

# The Continuing Quest for optimal Harvest Management and Storage of Apples'

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# The collective contributions of

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Thanks for the many growers and storage operators who contribute fruit for our research

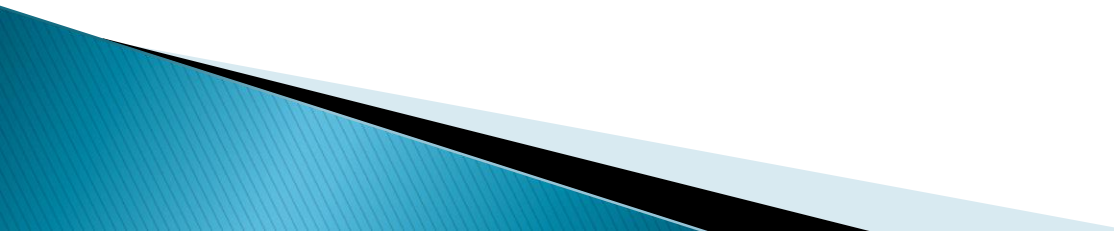
# Honeycrisp storage



# Focus

- ▶ Effects of conditioning and can we avoid this treatment?
- ▶ CA storage

# Effects of conditioning on bitter pit and soft scald of fruit stored at 33°F or 38°F (2013/2014)

- ▶ Honeycrisp apples from WNY (2 orchards) and PA (1 orchard)
  - ▶ Fruit untreated or conditioned at 50°F before storage at 33°F or 38°F
  - ▶ Stored for 20 weeks plus 7 days at 68°F
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# Effect of conditioning

## Soft scald (%)

	WNY-1	WNY-2	PA
33F	22a	28a	8a
33F + conditioning	3b	3b	6a
38F	0.3b	0b	0b
38F + conditioning	0b	0b	0b

# Effect of conditioning

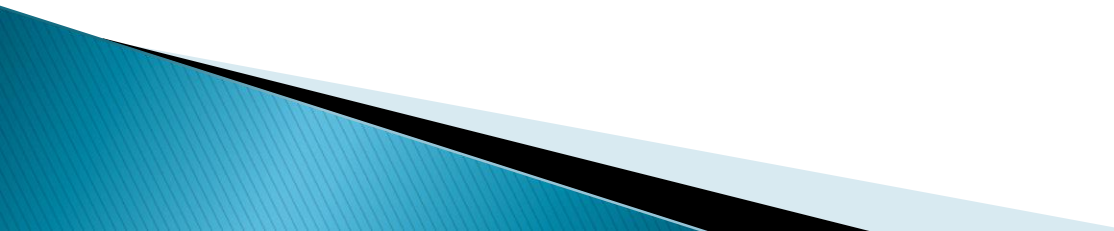
## Bitter pit (%)

	WNY-1	WNY-2	PA
33F	5c	2b	4b
33F + conditioning	8bc	2b	24a
38F	13ab	3b	5b
38F + conditioning	20a	5a	28a

- ▶ 38F is the safe storage temperature for HC
- ▶ Conditioning is a problem
  - Can increase bitter pit development
  - Annoying from management perspective



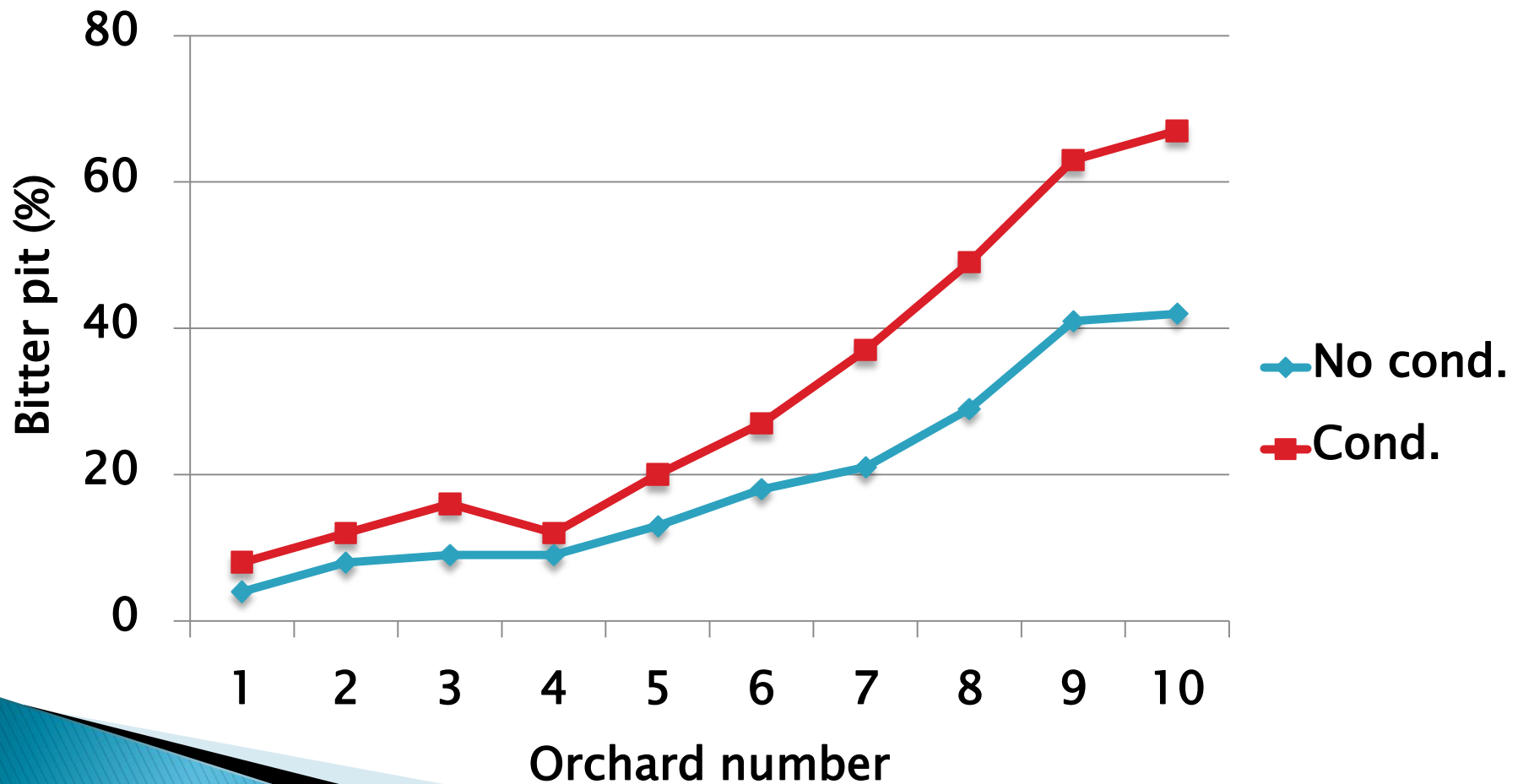
# Effects of conditioning on bitter pit and soft scald of fruit stored at 38°F (2014/2015)

- ▶ Honeycrisp apples from HV (3 orchards), WNY (2 orchards), Champlain (3 orchards) and PA (2 orchards)
  - ▶ Fruit untreated or conditioned at 50°F before storage at 38°F
  - ▶ Storage for 20 weeks plus 7 days at 68°F
  - ▶ *Results today are based on 10 weeks evaluations during cold storage*
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# Effects of conditioning on bitter pit incidence (%) at 10 weeks [2014/15]

	38°F	50°F + 38°F	% Increase over 'no conditioning'
PA1	21	37	76
PA2	9	16	78
HV1	42	67	60
HV2	29	49	69
HV3	13	20	54
WNY1	8	12	50
WNY2	18	27	50
CH1	41	63	54
CH2	4	8	50
CH3	9	12	33
<b>Average</b>	<b>19</b>	<b>31</b>	<b>63</b>

# Effect of conditioning on bitter pit incidence (%) at 10 weeks [2014/15]



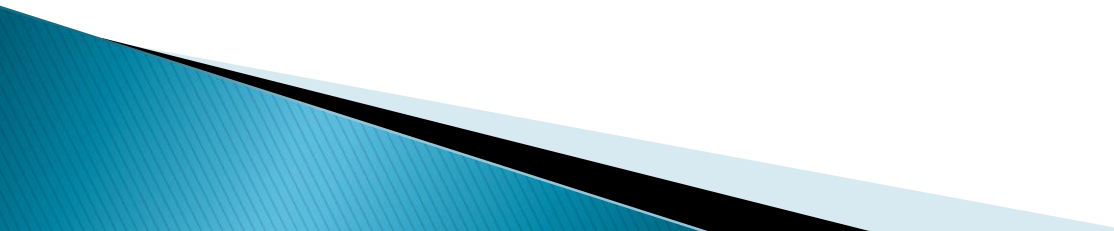
# Effects of conditioning on soft scald incidence (%) at 10 weeks [2014/15]

	38°F	50°F + 38°F
PA1	0.3	0
PA2	0	0
HV1	0	0
HV2	9	0
HV3	1	0
WNY1	3	0
WNY2	0	0
CH1	2	0
CH2	4	0
CH3	0.3	0
Average	2	0

# Sub-summary

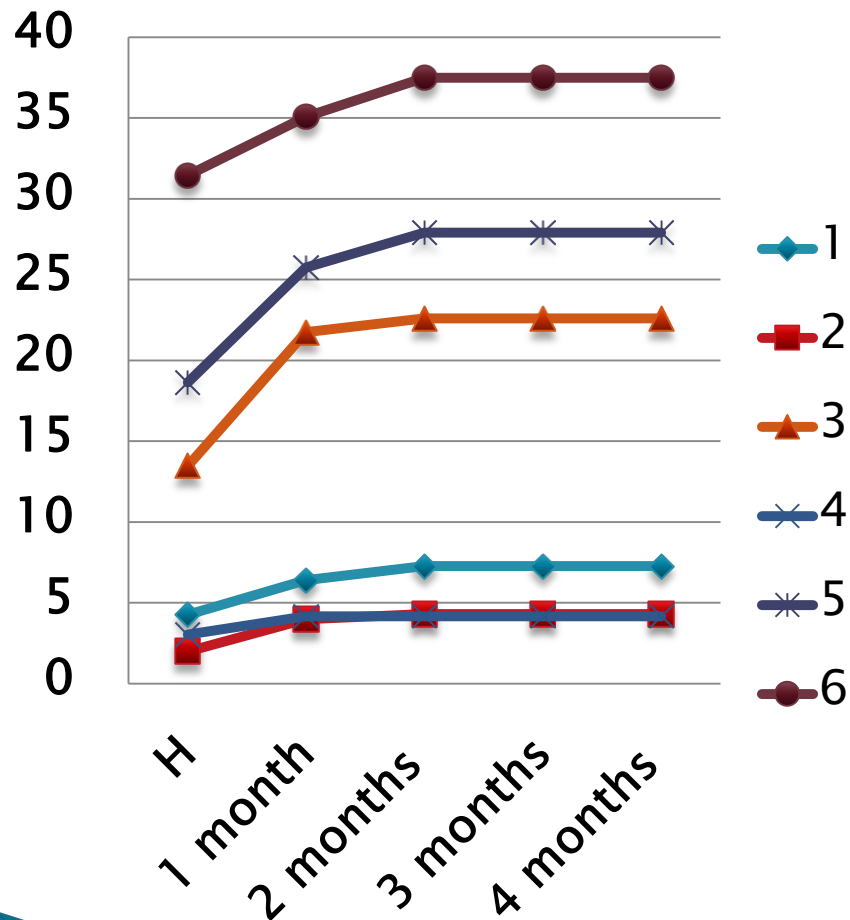
- ▶ Conditioning ALWAYS increases losses due to bitter pit
  - Only control factor is in the orchard
  - Less pit potential at harvest = less loss to pit after storage
- ▶ -----
- ▶ Interested in timing of disorder incidence

# The dynamics of bitter pit and soft scald development (2013/2014)

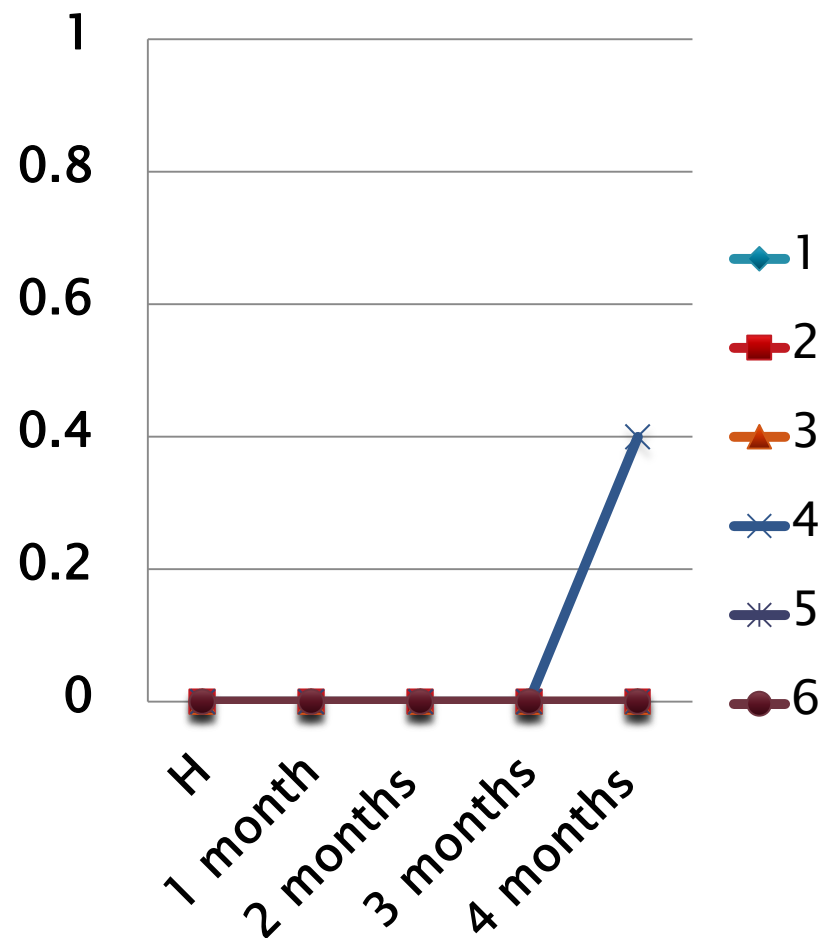
- ▶ Fruit from 6 HV orchard blocks and 12 western NY orchard blocks
  - ▶ Stored at 38°F without conditioning
  - ▶ Bitter pit and soft scald development assessed on stored fruit at monthly intervals for 4 months
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# Hudson Valley

Bitter pit (%)

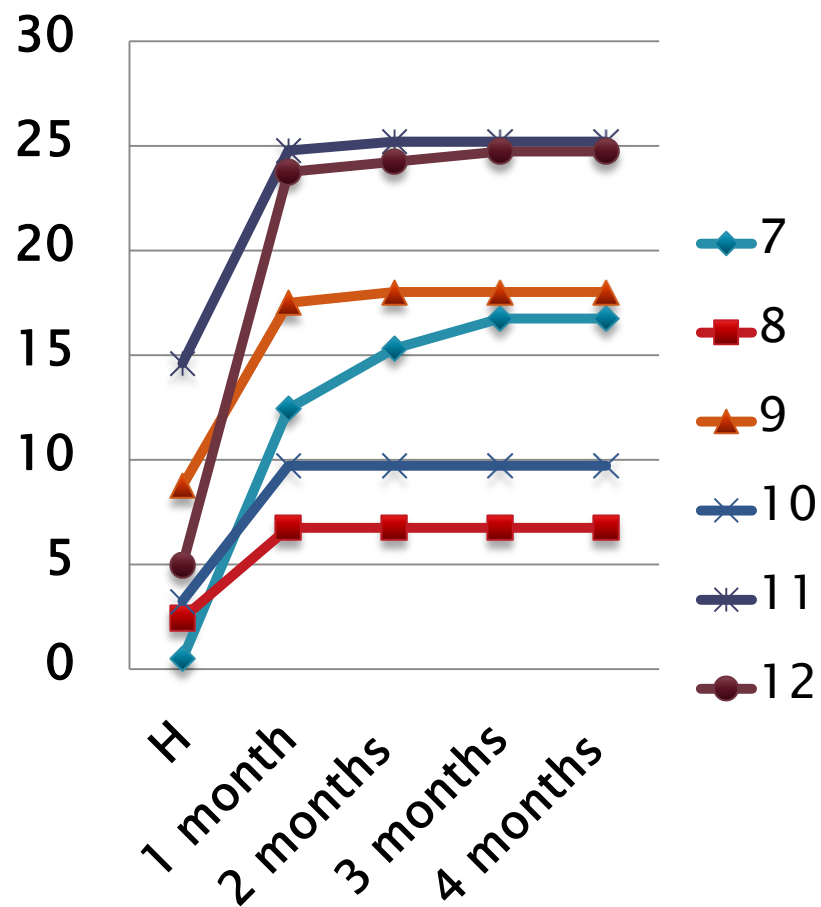


Soft scald (%)

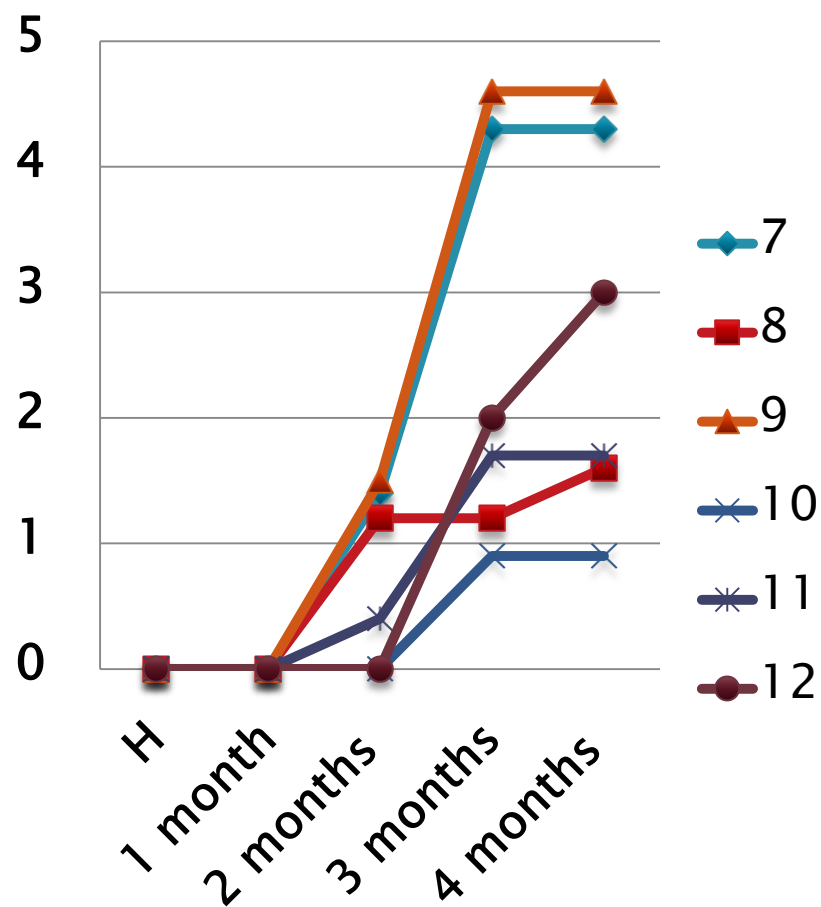


# Western NY

## Bitter pit (%)

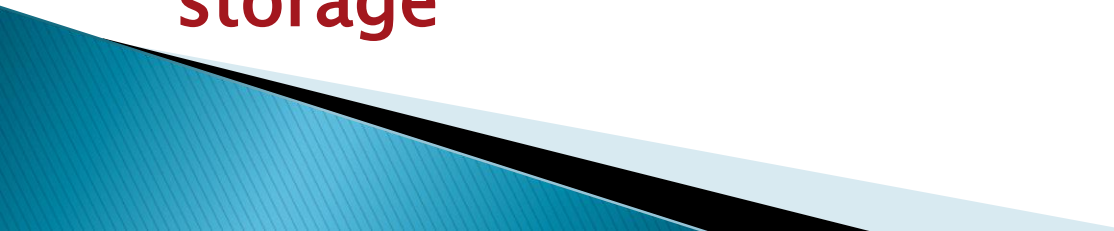


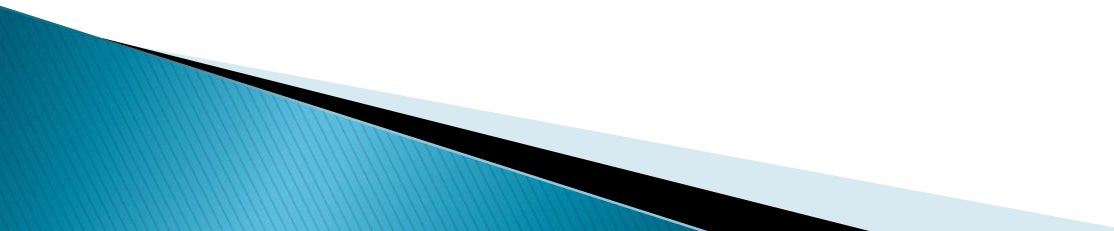
## Soft scald (%)





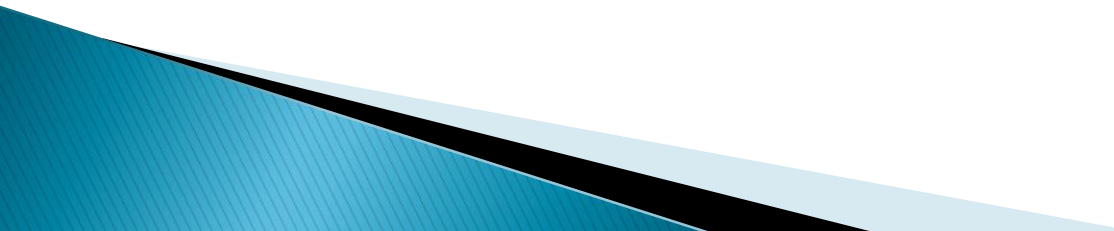
# Take home messages

- ▶ Variation among orchards – recurrent theme
  - ▶ *Storage of Honeycrisp at 33°F is a high risk endeavor regardless of conditioning (for long storage periods)*
  - ▶ Conditioning of fruit consistently reduces soft scald development but results in higher bitter pit development
  - ▶ **Lower bitter pit potential results in lower losses due to conditioning**
  - ▶ **Negligible soft scald at 38°F for short term storage**
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- ▶ Soft scald development risk is HIGH in the Champlain, low in Hudson Valley, while WNY is more variable.
  - ▶ Not conditioning in Champlain and WNY is a high risk activity! Every year is different!!!
  - ▶ In HV may be possible to use low storage temperatures and avoid conditioning if storage periods are short (1–2 months)
  - ▶ Ideal would be to have prediction test available ( $\beta$  testing this season), also testing ethanol, but you should sample.
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# Hudson Valley “recommendations”

Centered on high bitter pit risk and low soft scald risk

- ▶ If storing for less than a month (or so?)
    - No conditioning
    - Storage at 38F – but if you can bear the risk and know that you are not storing for than a month maybe 33F
    - Sample for presence of ethanol
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# Controlled atmosphere (CA) storage



# Untrt vs SF (air) vs CA – 6 months

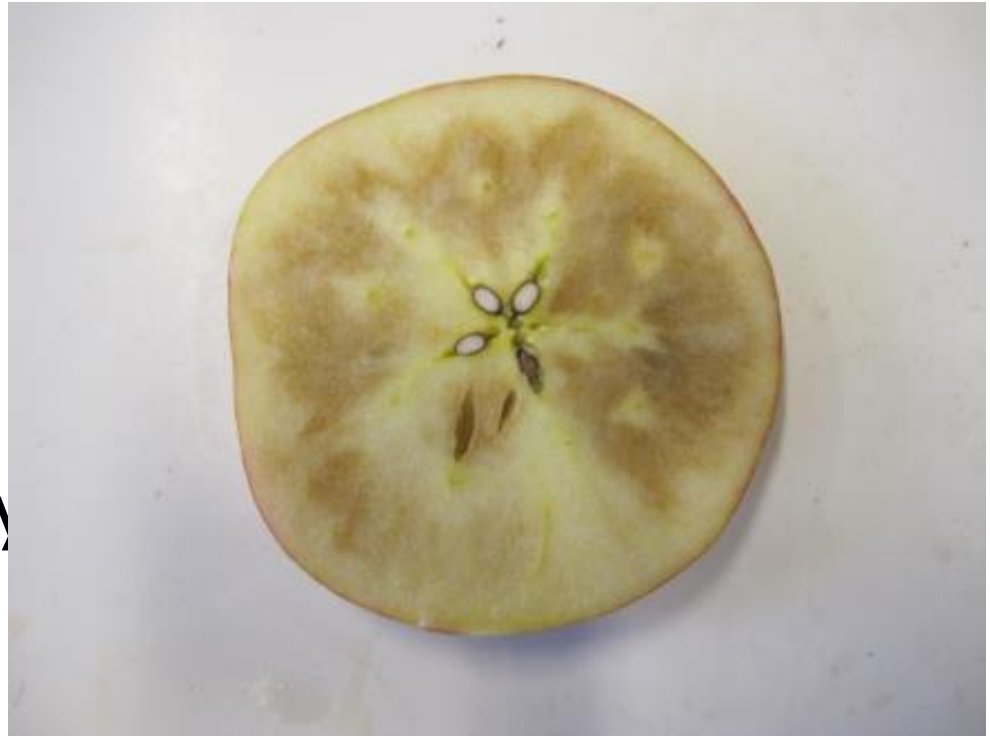
	<u>UNTRT</u>	<u>1-MCP</u>
Firmness (lb-f)	15.5	15.5
SSC (%)	12.0	12.4*
TA (%)	0.228	0.267***

# Untrt vs SF (air) vs CA – 6 months

	<u>UNTRT</u>	<u>1-MCP</u>	<u>CA</u>
Firmness (lb-f)	15.5	15.5	15.5
SSC (%)	12.0	12.4*	12.8***
TA (%)	0.228	0.267***	0.297***

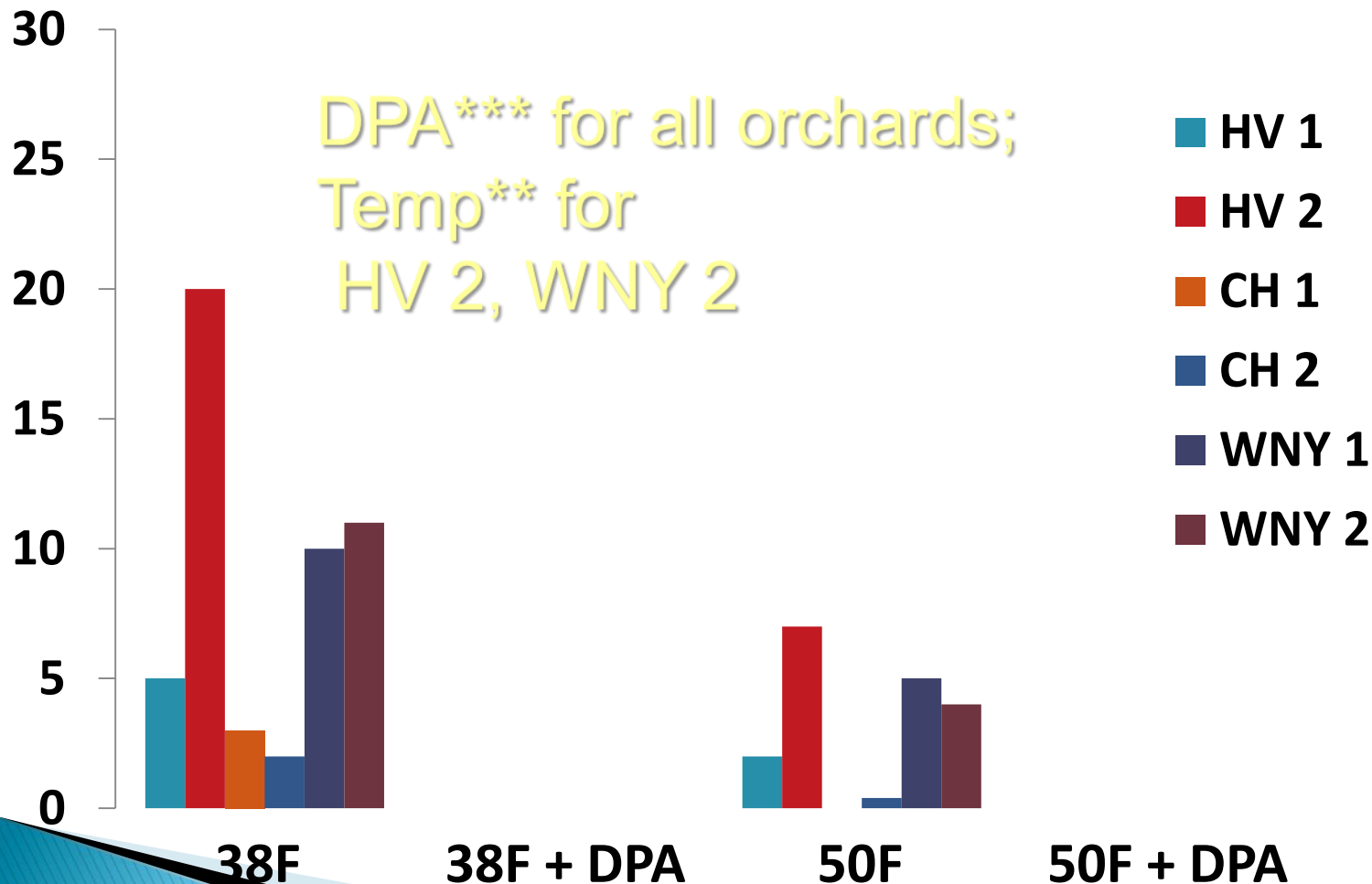
# Control of CO<sub>2</sub> injury

- ▶ Diphenylamine (DPA)
- ▶ Delayed CA
- ▶ High temperature conditioning (Randy Beaudry, MSU)



# CA storage

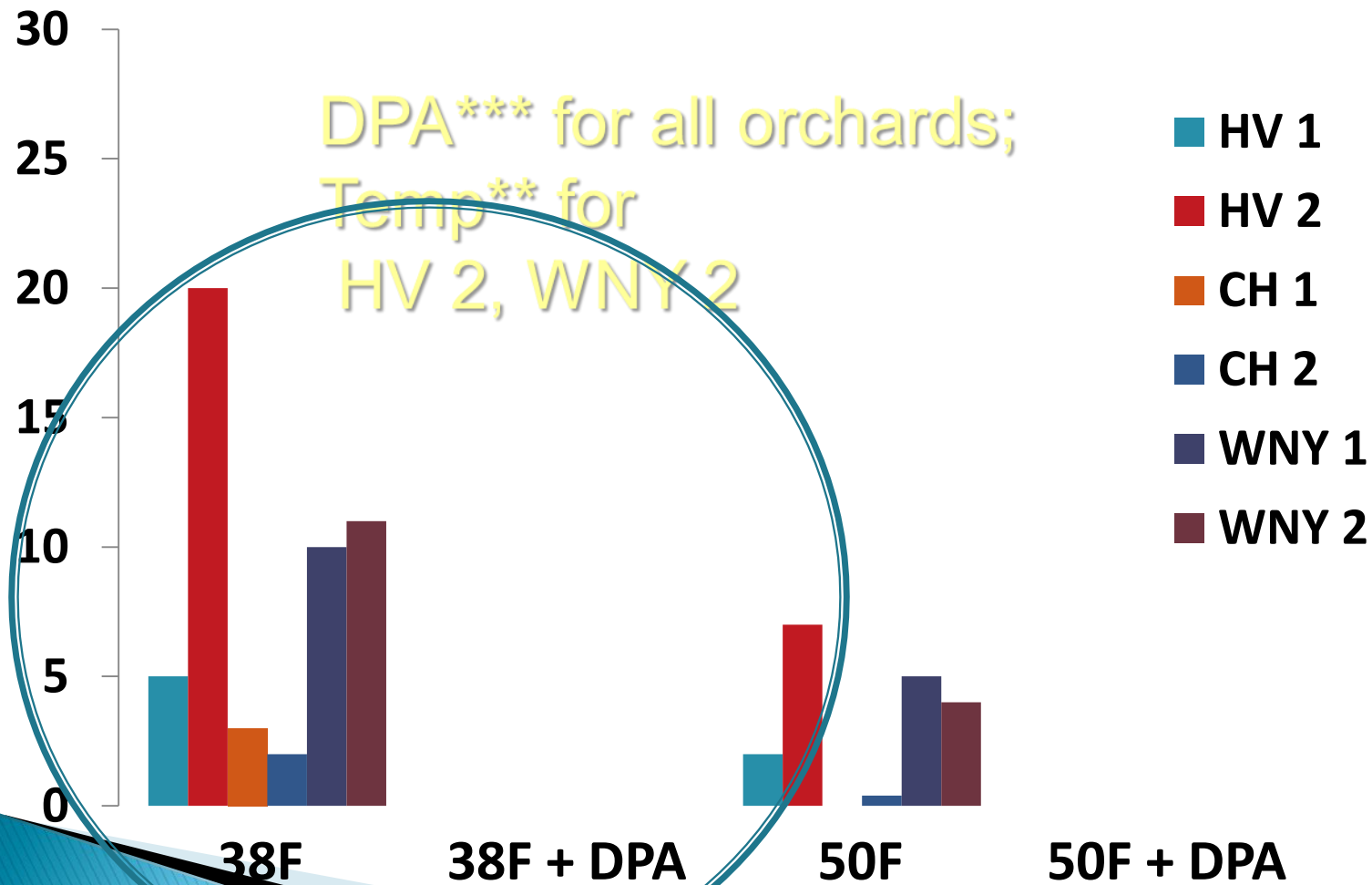
## % Internal CO<sub>2</sub> injury after storage (2012)





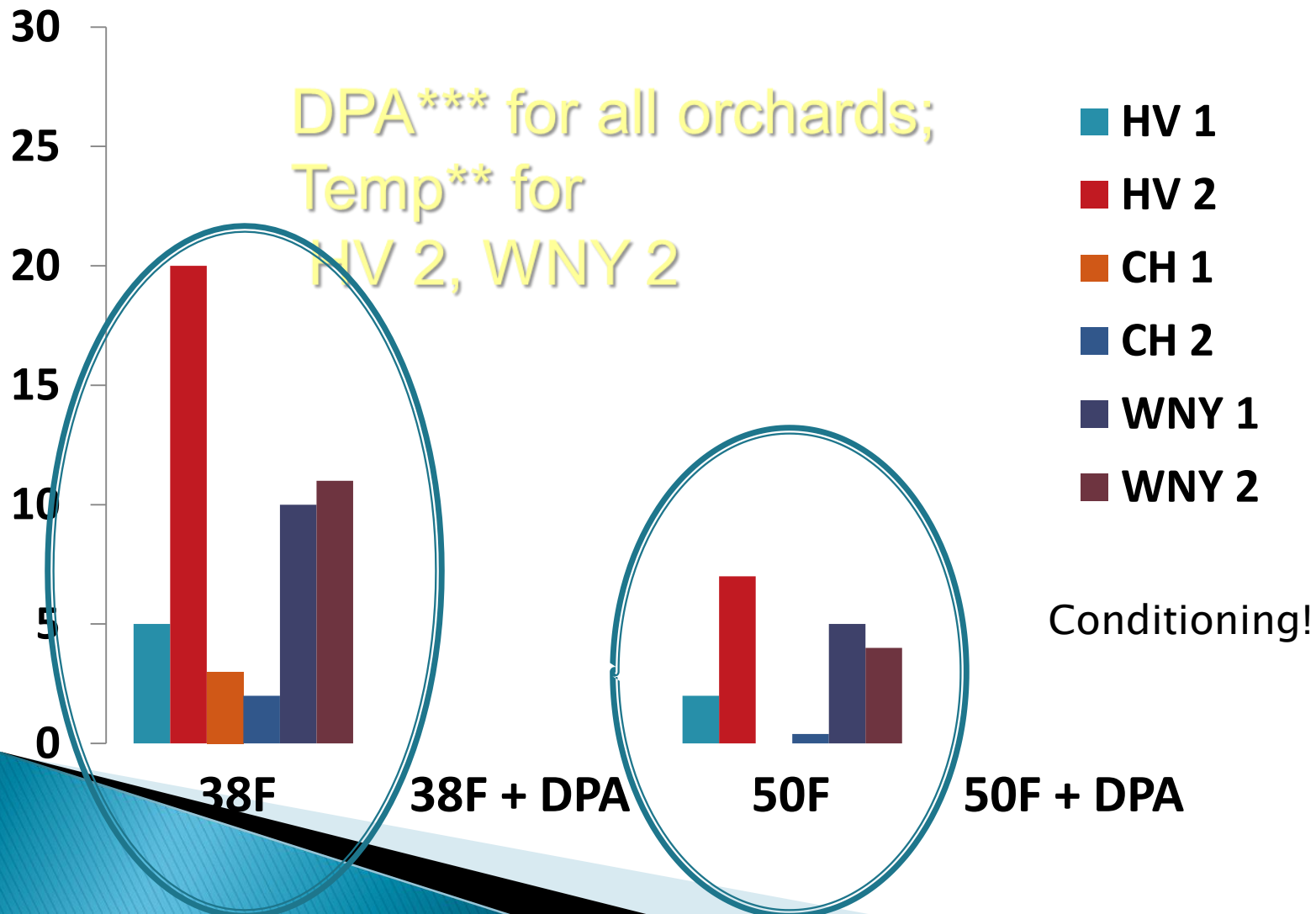
# CA storage

## % Internal CO<sub>2</sub> injury after storage (2012)



# CA storage

## % Internal CO<sub>2</sub> injury after storage



# Delayed CA

Table 1. % Internal CO<sub>2</sub> injury in ‘Honeycrisp’ apples from 5 WNY orchards after CA (3% oxygen/3% carbon dioxide) storage (2013).



	% Internal CO <sub>2</sub> injury				
	Orchard #				
delay	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>
1 week	15	10	2	2	32
3 week	10	1	0	0	10
5 week	1	2	0	0	4

# CA experiments 2014 harvest objective to control CO<sub>2</sub> injury by delaying CA

- ▶ Fruit from 3 orchard blocks in each of Champlain and Western NY
- ▶ Fruit treated on day 1 or day 6 during conditioning.
- ▶ CA (3% oxygen with 1.5% or 3% carbon dioxide) applied after 0 or 4 weeks.
- ▶ Assessment after 6 months of CA storage
  - Results to come, but confident.

Thank you  
for your  
ongoing  
support



Questions?