Regional and harvest date relationships with storage quality of Honeycrisp apples

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Today's presentation

- Background
- Maturity
- Fruit drop and yield
- Storage quality
- Storage disorders
- Conclusions

ReTain (aminoethoxyvinylglycine; AVG)

Harvista (1-MCP)

Plant Growth Regulator

ReTain®

Soluble Powder

FOR USE ON APPLE, PEAR, AND STONE FRUIT (EXCEPT CHERRY)

ACTIVE INGREDIENT:
(S)-trans-2-Amino-4-(2-aminoethoxy)-3-butenoic acid hydrochloride 15%
OTHER INGREDIENTS 85%
TOTAL 100%

EPA Reg. No. 73049-45
EPA Est. No. 33762-IA-001 (Lot No. Suffix '04')
33M07-NJ-1 (Lot No. Suffix '05') Lot No. 12017

INDEX:

KEEP OUT OF REACH OF CHILDREN
CAUTION

1.0 FIRST AID

If inhaled:	• Move person to fresh air. • If person is not breathing, call 911 or an ambulance, then give artificial respiration, preferably by mouth-to-mouth, if possible. • Call a poison control center or doctor for further treatment advice.
If on skin or clothing	• Take off contaminated clothing. • Rinse skin immediately with plenty of water for 15-20 minutes. • Call a poison control center or doctor for treatment advice.

HOT LINE NUMBER

Have the product container or label with you when calling a poison control center or doctor, or going for treatment. You may also contact 1-800-992-0099 (24 hours) for emergency medical treatment and/or transport emergency information. For all other information, call 1-800-0-VALENT (082-5368).

2.0 PRECAUTIONARY STATEMENTS

2.1 HAZARDS TO HUMANS AND DOMESTIC ANIMALS
CAUTION

Harmful if inhaled or absorbed through skin. Avoid breathing spray mist. Avoid contact with skin, eyes, or clothing. Wash thoroughly with soap and water after handling. Remove and wash contaminated clothing before reuse.

2.2 Personal Protective Equipment (PPE)

Applicators and other handlers must wear:
- Long sleeved shirt and long pants
- Shoes plus socks
- Waterproof gloves

Hand-wand applications must wear dust/mist filtering respirator (MSHA/NIOSH approval number prefix TC-21C), or a NIOSH approved respirator with N, R, P or HE filter when applying this product.

Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables, use detergent and hot water. Keep and wash PPE separately from other laundry.

2.3 User Safety Recommendations

Users should:
- Wash hands before eating, drinking, chewing gum, using tobacco, or using the toilet.
- Remove clothing immediately if pesticide gets inside. Then, wash thoroughly and put on clean clothing.
- Remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing.

2.4 Environmental Hazards

Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwater and rinsate.

3.0 DIRECTIONS FOR USE

It is a violation of Federal law to use this product in a manner inconsistent with its labeling. Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application. For any requirements specific to your State or Tribe, consult the State/Tribe agency responsible for pesticide regulation.

4.0 AGRICULTURAL USE REQUIREMENTS

Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170.

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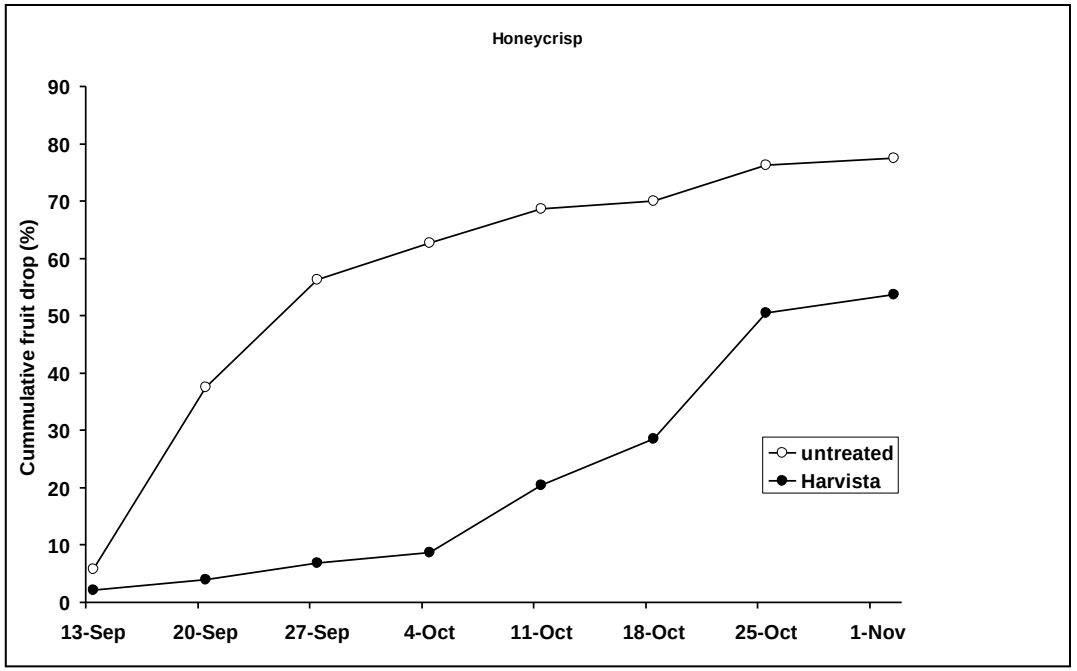
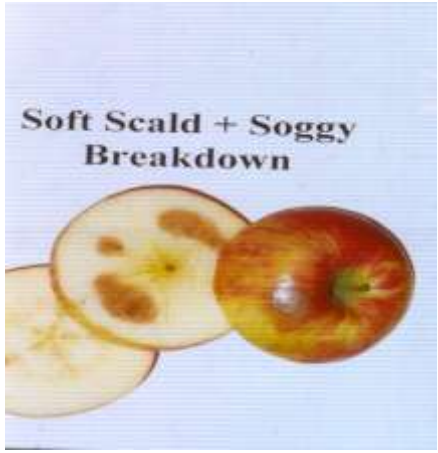


Honeycrisp – the profitable but difficult child!

1. Highly susceptible to a number of serious physiological problems in air storage
   - Bitter pit
   - Soft scald
   - Soggy breakdown
   - Senescent breakdown
   - Greasiness
   - Poorly understood, e.g. wrinkling



2. Fruit should be conditioned at 50F for 7 days to reduce risk of soft scald development

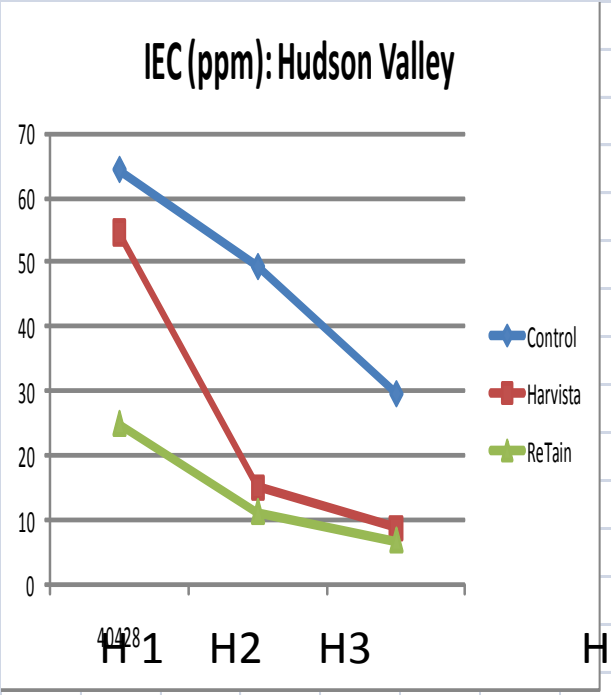
But, conditioning aggravates bitter pit in an already susceptible variety

Regional and harvest date effects

- **Two year trial (2009; 2010)**
- **Untreated, ReTain, Harvista**
- **3 harvest dates (commercial pickers), but variable among regions because of color issues**
- **Plus and minus Smartfresh after conditioning (50^{o}F for 7 days)**
- **Air (38^{o}F) and CA (3% O_2, 1.5% CO_2) (38^{o}F)**
- **3 and 6 months storage plus 4 days at 68^{o}F**

AT HARVEST - MATURITY

EFFECTS OF REGION AND PREHARVEST TREATMENT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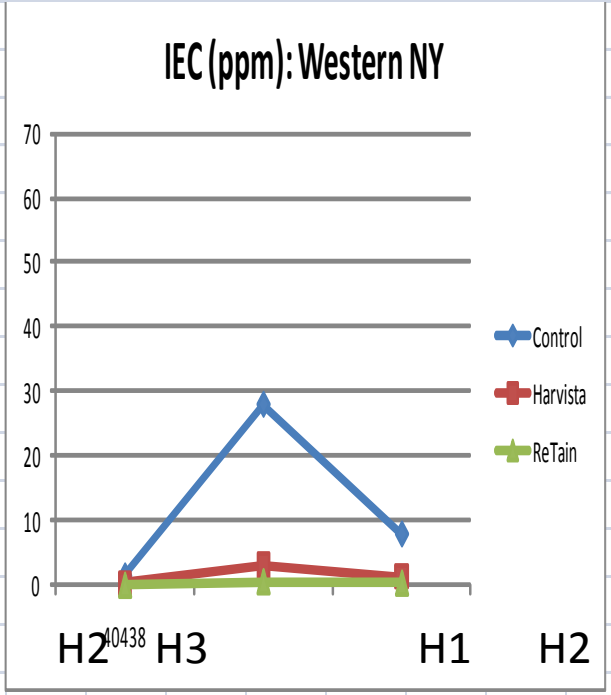
Control
Harvista
ReTain
40428
H1
H2
H3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ReTain
40438
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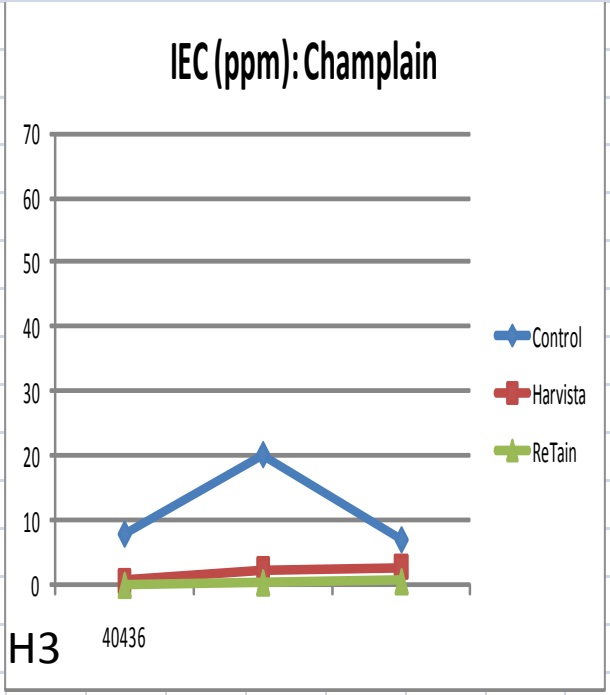
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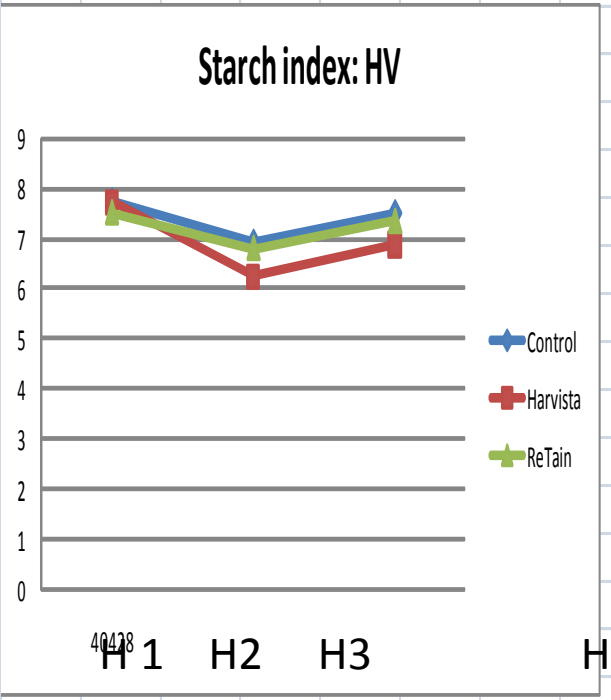
Control
Harvista
ReTain
40436
H1
H2
H3


Starch index: HV
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Harvista
ReTain
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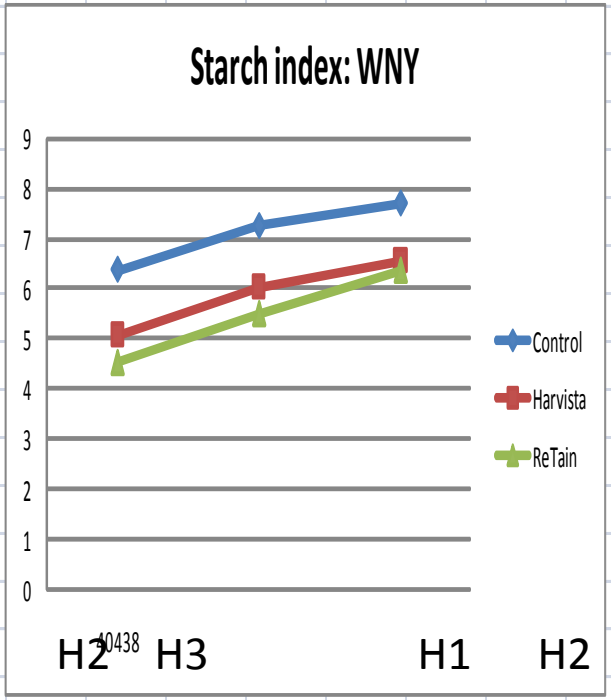
H3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Harvista
ReTain
40438
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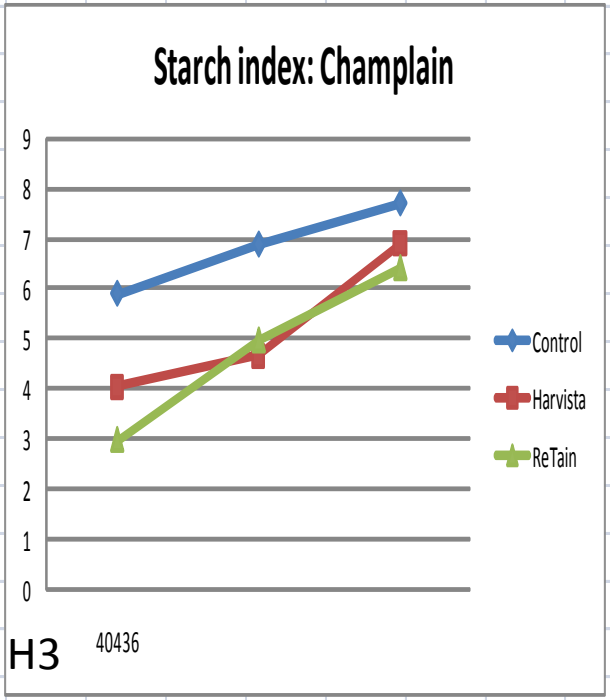
H3


Starch index: Champlain
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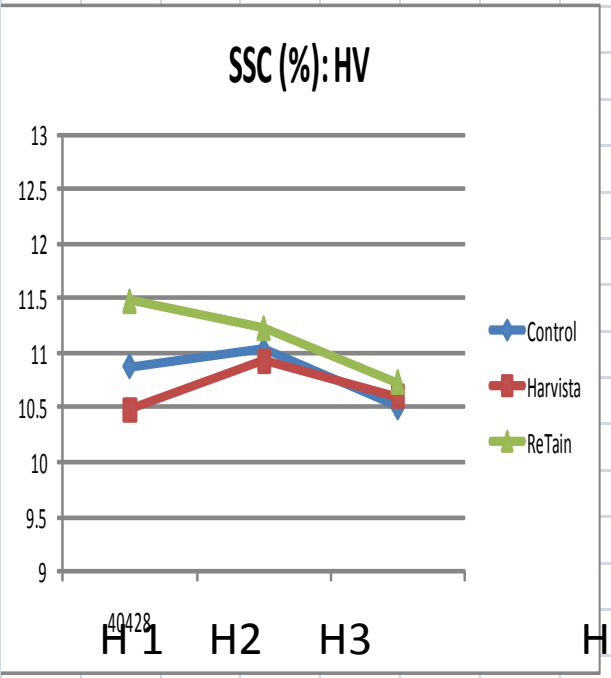
0
Control
Harvista
ReTain
40436
H1
H2
H3


SSC (%): HV
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12.5
12
11.5
11
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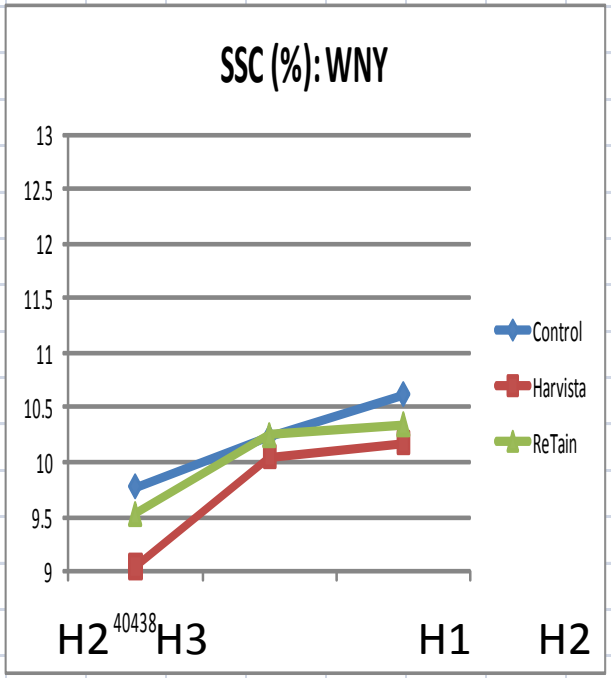
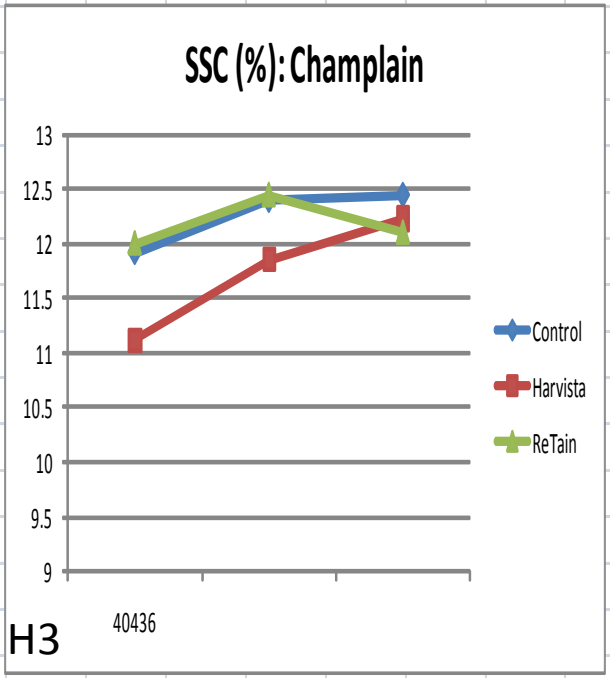
10
9.5
9
Control
Harvista
ReTain
40428
H1
H2
H3


SSC (%): WNY
13
12.5
12
11.5
11
10.5
10
9.5
9
Control
Harvista
ReTain
40438
H1
H2
H3


SSC (%): Champlain
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12
11.5
11
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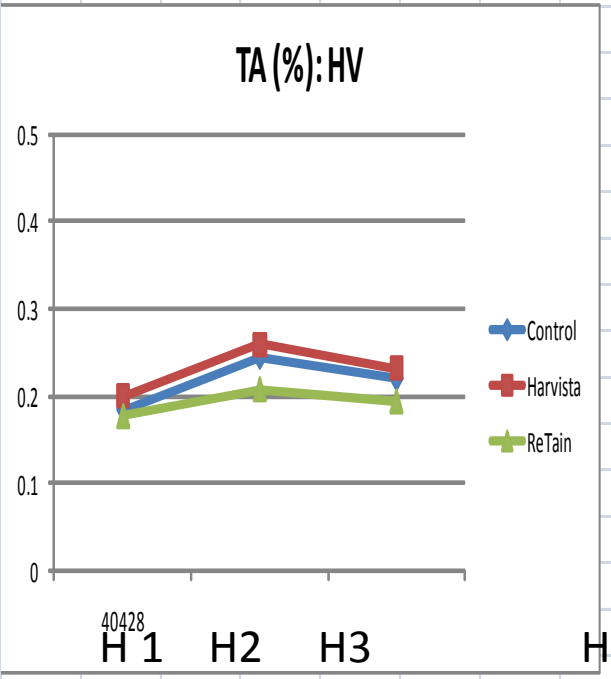
10
9.5
9
Control
Harvista
ReTain
40436
H1
H2
H3


TA (%): HV
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0.1
0
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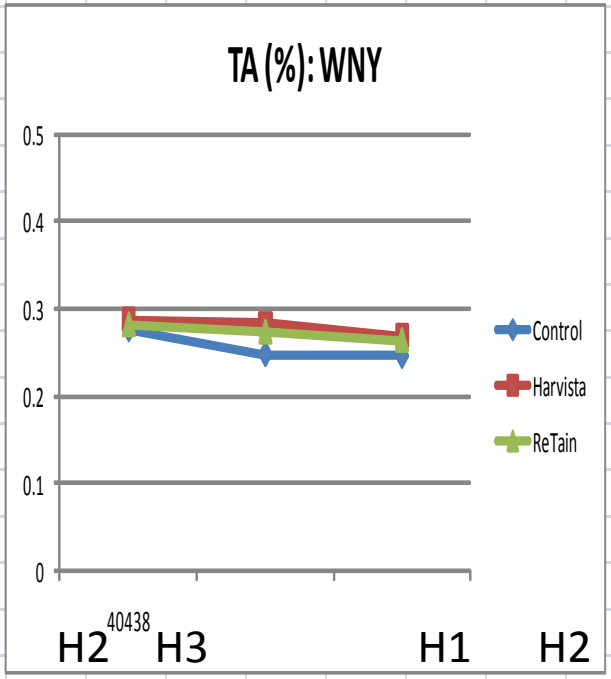
Harvista
ReTain
40428
H1
H2
H3


TA (%): WNY
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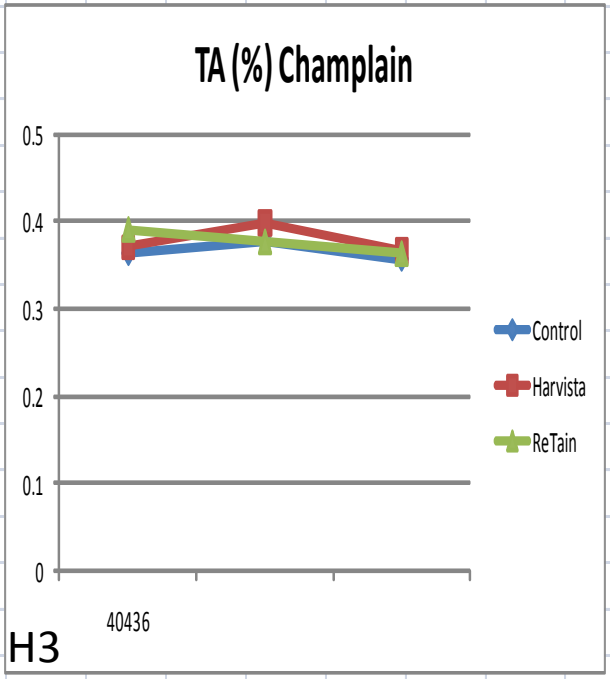
0.4
0.3
0.2
0.1
0
Control
Harvista
ReTain
40438
H1
H2
H3


TA (%) Champlain
0.5
0.4
0.3
0.2
0.1
0
Control
Harvista
ReTain
40436
H1
H2
H3

Effect of preharvest treatment on the starch index [2010]

Pre-harvest trt	HV	WNY	Champlain
Untreated	7.4	7.4	7.2
Harvista	7.2	5.8	6.4
ReTain	7.2	6.5	7.0
Significance	NS	***	***

Effect of preharvest treatment on acidity[2010]

Pre-harvest trt	HV	WNY	Champlain
Untreated	0.389	0.303	0.364
Harvista	0.347	0.328	0.355
ReTain	0.334	0.317	0.361
Significance	NS	NS	NS

Effect of preharvest treatment on firmness (lb-f) [2010]

Pre-harvest trt	HV	WNY	Champlain
Untreated	14.3	13.4	15.2
Harvista	14.3	14.0	15.5
ReTain	14.4	13.8	15.5
Significance	NS	*	NS

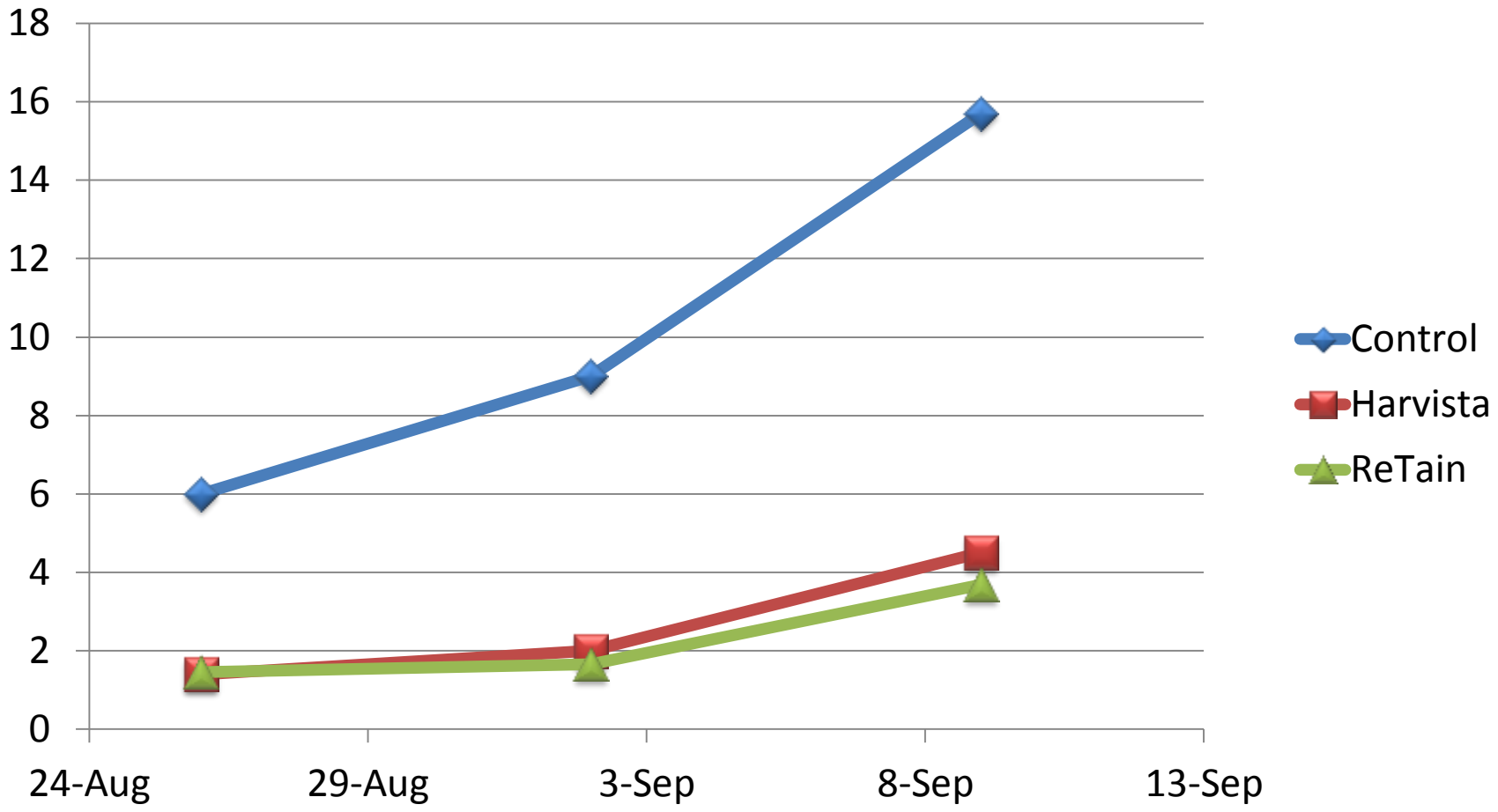
Summary

- Harvista and ReTain inhibit ethylene production of Honeycrisp apples
  - sometimes starch
  - sometimes firmness
- Effects on other maturity indices are small or absent
- Many factors affecting acidity and starch that are not simply growing region related

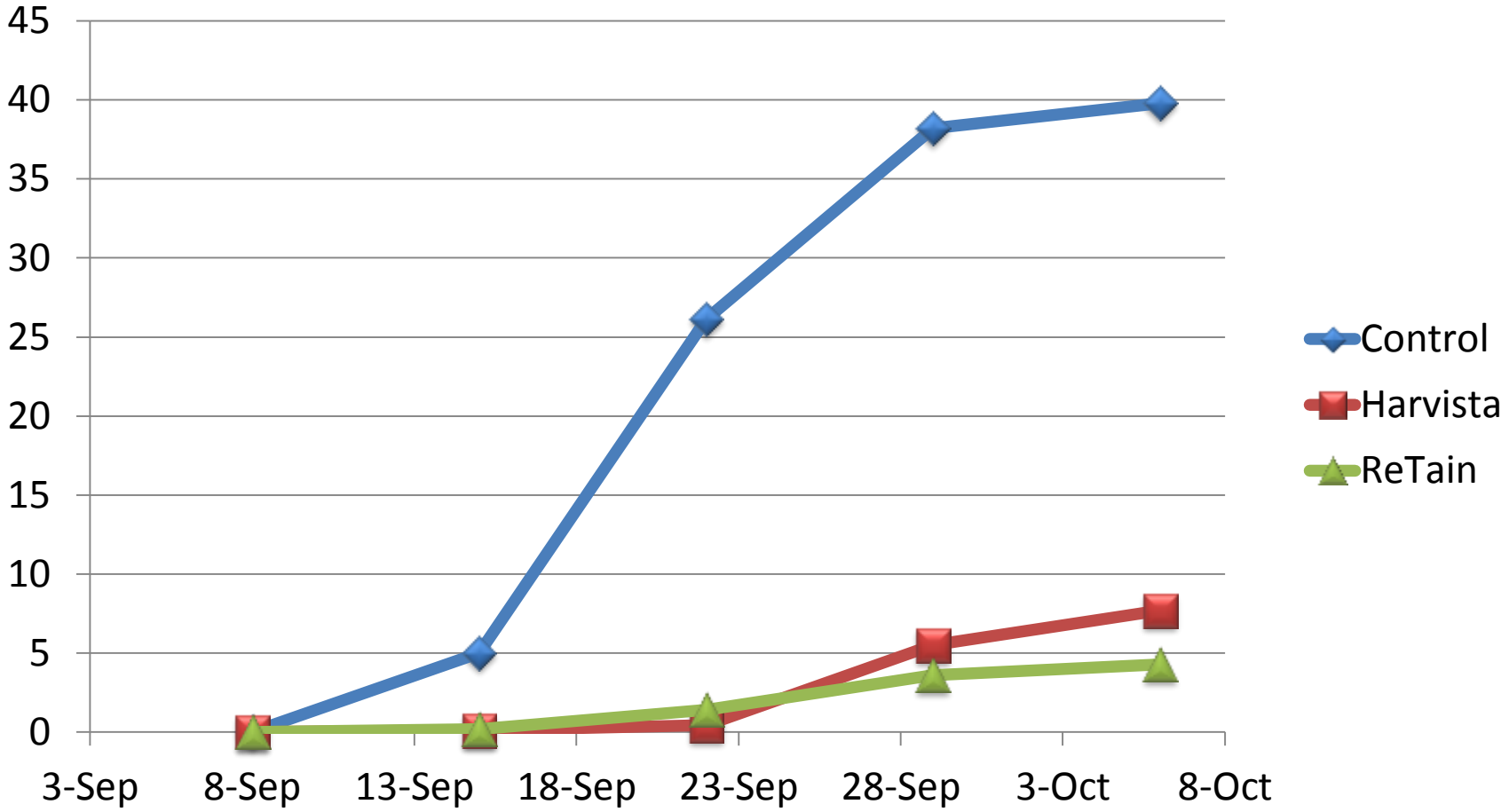
AT HARVEST – YIELD AND DROP

EFFECTS OF REGION AND PREHARVEST TREATMENT

HUDSON VALLEY (2010)
Accumulated drop (%)



CHAMPLAIN (2010)
Accumulated drop (%)



Summary

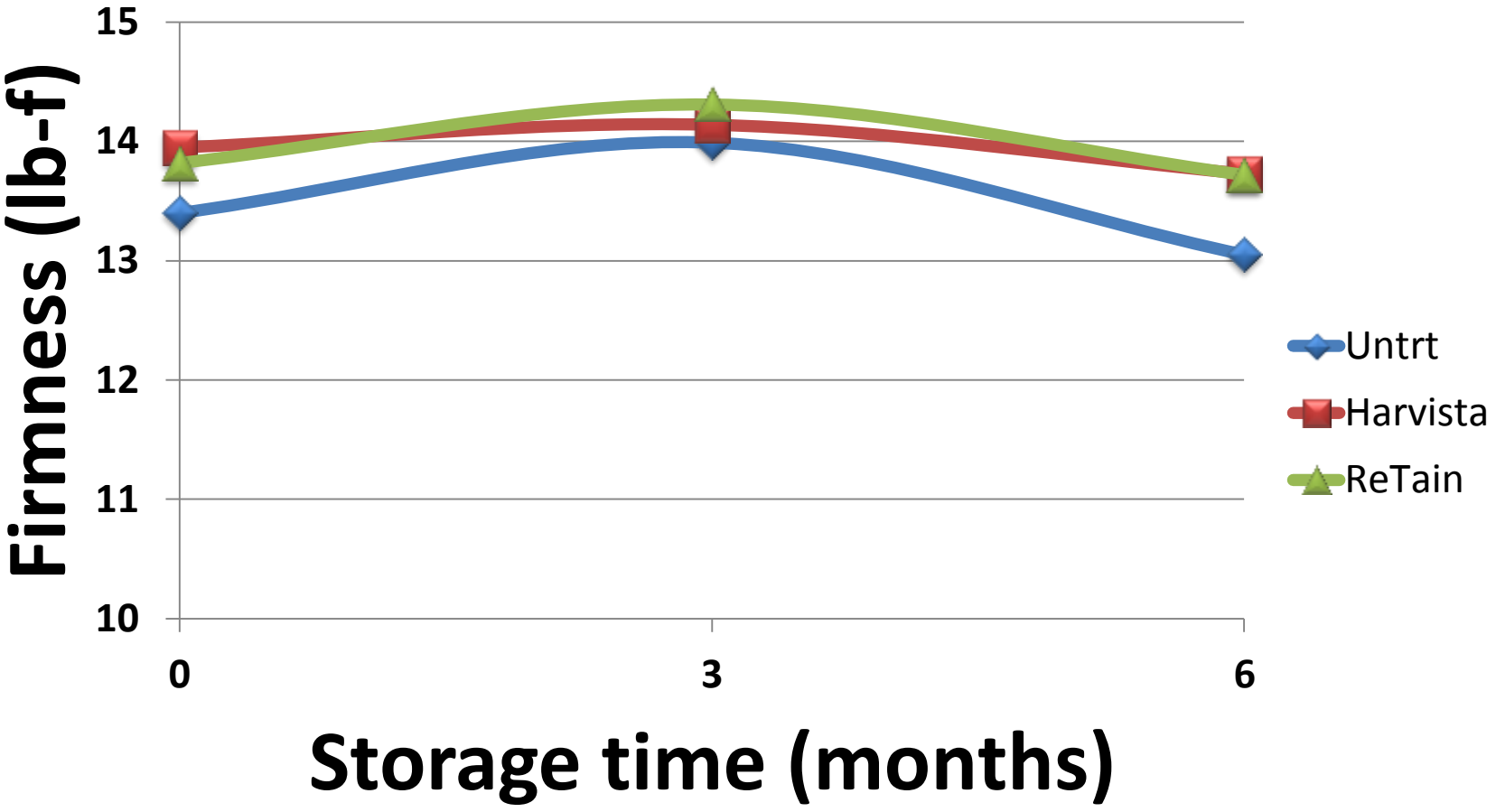
- Harvista and ReTain control drop of Honeycrisp apples, but can have undesirable effects on fruit color at the rates used
- Seriousness of red color inhibition depends on growing climate
- More work needed on ReTain rates

STORAGE

EFFECTS OF PREHARVEST TREATMENT AND STORAGE TYPE ON FIRMNESS, SSC AND TA

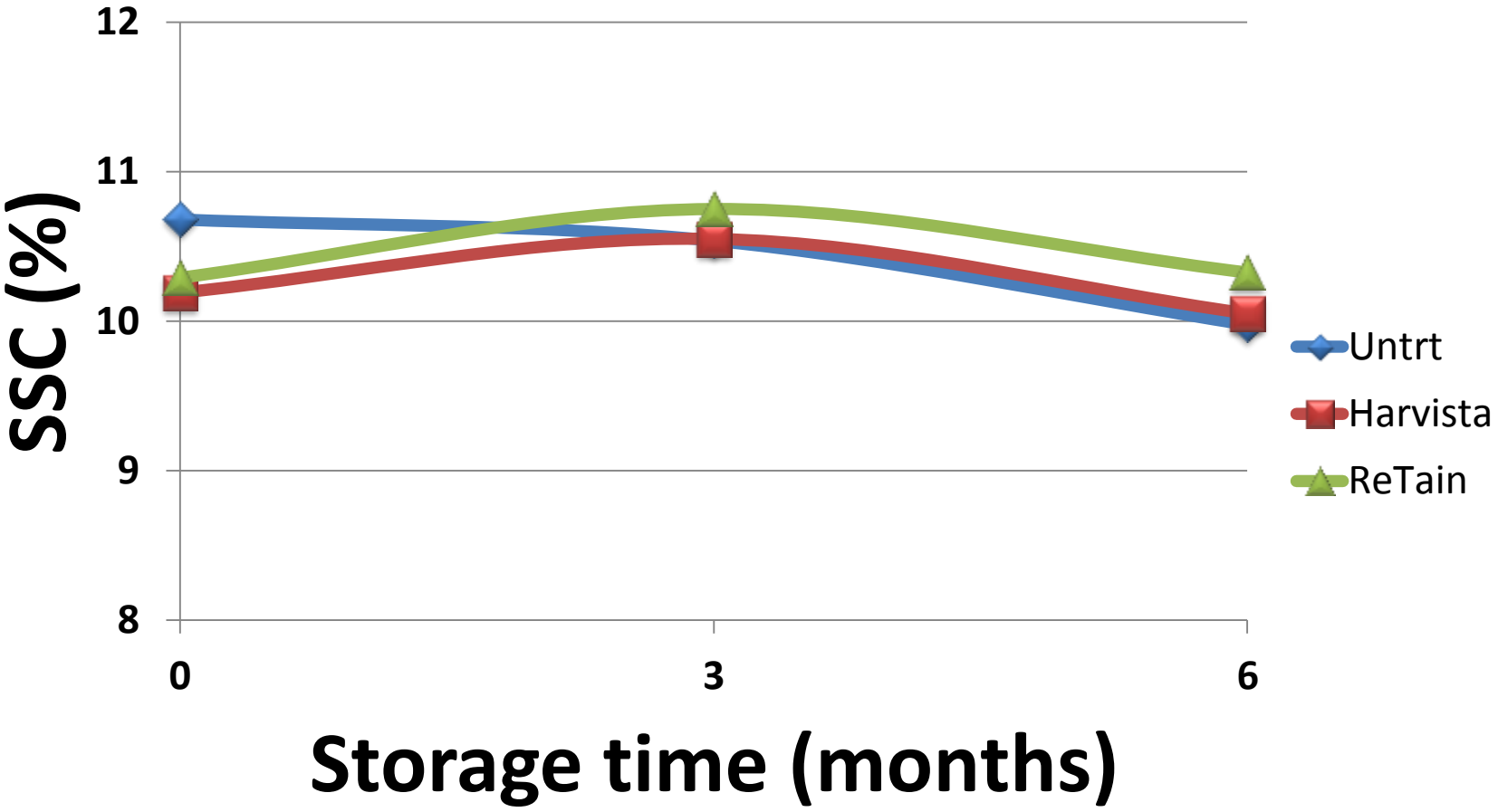
WNY: Firmness (lb-f) in air storage

Effect of preharvest treatment



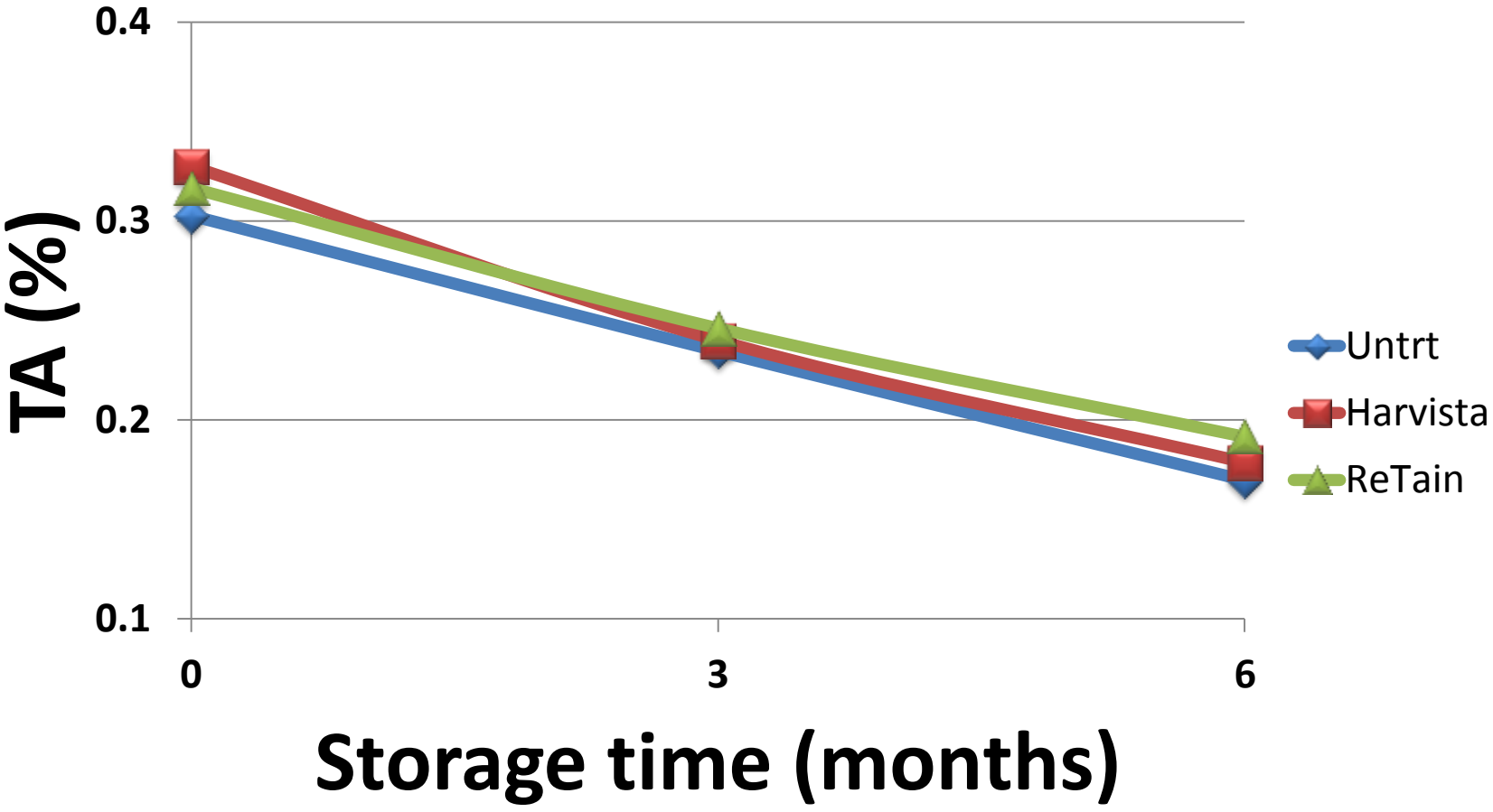
WNY: SSC (%) in air storage

Effect of preharvest treatment



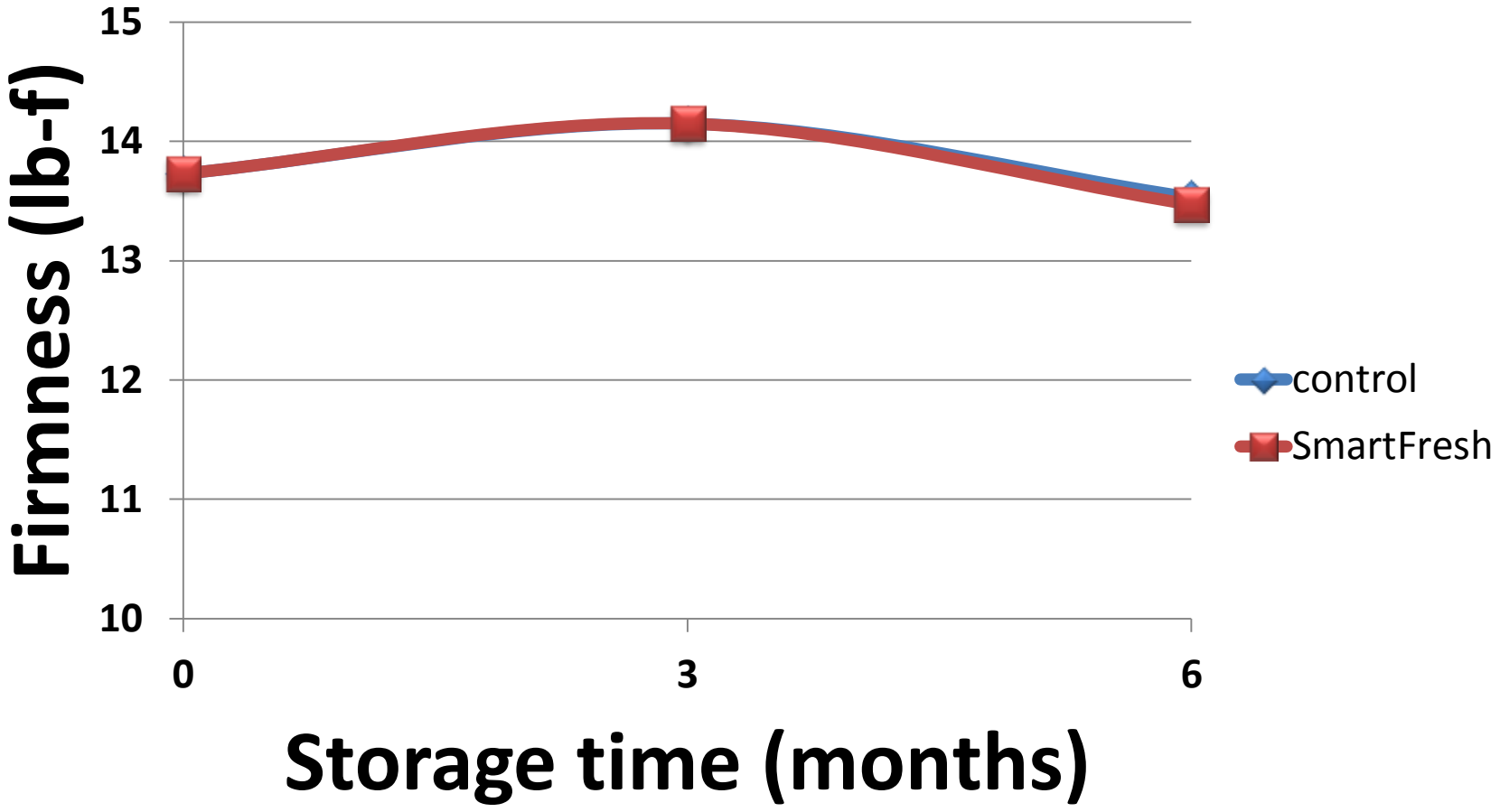
WNY: Acidity (%) in air storage

Effect of preharvest treatment



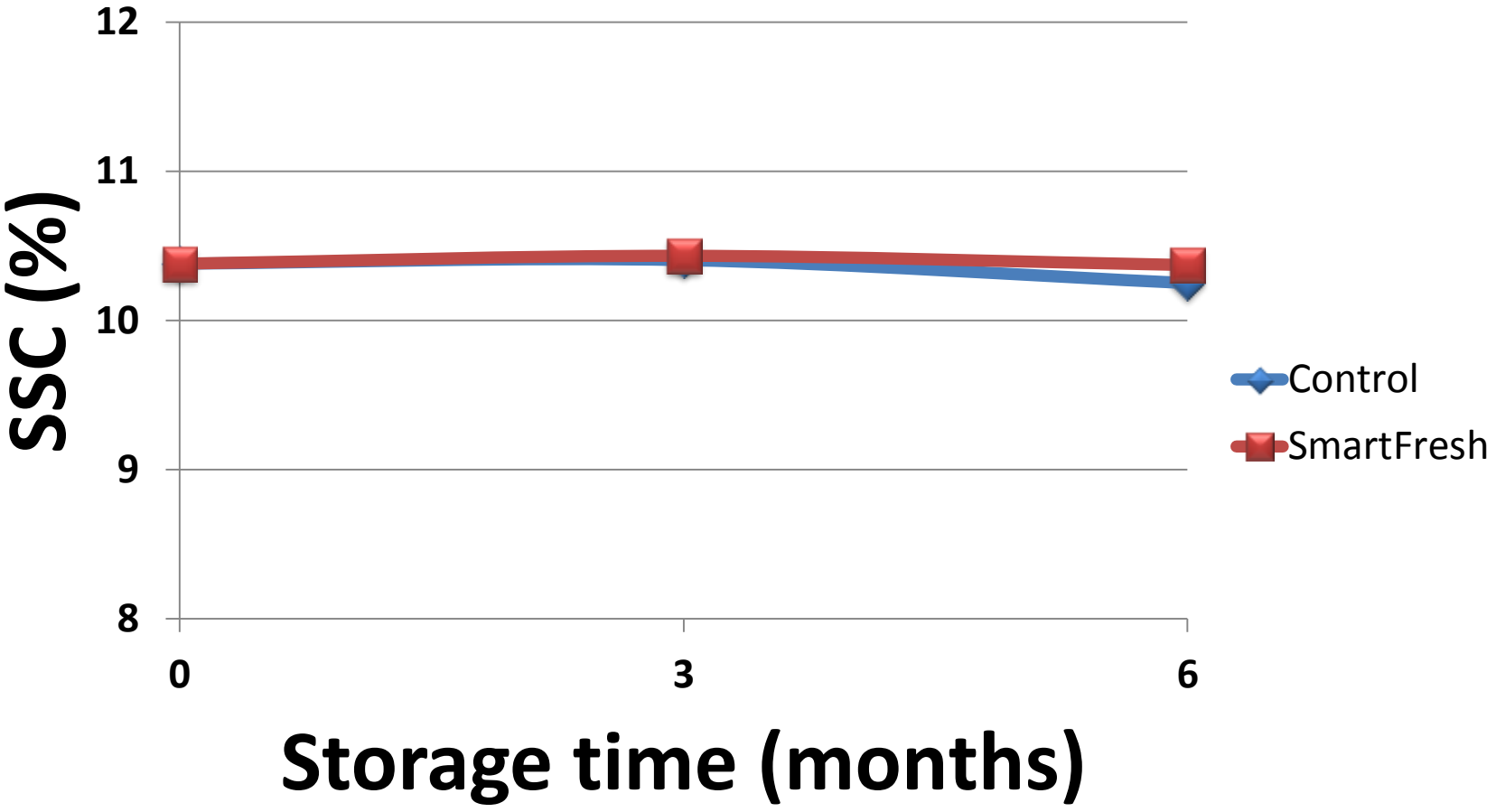
WNY: Firmness (lb-f) in air storage

Effect of SmartFresh



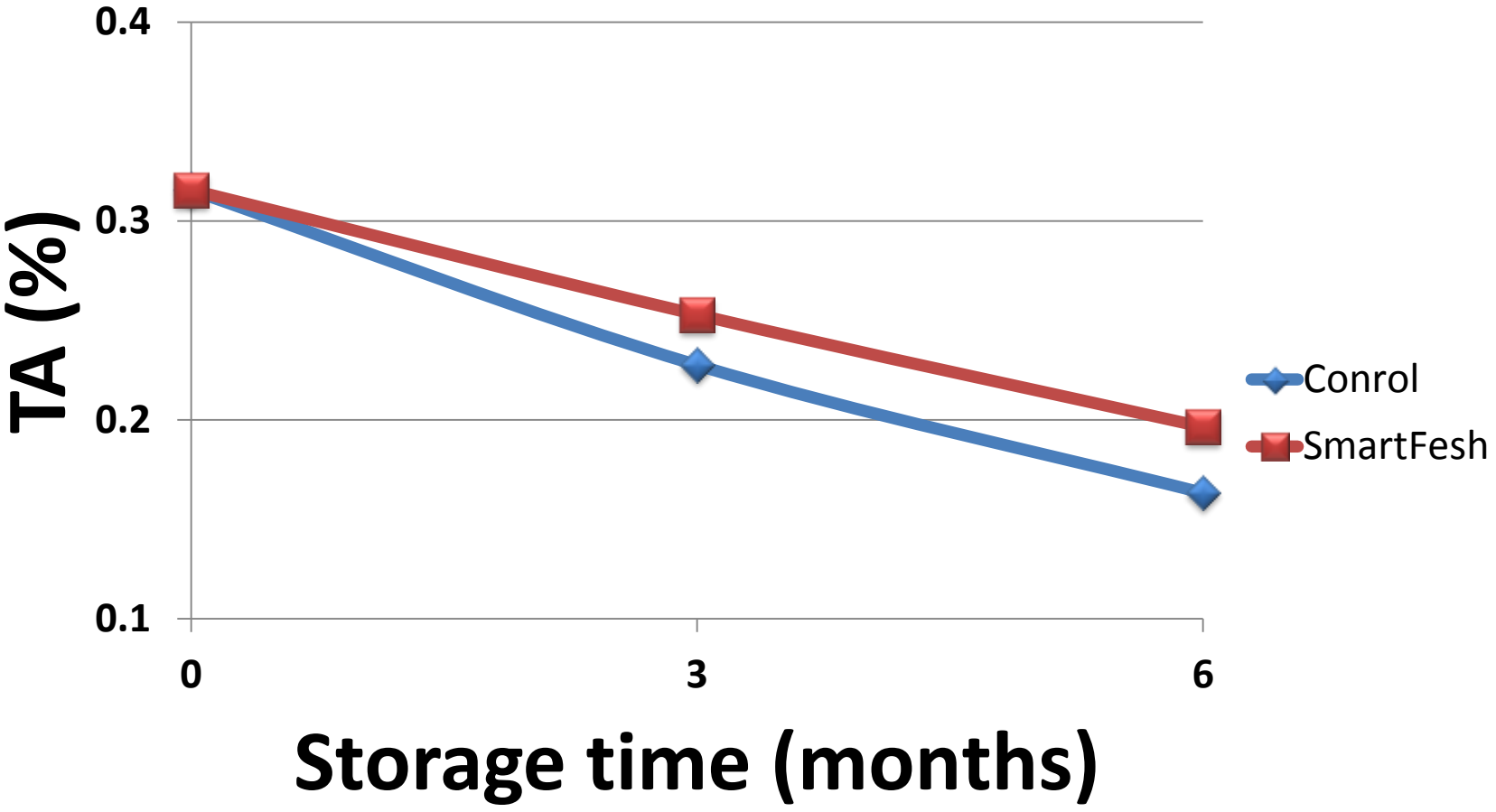
WNY: SSC (%) in air storage

Effect of SmartFresh



WNY: Acidity (%) in air storage

Effect of SmartFresh



Champlain summary: Air vs CA

	3 months		6 months	
	Air	CA	Air	CA
Firmness (lb-f)	15.9	16.0	15.5	15.5
SSC (%)	13.1	13.1	12.2	12.8***
TA (%)	0.305	0.310	0.248	0.297***

Champlain summary: Untrt vs SF (air)

	Untreated	SF	Untreated	SF
	3 mo	**3 mo**	**6 mo**	**6 mo**
Firmness (lb-f)	16.0	15.9	15.5	15.5
SSC (%)	13.0	13.2	**12.0**	**12.4***
TA (%)	0.291	0.318	**0.228**	**0.267*****

Champlain summary: Untrt vs SF (CA)

	Untreated	SmartFresh	Untreated	SmartFresh
	3 mo	3 mo	6 mo	6 mo
Firmness (lb-f)	16.0	16.0	15.6	15.5
SSC (%)	13.2	13.1	12.7	13.0
TA (%)	0.309	0.310	0.288	0.306

Summary

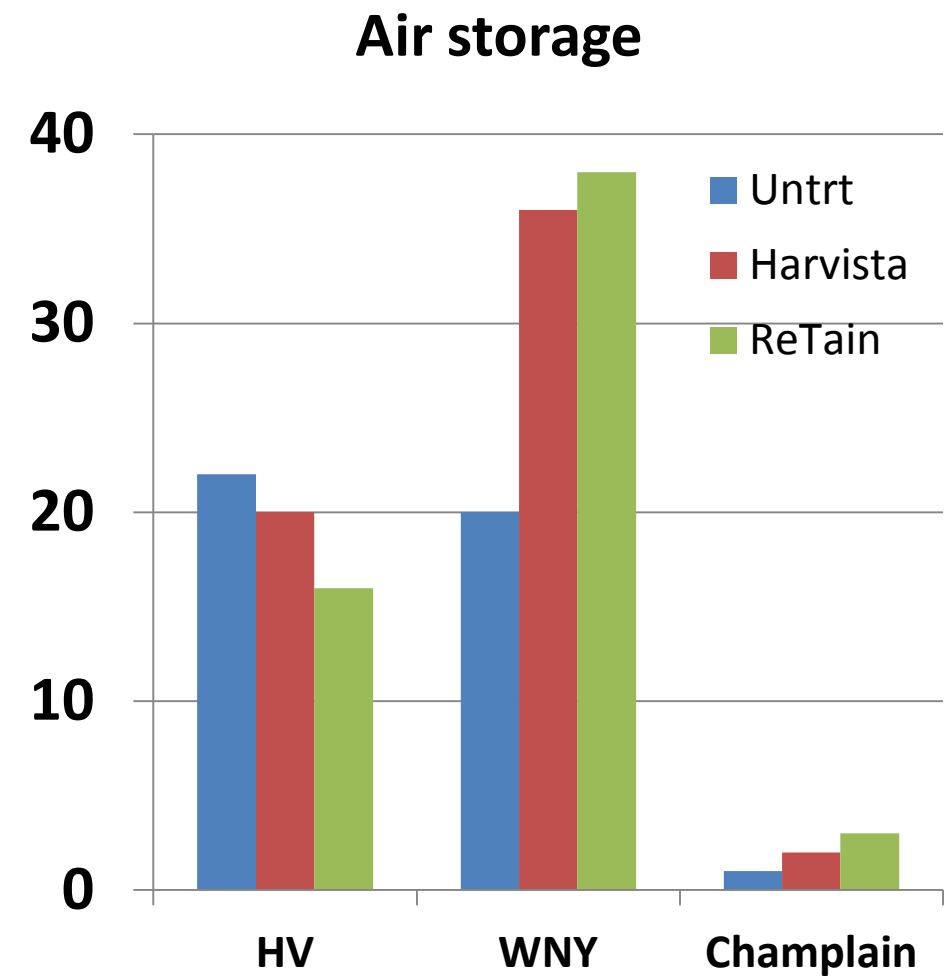
- Little consistent effect of preharvest treatments on firmness, SSC and acidity
- CA superior to air storage, especially acidity
- Air plus SmartFresh is roughly equivalent to CA storage
- Little effect of SmartFresh in CA

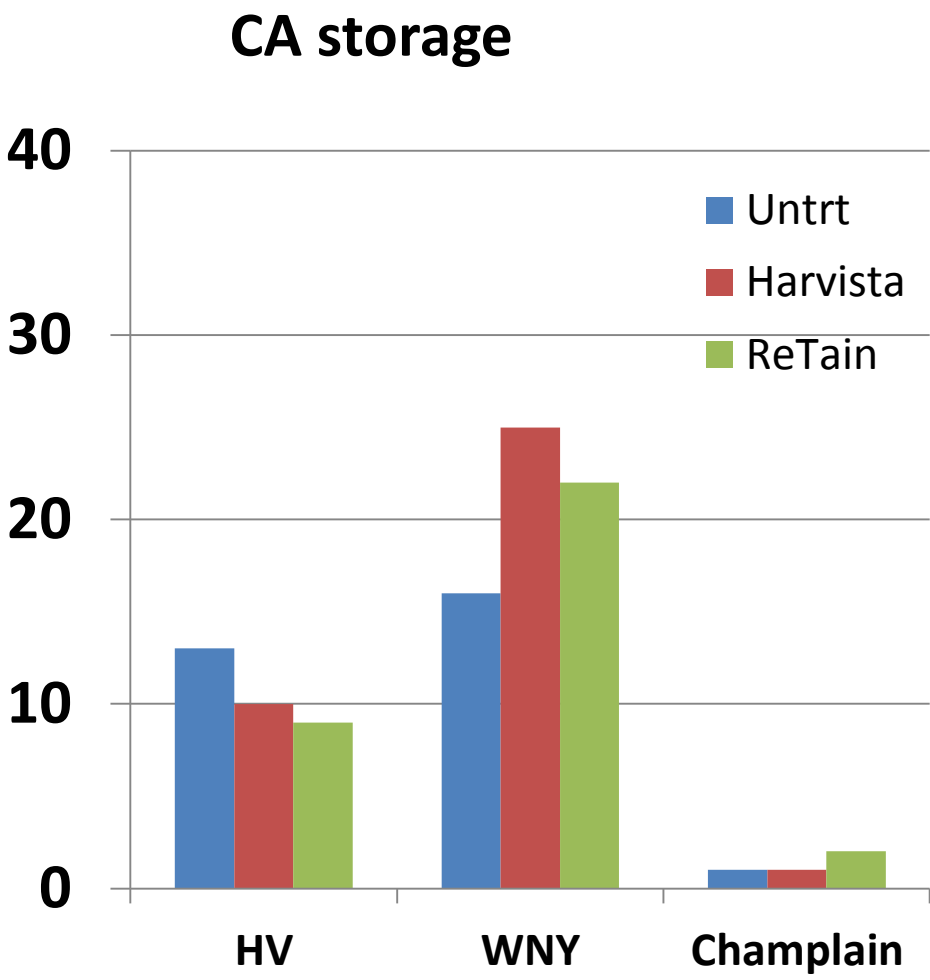
STORAGE

EFFECTS OF PREHARVEST TREATMENT AND STORAGE TYPE ON DISORDERS

Bitter pit

Effect of preharvest trt (storage removals combined)





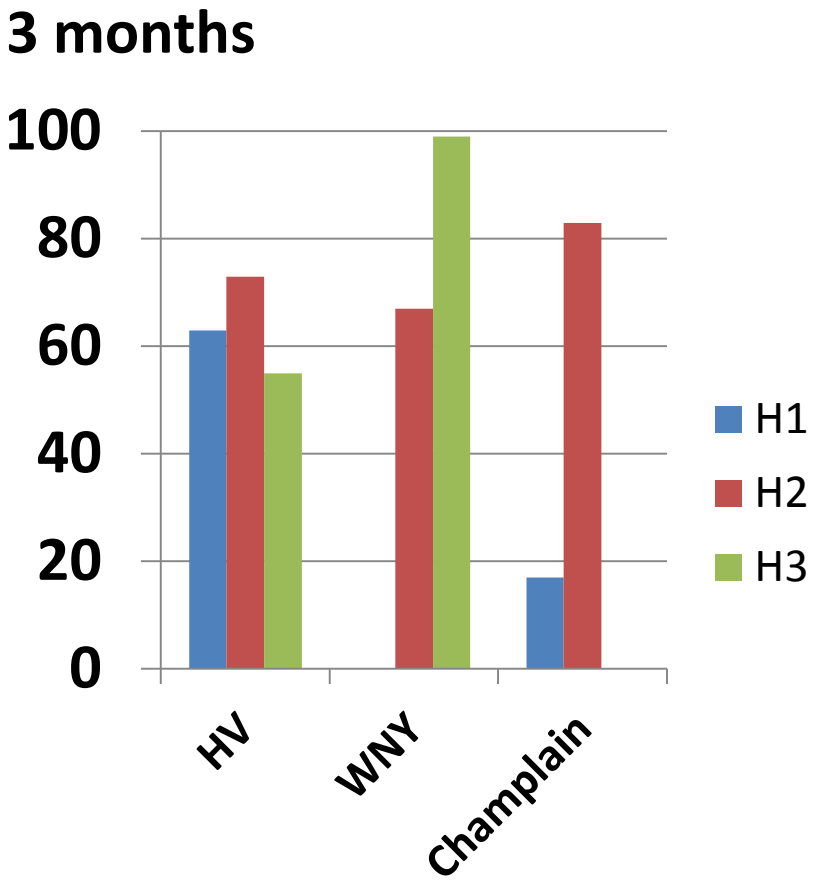
Soft scald (air)

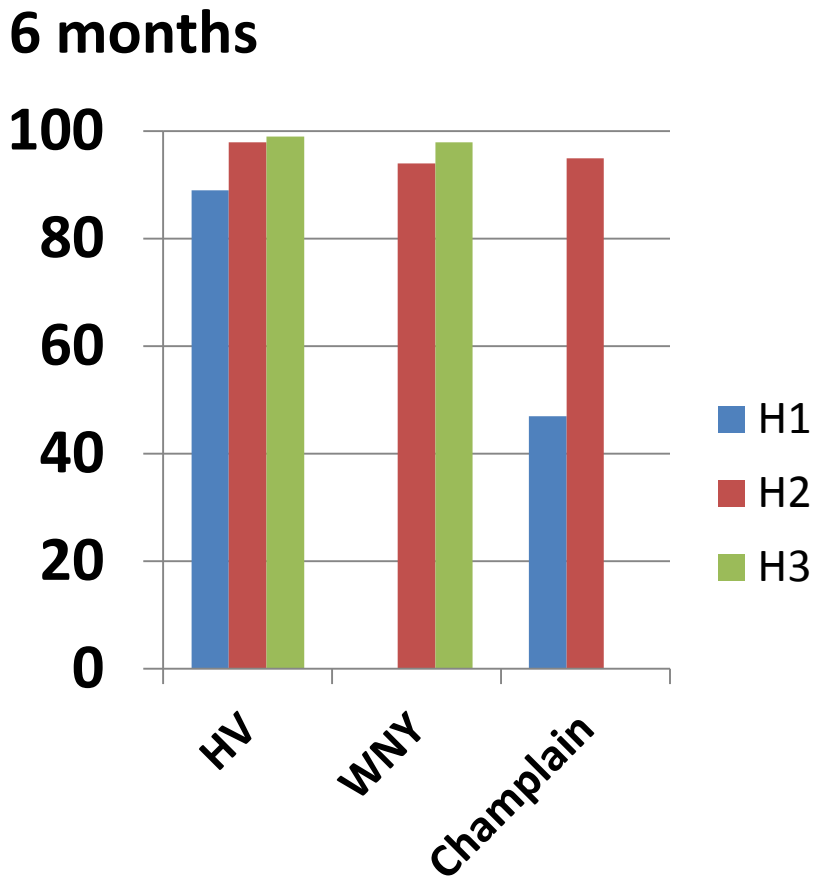
- Champlain: affected by harvest date only: 0% at H1, 12% at H2 (despite conditioning)

- HV and WNY: negligible (<1%)

Greasiness in air storage

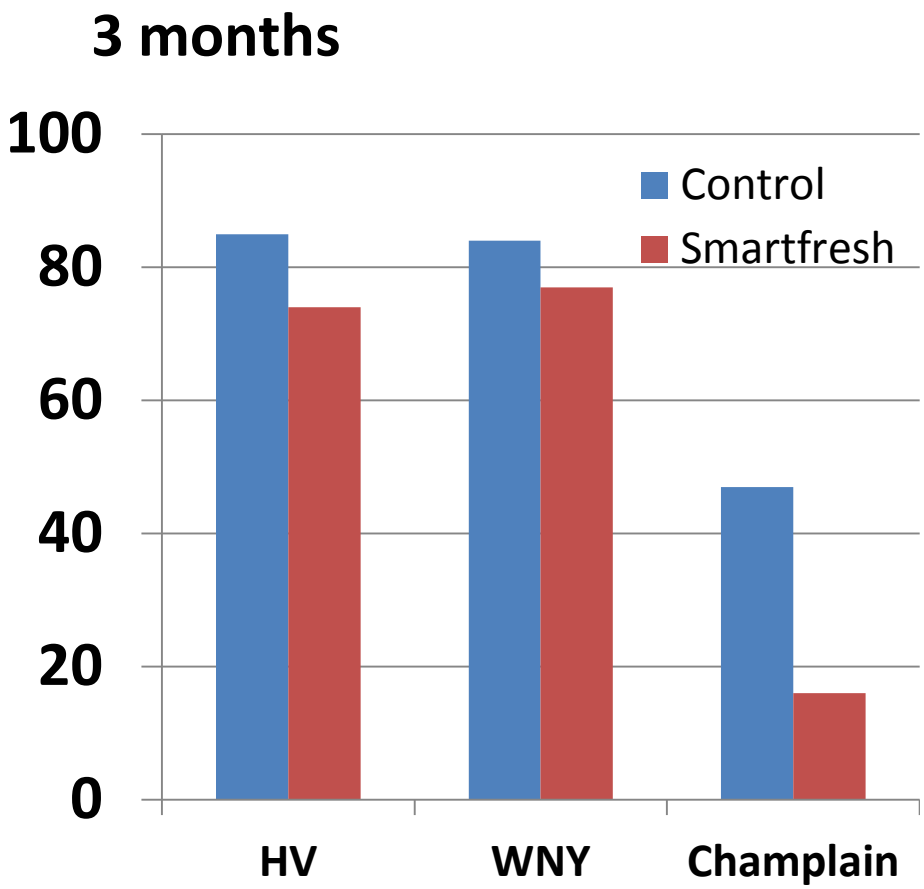
Effect of harvest date

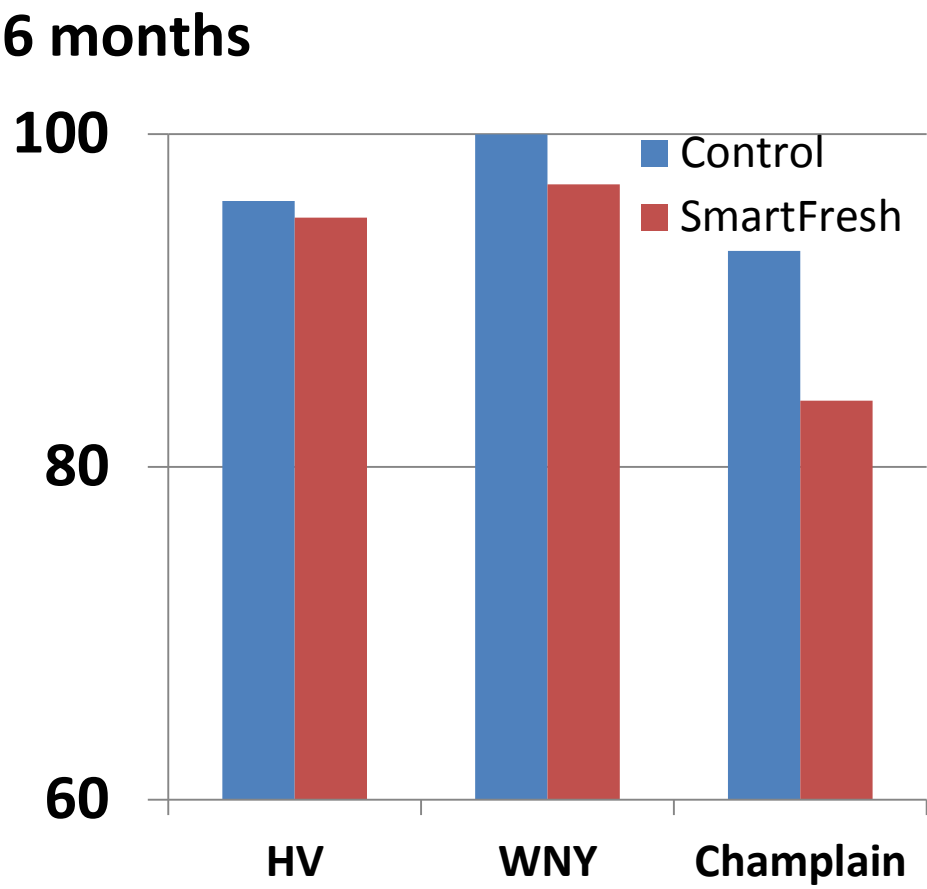




Greasiness in air storage

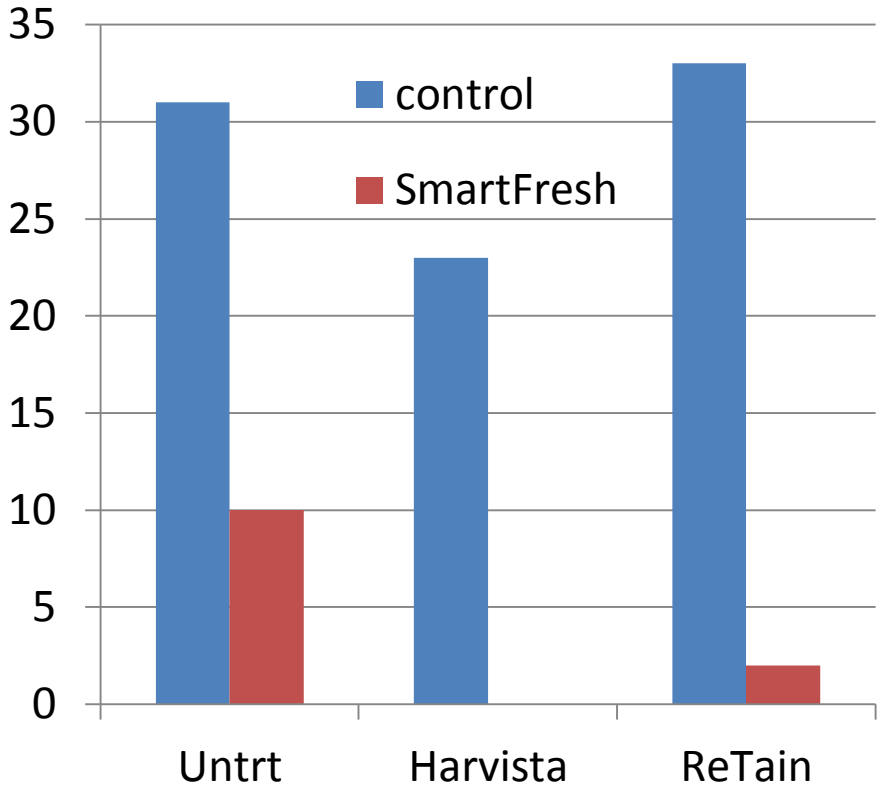
Effect of SmartFresh





Greasiness in air storage
Effect of preharvest treatment

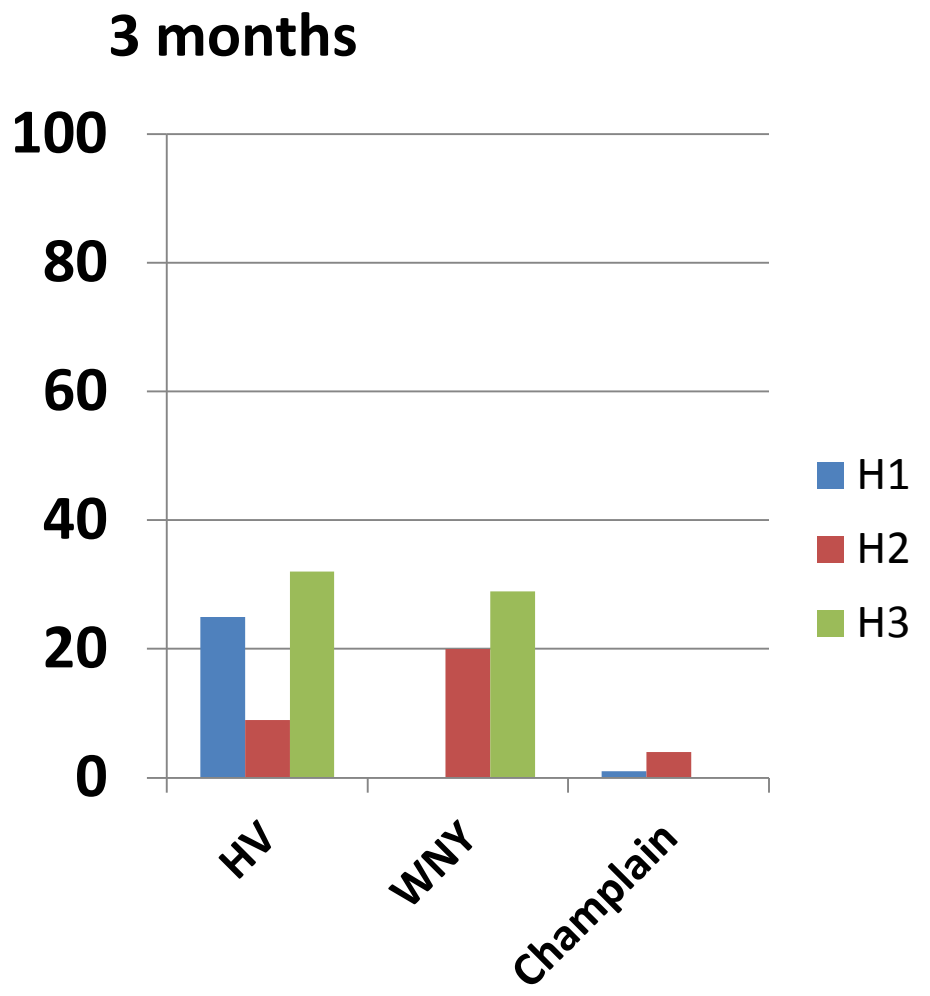
- Often significantly lower in Harvista and ReTain trts, but not commercially meaningful in timeframes tested
- Lower incidence resulted in best SF effect (Champlain, H1 and 3 months air storage)

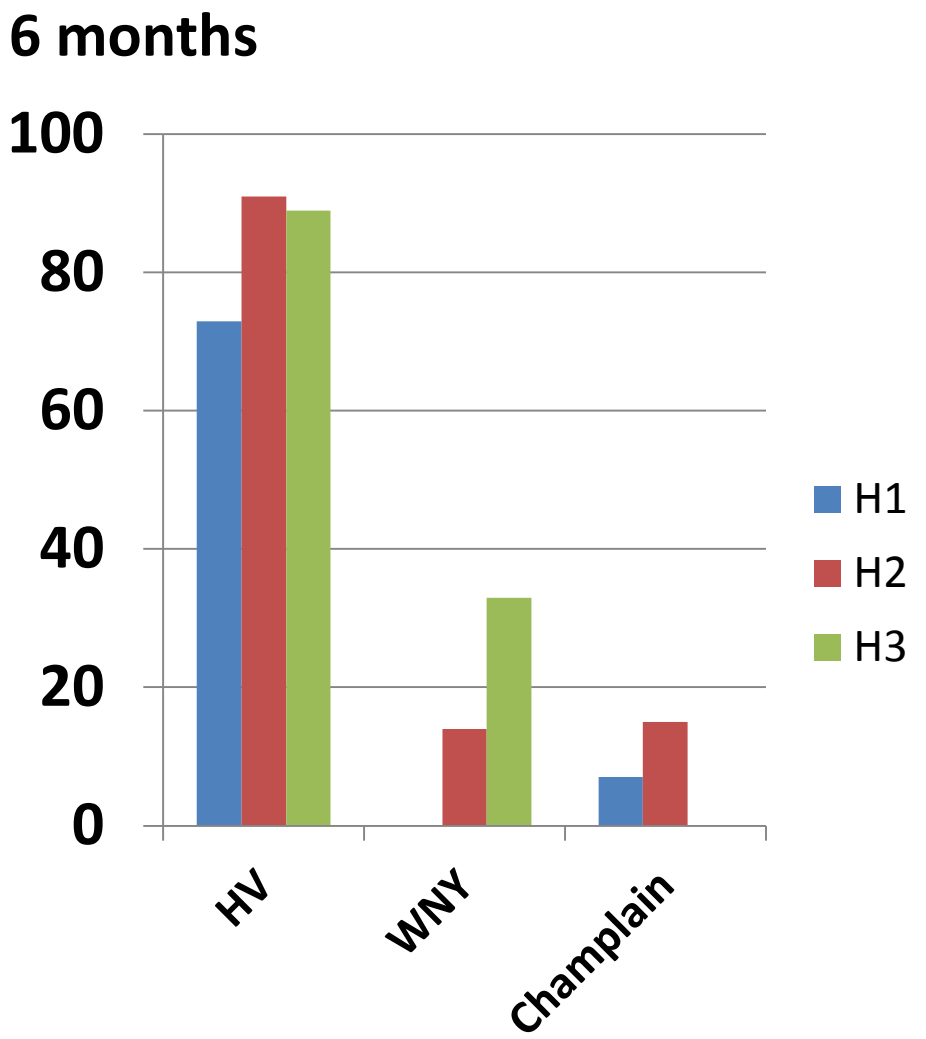


Champlain harvest 1; 3 months air storage

Greasiness in CA storage

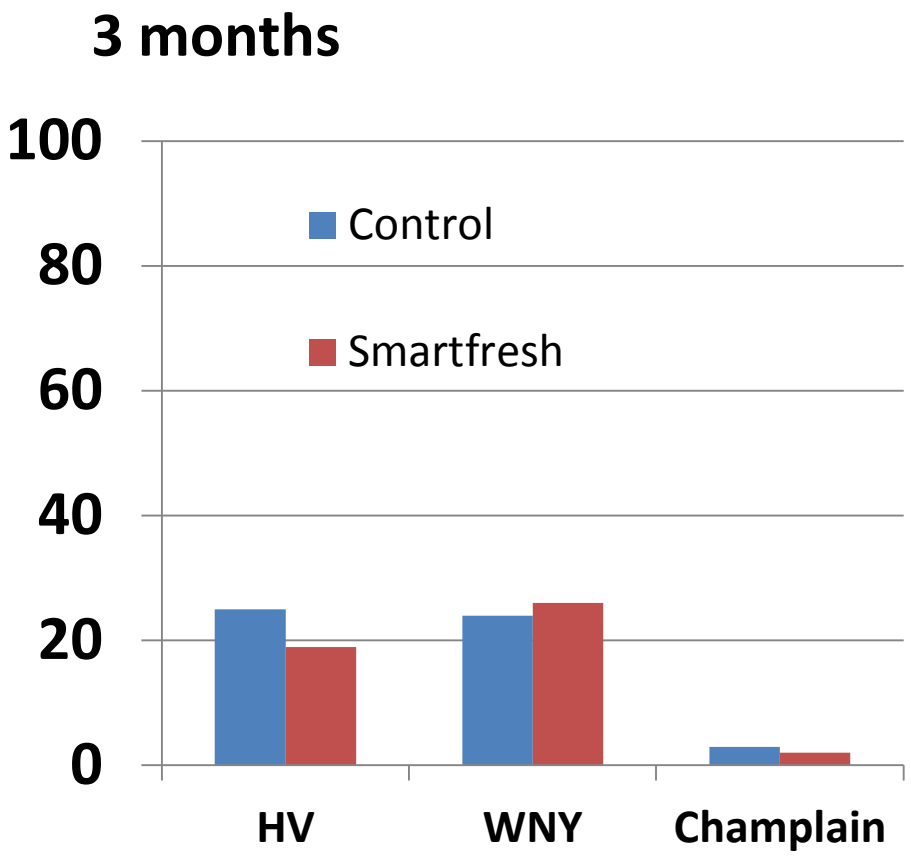
Effect of harvest date

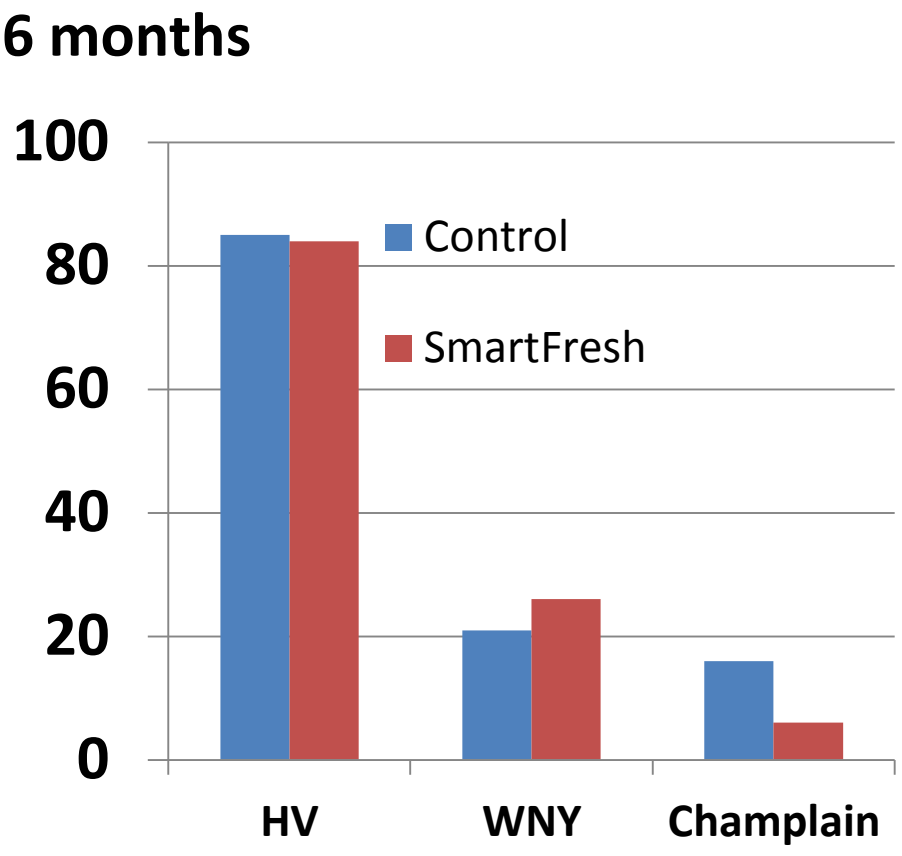




Greasiness in CA storage

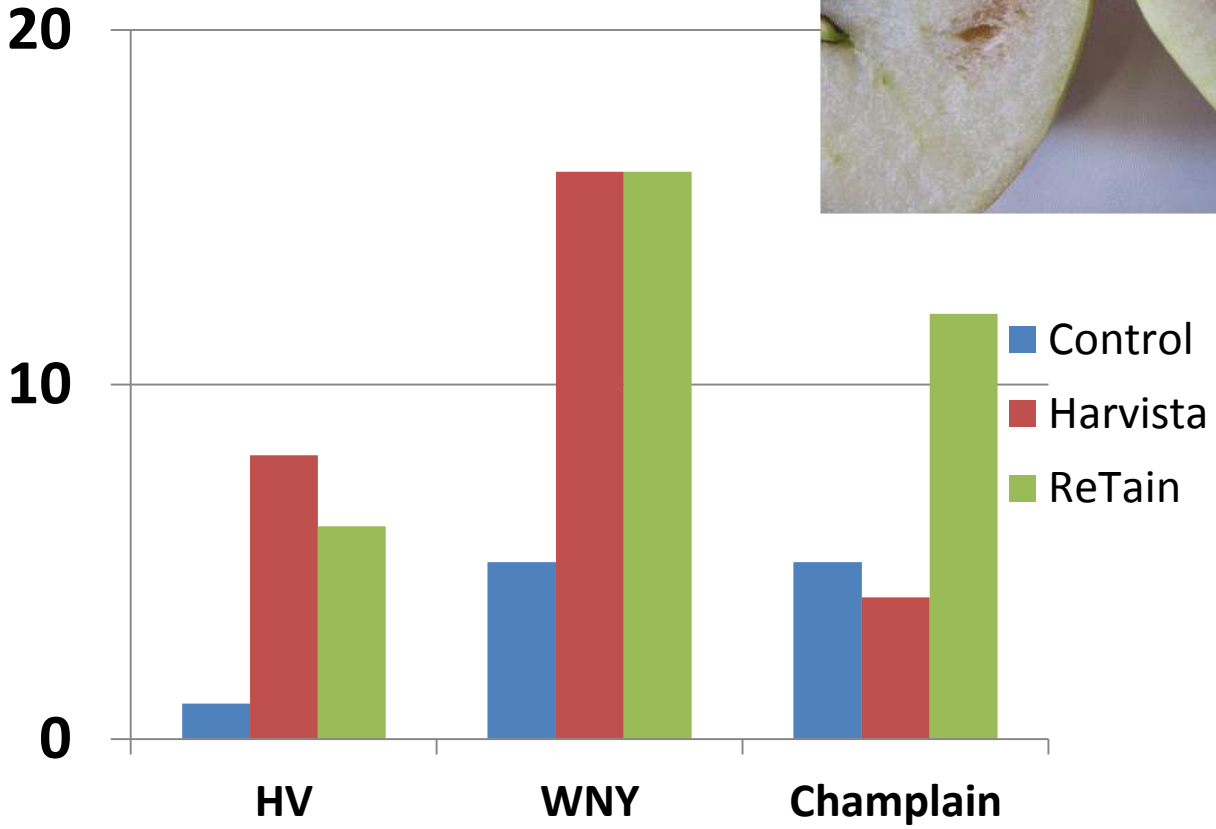
Effect of SmartFresh





Internal CO_2 injury (CA only)

Effect of preharvest trt



Conclusions

- Regional effects on HC storage quality are high, and marketing plans should reflect this reality
- More work is required on the effects of ReTain rates and timing, especially in southern regions
- SmartFresh recommended for longer term air storage – can help maintain higher SSC and TA , and reduce greasiness for short term storage
- CA can maintain TA, reduce pit and greasiness, but not recommended because of risk of carbon dioxide injury [Harvista and ReTain can aggravate].

The people and the funding

The people

- **Mike Fargione**
- **Ron Jones**
- **Randi Wintamute**
- **Liza White**

The growers

- **JD Fowler**
- **Jeff Crist**
- **Seth Forrence**

Visiting scholars and students

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- **Inkyu Kang**
- **Yifan Cheng**

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