</td>
<td>23</td>
<td>N/A</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>3.5 pts/A</td>
<td>Simazine 90 DF</td>
<td>1.1 lbs/A</td>
<td>Diuron 80 DF</td>
<td>1.25 lbs/A</td>
<td>13</td>
<td>30</td>
<td>90</td>
<td>97</td>
<td>LQ, PS, BP</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>3.5 pts/A</td>
<td>Chateau 51 SW</td>
<td>10 oz/A</td>
<td>na</td>
<td>na</td>
<td>0</td>
<td>3</td>
<td>20</td>
<td>67</td>
<td>RC, BG</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>3.5 pts/A</td>
<td>GoalTender</td>
<td>3 pts/A</td>
<td>na</td>
<td>na</td>
<td>3</td>
<td>7</td>
<td>23</td>
<td>67</td>
<td>CC, PR, LQ, PS</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>3.5 pts/A</td>
<td>Sandea 0.75</td>
<td>0.8 oz/A</td>
<td>na</td>
<td>na</td>
<td>13</td>
<td>50</td>
<td>90</td>
<td>93</td>
<td>LQ, PS, RC</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>3.5 pts/A</td>
<td>Casoron 1.4 CS</td>
<td>2.3 gal/A</td>
<td>na</td>
<td>na</td>
<td>0</td>
<td>13</td>
<td>83</td>
<td>97</td>
<td>PR, LQ, BG</td>
</tr>
</tbody>
</table>

* LI-700 at 0.125% added to all spray treatments

Key: LQ: Lambsquarters; PS: Pennsylvania Smartweed; CT: Canada Thistle; BG: Bermudagrass; BP: Broadleaf Plantain
RC: Red Clover; CC: Common Chickweed; PR: Perennial Ryegrass

Additional species found in the control plots: Buckhorn Plantain, Common Groundsel, Common Mallow, Dandelion, Mare’s Tail, Mouse Ear Chickweed, Orchardgrass, Redroot Pigweed, Yellow Wood Sorrel
Results from the 2014-2015 Hudson Valley Efficacy Trial

• The combination of Gramoxone and Alion resulted in near season-long control, producing 77% control as late as 2-October.

• Second best was Gramoxone/Chateau and Gramoxone/Goaltender at 33% control as late as 2-October.

• The ratings of these three treatments on 29-June were statistically identical, and significantly better than the other six treatments.

• With the exception of the above, all other treatment combinations would have required the follow-up application of a burn-down material such as Gramoxone, Rely, or Roundup sometime in June.
<table>
<thead>
<tr>
<th>Material #1</th>
<th>Rate</th>
<th>Material #2</th>
<th>Rate</th>
<th>% Weed Cover</th>
<th>Weed Species Breakthrough</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>na</td>
<td>na</td>
<td>na</td>
<td>92</td>
<td>See complete list</td>
</tr>
<tr>
<td>2,4-D</td>
<td>3 pt/A</td>
<td>na</td>
<td>na</td>
<td>85</td>
<td>OX, V, G</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>3 qt/A</td>
<td>na</td>
<td>na</td>
<td>65</td>
<td>OX, V, M, LQ</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>3 qt/A</td>
<td>2,4-D</td>
<td>3 pt/A</td>
<td>62</td>
<td>OX, V, M, LQ</td>
</tr>
<tr>
<td>Alion</td>
<td>5 oz/A</td>
<td>na</td>
<td>na</td>
<td>22</td>
<td>OX, V, G, HW</td>
</tr>
<tr>
<td>Casoron</td>
<td>2.8 gal/A</td>
<td>na</td>
<td>na</td>
<td>70</td>
<td>OX, V, G, M</td>
</tr>
<tr>
<td>Chateau</td>
<td>12 oz/A</td>
<td>na</td>
<td>na</td>
<td>36</td>
<td>OX, V, D, G, LT</td>
</tr>
<tr>
<td>GoalTender</td>
<td>4 pt/A</td>
<td>na</td>
<td>na</td>
<td>67</td>
<td>OX, V, G, HW</td>
</tr>
<tr>
<td>Matrix</td>
<td>4 oz/A</td>
<td>na</td>
<td>na</td>
<td>8</td>
<td>OX, V, G</td>
</tr>
<tr>
<td>ProwlH2O</td>
<td>4 pt/A</td>
<td>na</td>
<td>na</td>
<td>68</td>
<td>V, G, M, HW</td>
</tr>
<tr>
<td>Sandea</td>
<td>1 oz/A</td>
<td>na</td>
<td>na</td>
<td>18</td>
<td>OX, V, D, G</td>
</tr>
<tr>
<td>Stinger</td>
<td>0.67 pt/A</td>
<td>na</td>
<td>na</td>
<td>73</td>
<td>V, G, M</td>
</tr>
</tbody>
</table>

* no surfactants or Gramoxone used. Sprayed onto nearly bare ground.

**KEY:** OX: Oxalis, V: Vetch, D: Dandelion, G: Orchard Grass, M: Mustard, LQ: Lambs Quarters, LT: Lady's Thumbprint, HW: Horseweed
Results from the 2015-2016 Champlain Valley Efficacy Trial

• The best control in terms of ground cover was provided by Matrix, Sandea, and Alion, with 92%, 82% and 78% control respectively.

• Chateau provided moderate control (64%), but with considerable variability between plots.

• The remaining treatments provided on average less than 40% control, requiring a burndown material in the spring.
Read all the details of this study in the October 2016 issue of *ENYCHP Tree Fruit News*.

And

**Managing Apple Orchard Weeds in the Fall**  

Deborah Breth, Sr. Ext. Assoc. (retired), Cornell Cooperative Extension – LOF  
Anna Wallis, Area Extension Specialist, Cornell Cooperative Extension – ENYCHP  
Dan Donahue, Area Extension Specialist, Cornell Cooperative Extension – ENYCHP  
Elizabeth Tee, Program Aide, Cornell Cooperative Extension – Lake Ontario Fruit Program
Effective Orchard Spraying Workshop
with Dr. Andrew Landers

February 22, 2017
8:30 am - 3:15 pm
Cornell Hudson Valley Research Laboratory
3357 RT 9W
Highland, NY
Pre-Registration is required, $15 fee (covers lunch)
Workshop: NEWA and Orchard Pest Scouting

Instructors:

Dan Olmstead
Peter Jentsch
Dan Donahue
Dr. Srdjan Acimovic

March 30th, 2017  10:00 am - 3:00 pm
Cornell Hudson Valley Research Laboratory
3357 RT 9W  Highland, NY

Pre-Registration is required,
$20 fee (covers lunch)
Example of E-Alert

Cornell ENYCHP Tree Fruit E-Alert for May 23rd, 2016 @ 7:00 pm

In this E-Alert
Champlain Valley Thinning Meeting
An Apple Thinning Editorial
How Can the Current Thinners be Classified?
How to De-Fruit Young Apple Trees
For Crop Insurance Purposes, You Must Maintain the Orchard According
to Best Practices
Registration is Open for the 2016 IFTA Summer Tour of Western New
York
Tree, Post & Trellis Exchange
Meeting & Workshop Announcements

Out and About

Dan and Anna will be available by email and phone all of next week.
The early accumulation of heat units led to McIntosh being harvested in the Hudson Valley, Dan Donahue

By May 3rd it became clear that harvesting flowers, with viable pollen (most bloom) that set fruit, weren't going to drop off on their own. CEC ENYCEP issued an E-Alert suggesting that chemical thinnings should be used in normal rates based on the HEWA carbohydrate model. The resulting crop had a "clumped" distribution on the tree, reflecting the loss of the king bloom, along with a high degree of set of the side bloom, and poor thinning performance. In late June, growers and industry professionals estimated the Hudson Valley crop to be 70% of the 2015 crop. Harvest estimates calculated in early August resulted in a production of 640,000 bushels, and Honeycrisp two days earlier than 2015.

August turned out to be much warmer than average for the Hudson Valley. A local media outlet reported that we experienced 99 days of 80°F or above. August was also 9°F warmer than August 2015. It was the mildest August in recent memory. As we were experiencing generally cooler temperatures throughout the season, fruit set and development were slow, with a high percentage of fruit never fully developed. This may be attributed to the cooler temperatures leading to a delay in flowering and reduced pollination.

<table>
<thead>
<tr>
<th>Locations</th>
<th>Avg Temp (°F)</th>
<th>Max Temp (°F)</th>
<th>Min Temp (°F)</th>
<th>Total Rain (in)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chazy</td>
<td>54.5</td>
<td>80.1</td>
<td>35.4</td>
<td>1.74</td>
</tr>
<tr>
<td>Fortina</td>
<td>56.7</td>
<td>93.3</td>
<td>27.4</td>
<td>1.74</td>
</tr>
<tr>
<td>Crown Point</td>
<td>56.9</td>
<td>83.5</td>
<td>28.9</td>
<td>0.68</td>
</tr>
<tr>
<td>Clifton Park</td>
<td>59.6</td>
<td>89.2</td>
<td>23.9</td>
<td>1.32</td>
</tr>
<tr>
<td>Hudson</td>
<td>59.1</td>
<td>87.0</td>
<td>39</td>
<td>2.57</td>
</tr>
<tr>
<td>Highland</td>
<td>59.8</td>
<td>94.8</td>
<td>31.6</td>
<td>1.13</td>
</tr>
<tr>
<td>Mattawa</td>
<td>58.8</td>
<td>82.9</td>
<td>37.4</td>
<td>1.69</td>
</tr>
<tr>
<td>Riverhead</td>
<td>62.7</td>
<td>85.5</td>
<td>41.1</td>
<td>1.22</td>
</tr>
</tbody>
</table>
Capacity Building

- Agrosta fruit quality analyzer and supporting equipment
- Macro Camera
- Future needs: Gas Chromatograph for Ethylene Analysis