

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

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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
- Fruits with a high level of Ca have lower respiration rate and longer potential storage life than fruits containing low Ca

Background Calcium

- The easiest way to maximize fruit calcium level is through a foliar spray
- Fruit Ca content shown to significantly increase by foliar Ca sprays (mostly CaCl_2)

Ca and Mg in Soil

Out of Balance in Delta Orchards

PEAR SOIL ANALYSIS

Test Description	Result	Units	Optimum Range	Graphical Results Presentation					
				Very Low	Moderately Low	Optimum	Moderately High	Very High	
Primary Nutrients									
Nitrate-Nitrogen	9.5	PPM	20 - 30						
Ammonium Nitrogen	3	PPM	10 - 20						
Phosphorus-P ₂ O ₅	45.8	PPM	39 - 73						
Potassium-K ₂ O (Exch)	277	PPM	100 - 600						
Potassium-K ₂ O (Sol)	13.3	PPM	37 - 130			6%			
Secondary Nutrients									
Calcium (Exch)	2670	PPM	2600 - 3400						
Calcium (Sol)	36	PPM	74 - 210			40%			
Magnesium (Exch)	891	PPM	260 - 520						
Magnesium (Sol)	21.5	PPM	34 - 76			29%			
Sodium (Exch)	40	PPM	0.0 - 250						
Sodium (Sol)	16	PPM	0.0 - 190			16%			
Sulfate	63.4	PPM	62 - 990						
CEC	21.4	meq/100g	14 - 35						
% Base Saturation									
CEC - Calcium	62.1	%	60 - 80						
CEC - Magnesium	34.3	%	10 - 20						
CEC - Potassium	2.71	%	1.0 - 6.0						
CEC - Sodium	0.780	%	0.0 - 5.0						
CEC - Hydrogen	0.00	%	0.0 - 3.0						

Good Problem Indicates physical conditions and/or phenological and amendment requirements.

Ca and Mg in Leaves

Ca Levels are a Bit Low

PEAR PLANT TISSUE ANALYSIS - HARVEST

Test Description	Result	Units	Optimum Range	Graphical Results Presentation				
				Deficient	Low	Ample	High	Excessive
Macro Nutrients								
Total Nitrogen (Leaf)	2.50	%	2.3 - 2.8					
Phosphorus (Leaf)	0.14	%	0.060 - 0.80					
Potassium (Leaf)	1.11	%	1.0 - 14					
Calcium (Leaf)	1.95	%	1.0 - 8.0					
Magnesium (Leaf)	0.41	%	0.25 - 2.0					
Micro Nutrients								
Zinc (Leaf)	28.2	ppm	18 - 250					
Manganese (Leaf)	23	ppm	20 - 250					
Iron (Leaf)	61	ppm	59 - 250					
Copper (Leaf)	36	ppm	4.0 - 25					
Boron (Leaf)	27.8	ppm	21 - 70					
Sodium (Leaf)	0.009	%	0.0 - 0.25					

Good Problem Indicates physical conditions and/or phenological and amendment requirements.

Note: Some data may have been used to provide you with 'AT A GLANCE' interpretations.

Ca Problem in Delta Orchards

- OK by UC guidelines (decades old, unknown criteria), but longer storage sometimes needed
- 2009 – high fruit loss (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 may be a rate effect

Background

ReTain – aminoethoxyvinylglycine (AVG)

- Ethylene biosynthesis inhibitor, derived by fermenting a naturally occurring antibiotic (rhizobitoxine)
- May enhance fruit color and size by allowing fruit to remain on the trees longer, extending harvest
- More consistent effects on apple than pear

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

Treatments

RCBD, 5 treatments, 8 single-tree reps

1. Vigor-Cal + 9-24-3 (2 qts./acre each)
2. Vigor-Cal + 9-24-3 (4 qts./acre each)
 - 4 weekly applications starting late March
3. ReTain (1 bag/acre)
 - 1 application 2 weeks before harvest
 - Applied 6/26, harvest 7/9 (13 days later)
4. Both #2 and #3
5. Untreated

Evaluations

Leaf Nutrient Content

- 10 leaves/tree (80 total), 4-7' high from around tree
- Swished in soap water, double rinse
- Analyzed for N, P, K, Ca

Evaluations

First Harvest

- Sampled 40 high, 40 low fruit per tree (1³/₄")
- Evaluations at Mitcham lab:
- Fruit weights
- Color, firmness, starch, SS, TA
 - » 10 fruit/rep immediately and after ripening
 - » Cool 60 fruit/rep, evaluate color, firmness, and scald/internal browning (none):
 - » 15 fruit/rep after 1.5 and 3.5 months, with and without ripening

Evaluations

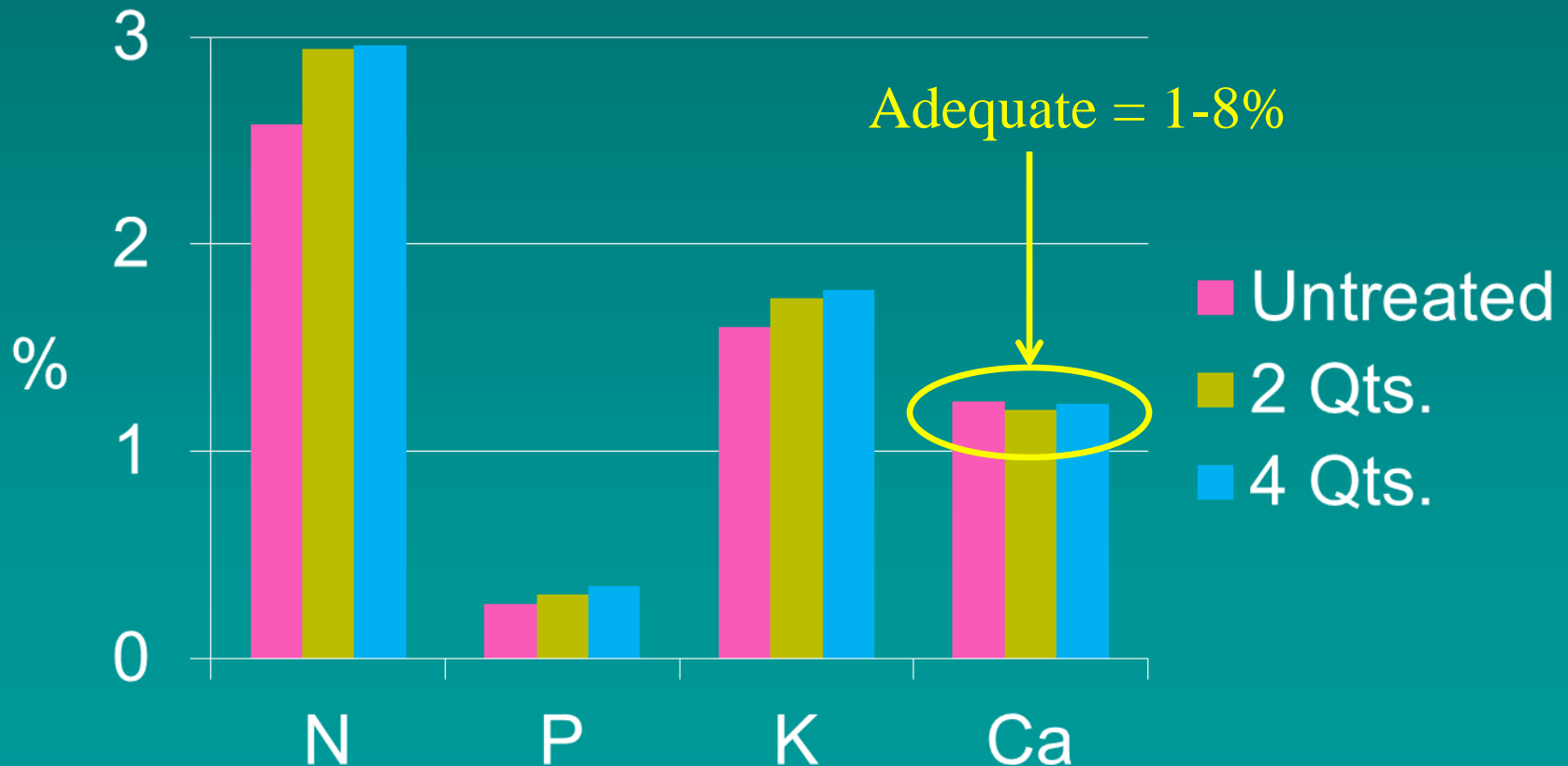
Second Harvest

- Random (strip) pick
- Evaluate 20 fruit/rep for fruit size & weight, skin color, firmness, SS, TA

Leaf Nutrient Content

Apr. 22

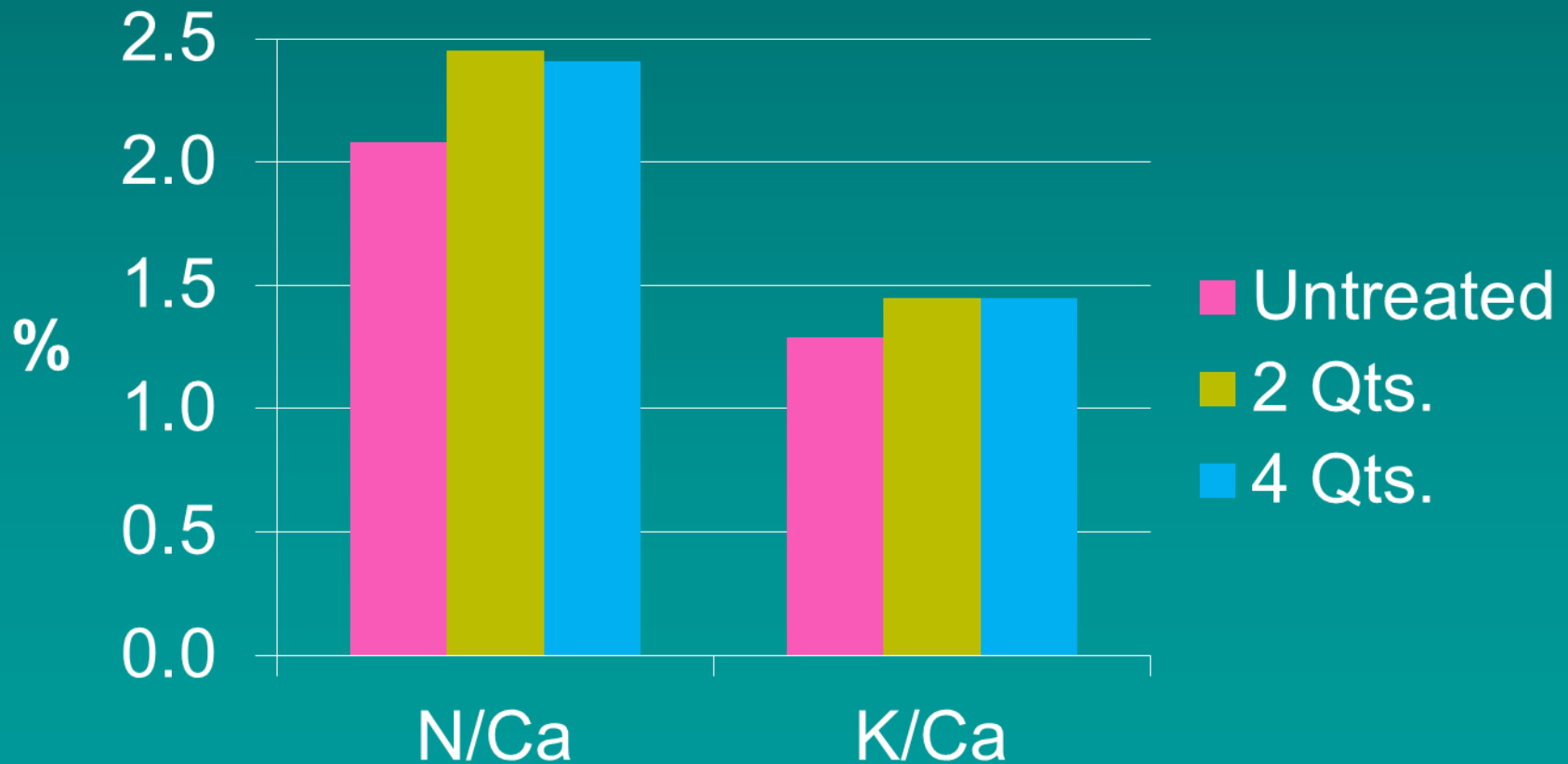
VigorCal + 9-24-3 (2 qts. vs. 4 qts.)



Leaf Nutrient Ratios

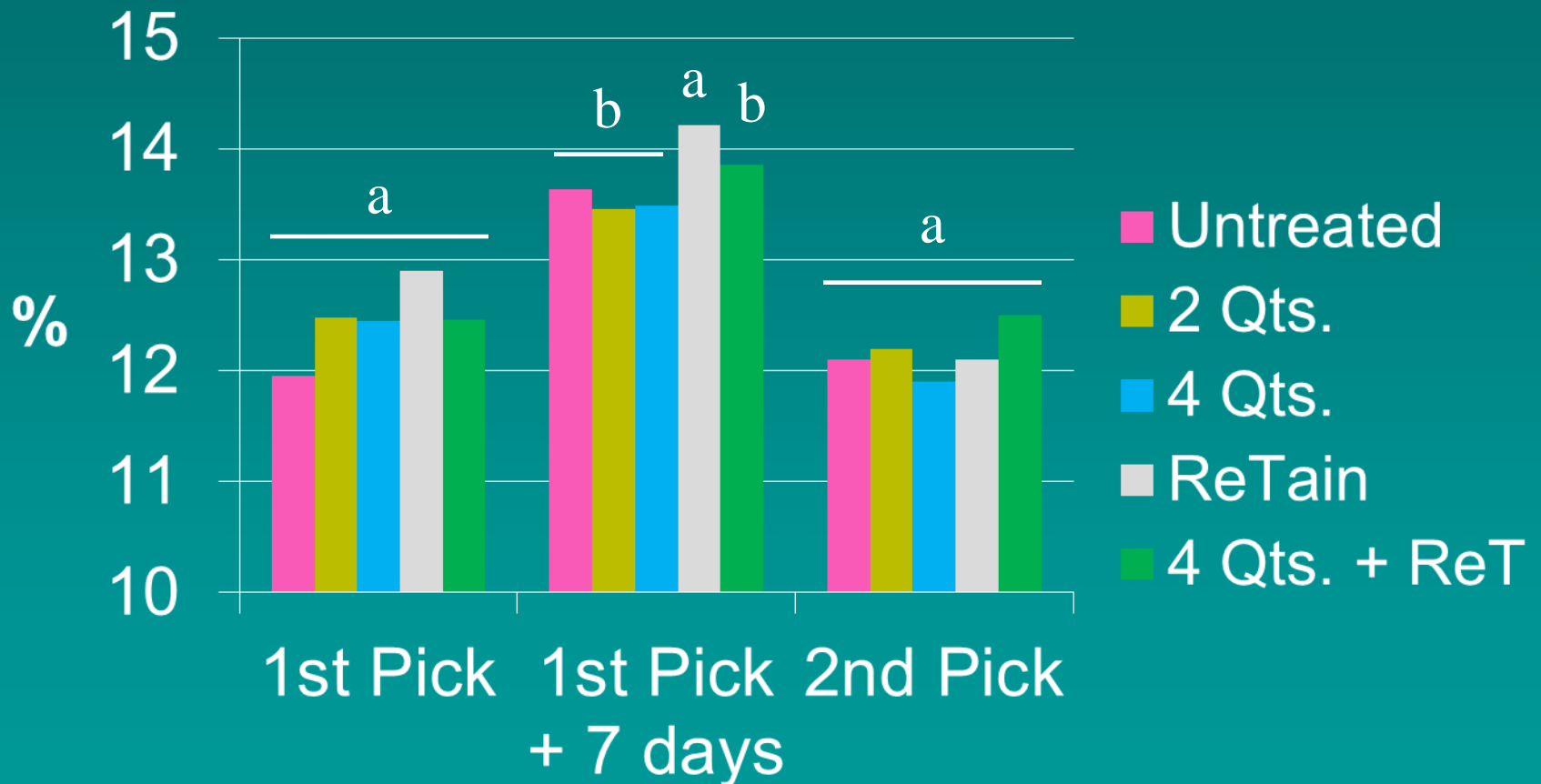
Apr. 22

VigorCal + 9-24-3 (2 qts. vs. 4 qts.)



Total Soluble Solids

1st pick July 9 (1³/₄"), 2nd pick July 14



Fruit Firmness (lbs.)

Weeks of storage, Days of ripening

1st pick 7/9 (1³/₄"

2nd pick

7/14



Treatment	0W0D	0W7D	6W0D	0W0D
Untreated	19.1 a	2.65 bc	18.1 a	20.8 a
2 qts.	18.9 a	2.68 bc	17.9 a	20.4 a
4 qts.	19.4 a	2.44 c	18.0 a	20.9 a
ReTain	18.7 a	2.94 ab	17.8 a	20.4 a
4 qts. + ReTain	18.8 a	3.13 a	18.4 a	20.9 a

Summary

- No storage problems in any treatment
 - » Fruit likely had sufficient Ca and nutrient balance
- No leaf Ca increase days after last application
 - » Translocated? (Immobile) Didn't get in?
- Ca treatments had no effect on fruit firmness
 - » Consistent with results of other Ca trials
- ReTain increased firmness 0.5 lb.
 - » Only after 7 days ripening

Notes on VigorCal

Agro-K Rep

- Apply VigorCal every 7-10 days starting 10% bloom, every 10-14 days starting 30 days after petal fall to just before harvest
 - » Most growers make 4-5 applications
- Apply micronutrients (esp. Zn, Mg) as leaves are expanding
- 2 vs. 4 qt. rate effect more obvious on varieties other than Bartlett

2014 Treatments

RCBD, 4 treatments, 8 single-tree reps

1. Vigor-Cal + 9-24-3 (4 qts./A)
 - 4 weekly applications in April,
2. 12% liquid CaCl_2 (1 qt./100 gal.)
 - 4 applic. every 3 weeks, late April-June
3. ReTain (1 bag/A)
 - 1 applic. 2 weeks before harvest, 1 bag
4. Both #1 and #3
5. Untreated



Questions?