Effects of calcium sprays and AVG on fruit quality at harvest and after storage

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Making a Difference for California

Background
Calcium

- Many physiological disorders in fruits are associated with Ca deficiency
- Ca foliar sprays have been shown to reduce fruit diseases and physiological disorders in apples
- Fruits with a high level of Ca have lower respiration rate and longer potential storage life than fruits containing low Ca

Ca Problem in Delta Orchards

- OK by UC guidelines (decades old, unknown criteria), but longer storage sometimes needed
- 2009 – $1M fruit bad (Argentina dumping)
- Growers use 200 lbs. $CaNO_3$ May & June in part to add Ca, thought to improve quality
- Many growers include Ca in blight sprays
- There appears to be a rate effect

Background
ReTain

- Ethylene biosynthesis inhibitor
- May enhance fruit color and size by allowing fruit to remain on the trees longer, extending harvest
- More consistent effects on apple than pear
- May extend pear storage life

Ca and ReTain Cost

- Vigor-Cal = $22/gal., Agro-K 9-24-3 = $16 gal.
- 2 qts./acre each → $19/application
- 4 tank-mixed applications = $76 total, no application cost

- ReTain applied at 11.7 oz./acre (1 bag) = $265
- Could be tank mixed with NAA, but timing might not be ideal

Objectives

1. Evaluate effects of foliar Ca sprays and ReTain on Bartlett fruit size and quality

2. Compare effects on postharvest fruit quality after storage and ripening

Experimental Protocol
2014

- Bartlett orchard on Merritt Island
- Some black end present
- Randomized complete block design
- 6 treatments, 9 single-tree replicates
- Trees separated by guard tree and full row
- 100 gal./acre, mist blower backpack sprayer

Treatments
2014

	Treatment	Rate/Acre	Application Dates
1	Vigor-Cal + 9-24-3	4 qts. each	3/19, 3/24, 4/2, 4/8, 4/15, 4/22, 5/13, 6/3
2	ReTain + NuFilm 17	11.7 oz.	6/26
3	# 1 and #2		
4	Ca chloride ($CaCl_2$)	1.8 lbs.	4/29, 5/13, 5/20
5	Soluble gypsum	8 lbs.	4/2, 4/8, 4/15, 4/22, 4/29, 5/13, 6/3
6	Untreated	--	--

Vigorous Black End Tree

Nutrients in Leaves

July 2014

Treatment	% N	% P	% K	% Ca
Vigor-Cal + 9-24-3	1.77	0.24	1.51	1.23
ReTain	1.88	0.25	1.62	1.32
#1 + #2	1.85	0.24	1.66	1.27
$CaCl_2$	1.93	0.24	1.66	1.54
Gypsum	1.94	0.24	1.52	1.30
Untreated	1.88	0.29	1.76	1.30
Black end trees	2.05	0.19	1.46	1.30

Nutrients in Fruit (Wedges)

July 2014

Treatment	% N	% P	% K	% Ca	% Mg
Vigor-Cal + 9-24-3	0.20	0.068	0.69	0.031	0.040
ReTain	0.23	0.073	0.75	0.033	0.041
#1 + #2	0.23	0.074	0.77	0.032	0.043
$CaCl_2$	0.22	0.072	0.76	0.033	0.042
Gypsum	0.22	0.073	0.73	0.028	0.039
Untreated	0.25	0.080	0.79	0.035	0.044
Black end trees	0.37	0.090	0.90	0.042	0.053

Evaluation of 1st Pick Fruit
At Harvest

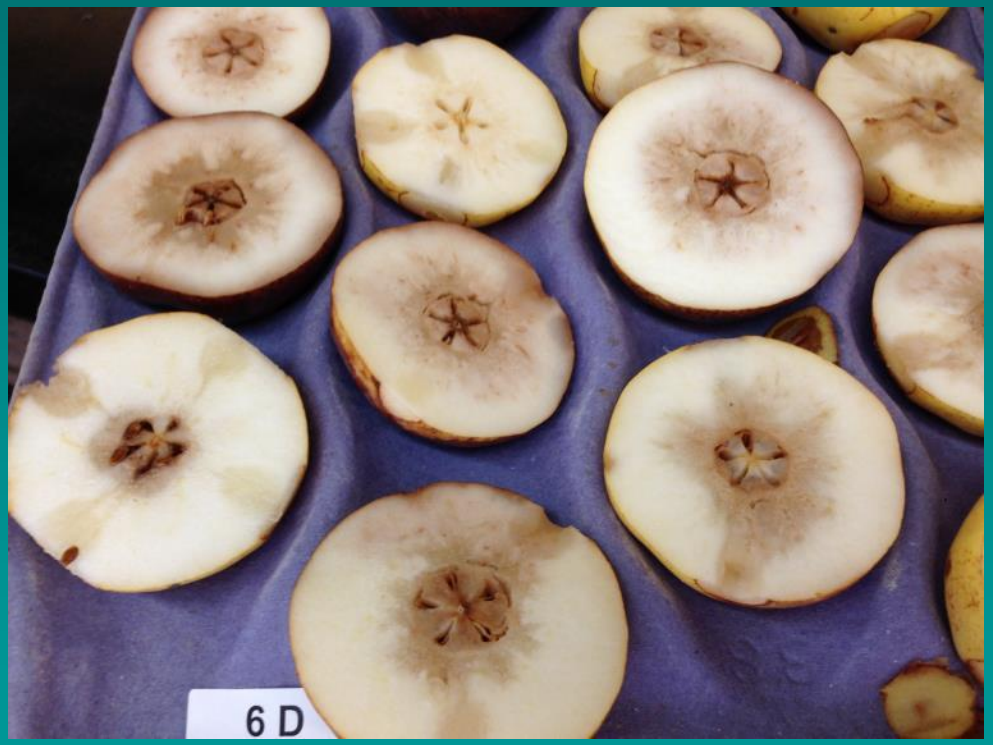
- Fruit quality evaluations at 1st or 2nd pick (both picked to 2¾”)
  - » Few or no differences in fruit weight, firmness, soluble solids, or color

Storage Disorders

Superficial scald

Senescent scald

Internal breakdown



Evaluation of 2nd Pick Fruit

3.5 months, no ripening

Treatment	Firmness (psi)		Color Rating (a*[C])		% of Fruit with Scald	
Vigor-Cal + 9-24-3	13.5	a	-8.46	ab	0.0	b
ReTain	13.8	a	-9.32	a	0.0	b
#1 + #2	13.7	a	-8.91	a	0.0	b
$CaCl_2$	14.3	a	-7.28	bc	0.0	b
Gypsum	11.6	b	-6.56	c	35.8	a
Untreated	9.7	c	-5.20	d	28.6	a

The more negative the color rating, the greener the fruit
The less negative the color rating, the yellower the fruit

Evaluation of 2nd Pick Fruit

3.5 months + ripening

Treatment	Firmness (psi)		% of Fruit w/ Scald		IB Score	
Vigor-Cal + 9-24-3	2.19	b	10.8	b	0.0	b
ReTain	2.32	b	7.8	b	0.0	b
#1 + #2	2.07	b	10.1	b	0.0	b
$CaCl_2$	2.13	b	4.8	b	0.0	b
Gypsum	3.29	a	61.0	a	0.60	a
Untreated	3.70	a	47.0	a	0.98	a

Selected Replicates

3.5 months, no ripening

CaCl2, rep 1

Gypsum, rep 6

Gypsum, rep 1

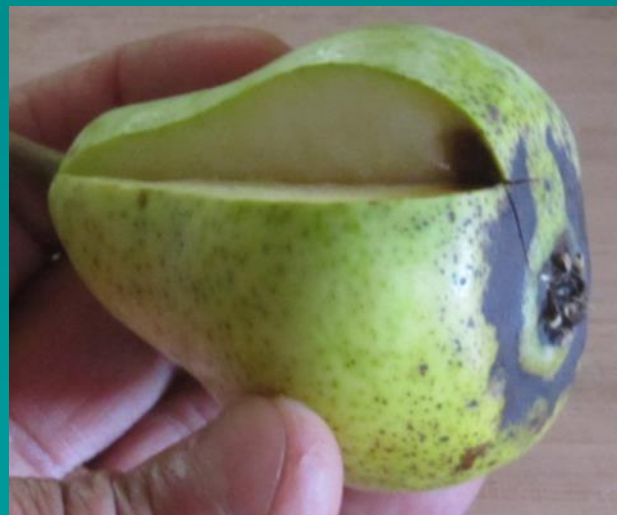
Untreated, rep 6

Black End Spray Trial
VLS Home Orchard, Twin Cities Rd.

- Rosired trees with black end (B.E.)
  - » 9 trees sprayed with $CaCl_2$
  - » 9 trees untreated
- 2 lbs./acre in 100 gal./acre water
  - » Backpack mist sprayer
- 5 sprays applied 4/29, 5/7, 5/13, 5/20, 6/3
- Preharvest evaluation:
  - » Sprayed trees: Avg.15 B.E./50 fruit (30%)
  - » Unsprayed trees: Avg. 17 B.E./50 fruit (34%)

Black End Sampling
VLS Home Orchard, Twin Cities Rd.

- 2 trees each of Rosired and Red Sensation with and without black end
  - » Good fruit from one side of orchard (near levee)
  - » Bad fruit from other side (away from levee)
- Sampled 50 leaves & 10 fruit each analyzed for nutrient content
- Soil samples taken from under each tree



Soil Nutrients (0-12″)

Good trees and black end (B.E.) trees

	NO3-N	Olsen-P	X[1]-K	X-Ca	X-Mg	CEC	OM
Variety	(ppm)		(meq/100g)				
Rosired (good)	10.7	27.3	0.56	16.5	9.2	26.6	3.4
Rosired (B.E.)	6.2	44.5	0.69	21.0	13.9	36.2	4.8
R. Sens. (good)	5.2	22.3	0.64	13.5	8.5	22.9	3.1
R. Sens. (B.E.)	7.5	38.1	0.70	22.2	12.6	35.9	4.6

Nutrient Analyses of Good and Black End (B.E.)

Leaves and Fruit

	N	P	K	Ca	Mg
Variety	(%)				
	Leaves				
Rosired (good)	2.40	0.146	0.79	1.12	0.358
Rosired (B.E.)	2.32	0.179	1.12	1.51	0.363
R. Sens. (good)	2.25	0.140	1.15	1.57	0.372
R. Sens. (B.E.)	2.26	0.158	0.95	1.59	0.323
	Fruit				
Rosired (good)	0.36	0.058	0.59	0.028	0.035
Rosired (B.E.)	0.54	0.094	0.83	0.045	0.050
R. Sens. (good)	0.41	0.065	0.71	0.031	0.038
R. Sens. (B.E.)	0.52	0.088	0.81	0.042	0.047

Conclusions

- Little effect of sprays on fruit quality at harvest
- Little effect of sprays on leaf or fruit nutrients
  - » $CaCl_2$ increased leaf Ca but not fruit Ca
- Most Ca sprays improved long-term storage
  - » Gypsum did not
- Black end trees at Merritt Island more vigorous
  - » Trees at both sites had higher leaf nutrient values
- $CaCl_2$ did not reduce black end

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