Citrus Research and Education Center

Field Day

December 3, 2014, St. Helena Project

Dundee, Florida

c/o Orie Lee

Citrus Research and Development Foundation, Inc.

UF UNIVERSITY of FLORIDA IFAS Extension

CREF Citrus Research and Education Foundation, Inc.

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Field Day at The St. Helena Project

Field Day Overview – December 3, 2014

The St. Helena Project is a collaborative field research effort with Mr. Orie Lee, the UF/IFAS Citrus Research and Education Center (CREC), and the Citrus Research and Education Foundation (CREF) to evaluate mid-season Valencia quality processing sweet orange selections combined with a series of new rootstocks. The original primary goal was to identify superior disease-resistant rootstocks that will facilitate ACPS (Advanced Citrus Production Systems). This includes fast growth in the nursery and the first few years in the field followed by substantial early yield and subsequent production of high quality fruit on trees of rootstock-controlled size as needed for higher density plantings. More recently, focus is on identifying rootstocks that have potential to produce and sustain a profitable grove under heavy HLB pressure.

Valquarius sweet orange

Vernia sweet orange

SCIONS: Processing sweet oranges Vernia and Valquarius (a new early-maturing clone of Valencia, recently released by IFAS); both produce juice of Valencia quality, but with optimal harvest dates between mid-January to March 1st (potential for a single season Valencia crop amenable to mechanical harvesting).

ROOTSTOCKS: More than 80 selections, mostly from the research program of Dr. Jude Grosser, but also including selections provided by Drs. Fred Gmitter and Bill Castle (including selections from Argentina and Italy) and commercial controls. 12 acres were planted in April of 2008. Additional selections have been planted as trees have become available. Several hundred newly planted trees were lost in freezes during 2011 and 2012.

Description of Rootstocks

1. **Conventionally bred diploid (2x) rootstocks**. This group includes trifoliate hybrids provided by Dr. Bill Castle, developed by retired Argentine rootstock breeder Jose Luis Foguet. These rootstocks were all selected in Argentina for superior performance with lemon and sweet orange scions. Trees on these rootstocks vary in tree size with Pink 1802 producing the smallest trees. Featured selections include:
   1. **Yellow 1800** (grapefruit x trifoliate orange)
   2. **White 1801** (Ruby blood orange x Barnes trifoliate orange)
   3. **Pink 1802** (Cleopatra mandarin x Swingle citrumelo
   4. **Aqua 1803** (Cleopatra mandarin x trifoliate orange)
   5. **Orange 1804** (Cleopatra mandarin x trifoliate orange)
   6. **White 1805** (Ruby Blood orange x Barnes trifoliate orange)

   This group also includes *Citrus latipes* (papeda) x trifoliate orange hybrids provided by Dr. Fred Gmitter, developed by Guiseppe Reforgiato in Sicily. *C. latipes* is reported to be tolerant of HLB in India. Featured selections include:
   1. **68-1G-26-F4-P2**
   2. **68-1G-26-F4-P6**
   3. **68-1G-26-F4-P20**

2. **Allotetraploid (4x) Somatic Hybrids**: produced in the Grosser laboratory (test tube babies) by fusing cells from two conventional diploid citrus genotypes with complementary traits and then regenerating a tetraploid plant that contains the entire diploid genome of each parent (additive hybridization). Featured somatic hybrid rootstock candidates include:
   1. **Sour orange + Carrizo citrange**
   2. **Cleopatra mandarin + Carrizo citrange**
   3. **Changsha mandarin + trifoliate orange 50-7**
   4. **Changsha mandarin + Benton citrange**
   5. **Sour orange + trifoliate orange 50-7**
   6. **White grapefruit + trifoliate orange 50-7**
   7. **Amblycarpa mandarin + Hirado Buntan pummelo sdlg.#1**

3. **Allotetraploid (4x) Tetrazygs**: produced by the conventional breeding of somatic hybrid parents at the tetraploid level. This approach is quite powerful genetically, because it

allows for the mixing of genes from the genomes of four conventional diploid genotypes simultaneously. The tetrazygs featured in the Field Day all have the Nova mandarin+Hirado Buntan seedling pummelo somatic hybrid as a mother – this is because it is a sour-orange like hybrid that has shown tolerance to CTV and to the Diaprepes/Phytophthora complex, and it produces zygotic seed (as needed to make hybrids). Featured Tetrazyg roostock candidates include:

A. Cross of Nova mandarin+Hirado Buntan seedling pummelo x Cleopatra mandarin+Argentine trifoliate orange: **Orange #2; Orange #4; Orange #13; Orange #14; Orange #15; Orange #16; Orange #18; Orange #19; and Orange #21.**

B. Cross of Nova mandarin+Hirado buntan seedling pummelo x sour orange+Carrizo: **Green #7.**

C. Cross of Nova mandarin + Hirado buntan seedling pummelo x sour orange+Palestine sweet lime: **Blue #1; Blue #2, Blue #3, Blue #4 and Blue #9**

D. Cross of Nova mandarin + Hirado buntan seedling pummelo x Cleopatra+sour orange: **Purple #4.**

4. **Commercial Diploid Rootstocks as Controls: Swingle, Volk, rough lemon, Cleopatra and Kuharske.**

ROOTSTOCK SEED TREES: Three rows along the clay road into the trial are available for rootstock seed trees (planting in progress, with the fence row completed).

GROVE OUTLAY: The grove is split into 3 sections, each with a different tree spacing. The Eastern block is planted in a 9 x 20 [242 trees/acre] higher density spacing. This block did not have water for cold protection, and there was significant cold damage and young tree loss following the 2011 freeze. The Southwestern block is planted in a 12 x 20 [181 trees/acre] medium-high density spacing. The Northwestern block is planted in a traditional 15 x 25 [116 trees/acre] spacing, and includes the commercial control rootstocks. The latter two blocks had water for cold protection.

PLANTING: Approximately 12 of the 19.9 acres were planted in April, 2008 and are now about 6 ½ years old. Trees were planted in 4-tree rectangles to facilitate yield data collection. The remaining acreage was planted as new trees became available, with trees on additional new rootstock selections from the CREC citrus improvement program. The latest planted rootstocks include diploid hybrids of Flying Dragon trifoliate orange developed by Fred Gmitter, diploid Shekwasha mandarin x pummelo hybrids developed by Jude Grosser, as well as new somatic hybrids and tetrazygs. **Resets in the older trees**: a few of the rootstock selections were from seed trees that unexpectedly produced zygotic seeds rather than nucellar-derived seeds, and thus many of these zygotic rootstocks were not growing off well – these trees were replaced with more promising selections.

CULTURAL PRACTICES: the goal was to apply the principles of open hydroponics, but with lower initial costs and inputs. Trees are being grown with slow release fertilizer from Harrell's, with daily 45 – 60 minutes per zone irrigation (unless there is adequate rainfall). The initial planting was started on Harrell's 12-month nursery mix and was used for the first two years; in 2010 we switched to a Harrell's/UF-CREC research mix (10-month) containing calcium nitrate, boron and additional micronutrients (formulas provided). All fertilizers were applied by hand thru 2010, after which they were applied using a Killebrew young tree spreader. Since 2008, the SR-Fertilizer has been applied in staggered applications in January and July as follows:

Year 1 (2008) 1.5 lbs/trees Harrell's 15-5-10 Nursery mix split into 2 applications (0.5lb @ planting, 1 lb summer)
Year 2 (2009) 2.5 lbs/tree Harrell's 15-5-10 Nursery mix split into 2 applications
Year 3 (2010) 5.2 lbs/tree Harrell's 13-4-9 UF mix split into 2 applications
Year 4 (2011) 5.2 lbs/tree Harrell's 13-4-9 UF mix split into 2 applications
Year 5 (2012) 6.0 lbs/tree Harrell's 13-4-9 UF mix split into 2 applications
A supplemental Zn application was applied to correct a minor element deficiency (Tiger-Sul 18% Zn - 65% S, 1 oz/tree July/2012)
Year 6 (2013) 6.0 lbs/tree Harrell's 13-4-9 UF mix split into 2 applications
Supplemental Tigersul Zn (5.85%), Mn (15%), Fe (3.85%), S(62%) custom mix applied in July 2013, 0.33lbs/tree.
Year 7 (2014) 6.6 lbs/tree Harrell's 12-3-8 UF mix containing Tigersul Zn,Mn,Fe and split into 2 applications (includes increased manganese and boron).
Estimated fertilizer cost (commercial) thru year 7 was $33.20 per tree.

HLB INCIDENCE and IMPACT: Considering the location of the grove, a high HLB incidence was expected due to the neighbor effect. We have an older unsprayed block of K-Earlies to the northeast, and both a top-worked and organic grove to the south. The last inspection by the CREC HLB/canker scouts was completed in November, 2014. The HLB incidence in fall of 2011 was about 8% and increased to 26% in the fall of 2012; infection increased to 59% in 2013 and is now at 92%. The highest initial infection frequencies were on commercial rootstocks, and tetraploid rootstocks in general were slower to develop symptoms. During 2014, we began removing trees based on their performance, removing unproductive, declining trees. Tree removal per rootstock data is being collected and presented in Table 3. The first tree with HLB was found in 2009 on UFR-14, and is still present in the grove – this tree has shown significant recovery and is currently holding about 2 boxes of normal fruit after five years of infection. We are now studying rootstock effects on disease severity. Rootstock differences are apparent, but need to be studied over time. A present goal is to identify rootstocks that can remain productive after infection, and that could possibly grow through the disease. Overall, 2013 yield for the trial was down 18% from that of 2012. This drop in yield can be mostly attributed to HLB, but could also be partially due to alternate bearing, especially in the juvenile budline Valquarius trees. A current visual assessment of the trial suggests that overall yield for the 2015 harvest could be similar to 2014, or possibly even higher depending on the severity of the fruit drop due to HLB. It is possible that the increases in specific minor nutrients including the Tiger micros could be making a difference.

CANKER: Canker has been present in the trial for approximately 3 years. CREC scouts have an aggressive program to identify and remove branches with canker (now discontinued). Copper sprays are now being used to suppress canker. There is no evidence from this trial that Vernia is more susceptible to canker than other sweet oranges.

OTHER ISSUES: We have had a significant problem with clogged micro-jets causing severe tree wilting; this problem was corrected by more frequent scouting and jet clearing, and this year by repairing a broken mainline that went undetected for some time. Excessive thorniness on some of the Valquarius trees is due to the fact that the trees were propagated from 1st generation budwood (less thorny 2nd and 3rd generation sources of budwood were destroyed by the state-run canker eradication effort). We have re-entered a more mature and less thorny budline of Valquarius into the DPI Parent Tree Program; pathogen-free budwood is now being grown in Chiefland and is available for nurseries.

Harrell's
Professional Fertilizer Solutions

16-5-10

Batch #:

12 Month.

NPK+ Minors

GUARANTEED ANALYSIS

* Total Nitrogen (N)	16.0000%
5.8630% Nitrate Nitrogen	
6.8750% Ammoniacal Nitrogen	
3.2620% Urea Nitrogen	
** Available Phosphate (P205)	5.0000%
*** Soluble Potash (K20)	10.0000%
Magnesium (Mg)	1.0830%
1.0830% Soluble Magnesium (Mg)	
Copper (Cu)	0.0620%
0.0620% Soluble Copper (Cu)	
Iron (Fe)	0.2580%
0.2580% Iron (Chelated)	
Manganese (Mn)	0.1000%
0.1000% Soluble Manganese (Mn)	
Molybdenum (Mo)	0.0090%
Zinc (Zn)	0.0620%
0.0620% Soluble Zinc (Zn)	

Derived From: Polymer Coated Ammonium Nitrate, Polymer Coated Copper Sulfate, Polymer Coated EDTA Iron Chelate, Polymer Coated Magnesium Sulfate, Polymer Coated Manganese Sulfate, Polymer Coated Mono-Ammonium Phosphate, Polymer Coated Sodium Molybdate, Polymer Coated Sulfate of Potash, Polymer Coated Urea, Polymer Coated Zinc Sulfate, Polymer-Coated Potassium Nitrate

* Has 14.05% slow release NITROGEN derived from Polymer Coated Ammonium Nitrate, Polymer Coated Mono-Ammonium Phosphate, Polymer Coated Urea, Polymer-Coated Potassium Nitrate

** Has 4.5% slow release PHOSPHATE derived from Polymer Coated Mono-Ammonium Phosphate

*** Has 8.916% slow release POTASH derived from Polymer Coated Sulfate of Potash, Polymer-Coated Potassium Nitrate

Warning: —This fertilizer is to be used only on soils which respond to Molybdenum. Crops high in Molybdenum are toxic to ruminants.

Density - 61 lb./(cu. ft.)

CAUTION MAY CAUSE STAINS ON CONCRETE

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020804

NET WEIGHT 50 LBS

Harrell's

Professional Fertilizer Solutions

13-4-9

Batch #: 1101-0201

Fertilizer - UF Citrus Research Center

GUARANTEED ANALYSIS

* Total Nitrogen (N)	13.0000%
7.4700% Nitrate Nitrogen	
5.0000% Ammoniacal Nitrogen	
0.5300% Urea Nitrogen	
** Available Phosphate (P205)	4.0000%
*** Soluble Potash (K20)	9.0000%
Calcium (Ca)	4.2800%
Magnesium (Mg)	1.1180%
1.1180% Water Soluble Magnesium (Mg)	
Boron (B)	0.0360%
Copper (Cu)	0.0460%
0.0460% Water Soluble Copper (Cu)	
Iron (Fe)	0.9480%
0.1620% Water Soluble Iron (Fe)	
0.3000% Iron (Chelated)	
Manganese (Mn)	0.1580%
0.1580% Water Soluble Manganese (Mn)	
Molybdenum (Mo)	0.0070%
Zinc (Zn)	0.0630%
0.0630% Water Soluble Zinc (Zn)	

Derived From: Calcium Nitrate, Polymer Coated Ammonium Nitrate, Polymer Coated Copper Sulfate, Polymer Coated EDTA Iron Chelate, Polymer Coated Magnesium Sulfate, Polymer Coated Manganese Sulfate, Polymer Coated Mono-Ammonium Phosphate, Polymer Coated Sodium Molybdate, Polymer Coated Sulfate of Potash, Polymer Coated Sulfate of Potash-Magnesia, Polymer Coated Sulphate of Potash, Polymer Coated Urea, Polymer Coated Zinc Sulfate, Iron Chelate, Iron EDTA, Iron Humate, Iron Oxide, ~~Iron Sulfate~~, Iron Sucrate, Manganese Sulfate, Sodium and Calcium Borate, Zinc Sulfate

*** 8.611% slow release NITROGEN derived from Polymer Coated Ammonium Nitrate, Polymer Coated Mono-Ammonium Phosphate, Polymer Coated Urea**

**** 3.984% slow release PHOSPHATE derived from Polymer Coated Mono-Ammonium Phosphate**

***** 8.134% slow release POTASH derived from Polymer Coated Sulfate of Potash, Polymer Coated Sulfate of Potash-Magnesia, Polymer Coated Sulphate of Potash**

Warning: — Some crops may be injured by Application of Boron.
— This fertilizer is to be used only on soils which respond to Molybdenum. Crops high in Molybdenum are toxic to ruminants.

Density - 54 lb./(cu. ft.)

CAUTION MAY CAUSE STAINS ON CONCRETE

Directions for Use

MANUFACTURED BY HARRELL'S LLC (F352) 720 KRAFT ROAD, LAKELAND, FL 33801 - (863) 687-2774 - (800) 282-8007
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Net Weight 50 LBS

1101-0201 101101

Note that the calcium nitrate has a 6-month polymer coating, whereas all other nutrients have a 12-month polymer coating. Overall this makes for a 10-month product.

Harrell's
Growing a Better World™

12-3-8

Batch #: 1406-1122

FERTILIZER ~ CREC Mix with Tiger micros

GUARANTEED ANALYSIS

* Total Nitrogen (N)	12.0000%
6.8800% Nitrate Nitrogen	
4.5200% Ammoniacal Nitrogen	
0.6000% Urea Nitrogen	
** Available Phosphate (P2O5)	3.0000%
*** Soluble Potash (K2O)	8.0000%
Calcium (Ca)	4.5270%
Magnesium (Mg)	0.9850%
0.9850% Water Soluble Magnesium (Mg)	
Boron (B)	0.0240%
Copper (Cu)	0.0400%
0.0400% Water Soluble Copper (Cu)	
Iron (Fe)	1.0980%
0.1100% Water Soluble Iron (Fe)	
0.2200% Chelated Iron (Fe)	
Manganese (Mn)	0.9160%
0.0690% Water Soluble Manganese (Mn)	
Molybdenum (Mo)	0.0060%
Zinc (Zn)	0.7150%
0.0400% Water Soluble Zinc (Zn)	

Derived From: Polymer Coated Ammonium Nitrate, Polymer Coated Calcium Nitrate, Polymer Coated Copper Sulfate, Polymer Coated Iron EDTA, Polymer Coated Magnesium Sulfate, Polymer Coated Manganese Sulfate, Polymer Coated Monoammonium Phosphate, Polymer Coated Sodium Molybdate, Polymer Coated Sulfate of Potash, Polymer Coated Sulfate of Potash-Magnesia, Polymer Coated Urea, Polymer Coated Zinc Sulfate, Elemental Sulfur, Ferrous Sulfate, Iron EDTA, Iron Humate, Iron Oxide, Iron Sucrate, Manganese Oxide, Sodium and Calcium Borate, Zinc Oxide

* 11.556% slow release NITROGEN derived from Polymer Coated Ammonium Nitrate, Polymer Coated Calcium Nitrate, Polymer Coated Monoammonium Phosphate, Polymer Coated Urea

** 3.195% slow release PHOSPHATE derived from Polymer Coated Monoammonium Phosphate

*** 8.01% slow release POTASH derived from Polymer Coated Sulfate of Potash, Polymer Coated Sulfate of Potash-Magnesia

Warning: —This fertilizer is to be used only on soils which respond to Molybdenum. Crops high in Molybdenum are toxic to ruminants.

Density - 46 lb./(cu. ft.)

CAUTION MAY CAUSE STAINS ON CONCRETE

Directions for Use

It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.

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1406-1122 271406

Net Weight 50 LBS

Note that the calcium nitrate has a 6-month polymer coating, whereas all other nutrients have a 12-month polymer coating. Overall this makes for a 10-month product.

Table 1. Yield (including cumulative yield) and Fruit Quality Data for Rootstock Candidates in the St. Helena Trial. Somatic Hybrid Rootstocks are in orange; Tetrazyg Rootstocks are in Blue; both of these types of rootstocks induce tree size control, as needed for ACPS.

Scion	Rootstock	Lbs Solids/Box		Yield Boxes/Tree			Cumulative Yield 2014
		2013	2014	2012 (47 mo.)	2013 (59 mo.)	2014 (71 mo.)	
VALQUARIUS	WHITE 1805	4.89	4.83	1.19	2.84	2.37	6.40
VALQUARIUS	AQUA 1803	5.58	5.39	0.98	2.38	2.08	5.44
VALQUARIUS	UFR-14 FG 1733	5.63	5.49	0.67	2.77	1.50	4.94
VALQUARIUS	UFR-13 FG 1731	6.81	6.39	0.68	2.20	2.00	4.88
VERNIA	BLUE 1	4.98	5.32	0.84	1.91	1.62	4.87
VALQUARIUS	UFR-1 ORANGE 3	4.87	4.68	0.72	2.23	1.81	4.76
VALQUARIUS	ORANGE 13	5.25	5.91	0.84	1.98	1.50	4.75
VERNIA	AQUA 1803	6.17	6.17	0.81	1.91	1.56	4.62
VALQUARIUS	VOLK	4.12	3.30	NS	2.58	2.00	4.58
VALQUARIUS	CLEO+CZO	5.02	4.88	0.62	1.66	1.81	4.49
VALQUARIUS	ORANGE 14	5.60	4.73	1.08	1.67	1.33	4.41
VALQUARIUS	UFR-6 CH+50-7	5.43	5.61	0.78	1.94	1.13	4.35
VALQUARIUS	UFR- 3 ORANGE 15	4.05	5.34	0.81	1.97	1.56	4.34
VERNIA	UFR-4 ORANGE 19	6.07	6.83	0.71	1.73	1.31	4.29
VALQUARIUS	68-1G-26-F6-P20	5.32	5.92	0.88	1.53	1.88	4.29
VERNIA	CLEO+CZO	5.61	6.14	0.75	1.72	1.31	4.28
VALQUARIUS	ORANGE 1804	5.16	5.08	1.02	2.10	1.12	4.24
VALQUARIUS	PINK 1802	5.25	5.60	0.76	1.73	1.50	4.24
VERNIA	CH+BENTON	5.68	6.61	0.72	1.56	1.44	4.22
VALQUARIUS	FG 1793	5.15	5.60	0.83	1.62	1.62	4.07
VALQUARIUS	UFR-5 WHITE 4	5.72	5.62	0.56	1.80	1.37	4.06
VALQUARIUS	ROUGH LEMON	4.22	4.77	1.00	1.91	1.12	4.03
VALQUARIUS	ORANGE 16	5.39	5.85	0.81	1.91	1.31	4.03
VALQUARIUS	AMB+HBJL1	5.79	5.32	0.63	2.13	0.75	4.02
VALQUARIUS	UFR-2 ORANGE 4	5.37	5.84	0.75	1.73	1.50	3.98
VERNIA	ORANGE 1804	6.34	6.09	0.25	1.98	1.50	3.98
VALQUARIUS	68-1G-26-F4-P6	5.74	5.94	0.4	1.45	2.12	3.97
VERNIA	UFR-5 WHITE 4	5.34	6.17	0.25	1.93	1.31	3.91
VERNIA	ORANGE 18	5.82	5.71	0.65	1.37	1.25	3.87
VERNIA	AMB+HBJL1-2B	5.80	6.20	0.5	1.77	1.21	3.86
VERNIA	ORANGE 1	5.93	6.28	0.25	1.71	1.41	3.77
VALQUARIUS	CH+BENTON	5.12	5.27	0.43	1.62	1.25	3.70
VALQUARIUS	SO+CZO	5.06	5.89	0.66	1.79	1.00	3.69

Table 1. (cont.) Yield (including cumulative yield) and Fruit Quality Data for Rootstock Candidates in the St. Helena Trial. Somatic Hybrid Rootstocks are in orange; Tetrazyg Rootstocks are in Blue; both of these types of rootstocks induce tree size control, as needed for ACPS.

Scion	Rootstock	Lbs Solids/Box		Yield Boxes/Tree			Cumulative Yield 2014
		2013	2014	2012 (47 mo.)	2013 (59 mo.)	2014 (71 mo.)	
VERNIA	WGFT+50-7	5.74	6.52	0.25	1.59	1.31	3.65
VERNIA	ORANGE 2	5.88	6.64	0.25	1.79	1.27	3.64
VERNIA	MG-11	6.44	6.68	0.54	1.37	1.40	3.64
VALQUARIUS	FG 1709	5.18	6.11	0.68	1.58	1.33	3.59
VERNIA	UFR-1 ORANGE 3	6.28	6.61	0.67	1.33	1.22	3.53
VALQUARIUS	69-LTX-AM-F14-P37	4.78	5.72	0.53	2.50	0.50	3.53
VALQUARIUS	BLUE 1	4.62	5.77	0.31	1.66	1.06	3.53
VERNIA	ORANGE 14	5.08	6.15	0.83	1.20	1.13	3.52
VALQUARIUS	UFR-4 ORANGE 19	5.07	5.93	0.65	1.59	0.87	3.51
VERNIA	UFR-3 ORANGE 15	5.82	6.51	0.38	1.82	0.94	3.51
VERNIA	BLUE 4	6.16	6.08	0.61	1.54	0.94	3.49
VERNIA	VOLK	4.73	3.59	1.13	0.83	1.13	3.49
VERNIA	YELLOW 1800	5.91	6.34	0.25	1.66	1.19	3.49
VERNIA	UFR-6 CH+50-7	6.01	7.06	0.63	1.41	1.00	3.44
VERNIA	PURPLE 4	5.63	6.30	0.25	1.35	1.44	3.44
VALQUARIUS	FG 1707	5.79	5.85	0.33	1.77	1.33	3.43
VALQUARIUS	68-1G-26-F2-P12	5.50	5.76	0.63	1.67	1.12	3.42
VALQUARIUS	BLUE 9	5.60	5.23	0.63	1.58	1.00	3.41
VERNIA	ORANGE 13	5.76	6.40	0.48	1.45	1.16	3.40
VERNIA	GREEN 7	5.85	5.65	0.42	1.63	0.96	3.40
VALQUARIUS	68-1G-26-F4-P2	5.44	6.24	0.34	1.22	1.81	3.37
VALQUARIUS	ORANGE 2	5.75	6.19	0.74	1.60	1.00	3.34
VALQUARIUS	KCZ	5.75	5.43	NS	2.20	1.13	3.33
VALQUARIUS	ORANGE 21	4.88	5.02	0.65	1.23	1.00	3.30
VERNIA	BLUE 2	5.69	6.28	0.41	1.48	1.19	3.28
VALQUARIUS	PURPLE 4	5.26	4.76	0.38	1.42	1.15	3.25
VALQUARIUS	WHITE 1801	5.58	5.89	0.75	1.60	0.88	3.23
VALQUARIUS	S0+50-7	5.17	5.92	0.41	1.28	1.12	3.21
VALQUARIUS	WGFT +50-7	5.29	5.68	0.51	1.19	1.00	3.18
VERNIA	SO+50-7	5.66	7.24	0.48	0.95	1.25	3.08
VALQUARIUS	AMB+HBJL-2B	5.12	5.65	0.38	1.20	1.50	3.08
VERNIA	BLUE 3	6.04	6.20	0.43	1.31	1.02	3.06
VALQUARIUS	GREEN 7	4.44	5.30	0.61	1.40	1.04	3.05
VALQUARIUS	BLUE 2	5.78	5.40	0.15	1.86	1.02	3.03

Table 1. (cont.) Yield (including cumulative yield) and Fruit Quality Data for Rootstock Candidates in the St. Helena Trial. Somatic Hybrid Rootstocks are in orange; Tetrazyg Rootstocks are in Blue; both of these types of rootstocks induce tree size control, as needed for ACPS.

Scion	Rootstock	Lbs Solids/Box		Yield Boxes/Tree			Cumulative Yield 2014
		2013	2014	2012 (47 mo.)	2013 (59 mo.)	2014 (71 mo.)	
VERNIA	SWINGLE	5.79	5.10	0.85	1.08	0.75	3.01
VALQUARIUS	PURPLE 2	5.66	5.69	0.13	1.75	1.13	3.01
VALQUARIUS	BLUE 4	5.07	6.05	0.25	1.83	0.91	2.99
VERNIA	ORANGE 21	na	6.08	0.25	1.35	0.94	2.98
VERNIA	BLUE 9	5.90	5.81	0.25	1.35	1.00	2.90
VERNIA	UFR-2 ORANGE 4	5.93	6.41	0.25	1.38	0.87	2.85
VERNIA	WHITE 1801	6.37	6.75	0.33	1.10	0.83	2.82
VERNIA	WHITE 1805	6.13	5.86	0.25	1.29	0.81	2.81
VALQUARIUS	MG-11	5.51	4.69	0.75	0.98	1.00	2.73
VALQUARIUS	FG 1792	5.32	4.39	NS	1.90	0.75	2.65
VERNIA	PURPLE 2	5.70	6.79	0.45	1.20	1.00	2.64
VERNIA	SO+CZO	6.23	7.15	0.25	1.12	0.88	2.53
VERNIA	KCZ	5.83	5.17	0.75	1.08	0.50	2.48
VALQUARIUS	CLEO	5.21	5.80	NS	1.70	0.75	2.45
VALQUARIUS	SWINGLE	5.61	6.18	NS	1.50	0.88	2.38
VALQUARIUS	ORANGE 18	4.86	5.39	0.59	0.85	0.41	2.31
VERNIA	CLEO	5.51	5.27	0.5	0.83	0.88	2.21
VALQUARIUS	FG 1702	5.27	5.94	NS	1.15	1.00	2.15
VERNIA	SORP X SH99-5*	5.76	6.75	0.43	0.83	0.88	2.14
VALQUARIUS	BLUE3	4.97	5.23	NS	0.93	0.56	1.49
VERNIA	PINK 1802	n/a	6.48	n/a	n/a	0.81	0.81

White = diploid; Orange = somatic hybrid; Blue = tetrazyg

* 3 year old trees ns = not significantly different na = data not available

Table 2. Projected Yields at Estimated Optimal Tree Densities Based on Average Tree Diameter per Rootstock after 6.5 years (with trees touching); Trees per Acre based on 20-Foot Middles. Note that smaller trees could be planted with middles less than 20 feet (increasing tree numbers), and larger trees could require middles larger than 20 feet (reducing tree numbers). Data can be used to predict performance in ACPS. Shaded boxes indicate a tetraploid rootstock. Trees listed from smallest to largest.

Scion	Rootstock	Average diameter ft. within the row	Trees/ acre	Boxes/ acre 2012	Boxes/ acre 2013	Boxes/ acre 2014	Cumm. yield (3) years
Valquarius	SO+50-7	5.8	379	155	485	424	1216
Valquarius	Blue 3	6.9	317	0	295	177	472
Vernia	Changsha+Benton	6.9	317	228	494	456	1337
Vernia	SO+50-7	6.9	317	152	301	396	976
Vernia	Purple 4	7.0	311	78	420	448	1070
Valquarius	Purple 4	7.1	309	117	439	355	1004
Vernia	Blue 3	7.1	306	131	400	312	935
Vernia	Blue 9	7.1	306	76	413	306	886
Valquarius	Orange18	7.2	303	179	258	124	700
Valquarius	Orange 2	7.2	303	224	485	303	1012
Valquarius	AMB+HBJL1	7.3	300	189	640	225	1208
Valquarius	Blue 2	7.3	300	45	559	306	910
Vernia	UFR-6 Chan+50-7	7.3	299	188	421	299	1028
Valquarius	Blue 4	7.3	298	74	545	271	891
Vernia	Purple 2	7.4	295	133	354	295	780
Vernia	SO+RPxSH99-5	7.4	295	127	245	260	632
Valquarius	Orange 21	7.4	293	190	360	293	966
Vernia	Blue 2	7.4	293	120	433	348	961
Vernia	Blue 4	7.5	292	178	450	275	1019
Valquarius	Blue 1	7.5	290	90	482	308	1025
Vernia	Blue 1	7.6	286	240	546	463	1391
Valquarius	FG1702	7.8	281	0	323	281	604
Valquarius	Orange 14	7.8	281	304	469	374	1239
Vernia	Cleo+CZO	7.8	281	211	483	368	1203
Valquarius	FG1709	7.9	277	188	437	368	994
Valquarius	WGFT507	7.9	277	141	329	277	879
Vernia	Amb+HBJL-2B	7.9	274	137	486	332	1059
Vernia	SO+CZO	7.9	274	69	307	241	694
Valquarius	Changsha+Benton	8.0	272	117	441	340	1007

Table 2. (Cont.) Projected Yields at Estimated Optimal Tree Densities Based on Average Tree Diameter per Rootstock after 6.5 years (with trees touching); Trees per Acre based on 20-Foot Middles. Note that smaller trees could be planted with middles less than 20 feet (increasing tree numbers), and larger trees could require middles larger than 20 feet (reducing tree numbers). Data can be used to predict performance in ACPS.

Scion	Rootstock	Average diameter ft. within the row	Trees/ acre	Boxes/ acre 2012	Boxes/ acre 2013	Boxes/ acre 2014	Cumm. yield (3) years
Vernia	White1805	8.0	272	68	351	221	765
Vernia	White1801	8.1	268	89	295	223	756
Valquarius	SO+CZO	8.1	268	177	480	268	989
Vernia	Wgft+50-7	8.2	266	67	423	348	971
Valquarius	UFR-13 FG1731	8.3	264	180	581	528	1288
Valquarius	White1801	8.3	264	198	422	232	853
Valquarius	Blue 9	8.3	264	166	417	264	900
Valquarius	Purple 2	8.3	264	34	462	298	795
Valquarius	Green 7	8.4	260	159	364	270	793
Valquarius	Orange 13	8.4	260	218	515	390	1235
Valquarius	UFR-6 Chan+50-7	8.4	258	201	501	292	1123
Valquarius	Cleo+CZO	8.4	258	160	429	467	1159
Vernia	Orange 18	8.4	258	168	354	323	999
Valquarius	UFR-5 White 4	8.5	257	144	463	352	1044
Valquarius	MG11	8.5	256	192	251	256	700
Vernia	Orange 21	8.6	254	64	343	239	758
Vernia	Orange 2	8.6	253	63	452	321	920
Valquarius	FG1792	8.8	249	0	473	187	660
Vernia	Green 7	8.8	249	105	406	239	846
Vernia	UFR-2 Orange 4	8.8	247	62	341	215	704
Valquarius	69LTXamF14P3	8.9	246	130	614	123	867
Vernia	MG11	8.9	245	133	336	344	893
Valquarius	681G26F2P12	8.9	244	154	407	273	833
Valquarius	UFR-4 Orange 19	8.9	244	158	387	212	855
Valquarius	UFR-1 Orange 3	8.9	244	175	543	441	1160
Valquarius	Aqua1803	9.1	239	234	568	496	1298
Vernia	Orange 13	9.2	237	114	344	275	806
Valquarius	FG1707	9.3	235	78	417	313	808
Valquarius	UFR-3 Orange 15	9.3	235	191	464	367	1022
Valquarius	Pink1802	9.3	235	179	407	353	998

Table 2. (Cont.) Projected Yields at Estimated Optimal Tree Densities Based on Average Tree Diameter per Rootstock after 6.5 years (with trees touching); Trees per Acre based on 20-Foot Middles. Note that smaller trees could be planted with middles less than 20 feet (increasing tree numbers), and larger trees could require middles larger than 20 feet (reducing tree numbers). Data can be used to predict performance in ACPS.

Vernia	Orange 14	9.3	235	195	283	266	829
Vernia	UFR-1 Orange 3	9.4	233	156	309	284	821
Valquarius	FG1793	9.4	231	192	375	375	941
Vernia	UFR-5 White 4	9.4	231	58	445	302	902
Valquarius	Swingle	9.5	229	0	344	202	546
Vernia	UFR-3 Orange 15	9.6	228	87	415	214	799
Valquarius	UFR-2 Orange 4	9.7	225	169	390	338	897
Valquarius	681G26F4P2	9.8	223	76	273	404	753
Valquarius	Orange 16	9.8	223	181	427	293	900
Vernia	Kuharske	9.8	223	168	241	112	554
Vernia	Swingle	9.8	223	190	241	168	672
Vernia	UFR-4 Orange 19	9.8	222	158	384	291	952
Vernia	Yellow 1800	9.9	219	55	364	261	765
Valquarius	Amb+HBJL-2B	10.0	218	83	261	327	671
Valquarius	UFR-14 FG1733	10.0	218	146	603	327	1076
Valquarius	681G26F4P6	10.1	215	86	312	456	854
Valquarius	Rough Lemon	10.2	214	214	408	239	862
Valquarius	Cleo	10.3	212	0	361	159	521
Valquarius	681G26F6P20	10.3	212	186	324	398	908
Vernia	Aqua1803	10.3	211	171	403	329	976
Vernia	Orange 1	10.3	211	53	361	298	796
Valquarius	Orange 1804	10.4	209	213	438	234	885
Vernia	Orange 1804	10.7	204	51	404	306	811
Vernia	Cleo	10.8	203	101	168	178	448
Valquarius	White1805	11.0	198	236	562	469	1267
Valquarius	Kuharske	11.4	192	0	421	216	638
Valquarius	Volk	11.6	187	0	484	375	858
Vernia	Volk	12.3	178	201	148	201	621

Table 3. Tree removal based on performance was initiated in the summer of 2014. Trees not expected to make a profit during the 2015 harvest were removed for resetting. Tree removal data per diploid and tetraploid rootstocks provided below. HLB was the cause of most of the removals (there were a few trees removed due to Phytophthora, and a few to wrap around root systems). * indicates trees planted 18 months later (now 5 years old).

Rootstock	Number of Trees in Trial	Trees Removed 2014	Percent Trees Removed due to Poor Performance
Diploid			
UFR-16 46X31-02-13*	8	0	0%
46X31-02-5*	13	0	0%
68-1G-26-F4-P2	12	0	0%
UFR-13 FG 1731	5	0	0%
UFR-14 FG 1733	5	0	0%
Orange 1804	18	0	0%
Volk	20	0	0%
Yellow 1800	11	0	0%
68-1G-26-F6-P20	17	1	6%
Rough Lemon	18	1	6%
46X31-02-11*	15	1	7%
68-1G-26-F2-P12	10	1	10%
Swingle	20	2	10%
46X31-02-S3*	19	2	11%
Aqua 1803	19	2	11%
White 1805	19	2	11%
68-1G-26-F4-P6	13	2	15%
HBJL-2B (n)*	23	4	17%
48-OP-01	28	5	18%
Cleo	16	3	19%
Kuharske Carrizo	63	12	19%
46X31-02-S9*	15	3	20%
Pink 1802	18	4	22%
MG11	40	12	30%
White 1801	11	4	36%
46X31-02-9*	18	3	38%
Chandler A1-11*	8	3	38%
FG 1793	5	2	40%

Table 3 (cont.) Tree removal based on performance was initiated in the summer of 2014. Trees not expected to make a profit during the 2015 harvest were removed for resetting. Tree removal data per diploid and tetraploid rootstocks provided below. HLB was the cause of most of the removals (there were a few trees removed due to Phytophthora, and a few to wrap around root systems). * indicates trees planted 18 months later (now 5 years old).

Rootstock	Number of Trees	Trees removed 2014	Percent Trees Removed due to Poor Performance
Tetraploid			
6058X6056-00-2*	19	0	0%
A-MAC*	19	0	0%
AMB+BENT*	20	0	0%
SO+RPXSH 99-4*	26	0	0%
SR+SH-99-11*	7	0	0%
SR+SH-99-6*	6	0	0%
UFR-17 Green 2*	16	0	0%
UFR-3 Orange 15	43	0	0%
WGFT+50-7	86	0	0%
Blue 4	37	5	1%
UFR-5 White 4	72	1	1%
Purple 4	64	1	2%
SO+CZO	265	4	2%
Blue 9	30	1	3%
Chang+Bent	34	1	3%
UFR-1 Orange 3	60	2	3%
Blue 1	69	3	4%
Blue 2	24	1	4%
Orange 13	50	2	4%
Orange 18	45	2	4%
UFR-2 Orange 4	70	3	4%
White 1	24	1	4%
UFR-4 Orange 19	128	6	5%
AMB+5-1-99-2*	18	1	6%
Orange 14	62	4	6%
6058X2071-01-02*	27	2	7%
Orange 16	27	2	7%
SO+50-7	45	3	7%
Orange 1	24	2	8%
Orange 21	46	4	9%

Table 3 (cont.) Tree removal based on performance was initiated in the summer of 2014. Trees not expected to make a profit during the 2015 harvest were removed for resetting. Tree removal data per diploid and tetraploid rootstocks provided below. HLB was the cause of most of the removals (there were a few trees removed due to Phytophthora, and a few to wrap around root systems). * indicates trees planted 18 months later (now 5 years old).

Rootstock	Number of Trees	Trees removed 2014	Percent Trees Removed due to Poor Performance
Tetraploid			
Nova+7-2-99-2*	46	5	11%
Orange 12	33	4	12%
AMB+HBJL-2B*	16	2	13%
WM-HBJL-12*	8	1	13%
Cleo+CZO	160	1	14%
N+HBP-SS-8*	22	3	14%
Green 7	69	10	15%
N+HBP-SS-9*	26	4	15%
Orange 10	20	3	15%
Murc+SN3*	6	1	17%
SR+SH-99-18*	6	1	17%
Blue 3	44	9	20%
Nova+8-1-99-4B*	5	1	20%
Orange 8	46	9	20%
Purple 2	20	4	20%
Purple 3	5	1	20%
Nova+7-3-99-1*	16	4	25%
AMB+VOLK*	35	9	26%
SORPXSH99-5*	15	4	27%
Orange 2	74	22	30%
Green 6	6	2	33%
AMB+HBJL-12*	5	2	40%
AMB+HBJL1*	12	5	42%
WMUR+HBJL-7*	27	13	48%
Milam+Kinkoji	8	4	50%

St. Helena Spray Program History (Administered by Troy Gainey, CREC Field Manager).

<u>2008</u>

May	Admire 2F	4oz acre
June	Admire 2F	4oz acre
August	Admire 2F	4oz acre
October	Admire 2F	4oz acre

2009

February	Danitol 2.4 EC	1 pint acre
March	Admire 2F	8 oz acre
April	Dimethoate 4E	1 pint acre
	435 spray oil	4 gallons acre
	Kocide	4 lbs acre
	Zn 2.0% Mn 2.0% Fe 1.6%	2 gallons acre
May	Alias 2F	8 oz acre
June	Provado 1.6F	10 oz acre
	435 spray oil	4 gallons
	Kocide	4 lbs acre
July	Lorsban 4E	5 pints acre
	435 spray oil	4 gallons
	Kocide	4 lbs acre
Early July	Alias 2F	8 oz acre
September	Movento	10 oz acre
	435 spray oil	4 gallons
	Zn 2.0% Mn 2.0% Fe 1.6%	2 gallons
	Kocide	3 lbs acre
Late Sept.	Alias 2F	8 oz acre
October	Danitol 2.4 EC	1 pint acre

<u>2010</u>

January	Danitil 2.4 EC	1 pint acre
February	Dimethoate 4E	1 pint acre
	Man-zinc	1 quart acre
	Boron	10 oz acre
	Copper Sulfate	2 lbs acre
	Li 700	.25 % V/V
March	Alias 2F	8 oz acre
April	Nexter	4.3 oz acre
May	Alias 2F	8 oz acre
	Movento	10 oz acre
	435 spray oil	4 gal acre
	11-8-5	.5lbs acre
	Ksar	10 oz acre
	Kocide	2.5lbs

June	Delegate WG	4 oz acre
	435 spray oil	4 gallons
	Zn 2.0% Mn 2.0% Fe 1.6%	2 gallons
	Kocide	2.5 lbs acre
July	Alias 4F	4 oz acre
	Imidan 70W	1 lb acre
	435 spray oil	2 gallons
	Zn 2.0% Mn 2.0% Fe 1.6%	2 gallons acre
	Trigger	7 oz acre
	Li 700	.25% v/v
	Kocide 3000	2.5 lbs acre
Late August	Actrara 25WG	4 oz acre
	Delegate	4 oz acre
	435 spray oil	2.5 gallons acre
	Zn 2.0% Mn 2.0% Fe 1.6%	2 gallons acre
	Kocide 3000	2.5 lbs acre
September	Alias 4F	4oz acre
October	Danitol 2.4 EC	16 oz acre
	435 spray oil	2 gallons acre
	Zn 2.0% Mn 2.0% Fe 1.6%	2 gallons acre

2011

January	Dimithoate 4E	16 oz acre
	Urea 3.26%	27lbs acre
	Li 700	.25% v/v
February	Danitol 2.4 EC	16 oz acre
	Solubor	1 lb acre
	Calcium Nitrate	5 lbs per 100 gallons water
April	Alias 4F all resets	4 oz acre
	Mustang	4.3 oz acre
	435 spray oil	3 gallon acre
	Zn 2.0% Mn 2.0% Fe 1.6%	2 gallons acre
May	Provado 1.6F	10 oz acre
	Zn 2.0% Mn 2.0% Fe 1.6%	2 gallons acre
	435 spray oil	2 gallons acre
June	Alias 4F all resets	4 oz acre
	Movento	10 oz acre
	435 spray oil	3 gallons
	Delegate	4 oz acre
	Nitro 30 SRN	1 gallon acre
	Recover RX 3-18-18	2 gallons acre
	Microtech AG	2 quarts acre
	TKO 0-29-26	1 quart acre
	Compainion 2-3-2	1 quart acre
Late June	Admire Pro all mature trees	14 oz acre
July	Imidan	1 lb acre

	Li 700	.25% v/v
	435 spray oil	2 gallons acre
	Zn 2.0% Mn 2.0% Fe 1.6%	2 gallons acre
August	Alias 4F all resets	4oz acre
September	Actara 25wg	4 oz acre
	435 spray oil	2 gallons acre
	Calcium Nitrate	5 lbs per 100 gallons
	Magnesium Sulphate	5lbs per 100 gallons
October	Alias 4F all resets	4 oz acre
	Danitol 2.4 EC	16 oz acre
	Calcium Nitrate	5 lbs per 100 gallons
December	Imidan 70 W	1 lb acre

2012

January	Danitol 2.4 EC	16 oz acre
	Calcium Nitrate	5 lbs per 100 gallons
	Solubor	1 lb per 100 gallons
	Induce	16 oz per acre
February	Dimethoate 4E	1 pint acre
	TKO	30 oz acre
	Induce	16 oz per acre
February	Admire Resets	2.8 oz acre
March	Mustang	4.3 oz acre
	Oil 435	2 gallon acre
	Kocide 3000	2 lbs acre
Late March	Imidan 70 W	1 lb acre
	Pottassium Nitrate	5 lbs acre
April	Admire Resets	2.8 oz acre
	Delegate	4 oz acres
	Oil 435	2 gallon acre
	Kocide 3000	2 lbs acre
May	Agri-flex	8 oz acre
	Oil 435	2 gallon acre
	Zn 2.0% Mn2.0% Fe1.6%	2 gal acre
	Kocide 3000	2 lbs acre
June	Admire Resets	2.8 oz acre
	Actara	4 oz acre
	DPK	2 gallon acre
	Kocide 3000	2 lbs acre
July	Kocide 3000	2 lbs acre
	Danitol 2.4 EC	16 oz acre
	Oil 435	2 gallon acre
	Pottassium Nitrate	5 lbs acre
	Key Plex	5 pints acre
August	Admire Resets	2.8 oz acre
	Delegate	4 oz acres

	Oil 435		2 gallon acre
	Kocide 3000		2 lbs acre
September	VoliamFlexi		7 oz acre
	Key Plex		5 pints acre
	Kocide 3000		2 lbs acre
October	Admire	Resets	2.8 oz acre
	Mustang		4.3 oz acre
	Oil 435		2 gallon acre
	Kocide 3000		2 lbs acre
November	Malathion		5 pints acre
	CN9		36 oz acre
	Induce		16 oz acre
	Solubor		1 lbs acre
December	Admire	Resets	2.8 oz acre

2013

January	Danitol		16 oz acre
	CN9		36 oz acre
	Induce		16 oz acre
	Solubor		1 lbs acre
February	Admire	Resets	2.8 oz acre
	Movento		16 oz acre
	Oil		3 gal acre
	TKO		29 oz acre\
	Recover RX		2 gal acre
March	Actara		4 oz acre
	Pottasium Nitrate		5 lbs acre
	Microtech CT		1Gal acre
	Induce		16 oz acre
	Copper		2 lbs acre
March	Admire	Resets	2.8 oz acre
April	Dimethoate 4E		1 pint acre
	TKO		29 oz acre
	Induce		16 oz per acre
	Recover RX		2 gal acre
	Induce		16 oz acre
	Citrus Fix		5 mil acre
Late May	AgriFlex		5 oz acre
	Oil		2 gal acre
	Copper		2 lbs acre
June	Admire Resets		2.8 oz acre
	Delegate		4 oz acres
	Oil		2 gallon acre
	Recover RX		2 gallon acre
	Copper		2 lbs acre
July	Mustang		4.3 oz acre

	Oil	2 gallon acre
	Pottasium Nitrate	5 lbs acre
	Microtech CT	1Gal acre
Early August	Copper	2 lbs acre
August	Admire Resets	2.8 oz acre
Late August	Imidan	1 lbs acre
	Oil	2 gal acre
	TKO	29 oz acre
	Recover RX	2 gal acre
September	VoliamFlexi	7 oz acre
	Copper	2 lbs acre
October	Actara	4 oz acre
	Oil	2 gallon acre
	Pottasium Nitrate	5 lbs acre
	Microtech CT	1Gal acre
December	Delegate	4 oz acre
	Oil	2 gal acre
	TKO	29 oz acre
	Recover RX	2 gal acre
2014		
Late January	Malathion	5 pt/acre
	Induce	16 oz/acre
	CN9	36 oz/acre
	Solubor	1 lb/acre
	Platinum 75 SG	0.0131 oz/tree (resets to 5')
Mid February	Movento	16 oz/acre
	Oil	3% v/v
	TKO	30 oz/acre
	Recover RX (3-18-18)	2 gal/acre
Late February	Border spray	
	Mustang	4.3 oz/acre
Early March	Admire Pro	0.05oz/tree (resets to 5')
Mid March	Closer	4 oz/acre
	Epson Salt (Mg sulfate)	8.5 lbs/acre
	Techmangam (Mn sulfate)	8.5 lbs/acre
	Zinc Sulfate	2.8 lbs/acre
	Sodium Molybdate	0.85 oz/acre
	Sodium Borate (Solubor)	3.3 lbs/acre
	KNO3 spray grade (13-0-44)	8.5 lbs/acre
	Salicylic Acid (Saver)	1 quart/acre
	435 oil	2.5 gal/acre
	Enable	8 oz/acre
	Belay 50 WDG	0.0458 oz/tree (resets 5' to 9')
Mid April	Imidan	1 lb/Acre
	Oil	3% v/v

	TKO	30 oz/acre
	Recover RX (3-18-18)	2 gal/acre
	ManZinc	2 qt/acre
	Copper	2 lb/acre
	Admire Pro	0.05oz/tree (resets to 5’)
Early May	Platinum 75 SG	0.0262 oz/tree (resets 5’ to 9’)
Late May	Belay 50 WDG	0.0229 oz/tree (resets to 5’)
Early June	Border spray	
	Agri-Flex	5 oz/acre
	Oil	3% v/v
Mid June	Delegate	4 oz/acre
	Epson Salt (Mg sulfate)	8.5 lbs/acre
	Techmangam (Mn sulfate)	8.5 lbs/acre
	Zinc Sulfate	2.8 lbs/acre
	Sodium Molybdate	0.85 oz/acre
	Sodium Borate (Solubor)	3.3 lbs/acre
	KNO3 spray grade (13-0-44)	8.5 lbs/acre
	Salicylic Acid (Saver)	1 quart/acre
	435 oil	2.5 gal/acre
	Copper	2 lb/acre
	Admire Pro	0.1 oz/tree (resets 5’ to 9’)
Early July	Belay 50 WDG	0.0229 oz/tree (resets to 5’)
Mid July	Border spray	
	Danitol	1 pt/acre
Late July	Agri-Flex	5 oz/acre
	Oil	3% v/v
	Potassium Nitrate	5 lbs/acre
	Copper	2 lbs/acre
	Belay 50 WDG	0.0458 oz/tree (resets 5’ to 9’)
August	Imidan	1 lbs/acre
	Epson Salt (Mg sulfate)	8.5 lbs/acre
	Techmangam (Mn sulfate)	8.5 lbs/acre
	Zinc Sulfate	2.8 lbs/ acre
	Sodium Molybdate	0.85 oz/acre
	Sodium Borate (Solubor)	3.3 lbs/acre
	KNO3 spray grade (13-0-44)	8.5 lbs/acre
	Salicylic Acid (Saver)	1 quart/acre
	435 oil	5 gal/acre
	Copper	2 lb/acre
	Admire Pro	0.05 oz/tree (resets to 5’)
Early September	Border spray	
		2 gal/acre
	435 Oil	2 gal/acre

	Admire Pro	0.1 oz/tree	(resets 5' to 9')
October	Voliamflexi	7oz/acre	
	Epson Salt (Mg sulfate)	8.5 lbs/acre	
	Techmangam (Mn sulfate)	8.5 lbs/acre	
	Zinc Sulfate	2.8 lbs/acre	
	Sodium Molybdate	0.85 oz/acre	
	Sodium Borate (Solubor)	3.3 lbs/acre	
	KNO3 spray grade (13-0-44)	8.5 lbs/acre	
	Salicylic Acid (Saver)	1 quart/acre	
	435 oil	2.5 gal/acre	
	Copper	2 lb/acre	
	Admire Pro	0.05 oz/tree	(resets to 5')
November	Border Spray Malathion	5 pt/acre	

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CREC Grove Crew: Troy Gainey (Grove Manager), Michael Clock, Danny Perkins, Jack Virgil Stewart, Jonathan Mercado Vega and Phillip Mitchell

CREC Plant Improvement Team: Gary Barthe, Dr. Paul Ling, Mauricio Rubio, Jim Baldwin, Gary Test and Ian Debarry

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