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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- Jackie Nock
- Yiyi Zhang
- Dan Donahue
- Mike Basedow
- Growers

Predicting bitter pit incidence

Bitter pit

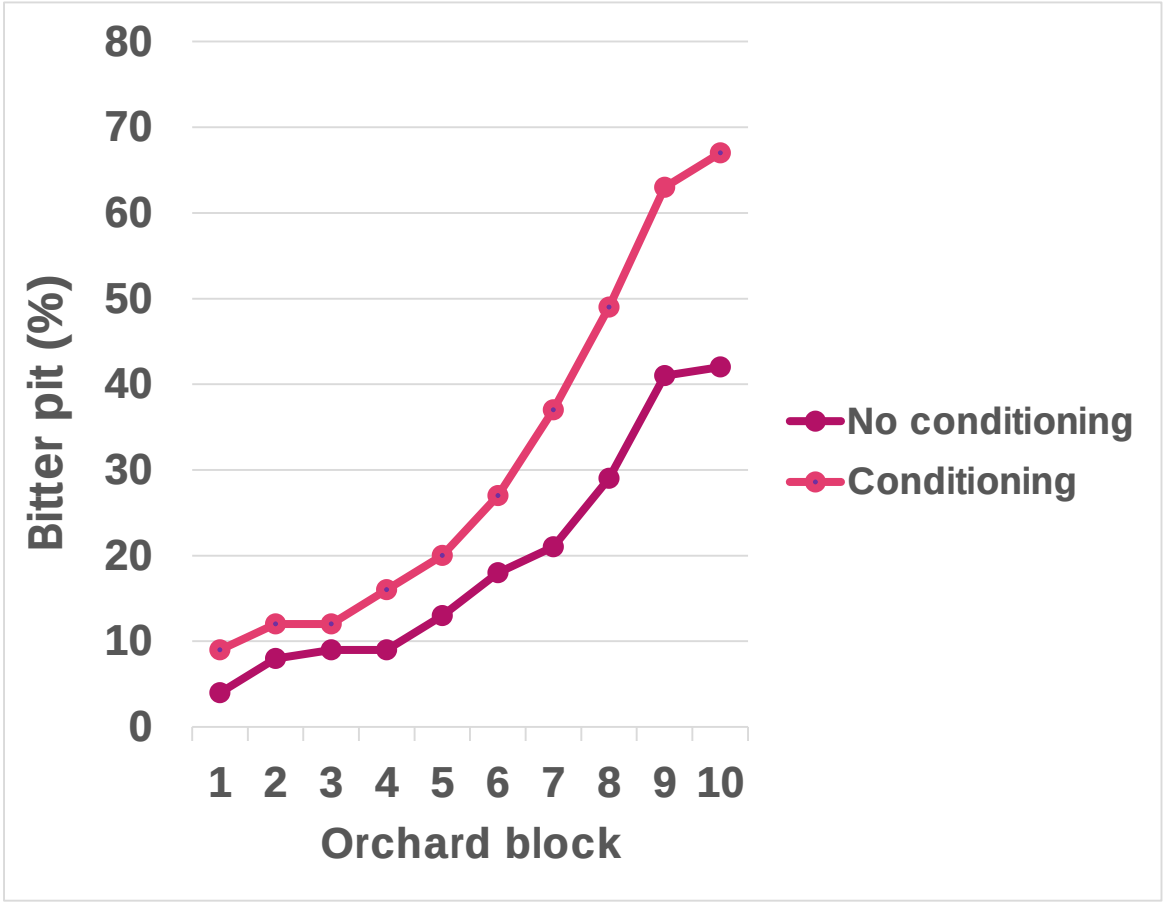
Objectives

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.

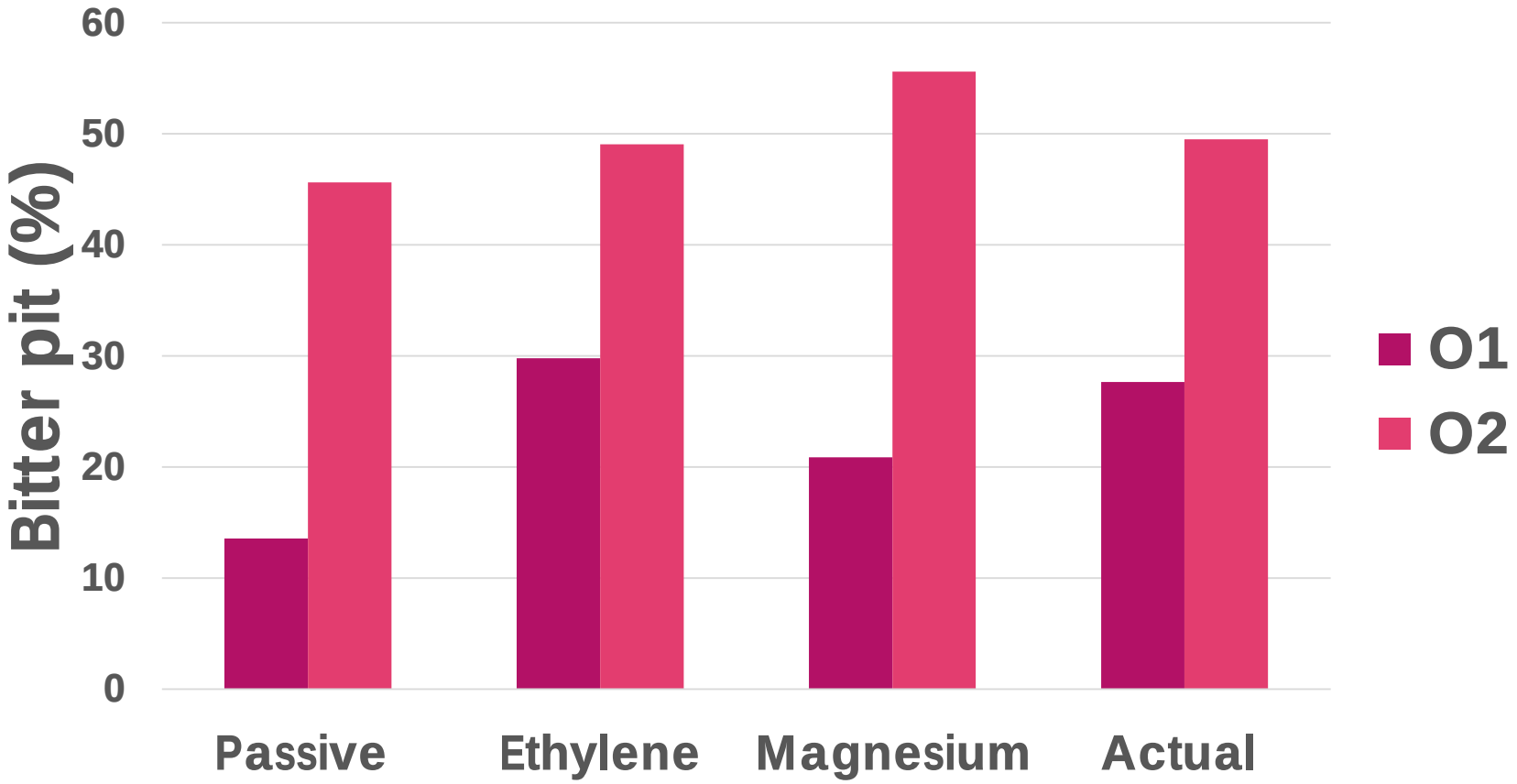
3- Magnesium: fruit dipped in 0.18 M $MgCl_2$ for 2 minutes then kept at 68°F for 3 weeks.

Compared with **mineral methods**.

Bitter pit in fruit after 3 weeks at68°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.

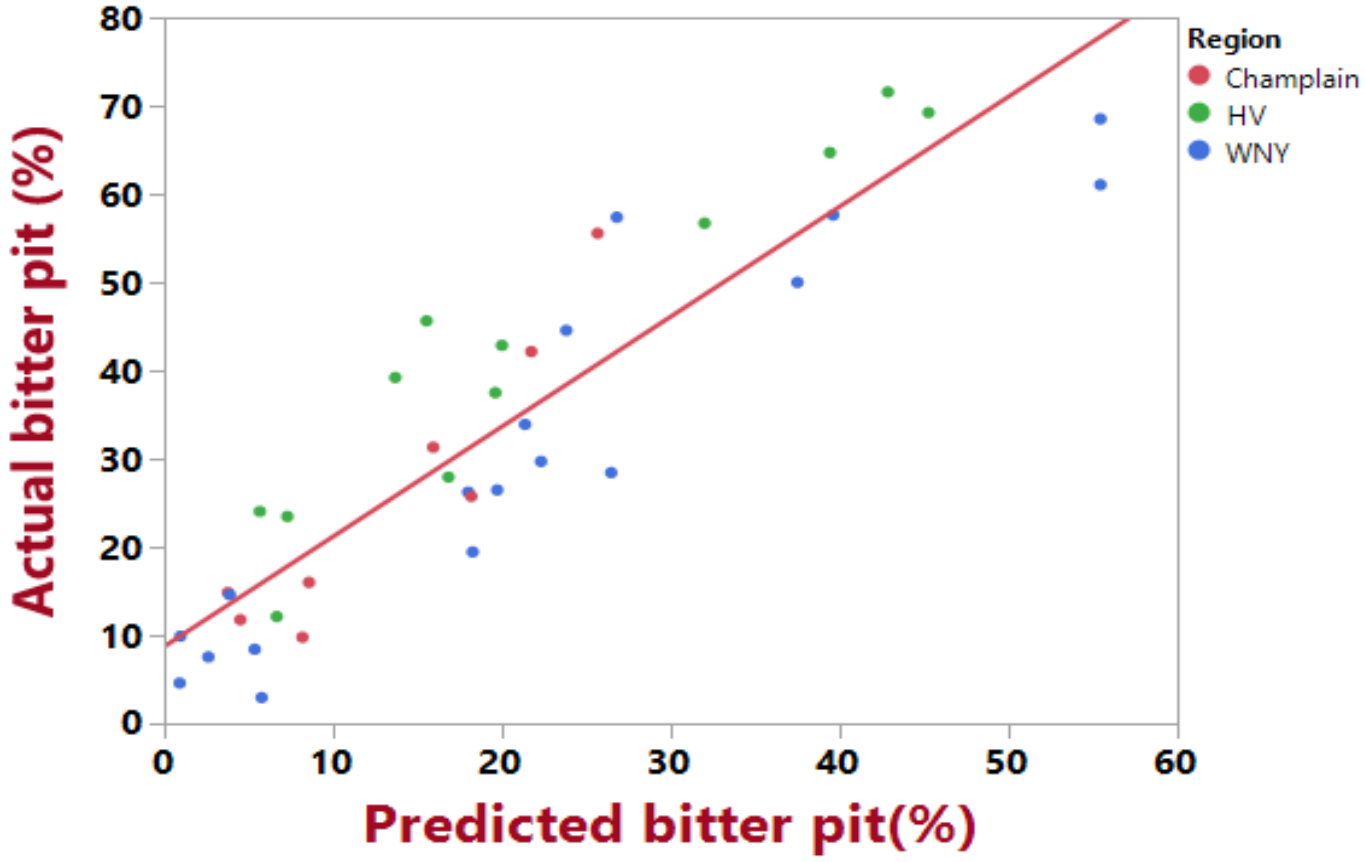
The magnesium method showed toxicity on the fruit that was difficult to distinguish from bitter pit, so we discarded this methods.

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

Passive is the easiest for growers and storage operators.

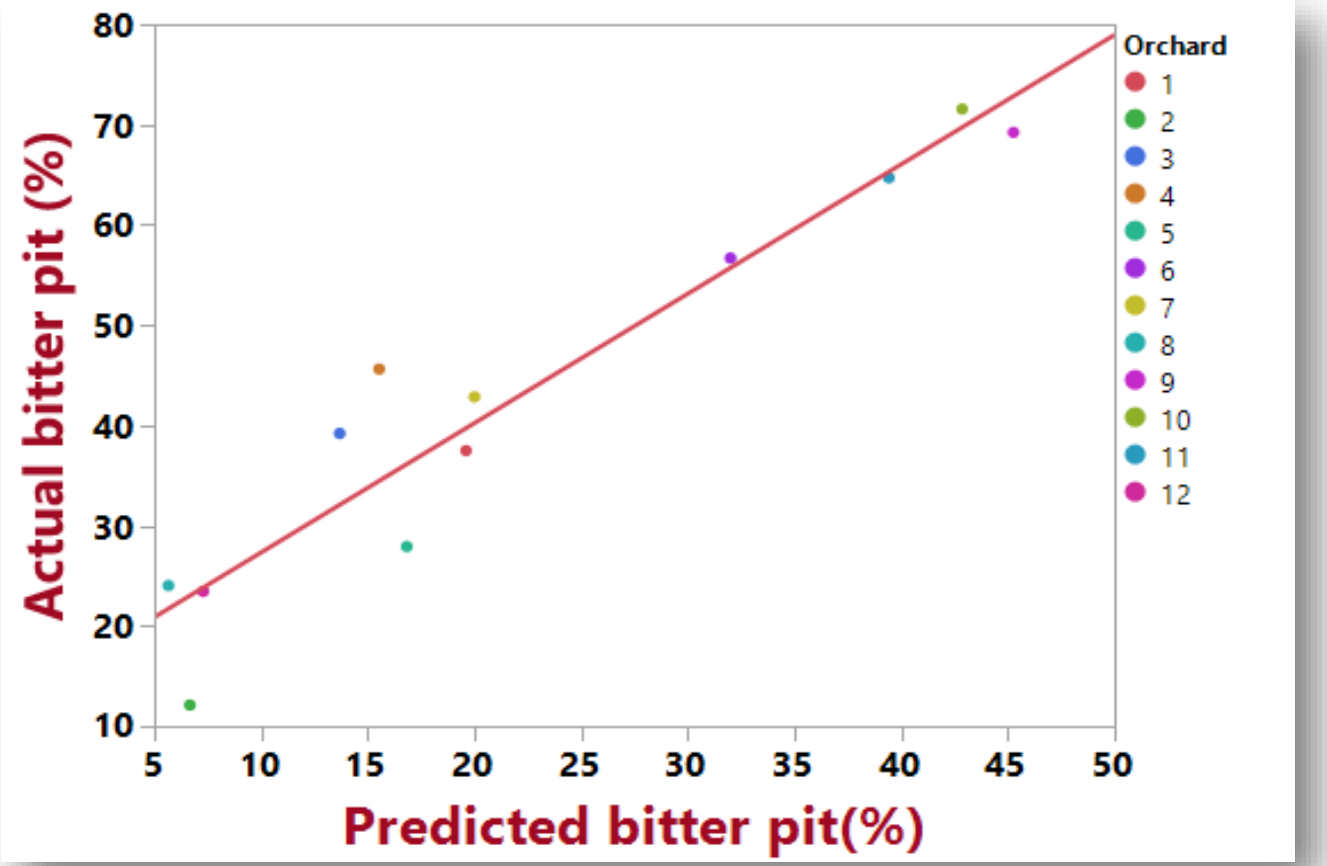
Actual and predicted Bitter pit for fruit from all regions (2018)

R^2= 0.82



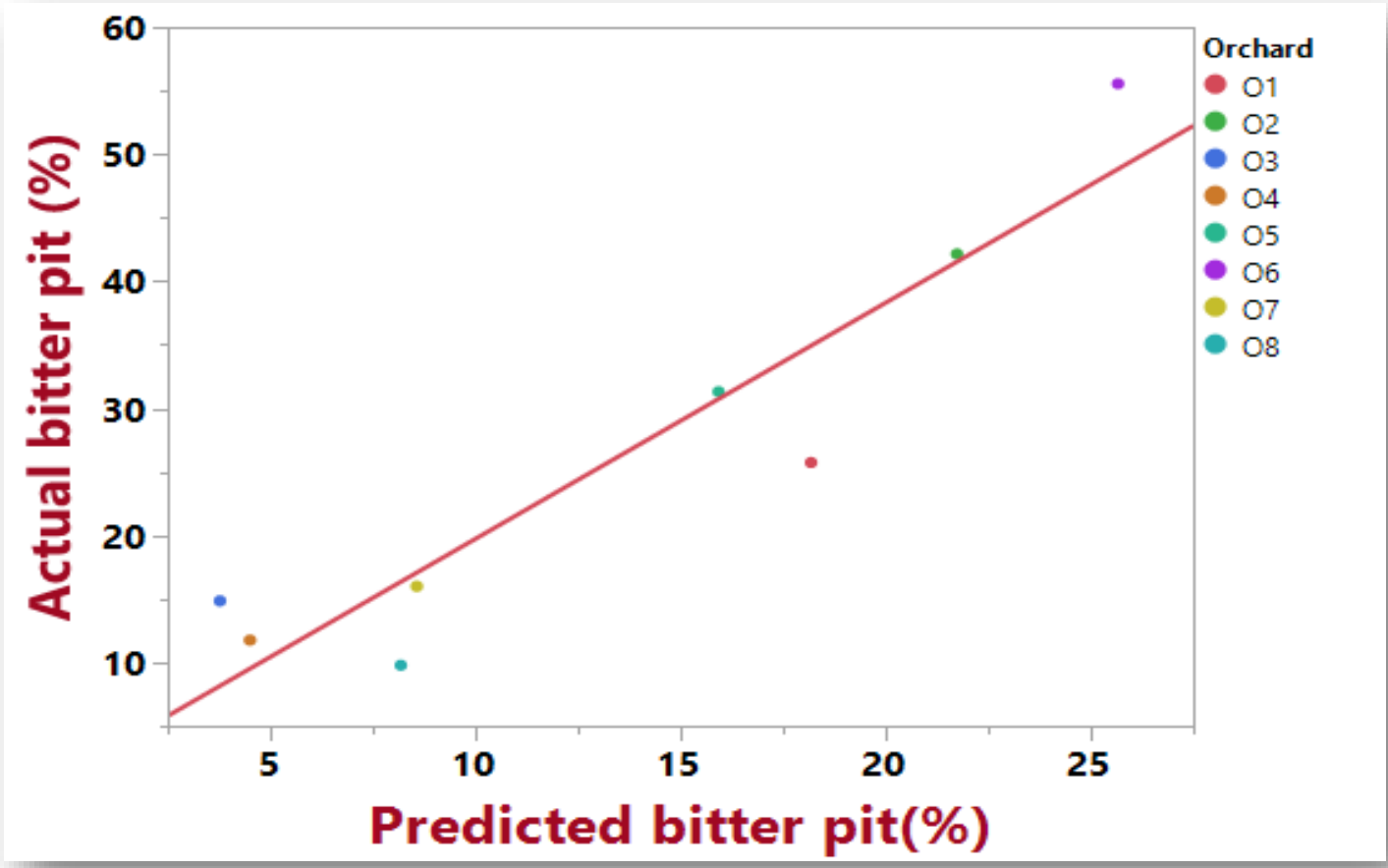
Actual and predicted Bitter pit regression for HV fruit

R^2= 0.90



Actual and predicted Bitter pit regression for Champlain fruit

R^2= 0.88



Comparison with mineral methods

Sampling time	Factors	C+ 38°F
		R^2
3WBH	Passive	0.91
	Ca	-0.67
	(K+Mg)/Ca	0.77

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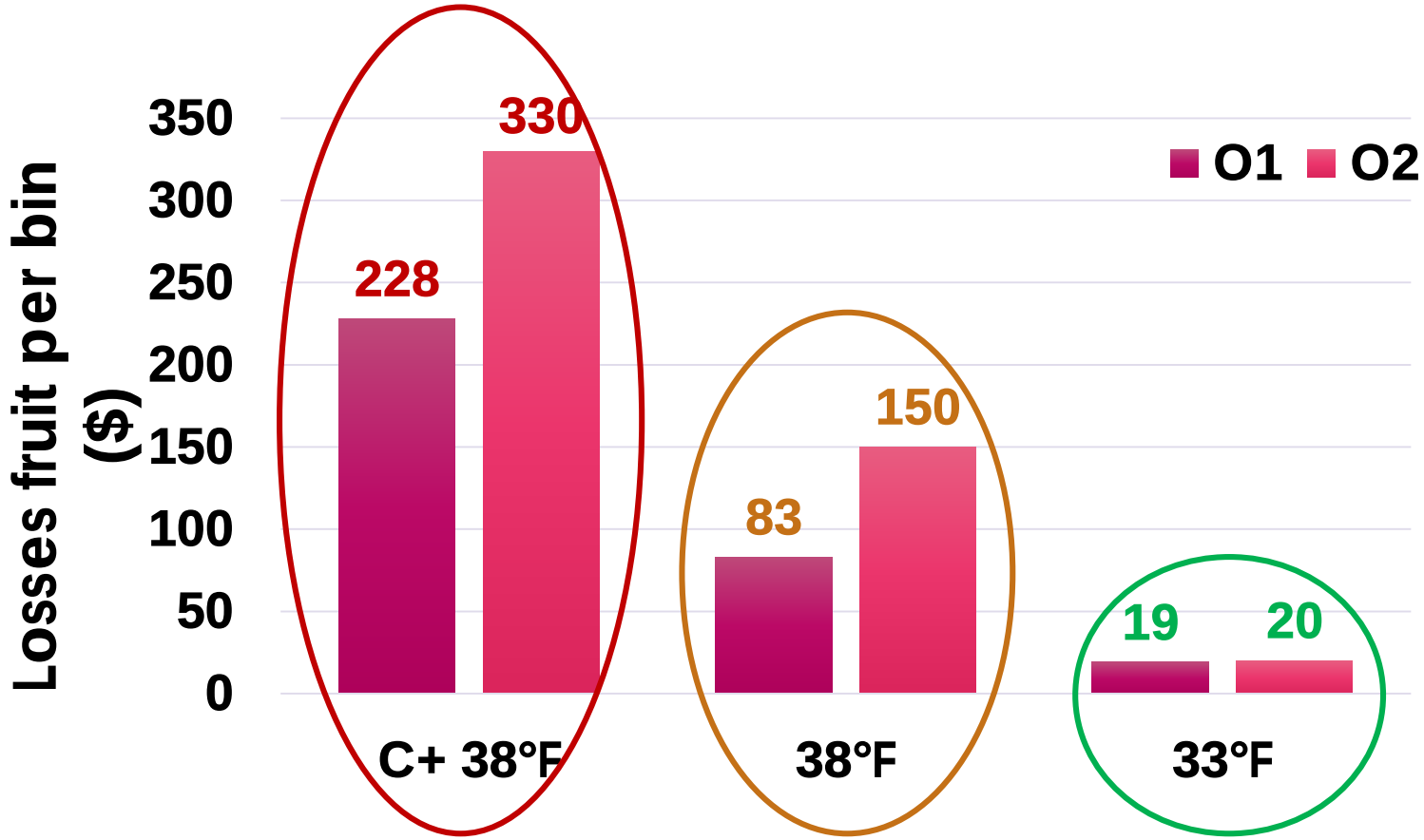
Economic losses at $700 per bin



Bottom line – how to 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.

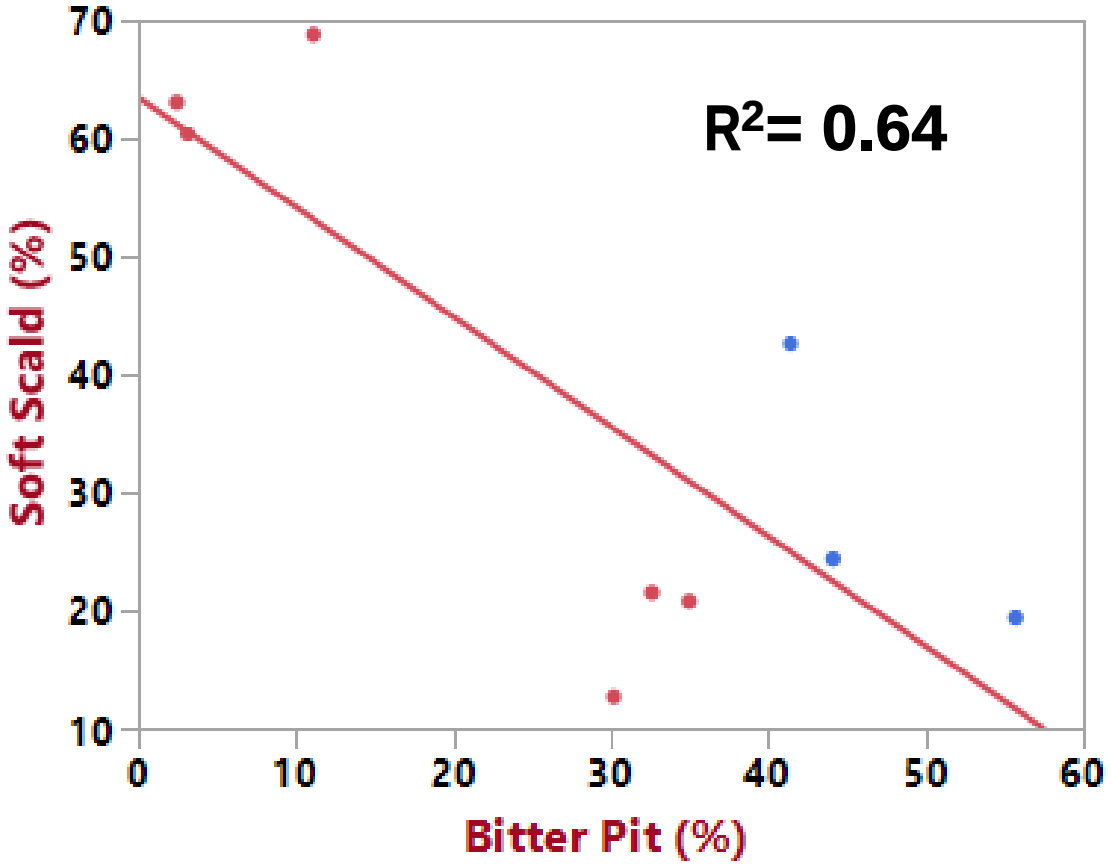
- Outcome = much reduced bitter pit after storage. Stabilize bitter pit for one month in storage to minimize pit in the marketplace.

(Do Not market high bitter pit risk immediately).

What is the risk? – rare risk of soft scald and soggy breakdown at 38ºF, 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.

An interesting observation



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 .

Summary

Passive prediction method is one that you as growers can start using now.

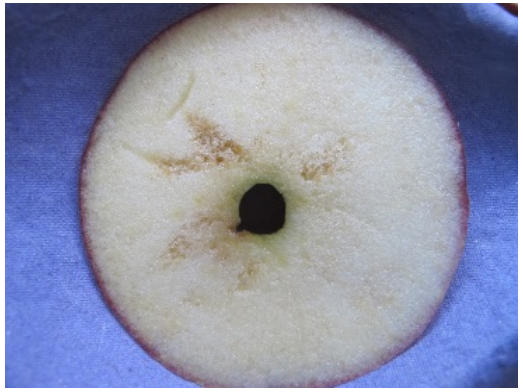
Results will allow you to save money by avoiding conditioning

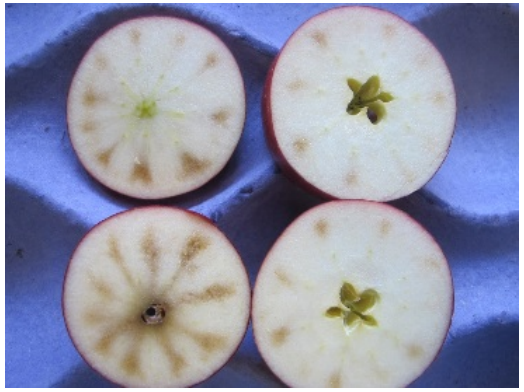
Future research is exploring use of even lower storage temperatures for high bitter pit risk fruit.

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.



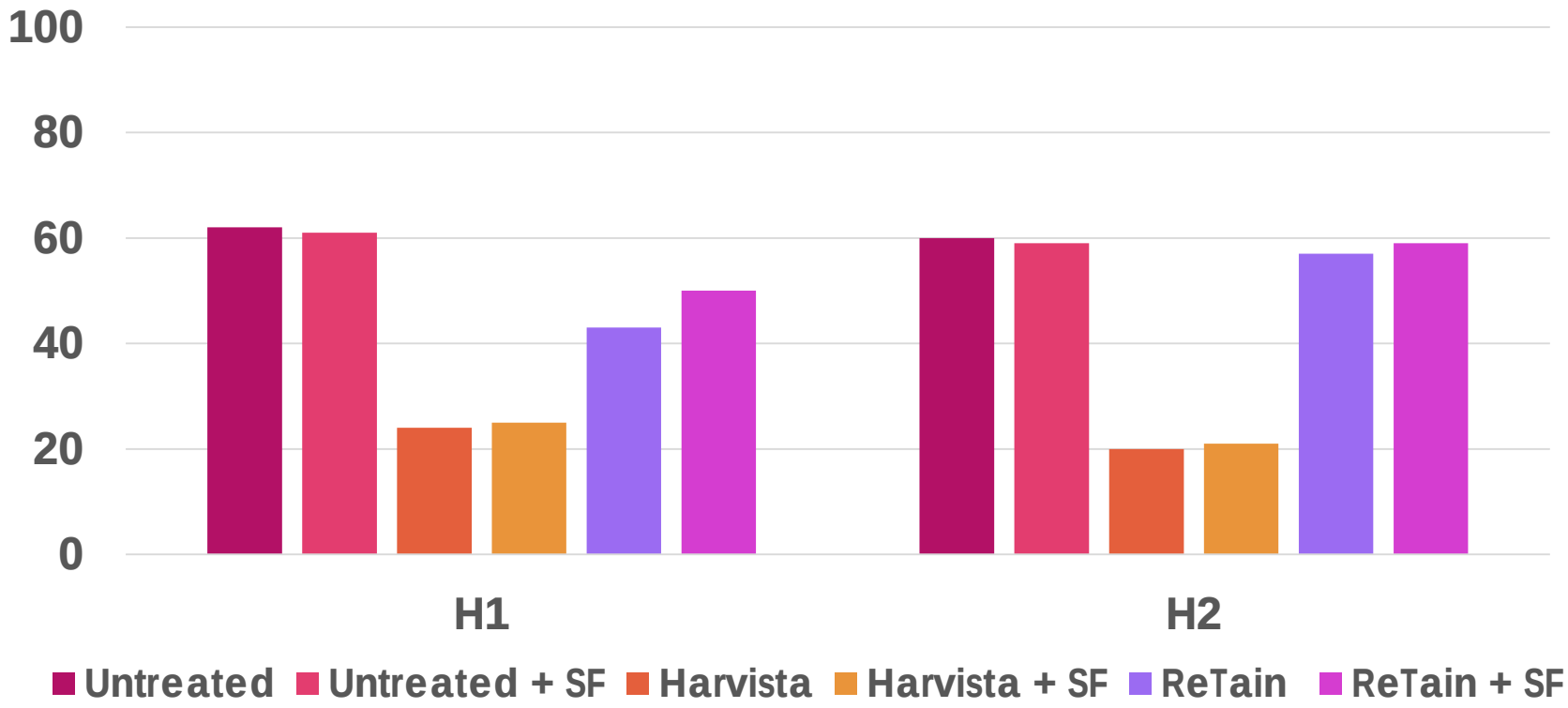


Important factors

- **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 (%)

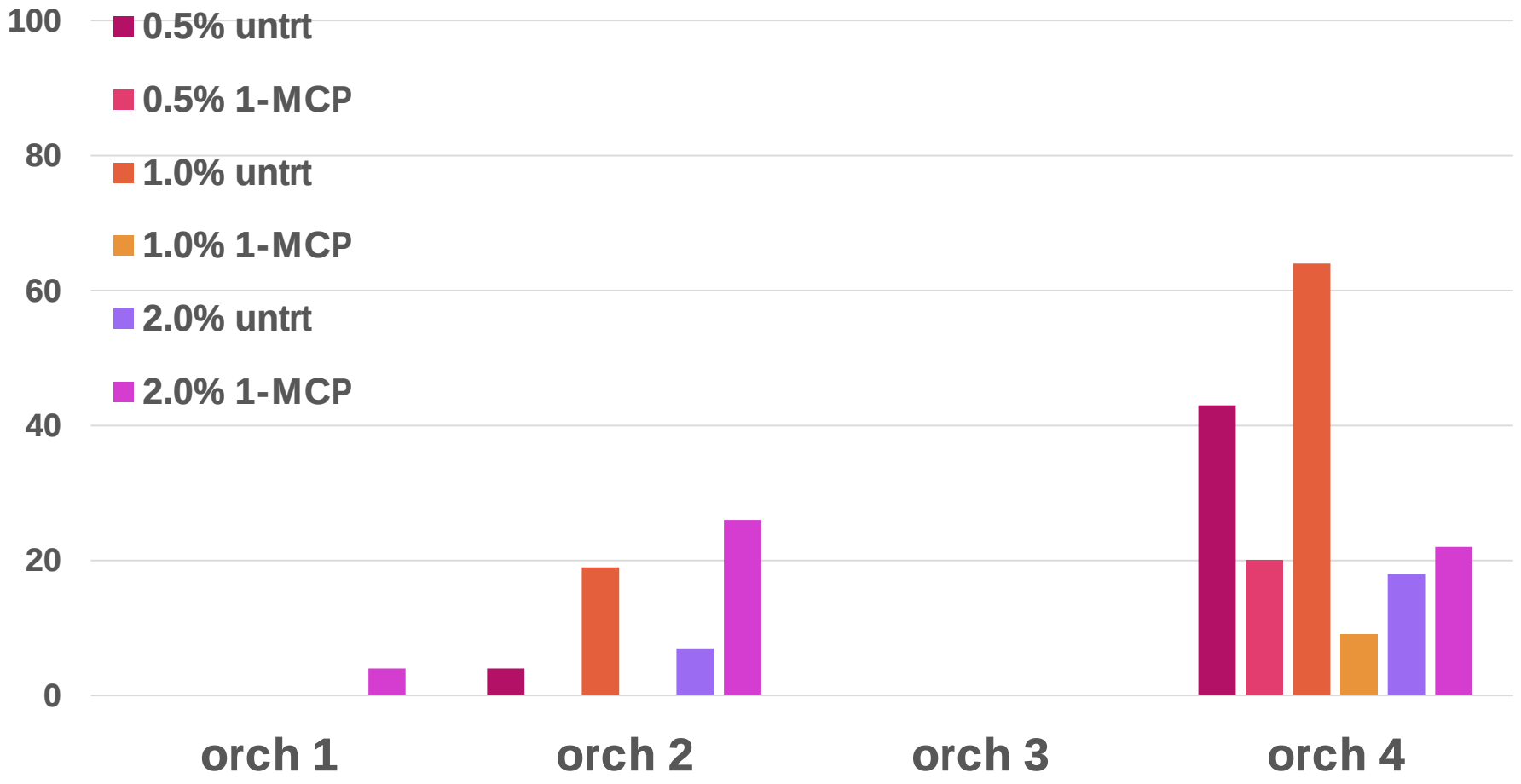
6 months CA storage



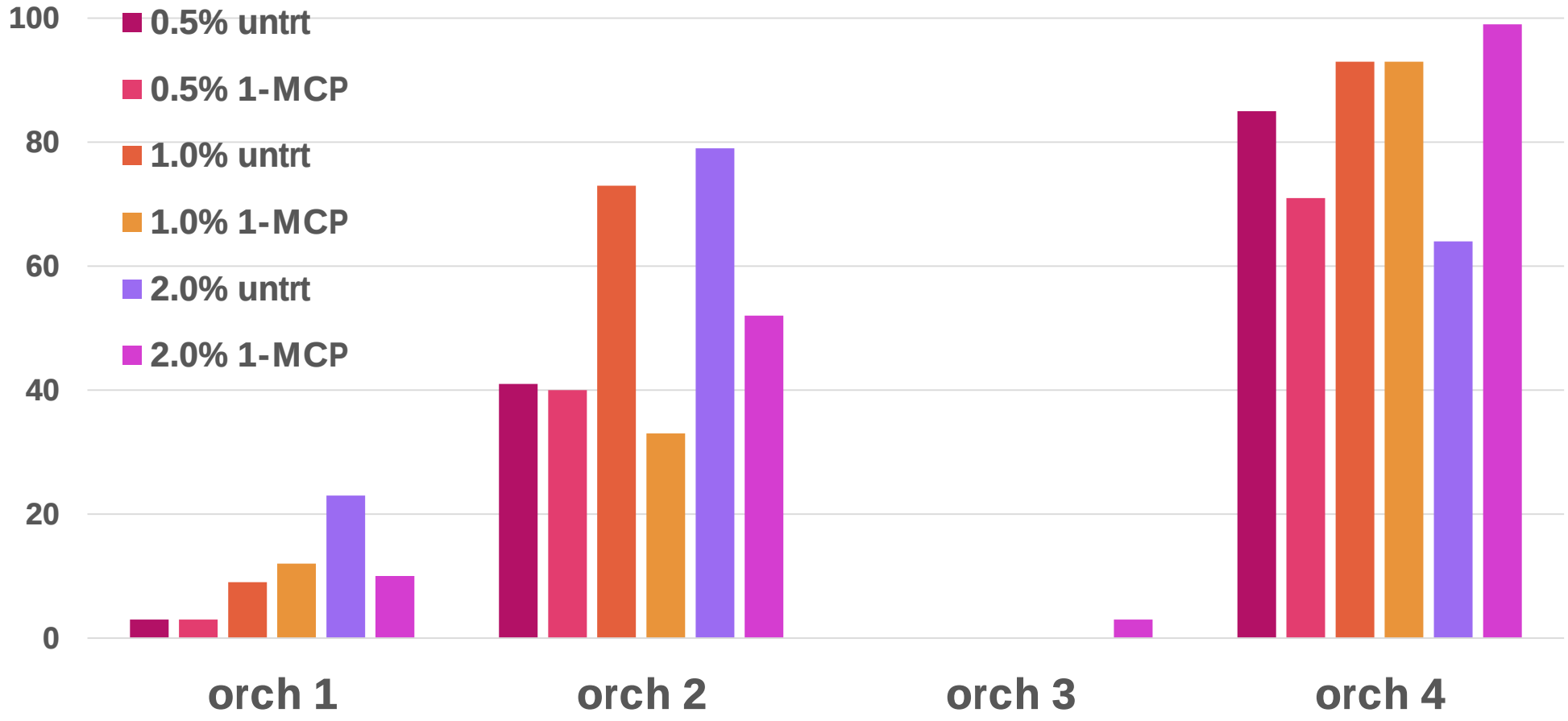
Harvest x Field treatment (p<0.001)

	Control	Harvista	ReTain
H1	62	25	47
H2	60	21	58

Gala (2017) – SEFB (%) 3 months - effect of carbon dioxide and 1-MCP

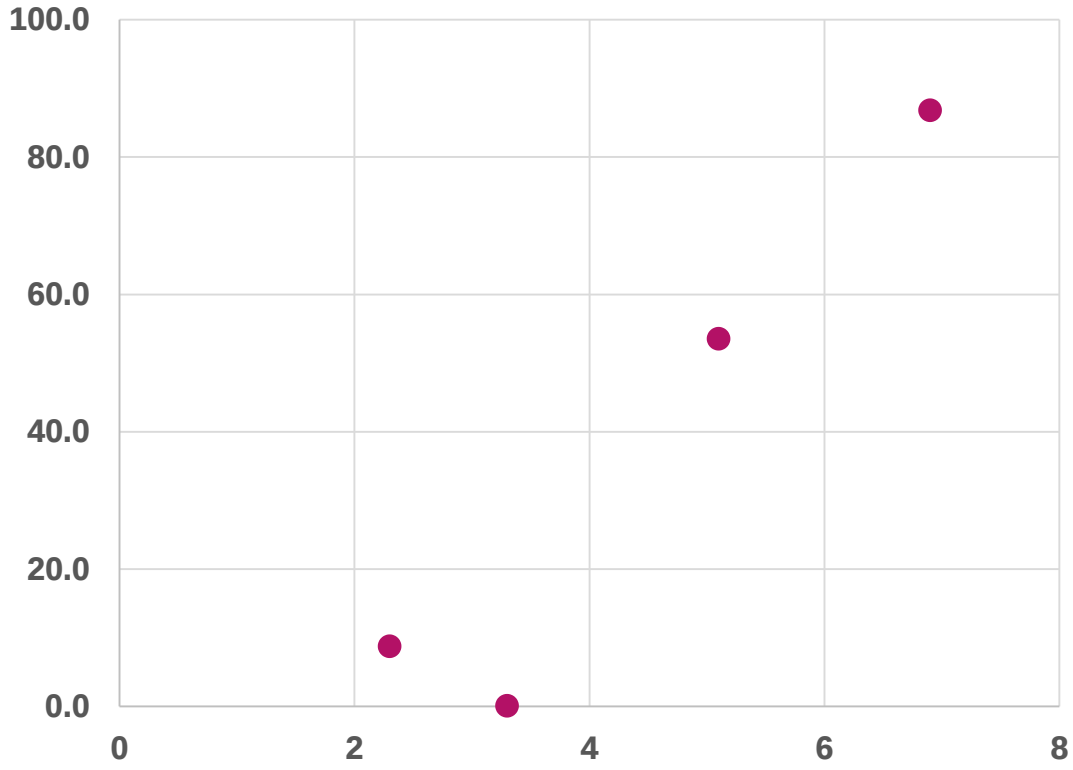


Gala (2017) – SEFB (%) 6 months - effect of carbon dioxide and 1-MCP

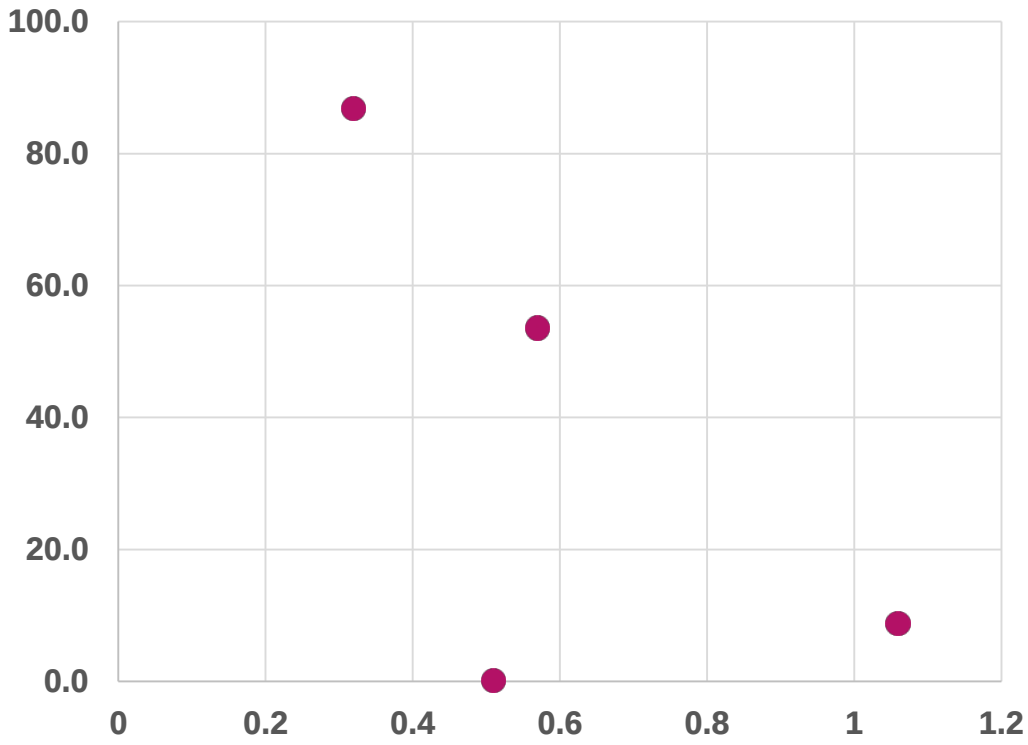


Variety or maturity – SEFB (%) vs

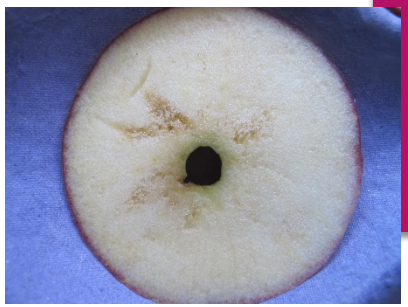
- Starch pattern index

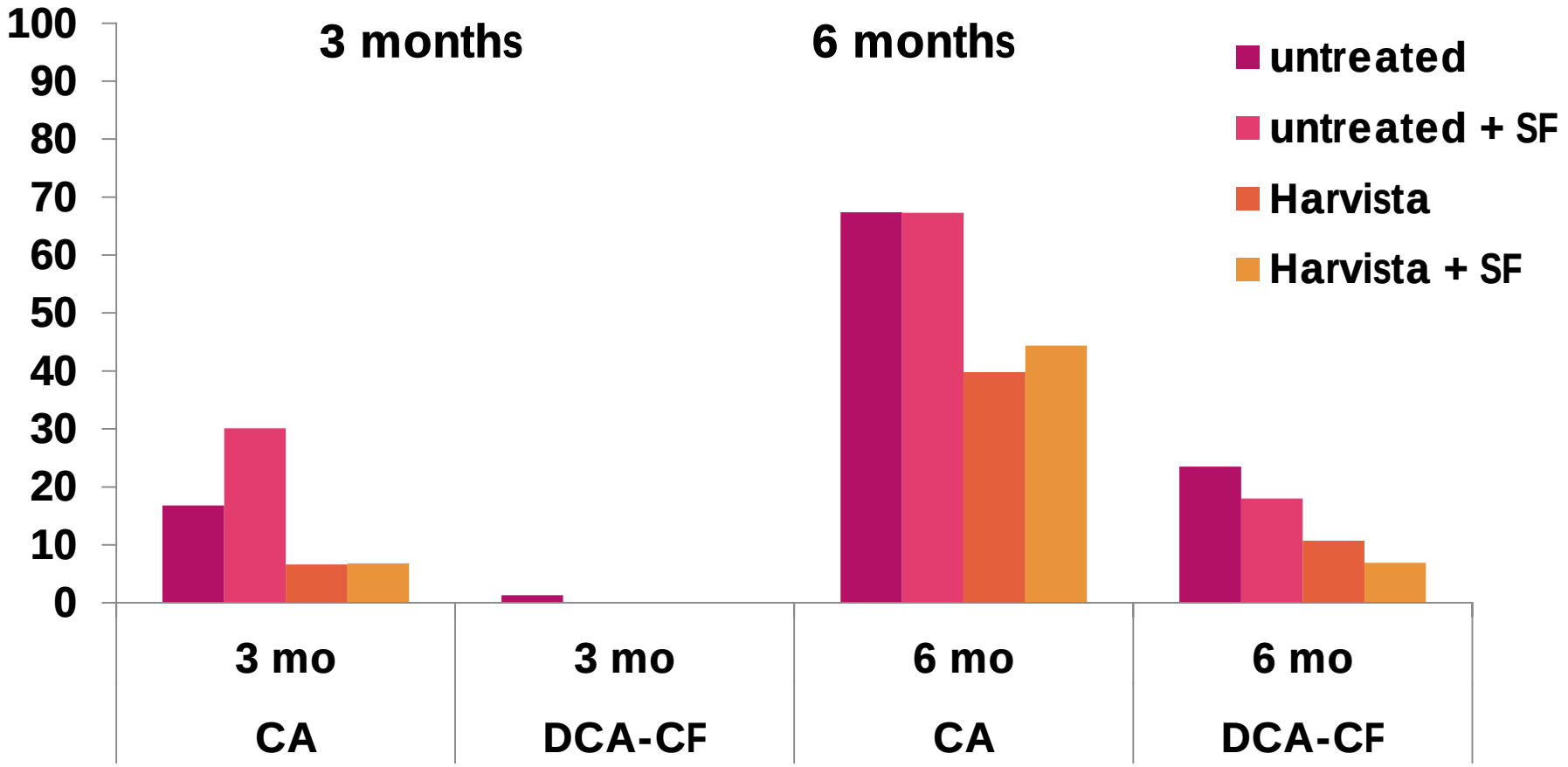


- DA meter reading



CA vs DCA




100
90
80
70
60
50
40
30
20
10
0
3 months
6 months
untreated
untreated + SF
Harvista
Harvista + SF
3 mo
CA
3 mo
DCA-CF
6 mo
CA
6 mo
DCA-CF

Summary – the maybe's!

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


Questions?