



Harvista treatment effects on quality and storage disorders of Gala and Honeycrisp

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Focus of today's presentation

Harvista trials on Gala and Honeycrisp

• in 2017 on behalf of AgroFresh,

with additional Hatch and NYAR&D support





Treatments (applied commercially) Fowler Brothers Farm

- 1. No Harvista (control)
- 2. 60 g rate 2 weeks before harvest (std early)
- 3. 60 g rate 1 week before harvest (std late)
- 4. 60 g rate 1 & 2 weeks before harvest (repeat)
- 5. 120 g rate 1 week before harvest (double late)



Harvest and storage procedures

- Gala harvested twice, Honeycrisp harvested once
 - to commercial color standards
- Fruit untreated or treated with postharvest 1-MCP
- Storage conditions

Gala – air, CA and DCA (33°F) Honeycrisp – air (33°F and 38°F)



The caveats

- Single year of data, with no follow up differences among Harvista treatments may be real, but often inconsistent
- Gala Fulford strain, which is generally more susceptible to stem end flesh browning
- Honeycrisp only one harvest
- No data on ReTain
- Conclusions today do not consider other aspects of Harvista such as harvest management



Gala

- At harvest
- After storage for 6 months plus 7 days at 68°F
 - Quality
 - Storage disorders





At harvest maturity (combined harvest 1 and harvest 2)

	Firmness (lb-f)	SSC (%)	TA (%)	SPI	IAD Index
Control	16.2 b	11.0	0.42	5.5 a	0.34 d
std early	17.4 a	10.5	0.45	3.8 b	0.60 ab
std late	16.7 ab	10.8	0.44	4.8 ab	0.46 c
repeat	17.1 ab	10.2	0.42	3.6 b	0.70 a
double late	16.7 ab	10.9	0.44	4.3 ab	0.53 bc



Storage results

Fruit quality: flesh firmness



- Harvista treatments maintained the highest flesh firmness.
- No effect of 1-MCP.

Fruit quality: titratable acidity



- Standard late and double rate of Harvista maintained the highest TA.
- No effect of 1-MCP

Fruit quality: DA meter reading higher number = greener fruit



- Standard early, repeated, and double treatments have the highest I_{AD} index.
- No effect of 1-MCP.

Gala: Stem-end flesh browning

- First appears as minor flesh browning on the shoulder but can affect the whole fruit over time.
- May not be noticeable to consumers but the fresh cut industry has zero tolerance.
- Found in various areas some growers in New York State and Washington State; Brazil; Italy; Ontario, Canada; possibly elsewhere.
- Appears to be an increasing problem as higher fruit volumes are stored, possibly resulting from longer storage periods.
- Orchard block factors are variable possibly a strain effect.





Disorders: Stem end flesh browning



- Standard early and repeated delayed the SEFB.
- No effect of the 1-MCP.



Disorders: Core browning





- Standard early, repeated, and doubled decreased core browning.
- 1-MCP increased core browning.

Disorders: Greasiness



- Standard early and repeated delayed greasiness.
- 1-MCP reduced greasiness.



A quick detour

Dynamic Controlled Atmosphere storage







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Fruit quality: DA meter reading higher number = greener fruit

'DCA'

CA

IAD index- CA IAD index- DCA 0.6 0.6 0.5 0.5 IAD index 0.4 AD index 0.4 CA 0.3 0.3 0.2 0.2 0.1 0.1 0 0 1-MCP 1-MCP 1-MCP no 1-MCP 1-MCP no 1-MCP 1-MCI no 1-MCP no 1-MCP no 1-MCP no 1-MCP 1-MCP no 1-MCP 1-MCP no 1-MCP 1-MCP no 1-MCP Contro Standard early Standard late Repeated Double Control Standard early Standard late



DCA

1-MCP

Repeated

no 1-MCP

1-MCP

Double

Disorders: Stem end flesh browning

CA

'DCA'





Disorders: Core browning

CA

Core browning- DCA Core browning- CA 70 70 60 60 Core browning (%) Core browning (%) 50 50 40 40 CA 30 30 20 20 10 10 0 no 1-MCP 1-MCP no 1-MCP 1-MCP no 1-MCE 1 MCD no 1-MCP MCP no 1 0 1-MCP no 1-MCP no 1-MCP no 1-MCP 1-MCP no 1-MCP 1-MCP no 1-MCP 1-MCP 1-MCP Control Standard early Standard late Double Repeated Control Standard early Standard late Repeated Double

'DCA'



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Disorders: Greasiness

CA

'DCA'





Gala Storage Summary

Harvista alone

- Slight benefit on firmness, acidity and greenness, but effects of timing and rate varied by factor
- Decreased stem end flesh browning, core browning and greasiness
- 1-MCP alone and in combination with Harvista
- Little effect on storage factors
- Increased core browning



Honeycrisp

- At harvest
- After storage for 20 weeks plus 4 days at 68°F
 - Quality
 - Storage disorders





At harvest maturity

		Firmness (lb-				
	IEC (ppm)	f)	SSC (%)	TA (%)	SPI	l _{AD} index
Control	19.9 a	13.8	11.6	0.44	7.8 a	0.27 b
Standard						
early	6.7 b	14.5	11.9	0.44	7.0 ab	0.41 ab
Standard lata						
Stanuaru late	4.1 b	14.5	11.8	0.5	7.1 ab	0.46 ab
Repeated	2.5 b	14.2	11.3	0.46	6.5 b	0.62 a
Double	4.1 b	14.5	11.8	0.47	6.7 b	0.44 ab



After storage

Quality

- Flesh firmness
- Soluble solids content (SSC)
- Titratable acidity (TA)
- DA meter reading

Physiological disorders

- Bitter pit
- Leather blotch
- Soft scald
- Soggy breakdown
- Air pockets
- Skin wrinkling
- Core browning
- Greasiness

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Fruit quality: flesh firmness



- Highest firmness in Harvista treated fruit with little difference between treatments
- No effect of 1-MCP

Fruit quality: SSC



- No differences between treatments
- No effect of 1-MCP

Fruit quality: TA



- Interactions but lowest in control and early treatment
- Highest with 1-MCP

Fruit quality: DA meter reading higher number = greener fruit



- Greener fruit in repeated and double rate applications
- Inconsistent effects of 1-MCP

(note - overall effects of quality lower at 38F than at 33F, probably because of diminished effects of 1-MCP)

Disorders – only 38F data shown today data for disorders reinforce that this is NOT a 33F apple! **Control – No 1-MCP**

	Bitter pit (%)	Soft scald (%)	Flesh browning (%)	Senescent breakdown (%)	Wrinkly skin (%)	Leather blotch (%)	Air pockets (%)	Core browning (%)	Vascular browning (%)	Greasiness (%)
33°F	1.8	17	0	12	16	0.9	0.1	1	5	99
38°F	16	0	0.3	22	14	0.3	1	0	0	100

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Control only – 1-MCP effects at 38F

	Bitter pit (%)	Soft scald (%)	Flesh browning (%)	Senescent breakdown (%)	Wrinkly skin (%)	Leather blotch (%)	Air pockets (%)	Core browning (%)	Vascular browning (%)	Greasiness (%)
No 1-MCP	16	0	0.3	22	14	0.3	1	0	0	100
1-MCP	8	0.3	0.7	12	9	6	0.3	8	0	100

Disorders: Bitter pit

- Harvista increases incidence of bitter pit
- 1-MCP usually decreases it slightly

Disorders: Leather blotch

- Harvista effects inconsistent
- 1-MCP aggravates in control fruit but to a large extent in Harvista treated fruit

Disorders: Soft scald

• Negligible incidence (38F)

Disorders: Soft scald -an exception to our 38F data only rule

• At 33F, soft scald is greatly decreased by Harvista

Disorders: Flesh browning

• No effect of Harvista or 1-MCP (note negligible)

Disorders: internal carbon dioxide injury

• No significant effect of either Harvista or 1-MCP

Disorders: skin wrinkling

• Generally lower in Harvista treated fruit

Disorders: core browning

• No disorder in fruit without 1-MCP

Disorders: senescent breakdown

• Lower in Harvista treated fruit, and in 1-MCP-treated control fruit

Disorders: greasiness

• No effect of Harvista and decreased incidence with 1-MCP in standard early, repeated and double rate.

Honeycrisp Story Summary

Harvista alone

- Slight benefit on firmness, and greener fruit with repeated and double rates
- Increased fruit susceptibility to bitter pit

1-MCP alone

- Maintained higher acidity
- Decreased bitter pit, senescent breakdown
- Increased leather blotch and core browning

Combination

• Overall, increased susceptibility of fruit to flesh browning and carbon dioxide injury, but generally little interaction

Extreme caution when using 1-MCP, especially in Harvista treated fruit

The overall take-home messages

PGRs are a valuable part of your tool kit to produce high quality fruit and manage harvest.

But can have profound effects on storability of fruit, especially storage disorders both positive and negative.

Full understanding is still lacking but most important for you is informing your storage operator.

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