



Apple Sensitivity to ReTain and NAA Pre-Harvest Treatments

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Thanks to:

Michigan Apple Research Committee
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Valent BioSciences, Valent USA
AmVac

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EXTENSION

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AgBioResearch

ReTain

AVG, aminoethoxyvinylglycine
An ethylene biosynthesis inhibitor.

- **Manage harvest** of apples.
- It **blocks** the auto-catalytic production of internal **ethylene** in 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.

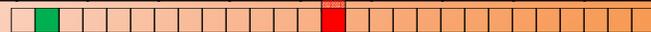
ReTain

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

DBH	30	21	14	7	0	-7	-14	-21	-30
Rate/Acre									
No ReTain					↓				
Full Rate	↓					↓			
3/4 Rate	↓					↓			
2/3 Rate	↓					↓			
1/2 Rate	↓					↓			
1/3 Rate	↓					↓			
1/4 Rate	↓					↓			

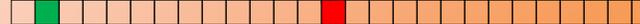


Time 

ReTain Rate Impact on Apple Maturity

DBH	30	21	14	7	0	-7	-14	-21	-30
Rate/Acre								Gala	
No ReTain								Jonagold	
Full Rate	↓						↓	↓	
3/4 Rate	↓						↓	↓	
2/3 Rate	↓						↓	↓	
1/2 Rate	↓						↓	↓	
1/3 Rate	↓						↓	↓	
1/4 Rate	↓						↓		

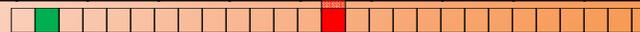
↓ Gala, Jonagold
 ↓ Other Varieties



Time →

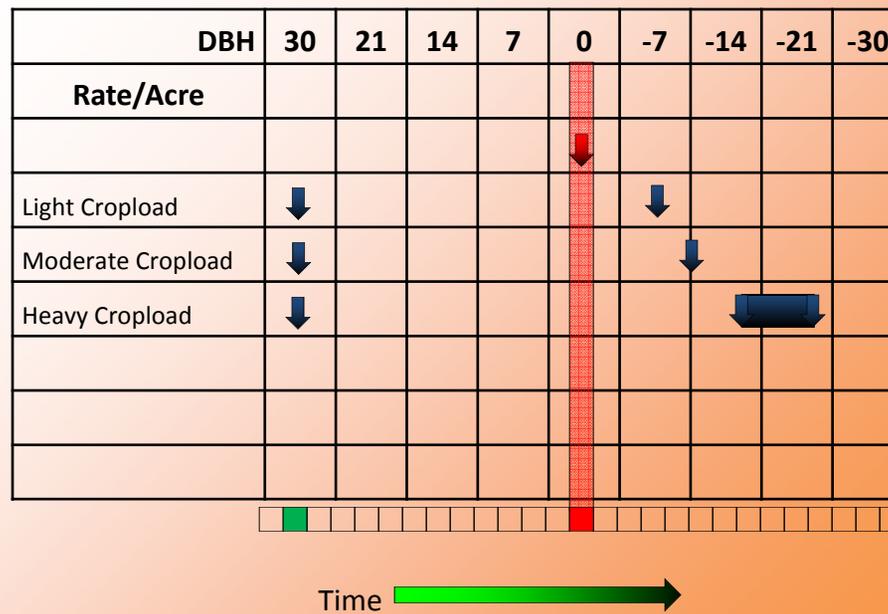
ReTain Timing Impact on Apple Maturity

DBH	30	21	14	7	0	-7	-14	-21	-30
Rate/Acre									
No ReTain					↓				
30 Days Before Harvest	↓						↓		
21 Days Before Harvest		↓					↓		
14 Days Before Harvest			↓				↓		
7 Days Before Harvest				↓		↓			
2 Applications	↓			↓			↓		
Split Applications	↓		↓				↓		



Time

Fig 3. Cropload Impact on Apple Maturity



COLOR

2010 – Imperial Gala
Red Color

Retain



UTC

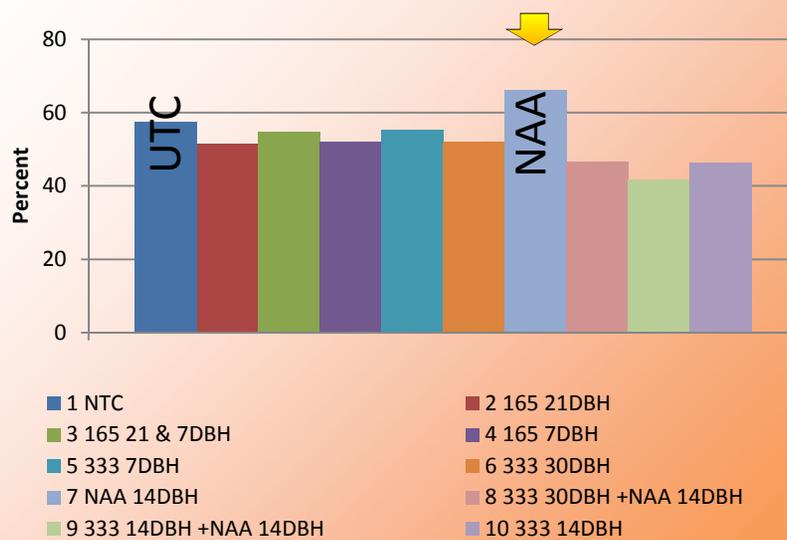


Treatment applied 28 days prior to harvest

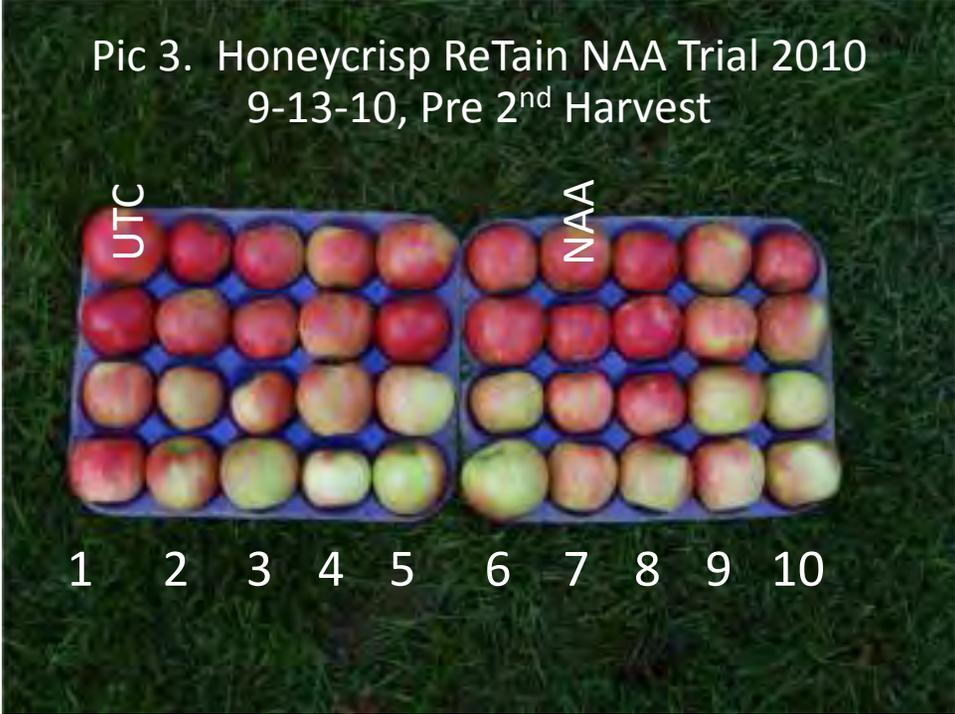
ReTain Trials

- Full Rate
- Half Rate
- 30 DBH
- 14 DBH
- With and without NAA

Honeycrisp ReTain Trial 2010 Percent Red Color 1st Harvest



Pic 3. Honeycrisp ReTain NAA Trial 2010
9-13-10, Pre 2nd Harvest



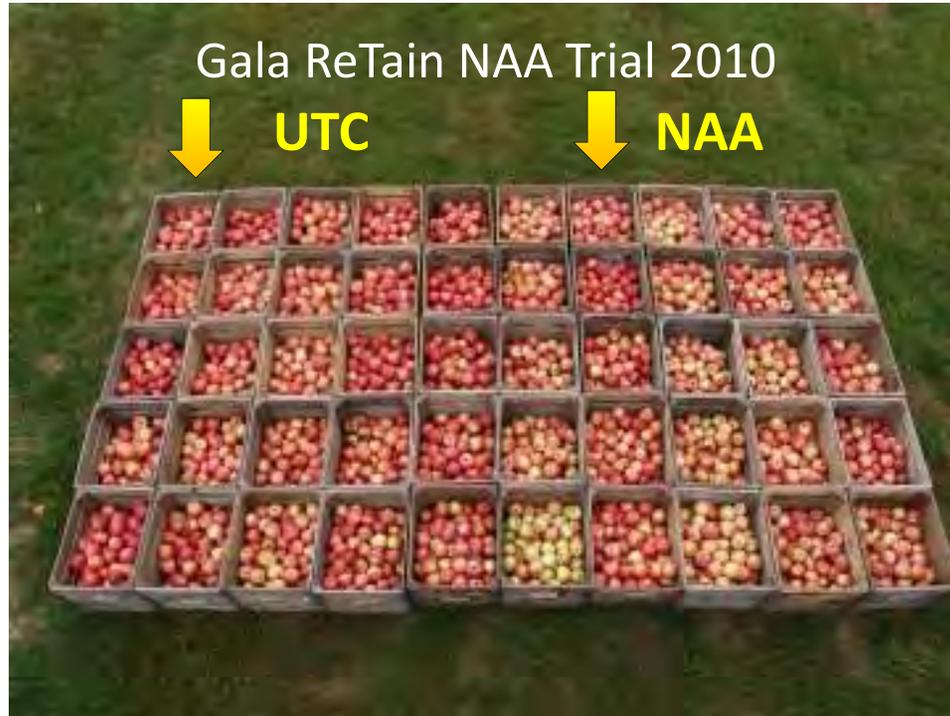
Gala ReTain NAA Trial 2010



UTC



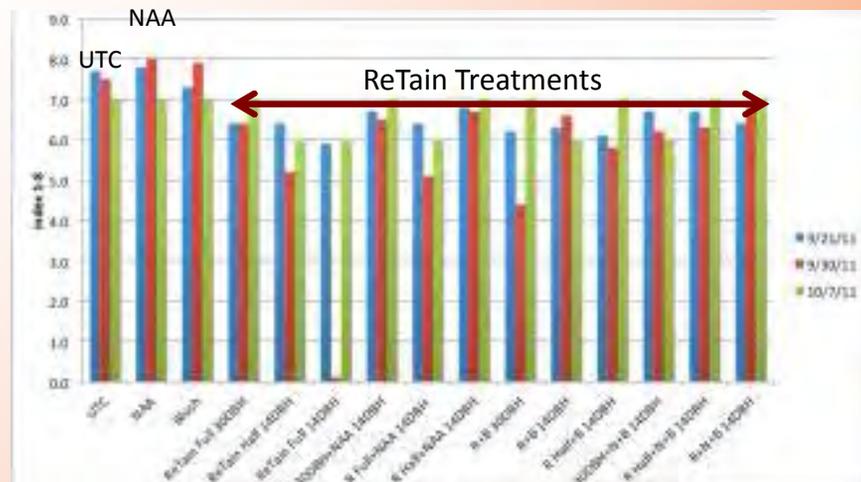
NAA



MATURITY

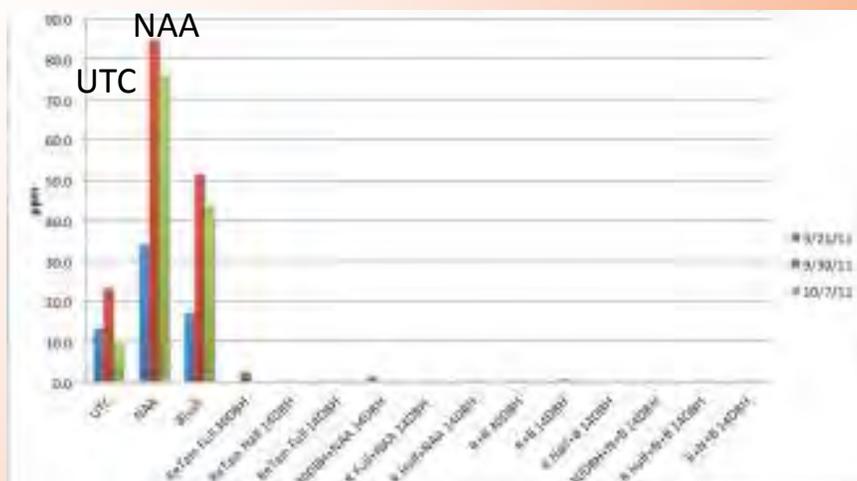
Honeycrisp Starch Index

ReTain delayed starch removal



Honeycrisp Internal Ethylene 2011

All ReTain tmts shut down ethylene



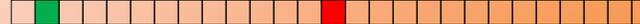
ReTain

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).

ReTain Rate Impact on Apple Maturity

DBH	30	21	14	7	0	-7	-14	-21	-30
Rate/Acre								Gala	
No ReTain								Jonagold	
Full Rate	↓						↓	↓	
3/4 Rate	↓						↓	↓	
2/3 Rate	↓						↓	↓	
1/2 Rate	↓						↓	↓	
1/3 Rate	↓						↓	↓	
1/4 Rate	↓						↓		

↓ Gala, Jonagold
 ↓ Other Varieties



Time →

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

Sensitivity	Variety	Recommendations
Very	Gala, Jonagold	Reduced Rates ½ rate is Full Rate
Moderately	Honeycrisp	Reduced Rates ½ rate is Full Rate
Normal	All other major varieties	Normal Rate
Special	McIntosh, other summer apples	Make early applications (30 to 21 DBH). Variable maturity, High ethylene variety.

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

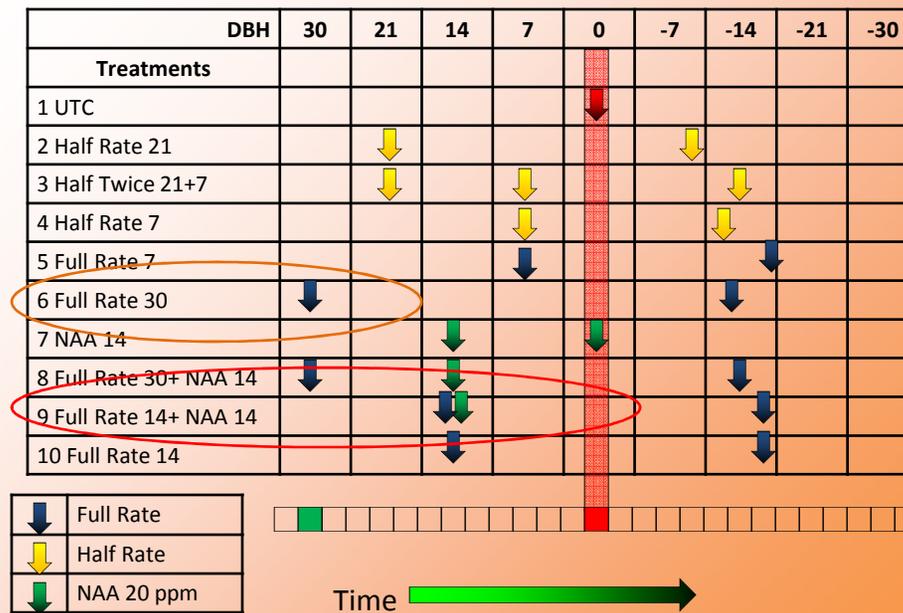
NAA stops Abcission but Promotes Ethylene

ReTain+NAA Block Ethylene and Blocks Abcission

ReTain + NAA

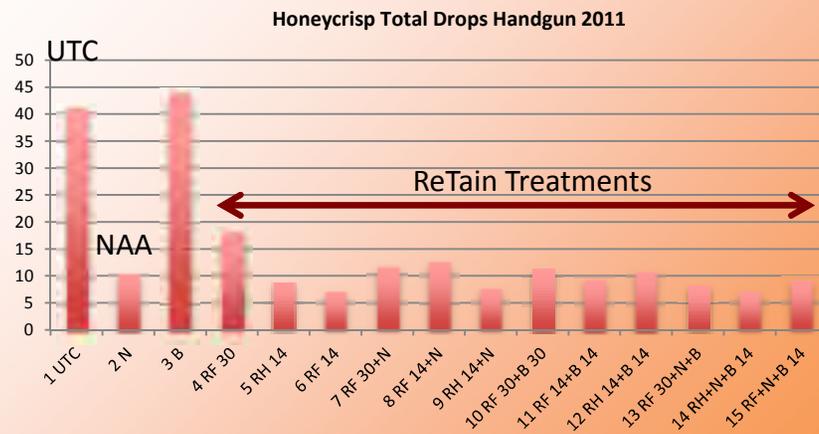
- Combination improves performance of both materials.
- NAA inhibits abscission zone for 7 days.
- However, NAA stimulates ethylene.
- ReTain blocks ethylene, prevents “NAA ethylene”.
- Thus a better combined performance.

Honeycrisp Retain Treatments 2010



DROP ReTain

Honeycrisp Total Drops 2011



UTC, Belding 2011.



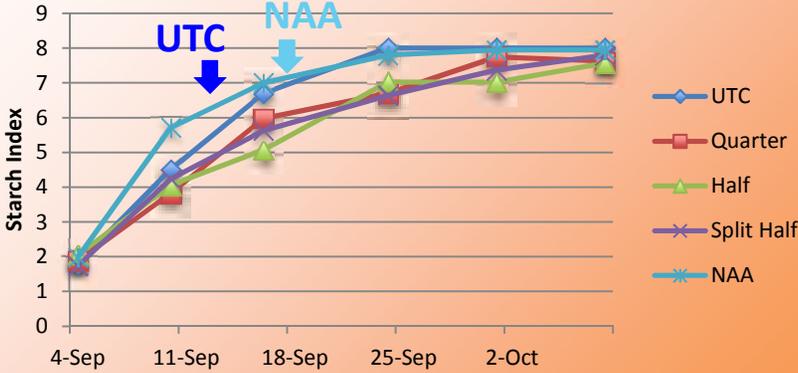
¼ Rate, 3 weeks before harvest, Belding.



2013 TRIALS

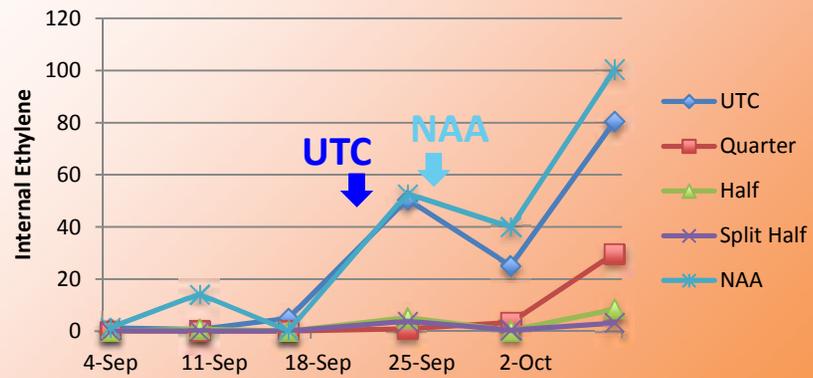
Starch Index

Honeycrisp ReTain/NAA 2013



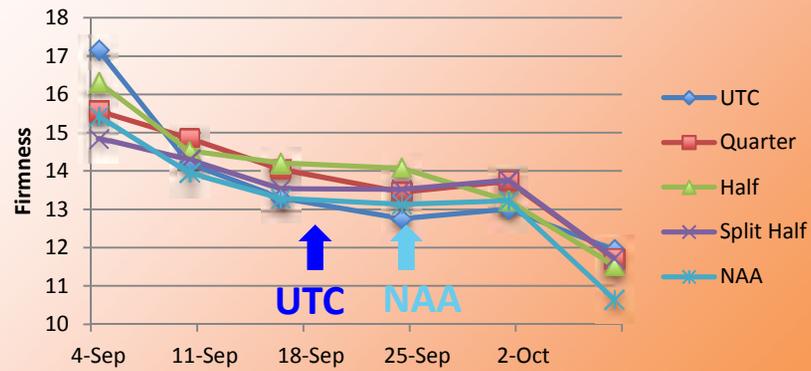
Internal Ethylene

Honeycrisp ReTain/NAA 2013



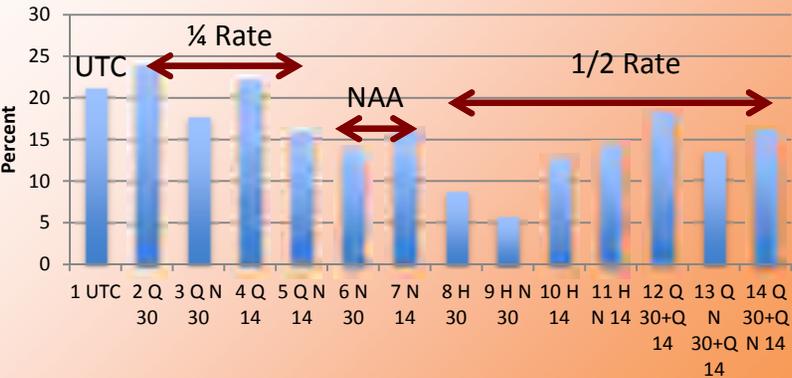
Firmness

Honeycrisp ReTain/NAA 2013



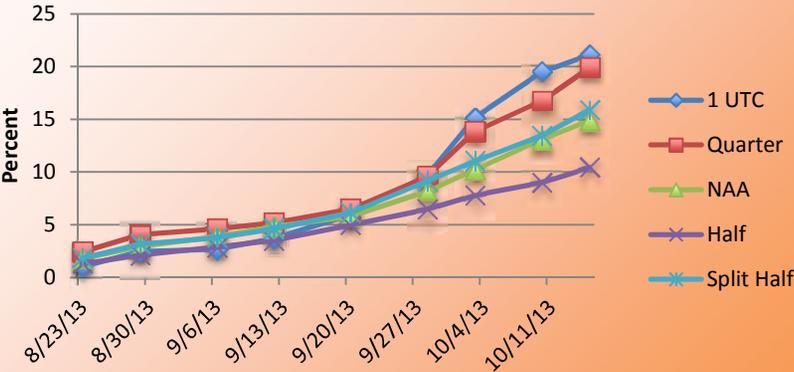
Honeycrisp ReTain/PoMaxa 2013

Honeycrisp ReTain/NAA Accumulated Drop 2013

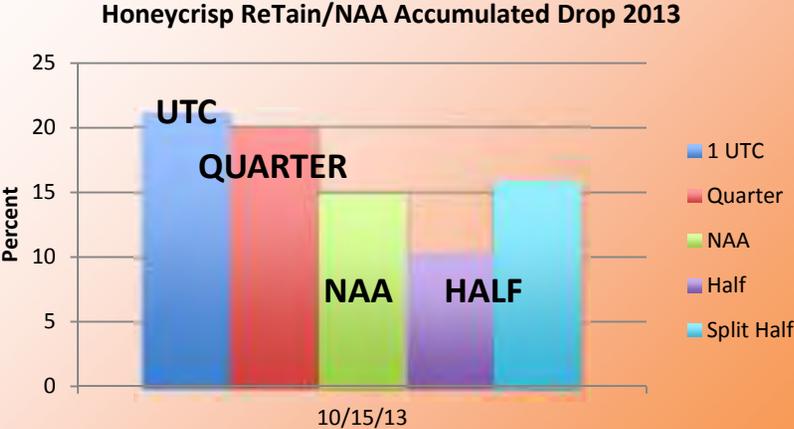


Honeycrisp ReTain/PoMaxa 2013

Honeycrisp ReTain/NAA Accumulated Drop 2013



Honeycrisp ReTain/PoMaxa 2013



Honeycrisp ReTain/PoMaxa 2013

UT

NAA



1 2 3 4 5 6 7 8 9 10 11 12 13 14

↑ ↑ ↑ ↑
Quarter Rate

↑ ↑ ↑ ↑
Half Rates

↑ ↑ ↑
Quarter Rate Twice

Harvested 9-30-2013

Gala ReTain/PoMaxa 2013

UT



NAA



1 2 3 4 5 6 7 8 9 10 11 12 13 14

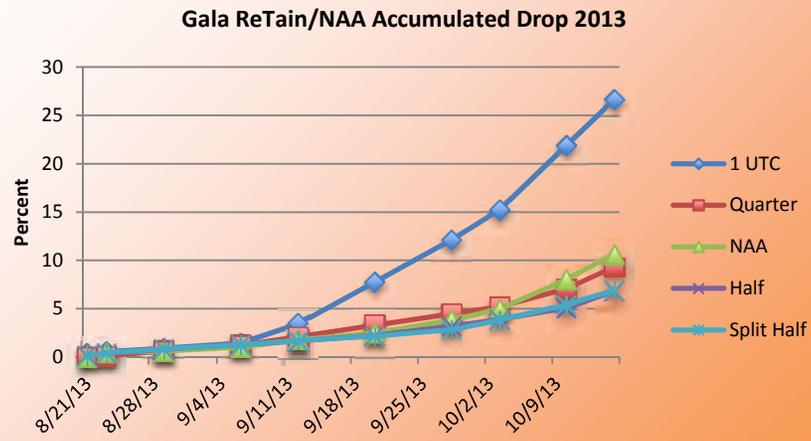
↑ ↑ ↑ ↑
Quarter Rate

↑ ↑ ↑ ↑
Half Rates

↑ ↑ ↑
Quarter Rate Twice

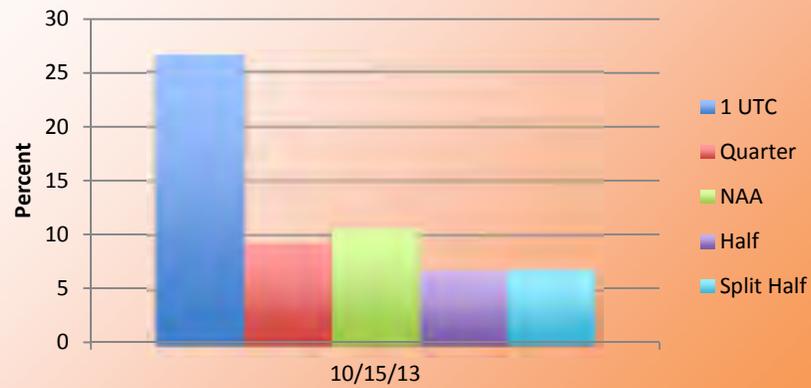
Harvested 10-9-2013

Gala ReTain/PoMaxa 2013

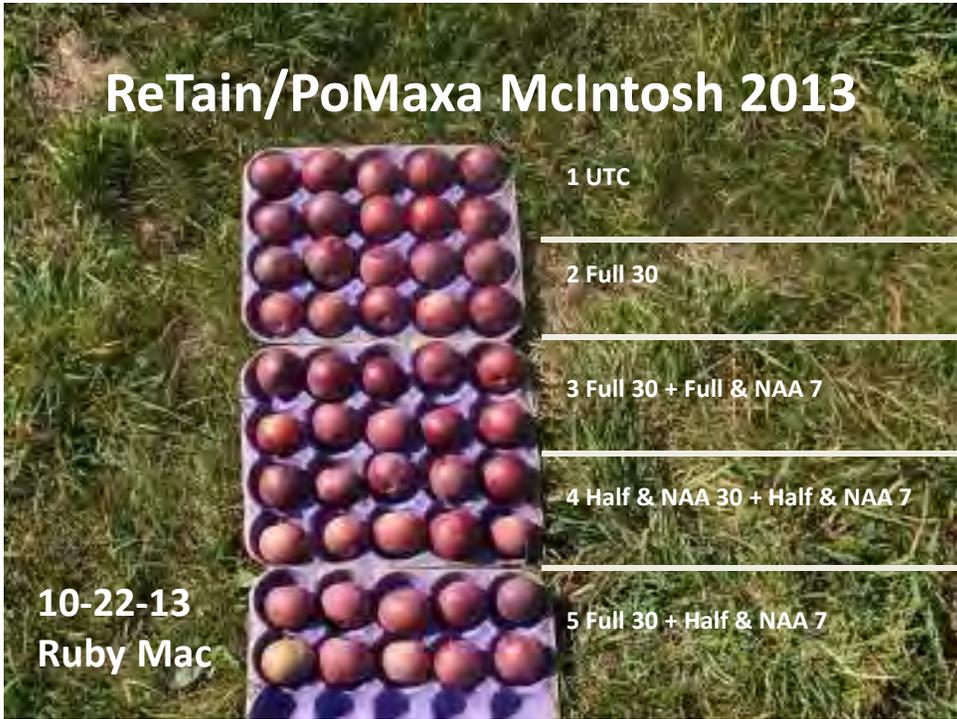


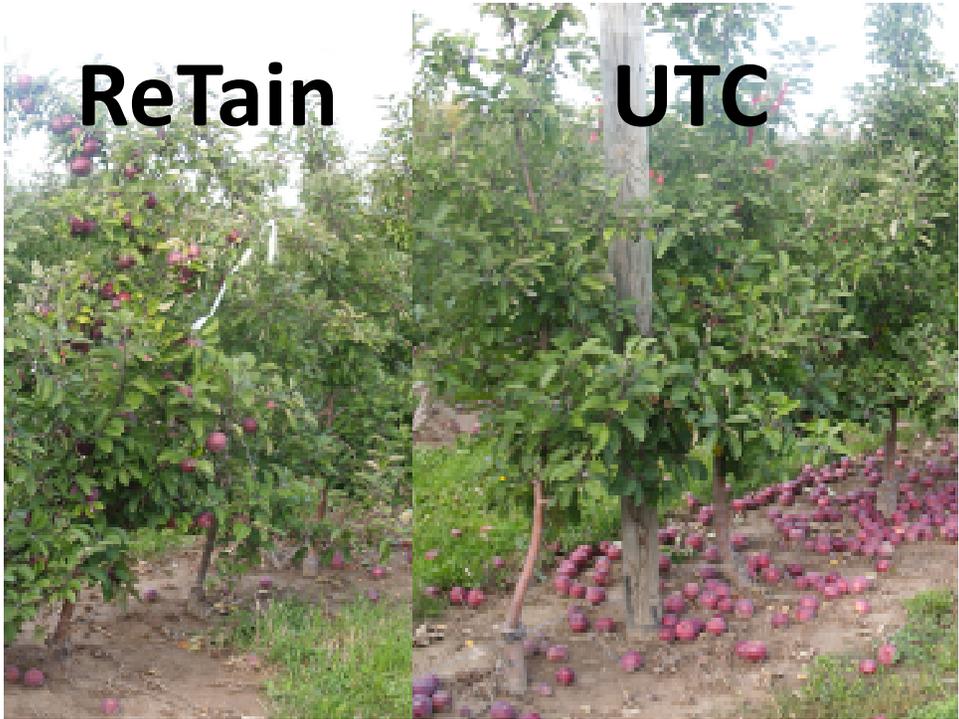
Gala ReTain/PoMaxa 2013

Gala ReTain/NAA Accumulated Drop 2013



ReTain/PoMaxa McIntosh 2013





ReTain

UTC

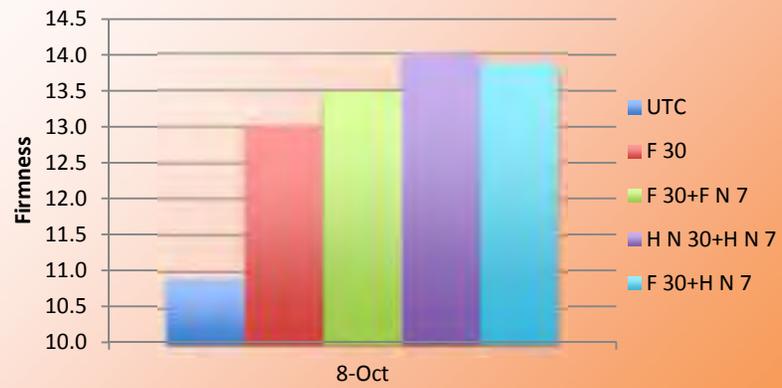
Internal Ethylene

Mac ReTain/ NAA 2013



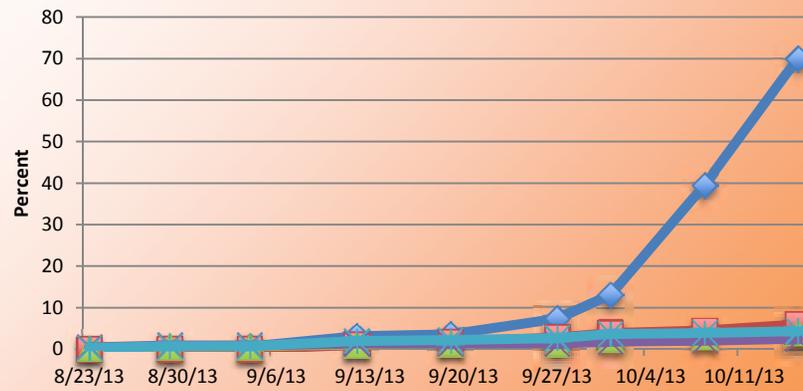
Firmness

Mac ReTain/ NAA 2013



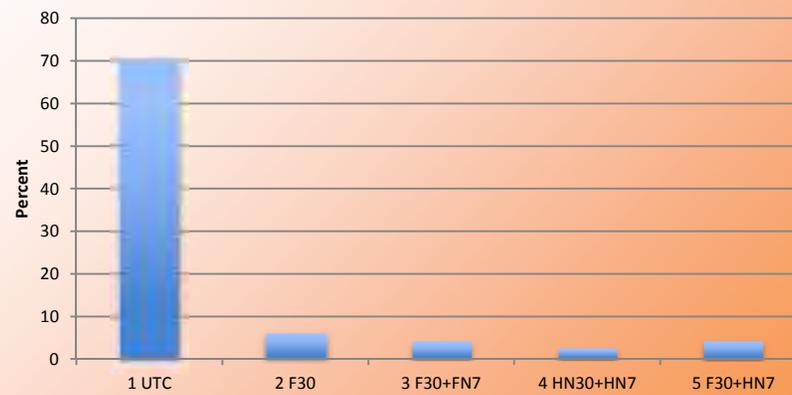
Mac ReTain/ NAA 2013

Mac ReTain/NAA Accumulated % Drop 2013



Mac ReTain/ NAA 2013

Mac ReTain/NAA Accumulated % Drop 2013



ReTain Stop Drop

For best performance use with NAA at 14 DBH.

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

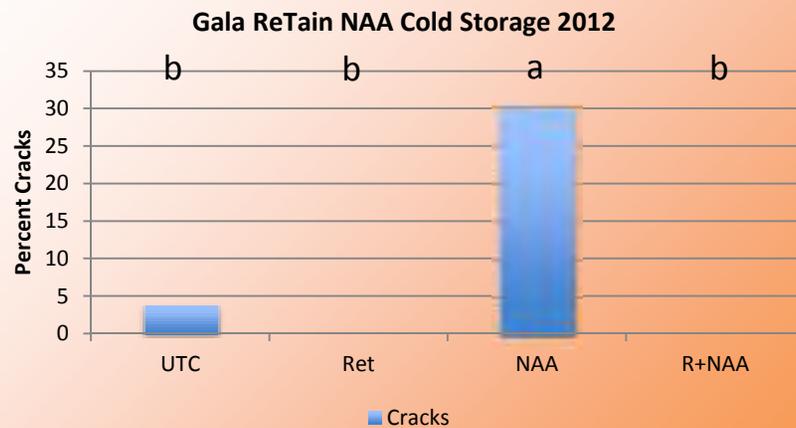
On sensitive varieties use $\frac{1}{2}$ rate of ReTain.

Retain Reduces Cracks

Reduces Greasiness
Reduces Watercore



Gala ReTain NAA Report 2012



ReTain

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An ethylene biosynthesis inhibitor.

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57rd IFTA Annual Conference 2014

Kelowna, BC Canada



Precision Orchard Management

The Early Years

Precision Harvesting

Varieties/Rootstocks

57rd IFTA Annual Conference 2014



Pre Conference Workshop

Feb 22, Sat: Sweet Cherries

Feb 23, Sun: Sweet Cherry Pruning Tour

57rd IFTA Annual Conference 2014



Post Conference Tour

Feb 27 to March 1

BC Canada and Washington

57rd IFTA Annual Conference 2014



IFTA

INTERNATIONAL FRUIT TREE ASSOCIATION

57rd IFTA Annual Conference 2014

Feb 22 to 26, 2014

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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. Full rate Full rate +NAA
- 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.