



Getting the Most Out of ReTain

Mid-Atlantic Fruit and Vegetable Convention 2017

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AgBioResearch

Harvest Management Tools

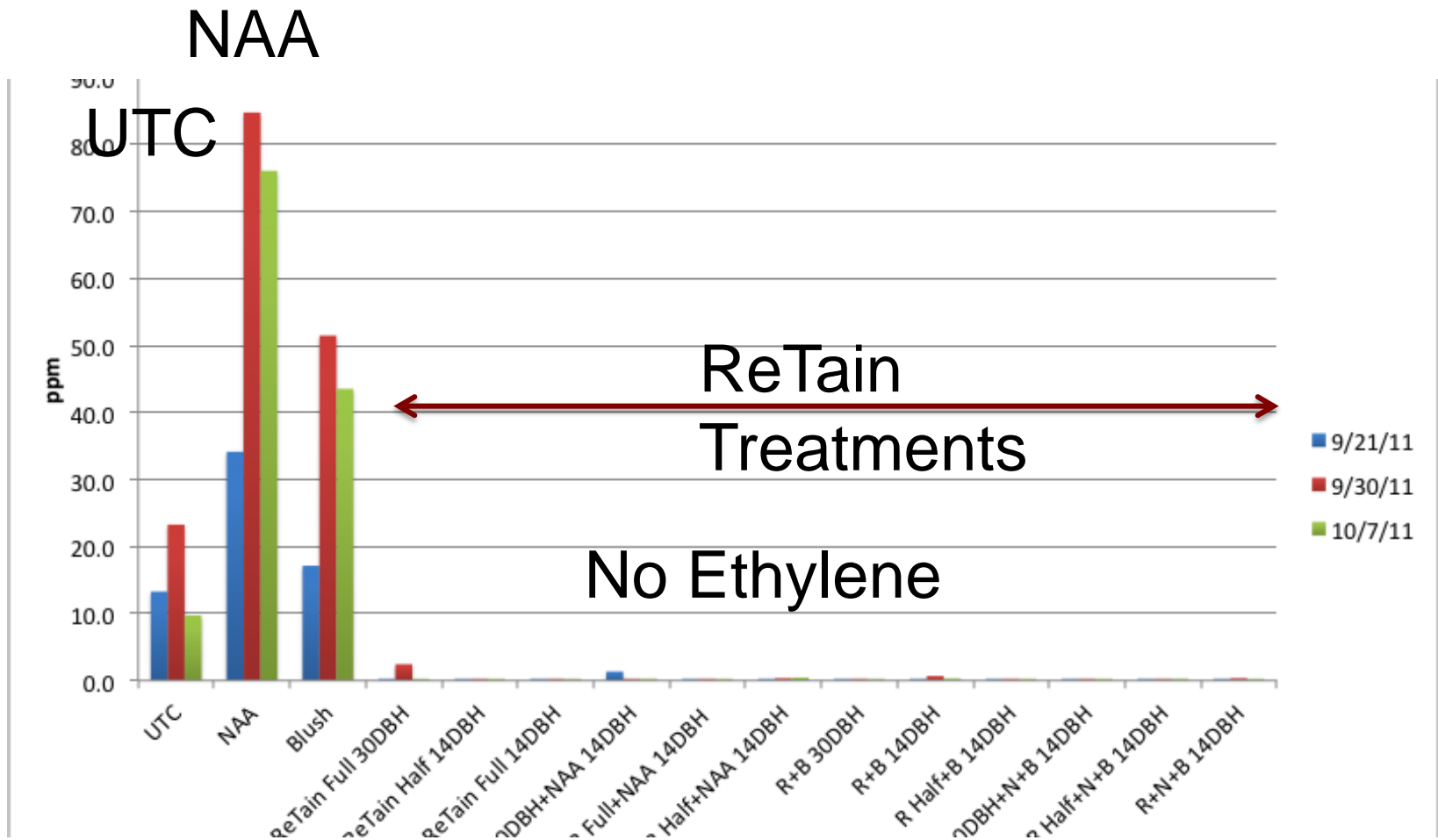
- ReTain
 - Harvista
 - NAA
-
- 2 Years of ReTain Trials
 - Gala, McIntosh, Honeycrisp

ReTain and Harvista

- **Ethylene** is a plant hormone that is involved in apple fruit ripening.
- ReTain (AVG) **stops** the production of ethylene in the apple fruit.
- Harvista (1-MCP) **blocks** the action of ethylene in the apple fruit.
- Thus they help with **harvest management**.
- They **delays maturity** and stop drops.
- Also improves fruit quality, storage quality and lengthen shelf life, reduces watercore, greasiness, cracking and improves fruit size, and can improve red color.

Honeycrisp Internal Ethylene

All ReTain treatments shut down ethylene



ReTain Characteristics

- **Dose Dependent**
 - The more applied, the more impact.
- **Time Dependent**
 - 30 DBH is the maximum impact.
- **Variety Sensitive**
 - Gala, Honeycrisp, Jonagold
- **Cropload Dependent**

ReTain and Varieties

Sensitivity	Variety	Recommendations
High	Gala, Jonagold	Reduced Rates ½ rate is Full Rate
Mod-High	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 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	↓					↓	↓		
½ Rate	↓					↓	↓		
1/3 Rate	↓					↓	↓		
¼ Rate	↓					↓	↓		

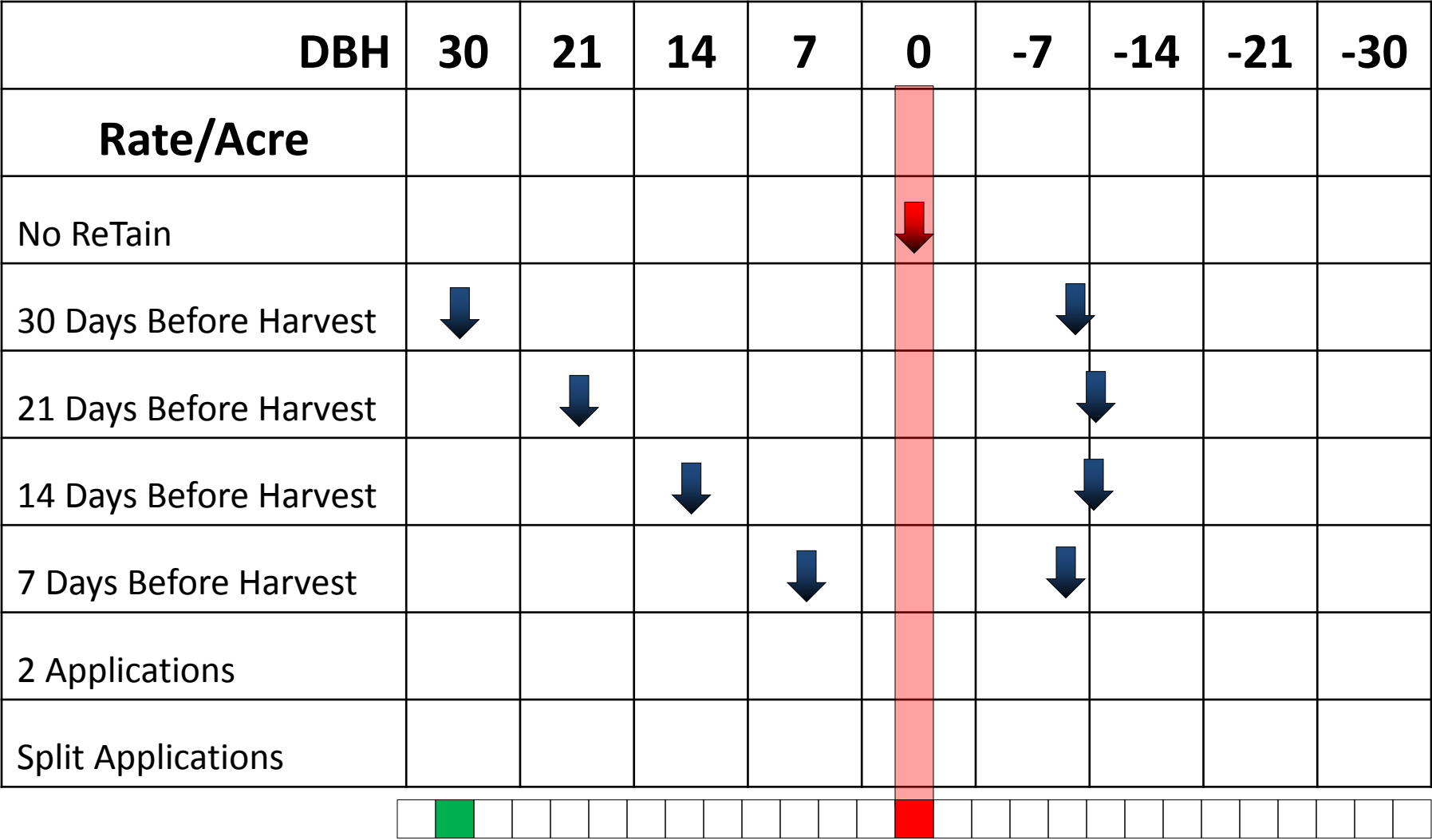
**Gala, Honey
Jonagold**

↓ Gala,
 ↓ Jonagold
 ↓ Other Varieties



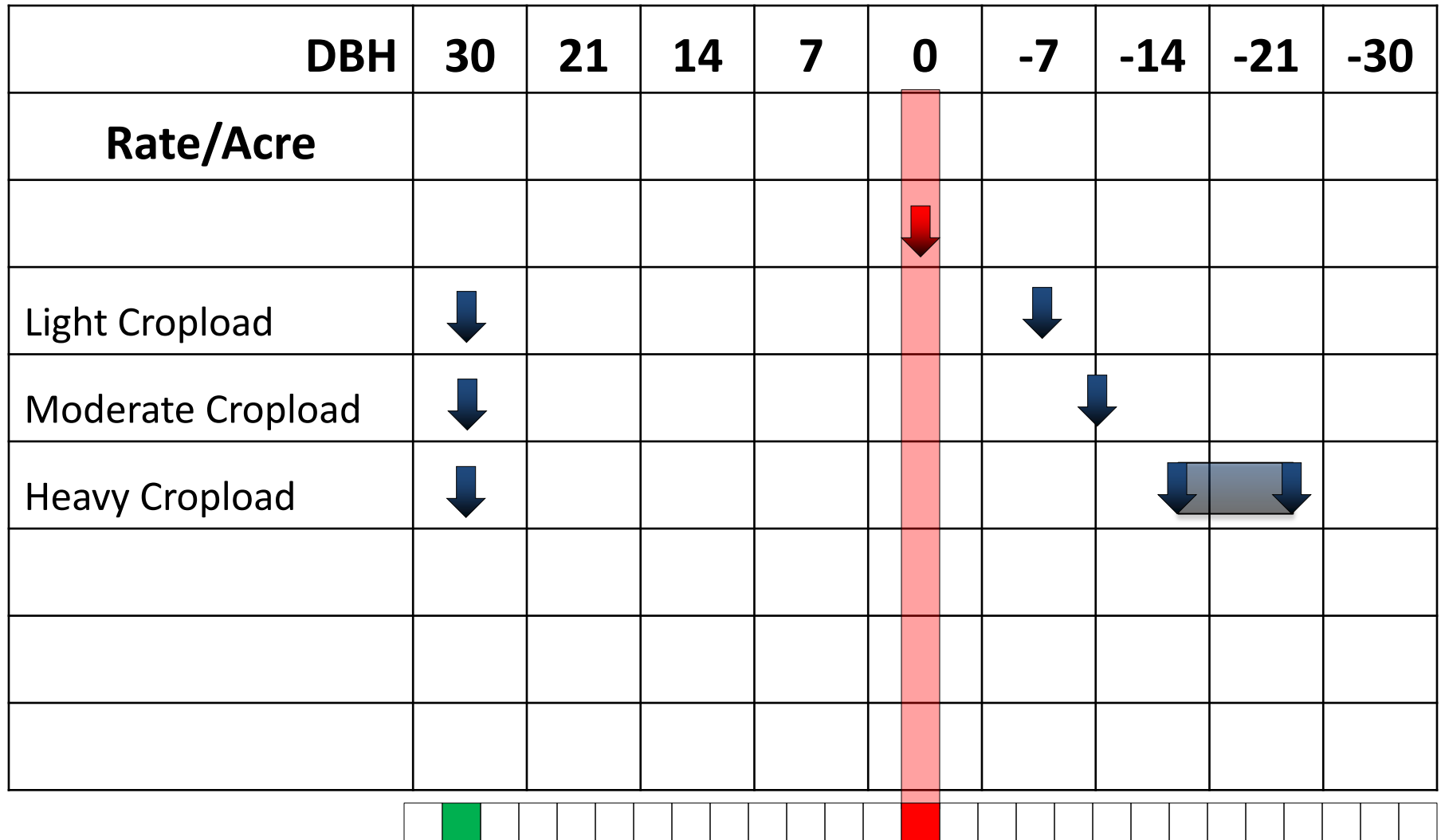
Time →

ReTain Timing Impact on Apple Maturity



Time 

Fig 3. Cropload Impact on Apple Maturity



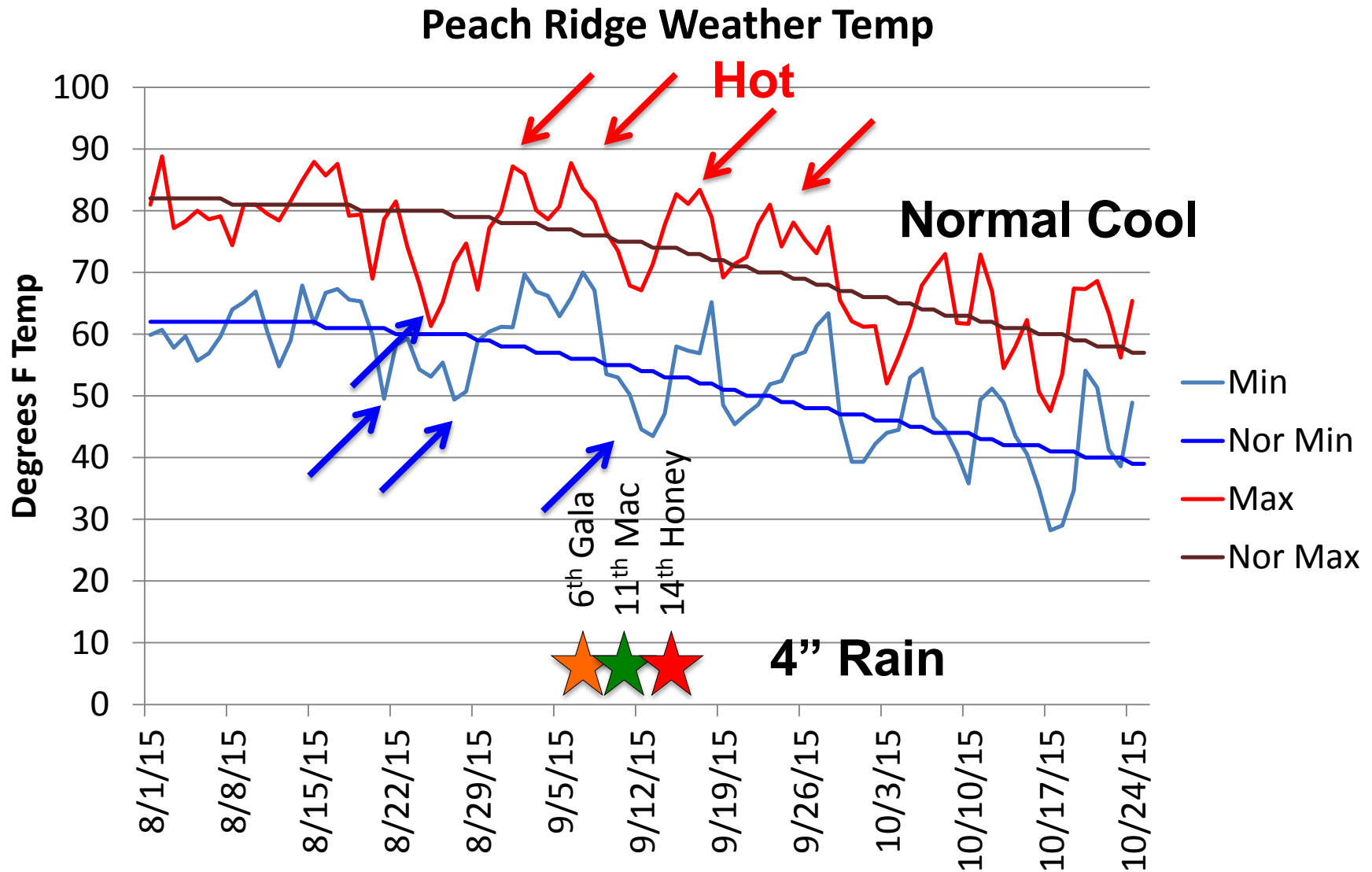
Time 

ReTain Trial Treatments

(Handgun)

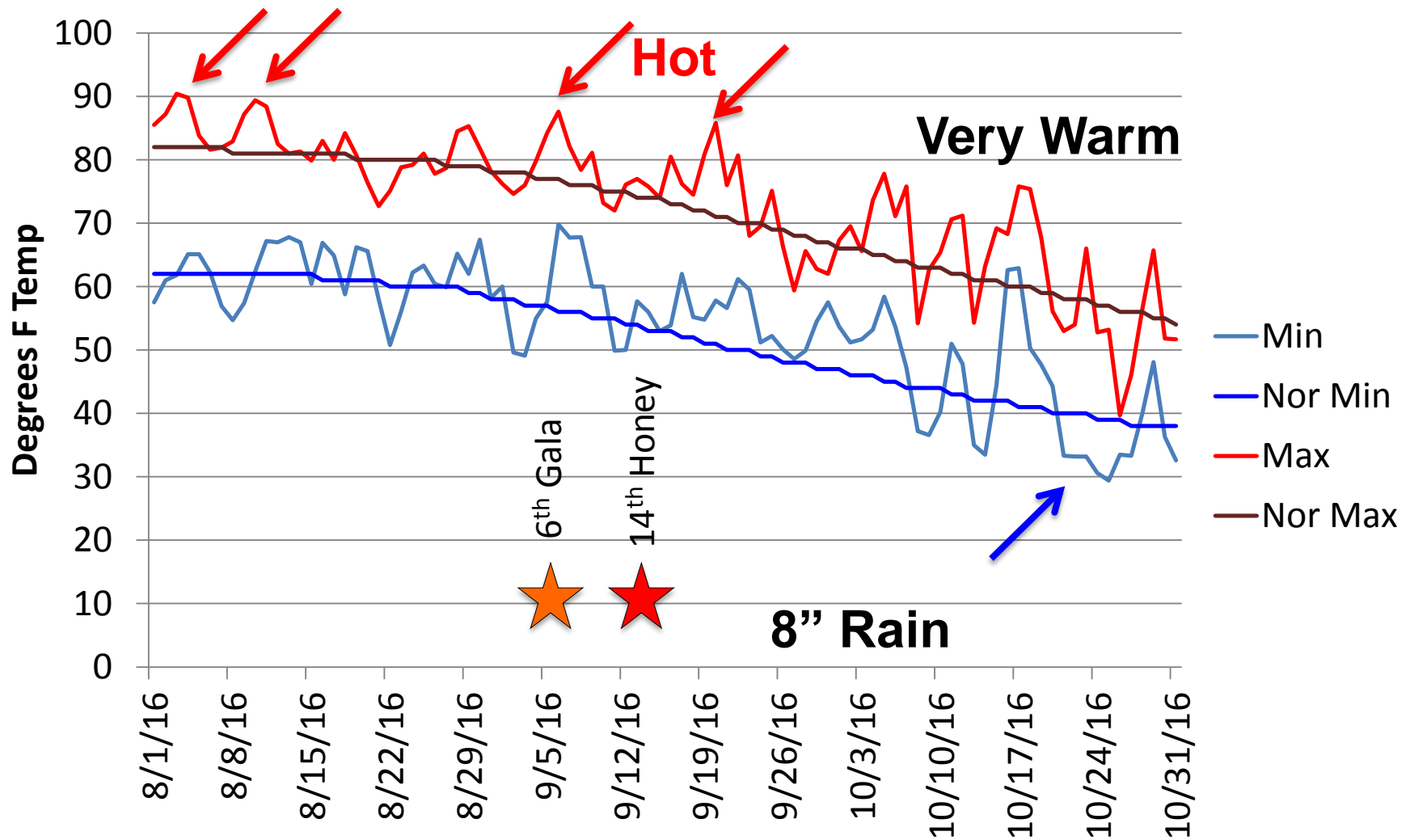
#	Treatment	ReTain/100	Widespread /100
1	UTC	-	-
2	1/4 Rate	83 g	+6.4 oz
3	Full Rate	333 g	+6.4 oz
4	1+1	333 g & 333 g	+6.4 & +6.4
5	2X	666 g	

Weather **2015**, Predicted Harvest Dates



Weather **2016**, Predicted Harvest Dates

Peach Ridge Weather Temp





Honeycrisp
Oct. 15, 2015

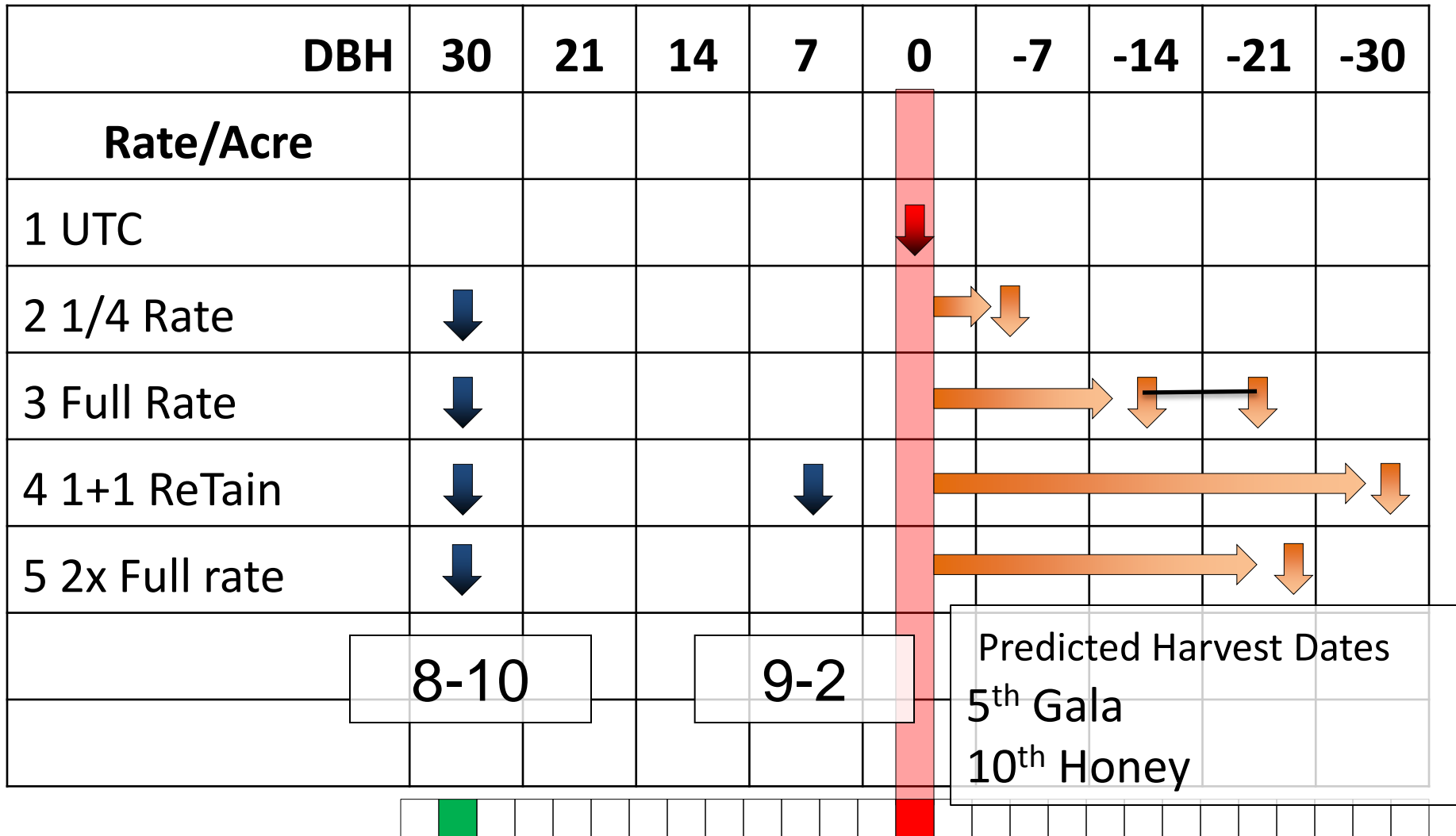
1+1 Pouch
30 DBH+
7 DBH

1 Pouch

UTC



ReTain Trial 2016 Treatments



Time

A large wooden crate is filled to the brim with ripe red Gala apples. The apples are densely packed, showing various shades of red and some yellow-green highlights. The wooden crate is made of weathered planks, and the background shows a glimpse of green grass.

Ultima Gala
Sept. 11, 2015

A large pile of Ruby Mac apples, showing a mix of red and yellow-green hues, filling the frame. The apples are densely packed, and some show signs of being picked, with small stems visible. The background is dark and indistinct.

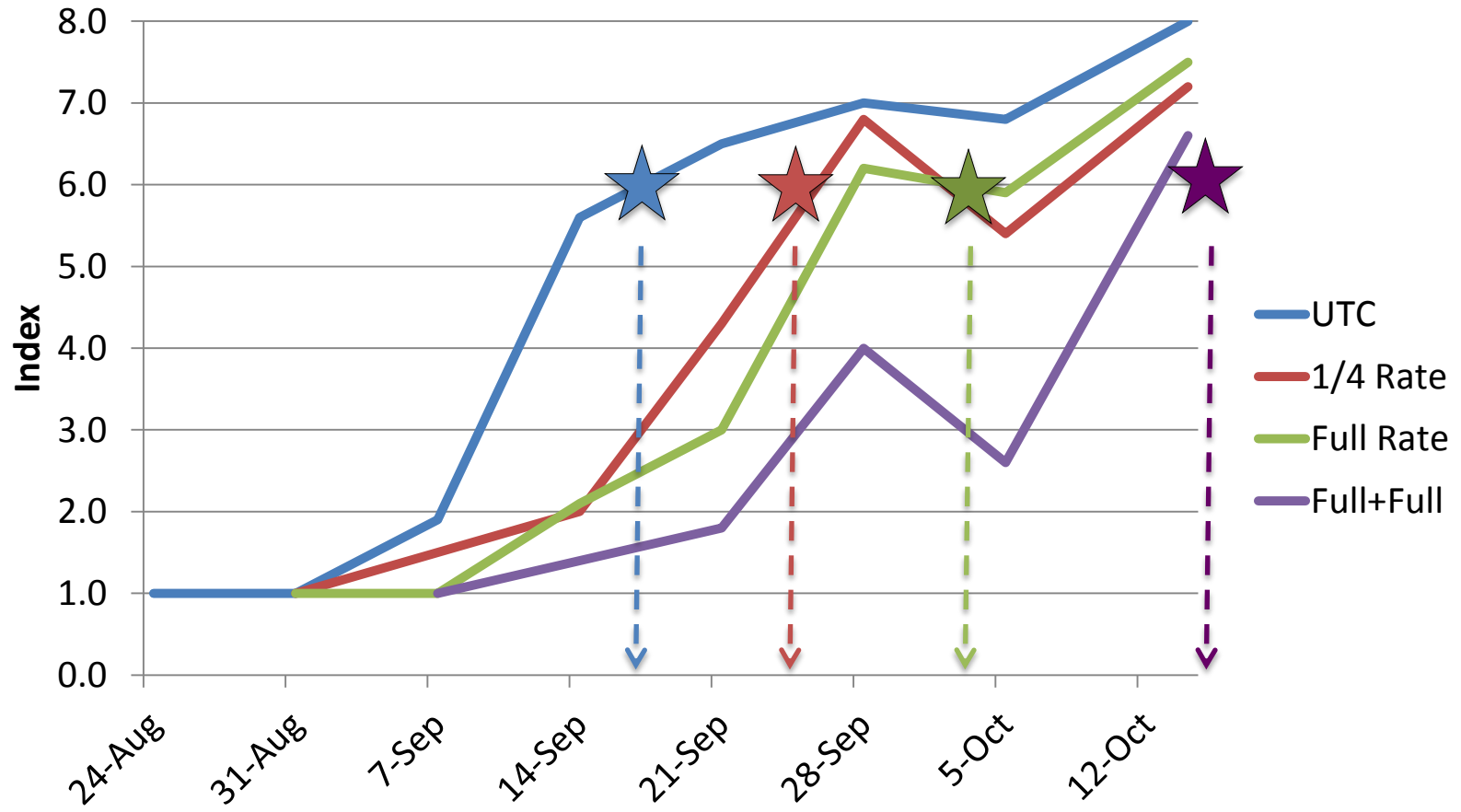
Ruby Mac
Sept. 11, 2015

A wooden crate is filled with a large quantity of Honeycrisp apples. The apples are predominantly red with some yellow-green streaks and patches, indicating they are ripe. They are packed closely together, filling the crate. The wooden crate's structure is visible at the top and right edges.

Honeycrisp
Sept. 10, 2015

ReTain Trial 2015

Honeycrisp Starch







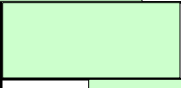

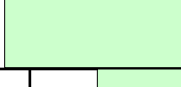

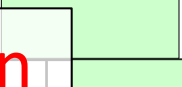

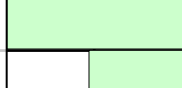

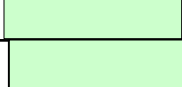

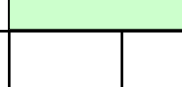
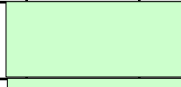

Honeycrisp ReTain Maturity Delay

Rate	2015	2016	Harvest Date 2015	Harvest Date 2016
Predicted			9-14	9-10
UTC	0	0	9-17	9-15
1/4 Rate	7	5	9-24	9-20
Full Rate	17	19	10-4	10-3
1+1	27	30	10-15	10-15
2X Rate		22		10-7

ReTain Maturity Delay

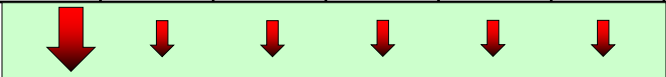
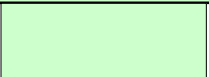

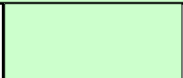
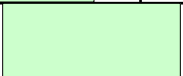
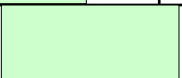
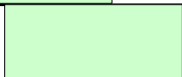
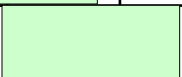
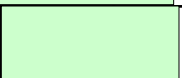
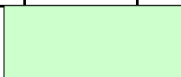
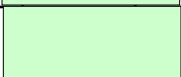
Rate	Honeycrisp		Gala		Average
	2015	2016	2015	2016	
UTC					
1/4 Rate	7	5	7	2	5
Full Rate	17	19	14	14	15
1+1	27	30	21	30	27
2X Rate		22		22	

Predicted & Normal Harvest Periods 2015



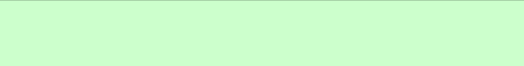









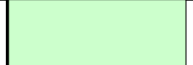







	August					September				October				
Date	1	8	15	22	29	5	12	19	26	3	10	17	24	31
Variety	% of Crop													
Gala		11												
Macs		7												
Honeys		6												
Empire		5												
Jons, JG		13												
Golden		11												
Reds		19												
Idared		8												
Rome		6												
Fuji		3												
Pink Lady		.01												

62% of Michigan Apples
Low Value Apples

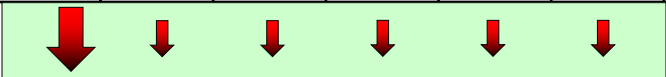

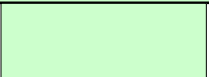


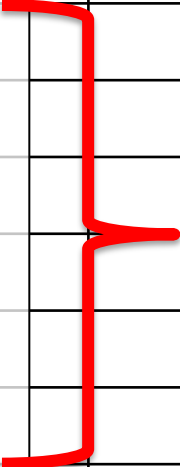
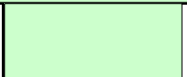

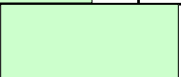

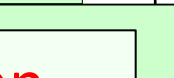

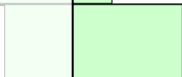

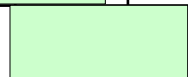

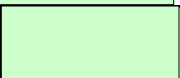
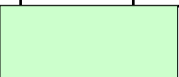
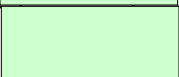
Managed Harvest Periods

	August					September				October				
Date	1	8	15	22	29	5	12	19	26	3	10	17	24	31
Variety														
Gala														
Macs														
Honeys														
Empire														
Jons, JG														
Golden														
Reds														
Idared														
Rome														
Fuji														
Pink Lady														

Predicted & Normal Harvest Periods 2015

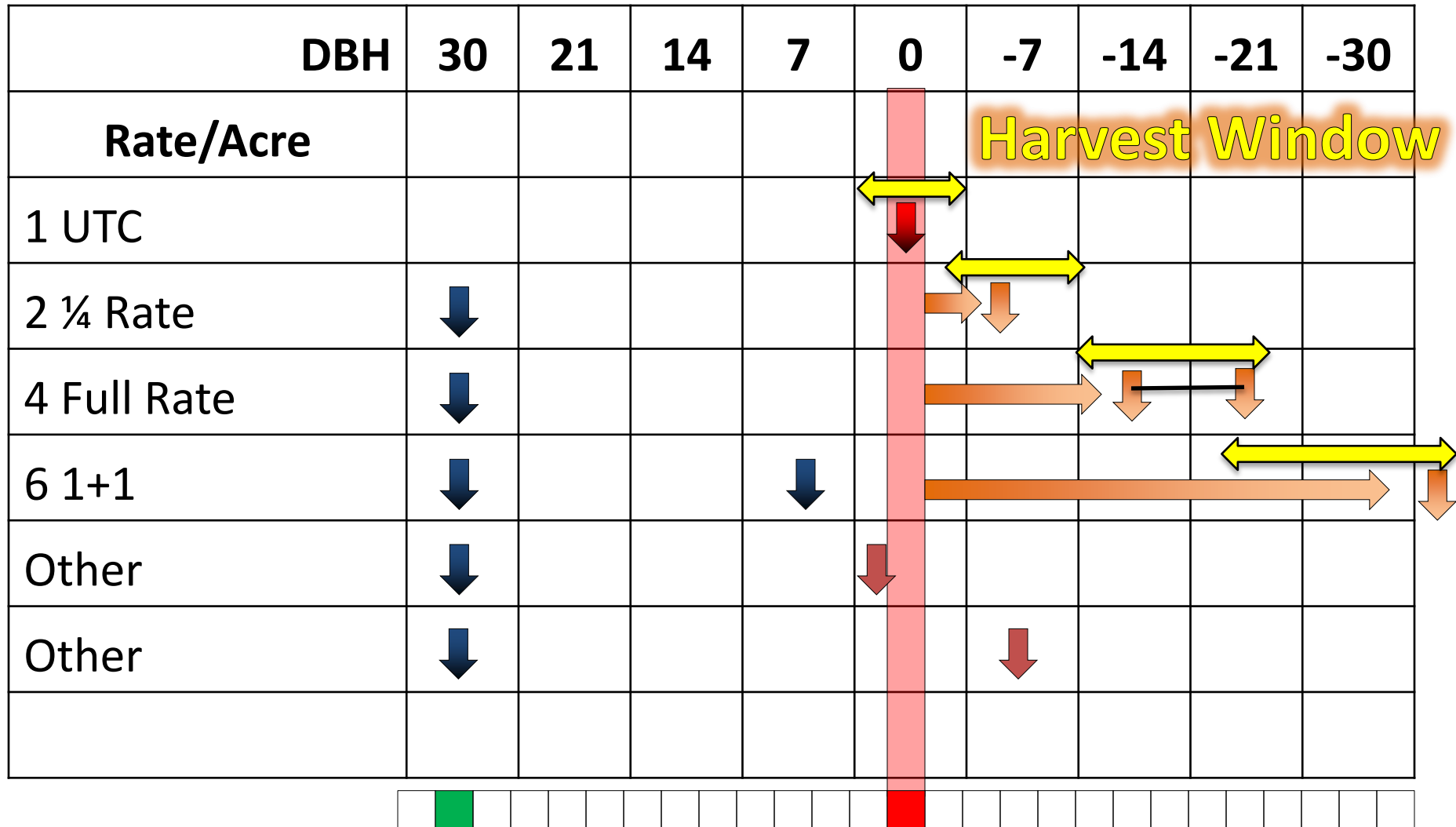
	August					September				October				
Date	1	8	15	22	29	5	12	19	26	3	10	17	24	31
Variety														
Gala														
Macs														
Honeys														
Empire														
Jons, JG		8-10 1 pouch /acre				9-2 1 pouch /acre								
Golden														
Reds														
Idared														
Rome														
Fuji														
Pink Lady														

2025 Managed Harvest Periods

	August					September				October				
Date	1	8	15	22	29	5	12	19	26	3	10	17	24	31
Variety	% of Crop													
Gala		30												
Macs		2												
Honeys		30												
Empire		2												
Jons, JG		3												
Golden		2												
Reds		8												
Idared		2												
Rome		1												
Fuji		5												
Pink Lady		1												

18% of Michigan Apples
Low Value Apples

ReTain Treatments



Time 

Honeycrisp
Oct. 15, 2015



UTC



1 Pouch



1+1 Pouch
30 DBH+
7 DBH

Regular Honeycrisp ReTain Trial 2015

Oct. 15, 2015

**Green
Side**



**Red
Side**



UTC

Full Rate

**Full+Full
Rate**

Regular Honeycrisp ReTain Trial 2015

Oct. 15, 2015

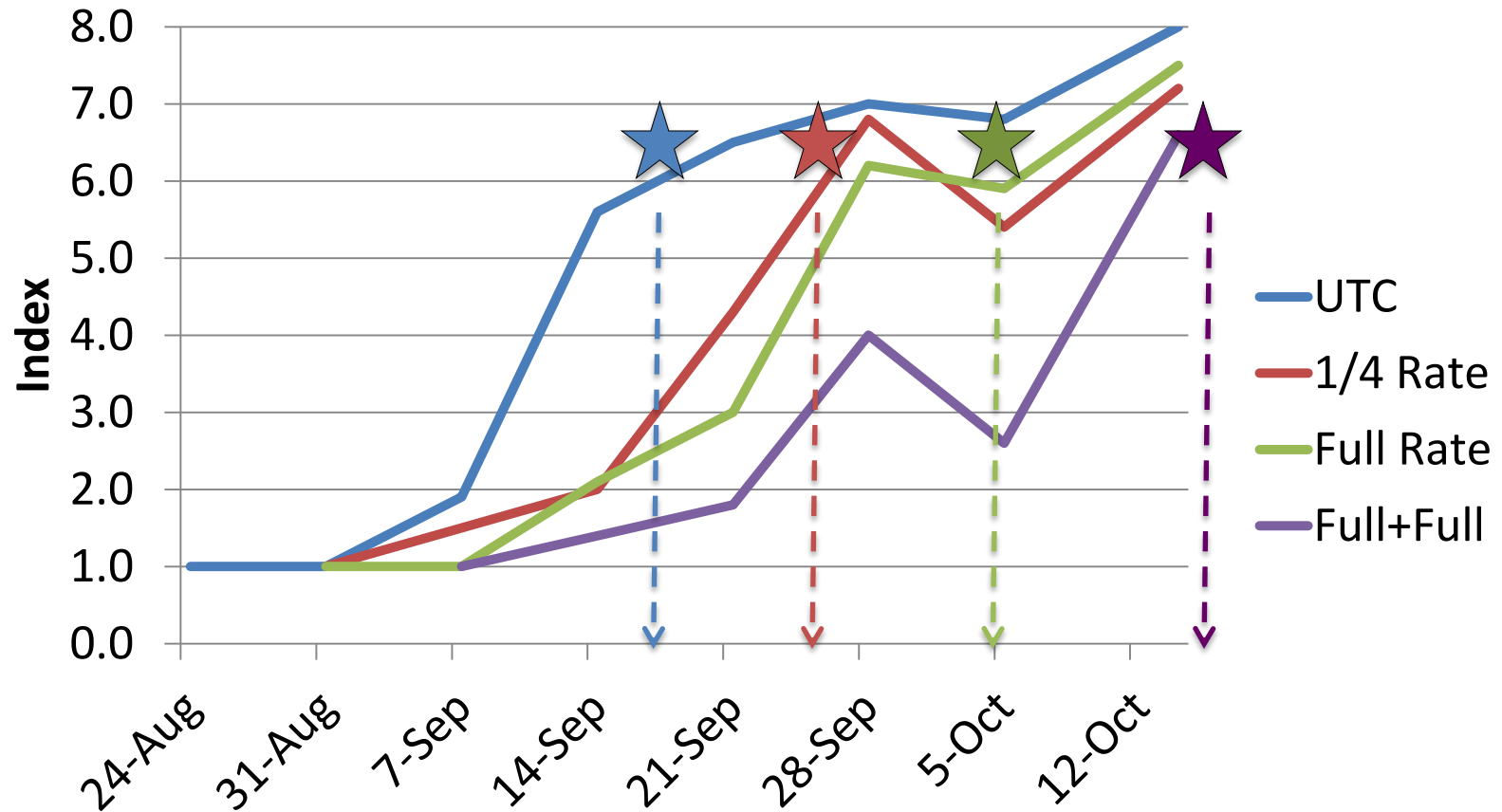
**Red
Side**

Full Rate

**Full+Full
Rate**

ReTain Trial 2015

Honeycrisp Starch



Regular Honeycrisp ReTain Trial 2015

Oct 15, 2015

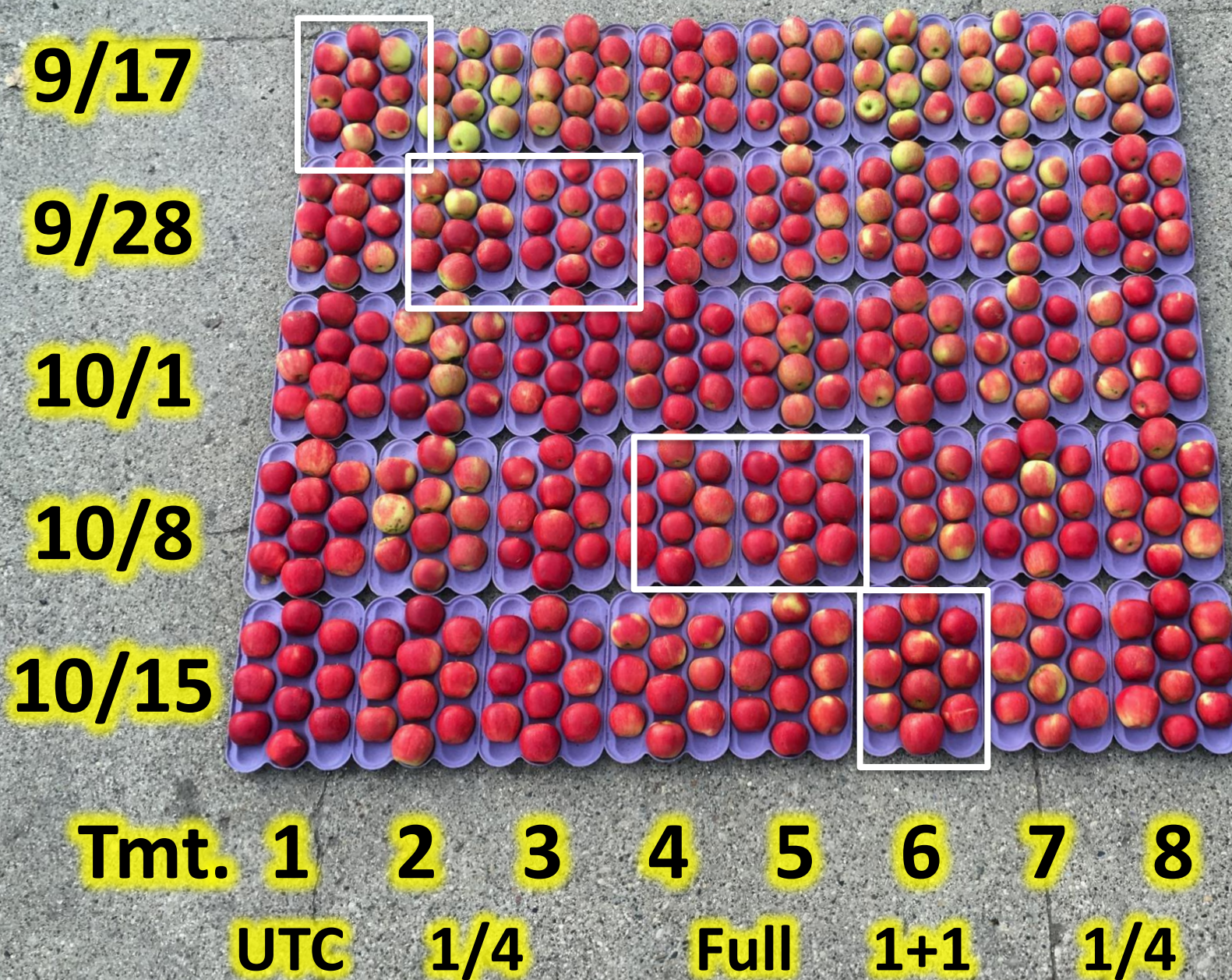
ReTain #1
UTC

ReTain #6
**Full+Full
Rate**

Full Rate



Honeycrisp ReTain Harvest 2015



Red Side

1st Pick

Green Side

9/28

10/1

10/8

10/15

Tmt.

1

2

3

4

5

6

7

8

UTC

1/4

Full

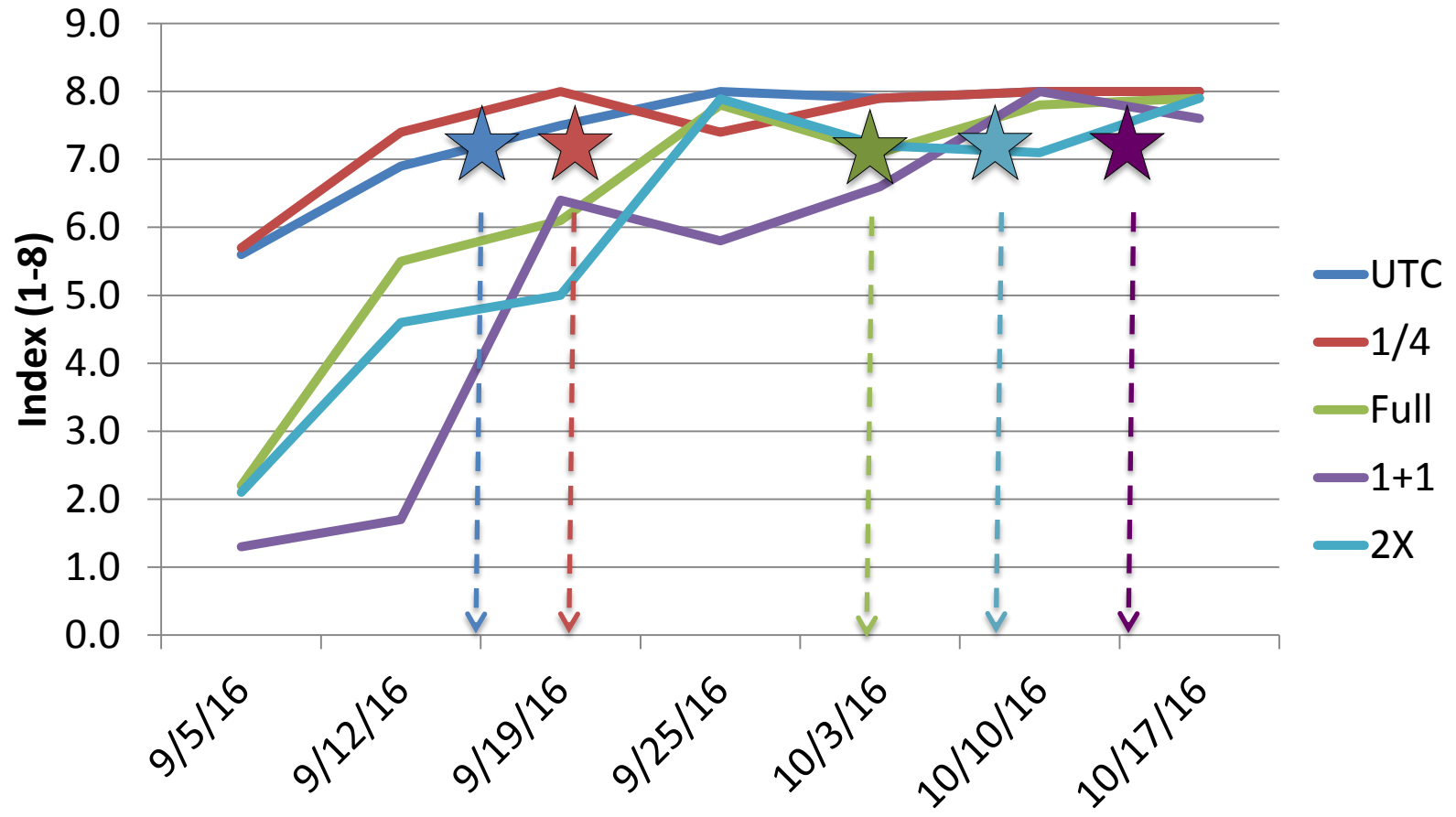
1+1

 $\frac{1}{4}$

1st Pick

ReTain Trial 2016

Honeycrisp Starch Index 2016



Honeycrisp ReTain Harvest 2016

Rep 1

10/1

Rep 2

Rep 3

Rep 4



Tmt. 1

2

3

4

5

UTC

1/4

Full

1+1

2X

Honeycrisp ReTain Harvest 2016

Rep 1

9/26

Rep 2

Rep 3

Rep 4



Tmt. 1

2

3

4

5

UTC

1/4

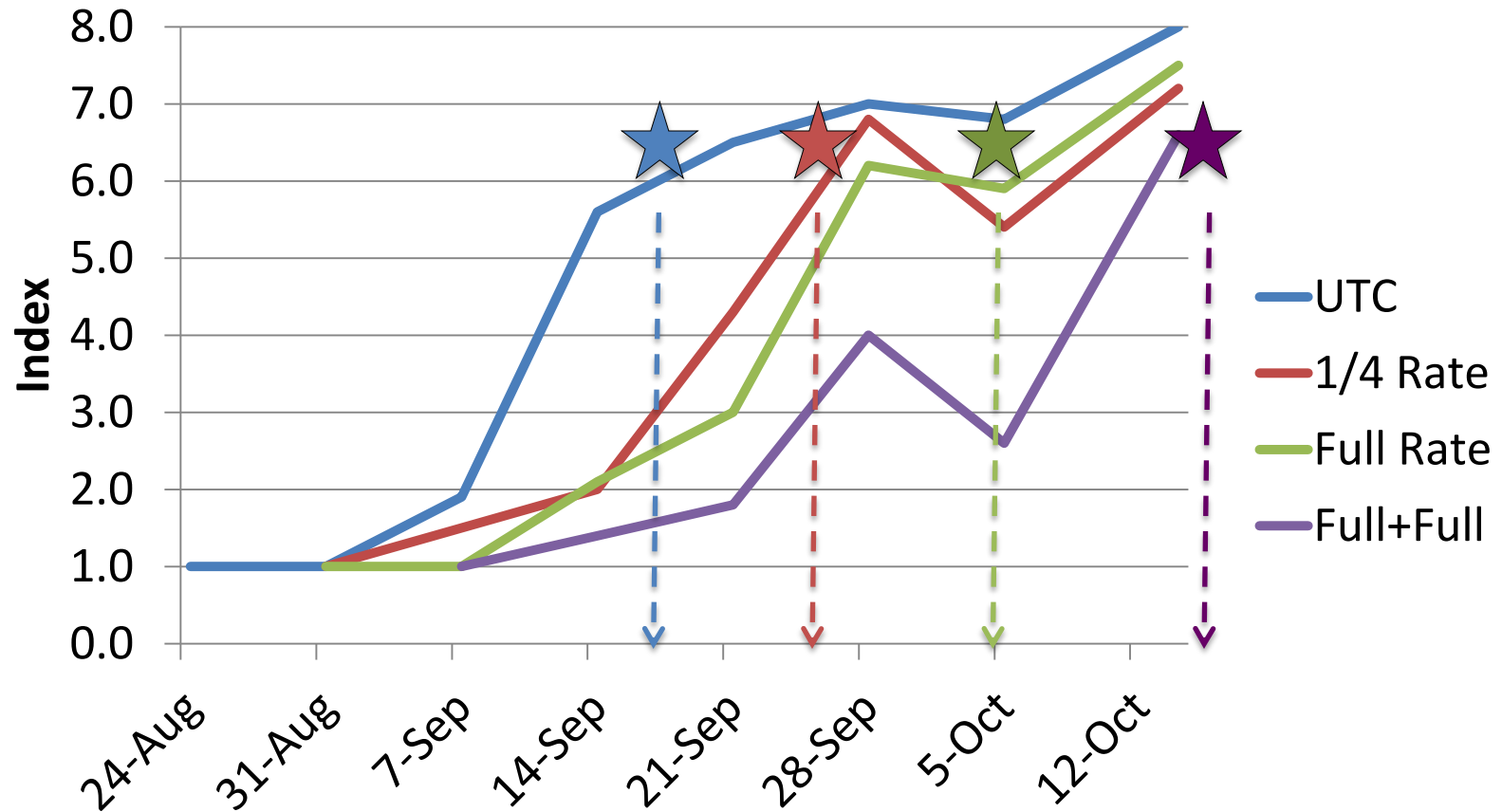
Full

1+1

2X

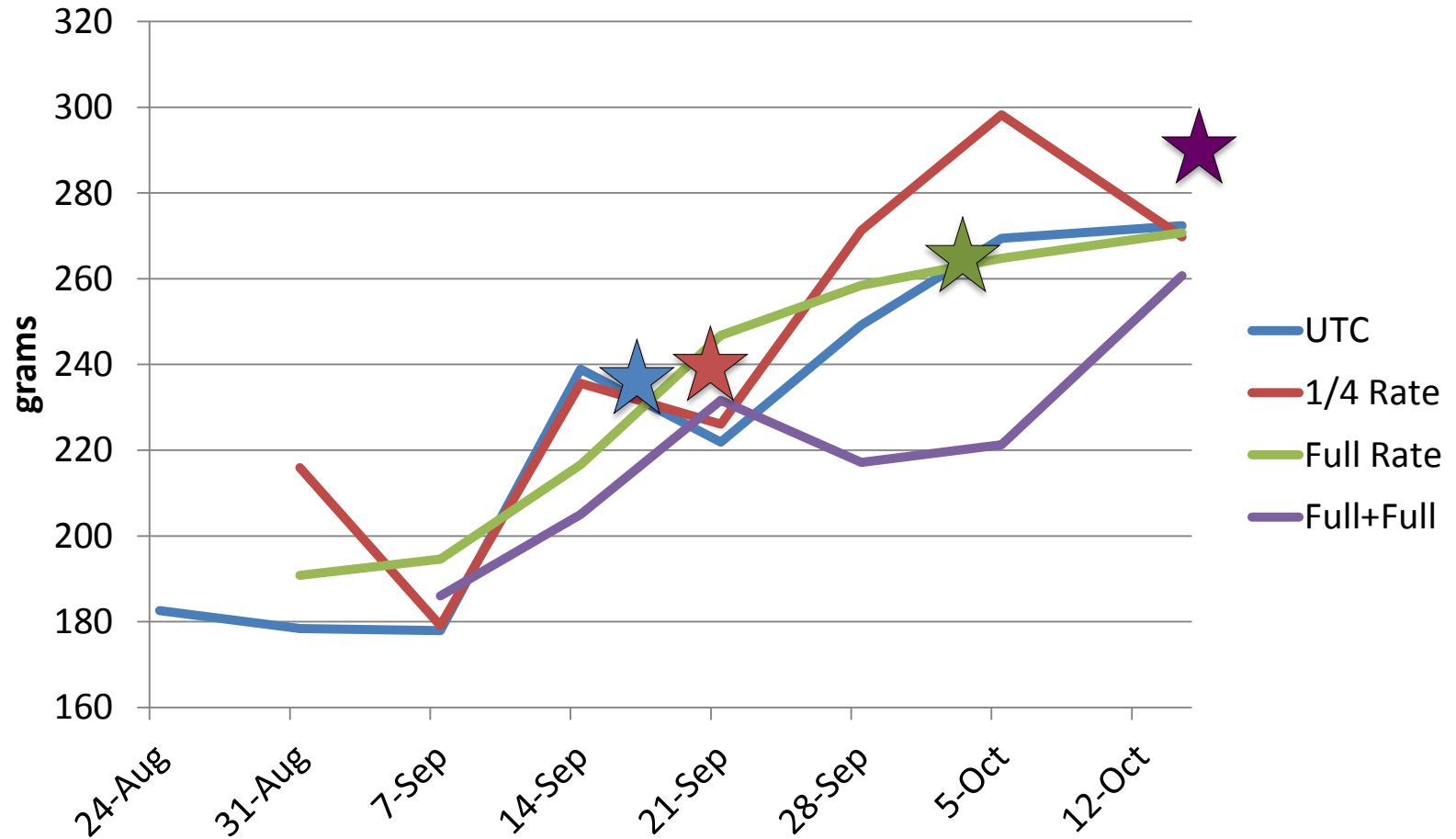
ReTain Trial 2015

Honeycrisp Starch



ReTain Trial 2015

Honeycrisp Weight



Ultima Gala
Oct. 15, 2015

1+1 Pouch
30 DBH +7 DBH

UTC



AFW ReTain Gain (g)

Rate	Honeycrisp		Gala		Average
	2015	2016	2015	2016	
1/4 Rate	10	20	10	10	12.5
Full Rate	30	30	20	30	28
1+1	50	100	50	40	60
2X Rate		40		30	35

Diameter ReTain Gain (inches)

Rate	Honeycrisp		Gala		Average
	2015	2016	2015	2016	
1/4 Rate	.1	.1	.06	.05	.08
Full Rate	.12	.12	.12	.15	.13
1+1	.2	.4	.25	.19	.26
2X Rate		.18		.15	.17

Red Color ReTain Gain (%)

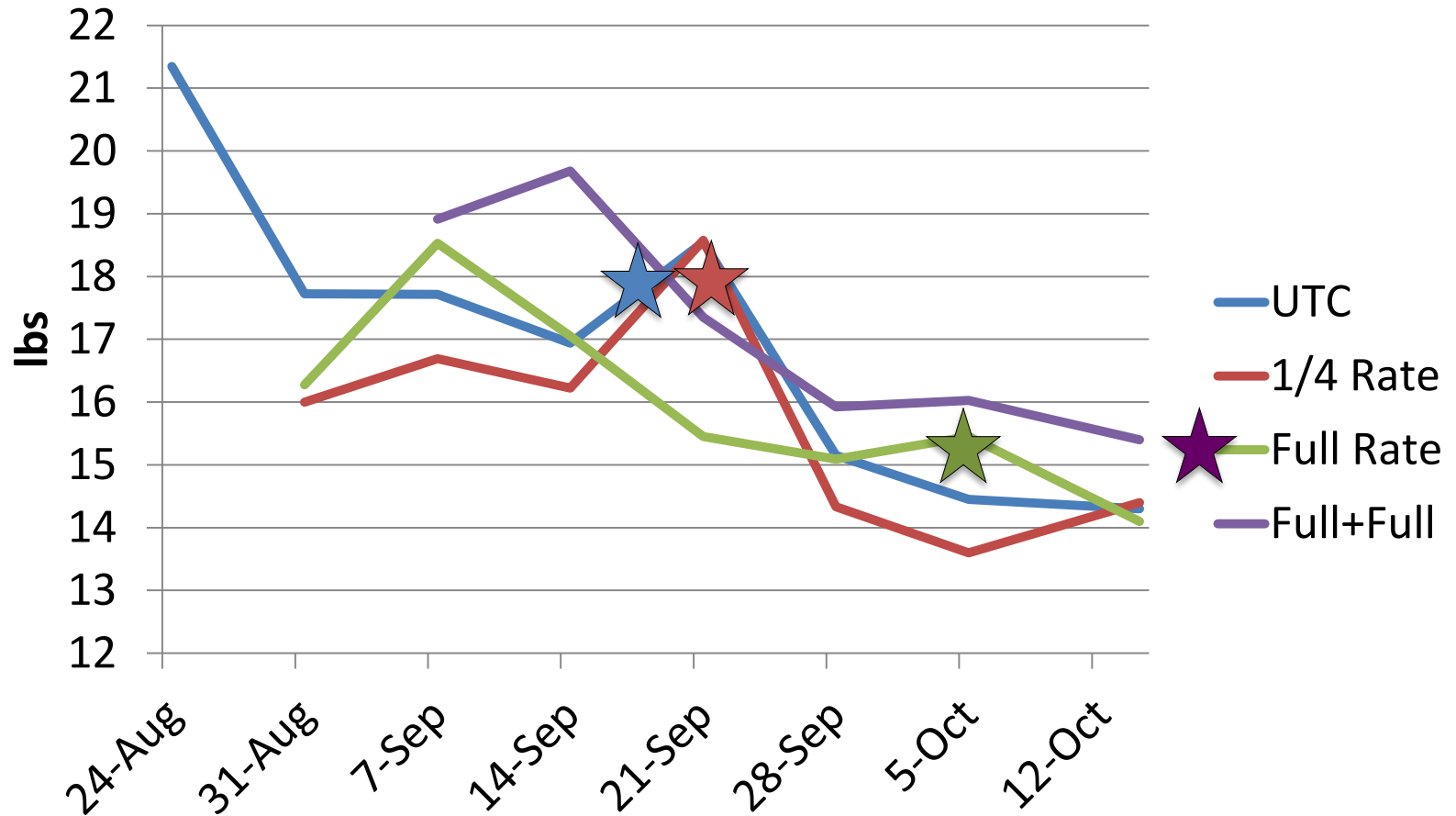
Rate	Honeycrisp		Gala		Average
	2015	2016	2015	2016	
1/4 Rate	1	7	0	5	4
Full Rate	18	2	5	6	8
1+1	25	4	0	5	8.5
2X Rate		10		5	8.5

Gains

Table 1. ReTain Maturity Delay				
Rate	Gala		Honeycrisp	
	2015	2016	2015	2016
1/4 Rate	6	7	6	7
Full Rate	15	17	15	17
1+1	27	32	27	32
2X Rate		20		20

ReTain Trial 2015

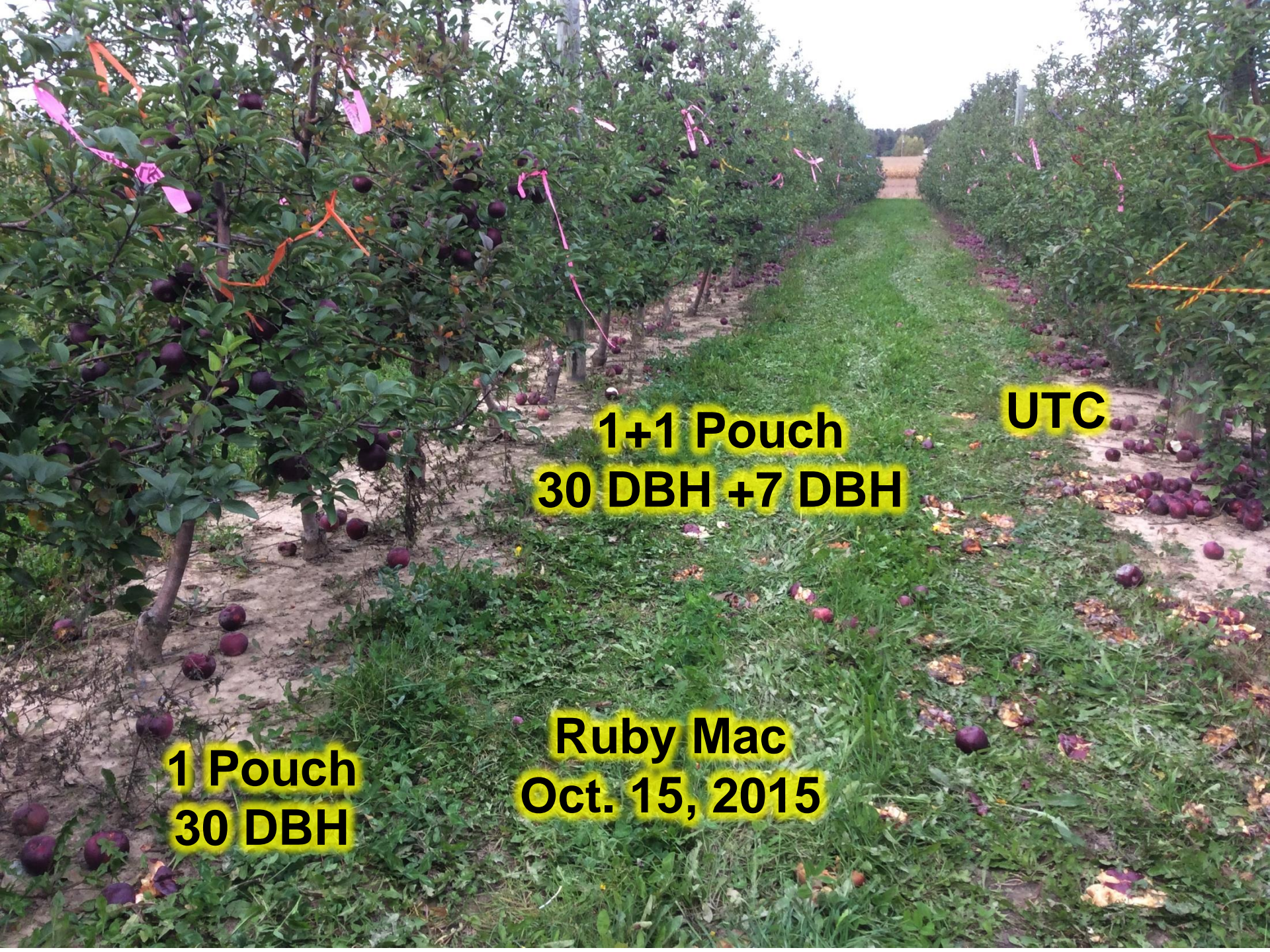
Honeycrisp Firmness





Ruby Mac
Oct. 15, 2015

1+1 Pouch
30 DBH +7 DBH

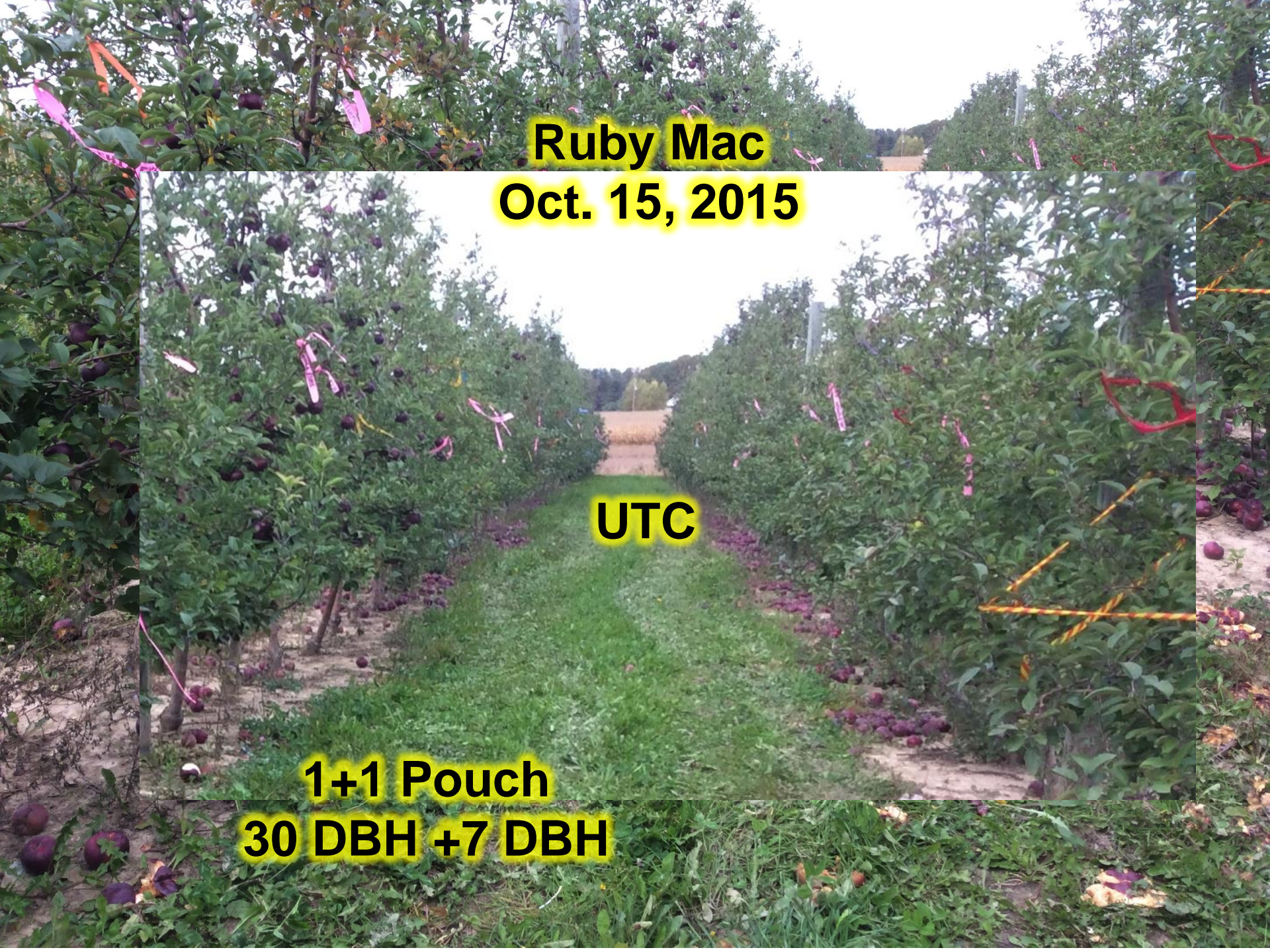


**1+1 Pouch
30 DBH +7 DBH**

UTC

**1 Pouch
30 DBH**

**Ruby Mac
Oct. 15, 2015**



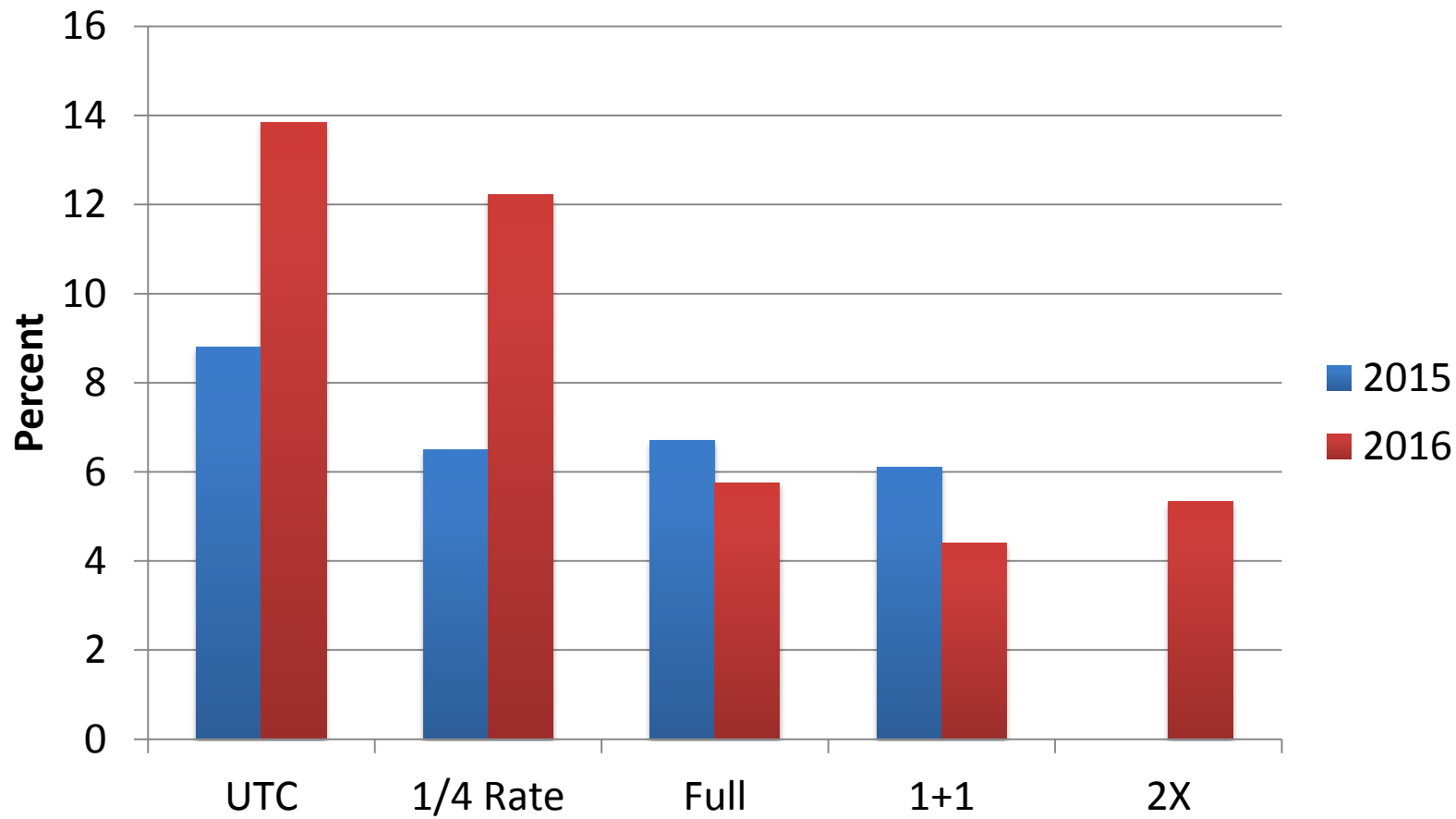
Ruby Mac
Oct. 15, 2015

UTC

1+1 Pouch
30 DBH +7 DBH

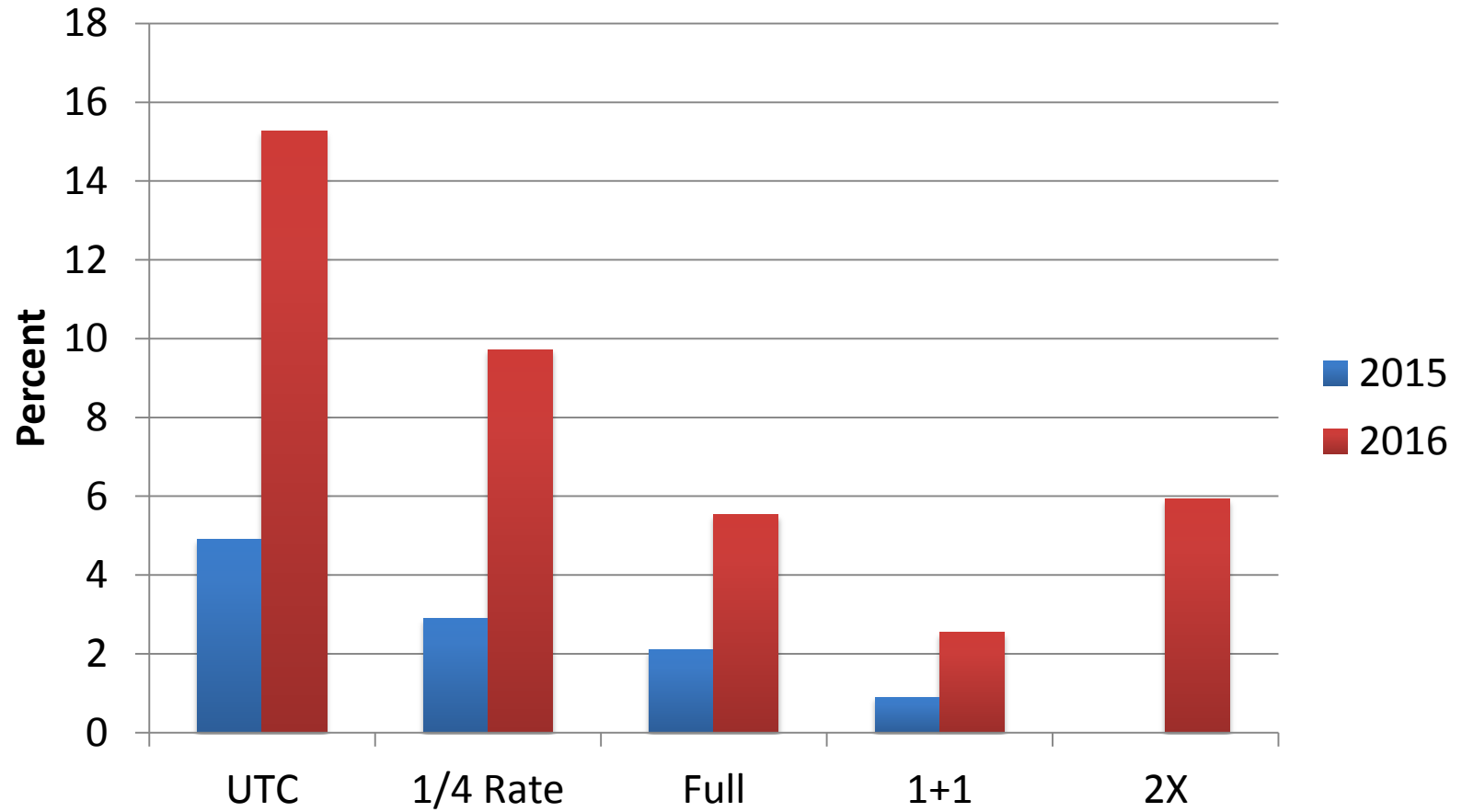
Honeycrisp ReTain Trial

Honeycrisp Accumulative % Drop



Gala ReTain Trial

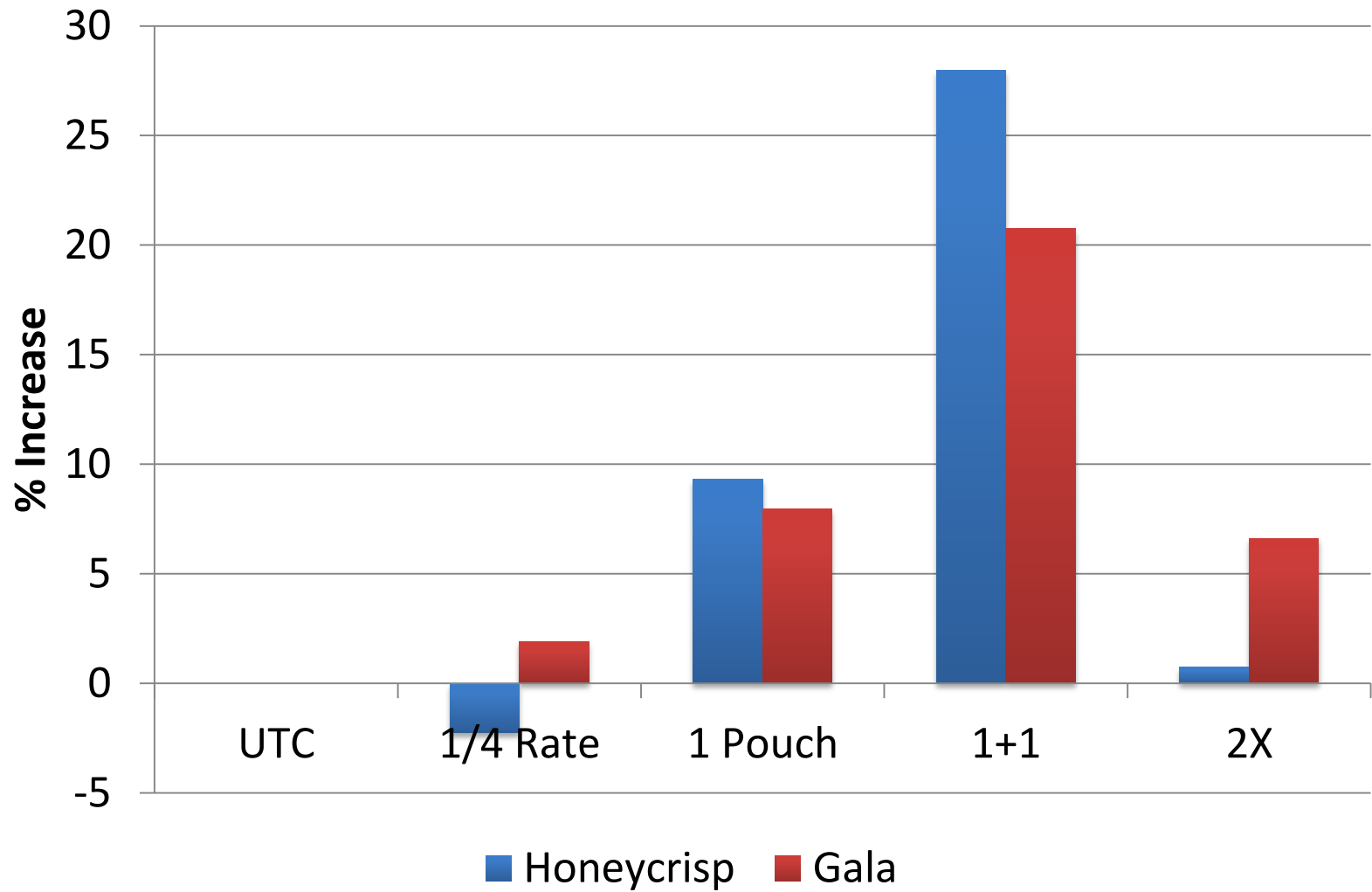
Gala Accumulative % Drop



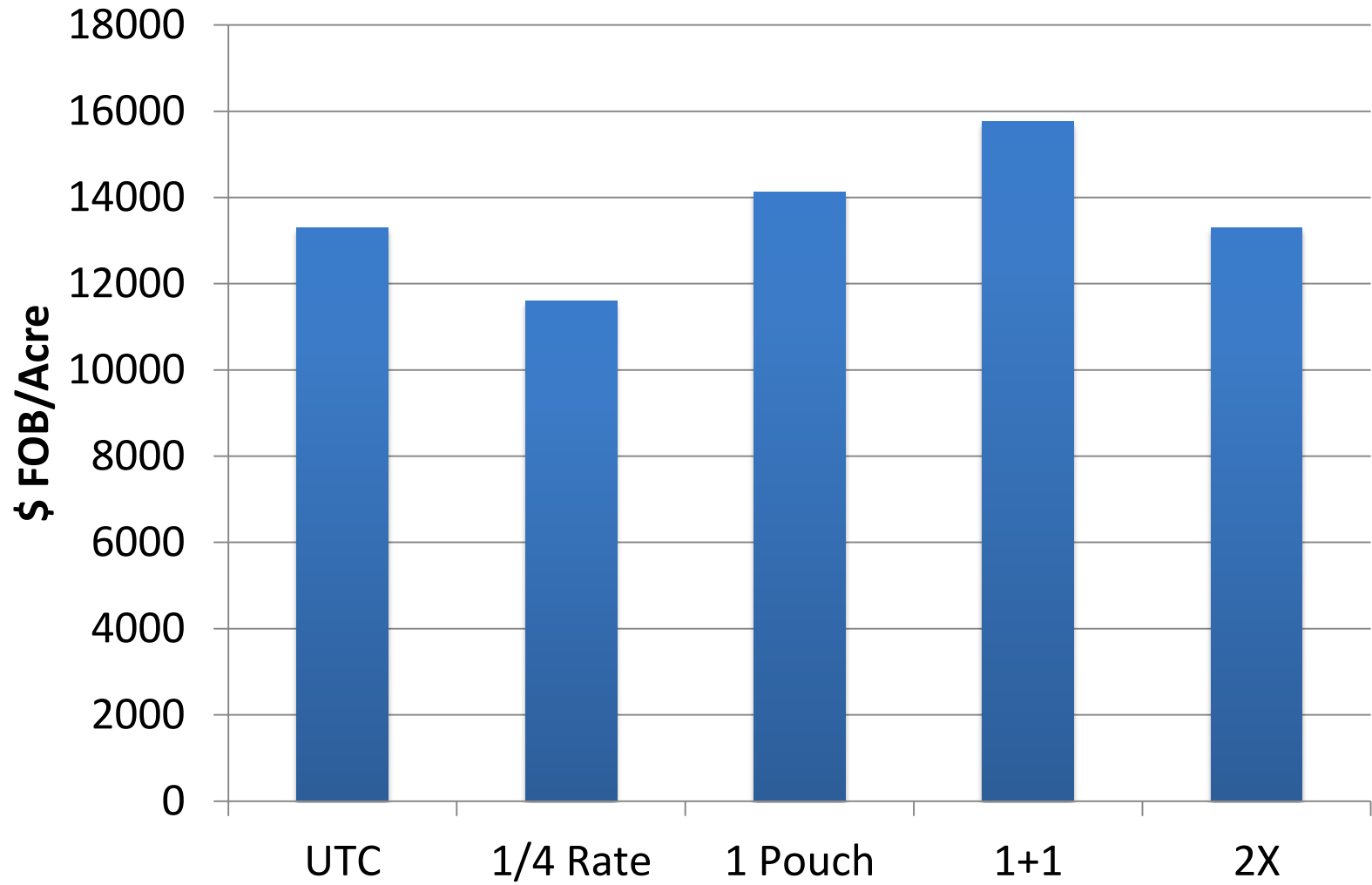
Stop Drop ReTain Gain (%)

Rate	Honeycrisp		Gala		Average
	2015	2016	2015	2016	
1/4 Rate	2.3	1.6	2	5.6	2.9
Full Rate	2.1	8.1	2.8	9.7	5.7
1+1	2.7	9.5	4	12.7	7.2
2X Rate	8.8	8.5	4.9	9.3	7.9

ReTain % Yield Increase 2016

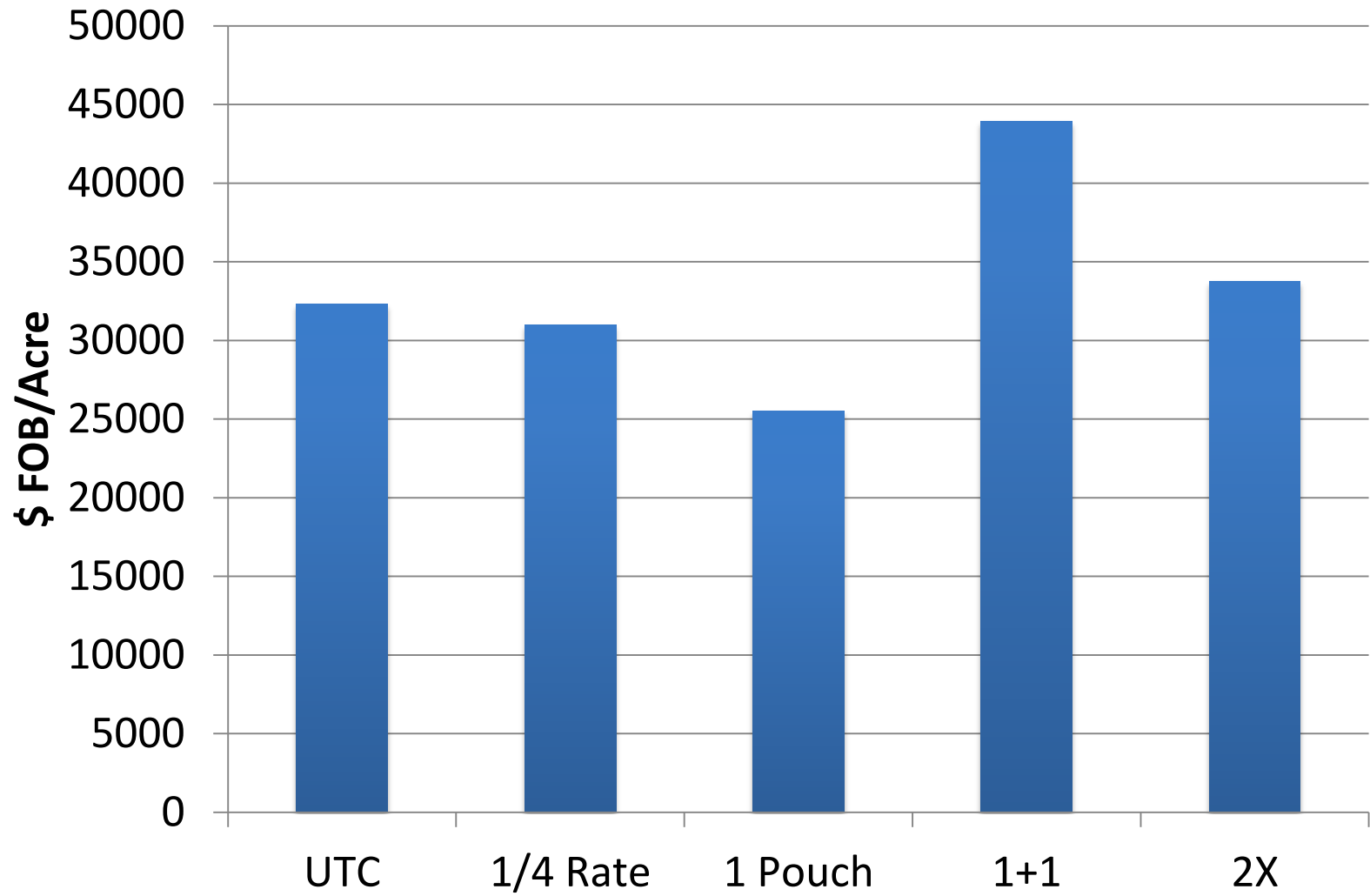


Gala \$ Value/Acre @Prime Maturity 2016

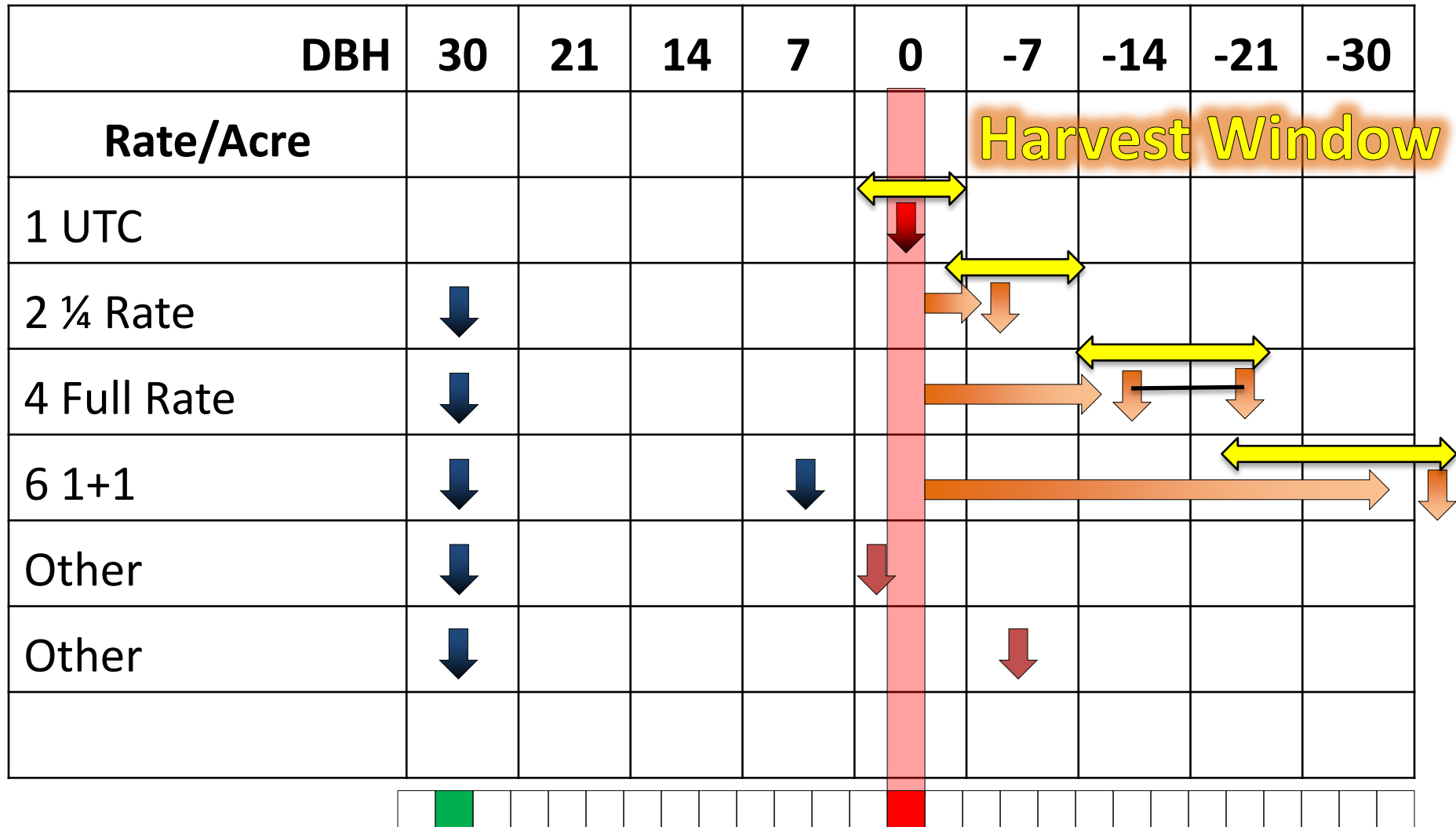


2016

Honeycrisp \$ Value/Acre @Prime Maturity 2016



ReTain Treatments



Time 

ReTain Rate Impact on Apple Maturity

DBH	30	21	14	7	0	-7	-14	-21	-30	-40
Rate/Acre										
1/2+1/2 (Estimate)	↓			↓			↓	↓		
2X Rate	↓↓							↓	↓	
1+1 Rate	↓			↓				↓	↓	
Full Rate	↓						↓	↓		
3/4 Rate	↓						↓	↓	Gala, Honeys	
1/2 Rate	↓						↓	↓	Jonagold	
1/4 Rate	↓						↓	↓		

↓ Gala, Jonagold,
↓ Honeys
↓ Other Varieties

Time



Do you need NAA?

- Yes.
 - When using low ReTain rates.
(1/4 to 1/3 rate)
 - High drop varieties.
(McIntosh, etc.)
 - On hot stressful years.
(August)

Multiple or Split Retain Applications

- Good planning will eliminate multiple applications.
 - Choose harvest window and make application 30 to 21 DBH.
- When is multiple applications needed.
 1. Planning to delay harvest 30 days (1+1).
 2. Labor shortage or behind schedule.
 3. Realize a under treated mistake on first application.
 4. Want to delay harvest more than planned.
- An 2 application of $\frac{1}{4}$ to $\frac{1}{2}$ rate will delay harvest additional 7 to 14 days.

Benefits

- More harvestable quality fruit
- Improve fruit **quality** and quantity.
- Increase **size** and **color**.
 - Fruit will hang 30 extra days or more.
- One pick.
- Spread harvest out evenly.
- Improve storage quality.
- **Stop drop.**
- Cracking, Greasiness, Watercore

Risks and Impacts

- Not without risks.
- Do not apply **high rates** to **heavy croploads**.
- Fruit will hang **30+** extra days, open for hail, winds, pests, etc.
- Watch for longer pest risk, increase spray needs?
- Concentrating production into fewer varieties.
- 1 year results, need a couple more years to validate results.
- Storage disorders??, look good so far.
- Climate is a major factor?

Getting the Most Out of ReTain

Mid-Atlantic Fruit and Vegetable Convention 2017

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Thank you!

