Updates on Management of Bitter Pit and Other Storage Disorders of Honeycrisp and Gala

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Two topics

- Predicting bitter pit
- Stem end browning of Gala

Theory and practice
Acknowledgements

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People
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- Mike Basedow
- Growers
Predicting bitter pit incidence
Bitter pit
Objectives

1. To evaluate non-mineral prediction methods to induce bitter pit in ‘Honeycrisp’ apples.

2. To use these predictions to reduce economic losses by modifying postharvest fruit management.
Bitter pit is exacerbated by conditioning

- Conditioning reduces/eliminates soft scald and soggy breakdown.
- Conditioning exacerbates bitter pit.
- Soft scald/soggy breakdown does not always occur (lowest in HV)
- Can we avoid conditioning?
Three non-mineral methods

HARVEST FRUIT THREE WEEKS BEFORE ANTICIPATED COMMERCIAL HARVEST

1- Passive: Fruit kept at 68°F for 3 weeks.

2- Ethylene: fruit dipped in 2000 ppm ethephon for 5 minutes then kept at 68°F for 3 weeks.

3- Magnesium: fruit dipped in 0.18 M MgCl₂ for 2 minutes then kept at 68°F for 3 weeks.

Compared with mineral methods.
Bitter pit in fruit after 3 weeks at 68°F
The prediction methods in relation to bitter pit development

2016-WNY

Bitter pit from all prediction methods is similar to actual bitter pit after storage.
Focused on passive method

Passive, ethylene, and magnesium methods have a higher correlation with the actual bitter pit after storage compared with mineral analyses either three weeks before harvest or at harvest.

The magnesium method showed toxicity on the fruit that was difficult to distinguish from bitter pit, so we discarded this methods.

Ethylene method requires dipping of fruit in ethephon (not a labelled use).

**Passive is the easiest for growers and storage operators.**
Actual and predicted Bitter pit for fruit from all regions (2018)
Actual and predicted Bitter pit regression for HV fruit

$R^2 = 0.90$
Actual and predicted Bitter pit regression for Champlain fruit

$R^2 = 0.88$
<table>
<thead>
<tr>
<th>Sampling time</th>
<th>Factors</th>
<th>C+ 38°F</th>
</tr>
</thead>
<tbody>
<tr>
<td>3WBH</td>
<td>Passive</td>
<td>0.91</td>
</tr>
<tr>
<td></td>
<td>Ca</td>
<td>-0.67</td>
</tr>
<tr>
<td></td>
<td>(K+Mg)/Ca</td>
<td>0.77</td>
</tr>
</tbody>
</table>
Objectives

1. To evaluate non-mineral prediction methods to induce bitter pit in ‘Honeycrisp’ apples.

2. To use these predictions to reduce economic losses by modifying postharvest fruit management.
Economic losses at $700 per bin

Bottom line – how do we manage fruit with high bitter pit incidence in order to reduce these losses?
Alternative strategies

1. For fruit with high bitter pit potential, based on passive prediction model

**Do Not Condition** but store at 38°F.

- **Outcome** = much reduced bitter pit after storage. Stabilize bitter pit for one month in storage to minimize pit in the marketplace.

(Do Not market high bitter pit risk immediately).

**What is the risk?** - rare risk of soft scald and soggy breakdown at 38°F, but remember that actual losses with bitter pit are usually much greater than occasional losses with soft scald/soggy breakdown.
2. To find ‘safe’ time periods when fruit can be kept at 33 °F without conditioning for short time periods without soft scald developing.
The correlation between soft scald at 33°F and bitter pit at 38°F after 1 week of conditioning at 50°F for ‘Honeycrisp’ apples from 3 orchard blocks in WNY after 4 months of storage in 2015 harvest season.

An interesting observation

\[ R^2 = 0.64 \]
Passive prediction method is one that you as growers can start using now.

Results will allow you to save money by avoiding conditioning

Future research is exploring use of even lower storage temperatures for high bitter pit risk fruit.
Stem end browning of Gala
Stem-end flesh browning

- First appears as minor flesh browning on the shoulder but can affect the whole fruit over time.
- May not at first be noticeable to consumers but the fresh cut industry has zero tolerance.
- Appears to be an increasing problem as higher fruit volumes are stored, possibly resulting from longer storage periods.
- Found in various areas - some growers in New York State and Washington State; Brazil; Ontario, Canada; Europe.
Important factors

- Strain
- Maturity
- Storage period
- Decreased by Harvista, but need to know more about ReTain effects
- Decreased by dynamic controlled atmosphere storage (0.5% oxygen)
- 1-MCP and carbon dioxide effects are inconsistent
Stem-end flesh browning (%)
6 months CA storage

<table>
<thead>
<tr>
<th>Harvest x Field treatment (p&lt;0.001)</th>
<th>Control</th>
<th>Harvista</th>
<th>ReTain</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1</td>
<td>62</td>
<td>25</td>
<td>47</td>
</tr>
<tr>
<td>H2</td>
<td>60</td>
<td>21</td>
<td>58</td>
</tr>
</tbody>
</table>
Gala (2017) - SEFB (%) 3 months
- effect of carbon dioxide and 1-MCP
Gala (2017) – SEFB (%) 6 months - effect of carbon dioxide and 1-MCP
Variety or maturity - SEFB (%) vs

- Starch pattern index
- DA meter reading
Summary – the maybe’s!

- Early coloring strain
- Early harvest
- PGR
- CA for short term and DCA for long term
Questions?