Apple Sensitivity to ReTain and NAA Pre-Harvest Treatments

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District Hort Agent
Clarksville Research Center

Thanks to:
Michigan Apple Research Committee
Michigan State Horticulture Society
Valent BioSciences, Valent USA
AmVac
ReTain
AVG, aminoethoxyvinylglycine
An ethylene biosynthesis inhibitor.

• Manage harvest of apples.
• It blocks the auto-catalytic production of internal ethylene is the plant.
• Ethylene is involved in the ripening of apple fruit,
• Controls the maturity process of the fruit.
ReTain
AVG, aminoethoxyvinylglycine
An ethylene biosynthesis inhibitor.

• Manage Harvest
• Blocks Ethylene
• Control Maturity
  • Time Dependent
  • Rate Dependent
  • Variety Sensitivity
ReTain

- Improve fruit quality, firmness, shelf life
- Increase packing, processing packout yield,
- Reduce drop,
- Reduce greasiness,
- Reduce watercore,
- Reduce cracking,
- Deliver higher quality to consumers,
- Increase repeat demand value of your crop.
ReTain

ReTain has many effects on apples.
• Slows fruit growth, but overall increases fruit size.
• Improves quality.
• Delays red color development, but returns.
• Late application, less color impact.
• Apply multiple times.
• Apply split applications.
# ReTain Rate Impact on Apple Maturity

<table>
<thead>
<tr>
<th>Rate/Acre</th>
<th>DBH 30</th>
<th>21</th>
<th>14</th>
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Gala, Jonagold

Other Varieties
### ReTain Timing Impact on Apple Maturity

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**Fig 3. Cropload Impact on Apple Maturity**

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<th>Rate/Acre</th>
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Time
COLOR
2010 – Imperial Gala
Red Color

Retain

UTC

Treatment applied 28 days prior to harvest
ReTain Trials

- Full Rate
- Half Rate
- 30 DBH
- 14 DBH
- With and without NAA
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Percent Red Color 1st Harvest</th>
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<tr>
<td>UTC</td>
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<tr>
<td>3 333 7DBH</td>
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<tr>
<td>4 165 7DBH</td>
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<tr>
<td>5 333 7DBH</td>
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<tr>
<td>7 NAA 14DBH</td>
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<tr>
<td>8 333 3DBH + NAA 14DBH</td>
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<tr>
<td>9 333 14DBH + NAA 14DBH</td>
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<td>10 333 14DBH</td>
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Pic 3. Honeycrisp ReTain NAA Trial 2010
9-13-10, Pre 2nd Harvest
Honeycrisp Starch Index
ReTain delayed starch removal
Honeycrisp Internal Ethylene 2011
All ReTain tmts shut down ethylene
Some varieties are more sensitive to ReTain than others. Gala, Jonagold and Honeycrisp have an increased sensitivity and a recommended half rate will perform similar to other varieties treated with full rate. The gold standard for ReTain applied alone is 30 DBH at full rate (except for sensitive varieties).
<table>
<thead>
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<th>Rate/Acre</th>
<th>DBH</th>
<th>30</th>
<th>21</th>
<th>14</th>
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Gala, Jonagold

ReTain Rate Impact on Apple Maturity

<table>
<thead>
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<th>Time</th>
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GOLD STANDARD

ReTain 30 Days Before Harvest

• The “Gold Standard”
• Full Rate
• Most Normal Varieties
• Best ReTain results,
• Best repeatable results year to year
• Label confidence from Valent
• Summer varieties especially Macs, need ReTain early to give maximum stop drop protection.
## ReTain and Varieties

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<th>Sensitivity</th>
<th>Variety</th>
<th>Recommendations</th>
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<td>Reduced Rates</td>
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<td>½ rate is Full Rate</td>
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<td>Moderately</td>
<td>Honeycrisp</td>
<td>Reduced Rates</td>
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<tr>
<td>Normal</td>
<td>All other major varieties</td>
<td>Normal Rate</td>
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<tr>
<td>Special</td>
<td>McIntosh, other summer apples</td>
<td>Make early applications (30 to 21 DBH). Variable maturity, High ethylene variety.</td>
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</table>
RETAIN+NAA

ReTain

• All rates and timings shut down ethylene.
• Best stop drop:
  • ReTain + NAA, 14 DBH
  • ReTain + NAA, anytime 30 to 14 DBH
• Stressful years
  – Apply ReTain earlier 30 to 21 DBH.
  – Or increase ReTain rate
Fruit Abcission

Ethylene → Ripening → Drop

ReTain → Ethylene → Drop

NAA stops Abcission but Promotes Ethylene

ReTain+NAA Block Ethylene and Blocks Abcission
ReTain + NAA

• Combination improves performance of both materials.
• NAA inhibits abscission zone for 7 days.
• However, NAA stimulates ethylene.
• ReTain blocks ethylene, prevents “NAA ethylene”.
• Thus a better combined performance.
## Honeycrisp Retain Treatments 2010

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<th>DBH</th>
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- **Full Rate**: Green arrows
- **Half Rate**: Yellow arrows
- **NAA 20 ppm**: Blue arrows

### Time

- **Full Rate**: Green
- **Half Rate**: Yellow
- **NAA 20 ppm**: Blue
DROP ReTain
Honeycrisp ReTain & NAA 2010
Accumulated Fruit Drop/Tree

STOP DROP

Number of Fruit

0 10 20 30


1 NTC
2 165 21DBH
3 165 21 & 7DBH
4 165 7DBH
5 333 7DBH
6 333 30DBH
7 NAA 14DBH
8 333 30DBH + NAA 14DBH
9 333 14DBH + NAA 14DBH
10 333 14DBH
Honeycrisp Total Drops 2011

Honeycrisp Total Drops Handgun 2011

ReTain Treatments

UTC
¼ Rate, 3 weeks before harvest, Belding.
2013 TRIALS

Starch Index

Honeycrisp ReTain/NAA 2013

- UTC
- NAA
- Quarter
- Half
- Split Half
- NAA

Graph showing the starch index over time for different treatments.
Internal Ethylene

Honeycrisp ReTain/NAA 2013

UTC
NAA

UTC
Quarter
Half
Split Half
NAA

Internal Ethylene

0 20 40 60 80 100 120

4-Sep 11-Sep 18-Sep 25-Sep 2-Oct
Firmness

Honeycrisp ReTain/NAA 2013

Firmness over time from 4-Sep to 2-Oct, with different treatments indicated by colors and markers.
Honeycrisp ReTain/PoMaxa 2013
Honeycrisp ReTain/PoMaxa 2013

Honeycrisp ReTain/NAA Accumulated Drop 2013

- UTC
- QUARTER
- NAA
- HALF

Percent

10/15/13

Graph showing the accumulated drop of Honeycrisp ReTain/NAA for UTC, Quarter, NAA, and Half categories.
Honeycrisp ReTain/PoMaxa 2013

UT

Quarter Rate

NAA

Harvested 9-30-2013
Gala ReTain/PoMaxa 2013

Harvested 10-9-2013

Quarter Rate

Half Rates

Quarter Rate Twice
Gala ReTain/PoMaxa 2013

Gala ReTain/NAA Accumulated Drop 2013

Gala ReTain/NAA Accumulated Drop 2013

1 UTC
Quarter
NAA
Half
Split Half
ReTain/PoMaxa McIntosh 2013

1 UTC

2 Full 30

3 Full 30 + Full & NAA 7

4 Half & NAA 30 + Half & NAA 7

5 Full 30 + Half & NAA 7

10-22-13 Ruby Mac
ReTain Stop Drop

For best performance use with NAA at 14 DBH.

Stressful years, apply ReTain earlier and/or consider higher application rate.

On sensitive varieties use ½ rate of ReTain.
Retain Reduces Cracks

Reduces Greasiness

Reduces Watercore
Gala ReTain NAA Report 2012

Gala ReTain NAA Cold Storage 2012

Percent Cracks

UTC  Ret  NAA  R+NAA

Cracks

60 Day Cold Storage
ReTain
AVG, aminoethoxyvinylglycine
An ethylene biosynthesis inhibitor.

• Manage Harvest
• Blocks Ethylene
• Control Maturity
• Time Dependent
• Rate Dependent
• Variety Sensitivity
### ReTain and Varieties

<table>
<thead>
<tr>
<th>Sensitivity</th>
<th>Variety</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very</td>
<td>Gala, Jonagold</td>
<td>Reduced Rates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>½ rate is Full Rate</td>
</tr>
<tr>
<td>Moderately</td>
<td>Honeycrisp</td>
<td>Reduced Rates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>½ rate is Full Rate</td>
</tr>
<tr>
<td>Normal</td>
<td>All other major varieties</td>
<td>Normal Rate</td>
</tr>
<tr>
<td>Special</td>
<td>McIntosh, other summer apples</td>
<td>Make early applications (30 to 21 DBH). Variable maturity, High ethylene variety.</td>
</tr>
</tbody>
</table>
57th IFTA Annual Conference 2014

Pre Conference Workshop
Feb 22, Sat: Sweet Cherries
Feb 23, Sun: Sweet Cherry Pruning Tour
57th IFTA Annual Conference 2014

Post Conference Tour
Feb 27 to March 1
BC Canada and Washington
57th IFTA Annual Conference 2014
Feb 22 to 26, 2014
Ifruittree.com
Thanks to:
Michigan Apple Research Committee
Michigan State Hort Society
Valent BioSciences
Supporting Growers
Amvac
Recommendations

• **General Use** on Most Varieties
  
  - **Objective**
    - 30 DBH
    - 14 DBH
  
  - Full maturity delay.
  
  - Provides early stop drop and maturity delay and best for stressful years.

  - **Objective**
    - 30 DBH
    - Stressful Years Stop drop
    - Apply 1st ReTain early and add NAA

  - **Objective**
    - 14 DBH
    - Stressful Years Stop Drop
    - Apply 2nd ReTain add NAA

  - Stressful years will hasten drop, early control is required.
Recommendations

• **McIntosh** (Drop Prone, High Ethylene)
  - **Objective**
  - **30 DBH**
  - **14 DBH**
  - Maturity delay and stop drop.
    - Half rate +NAA
    - Half rate +NAA
  - Provides best overall performance.
  - **Objective**
  - **30 DBH**
  - **14 DBH**
  - Some maturity delay and stop drop.
    - 1/3 rate +NAA
    - 1/3 or 1/4 rate +NAA
  - Less maturity delay and color impact, but still excellent stop drop.
Recommendations

- **Gala, Jonagold, Honeycrisp** (Retain sensitive)
  - Objective: 30 DBH 14 DBH
  - Maturity delay and stop drop: 1/4 rate 1/4 rate +NAA
  - Provides excellent performance.

- **All Other Varieties**
  - Maturity delay and stop drop: 1/2 rate 1/2 rate +NAA
  - Provides excellent overall performance.