

Citrus Rootstock Breeding for an HLB- Endemic Florida: The Way Forward

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Citrus Rootstock Breeding:

The UF/CREC Citrus Improvement Team has worked very hard to establish a common sense delicate **BALANCE** between providing viable/profitable rootstock options for the short-medium term, and developing the **HOMERUN** rootstock(s) that will be the **ANSWER** to HLB for the future, regardless of the scion.



University of Florida Rootstocks (UFR's)

In 2011, we were asked to assess our new rootstock germplasm and release a group of rootstocks that we thought had the best potential against HLB, not waiting for the usual traditional data sets.

We chose to divide this up into appropriate categories, and we released the following 17 following UFR rootstocks, based on limited but positive data:

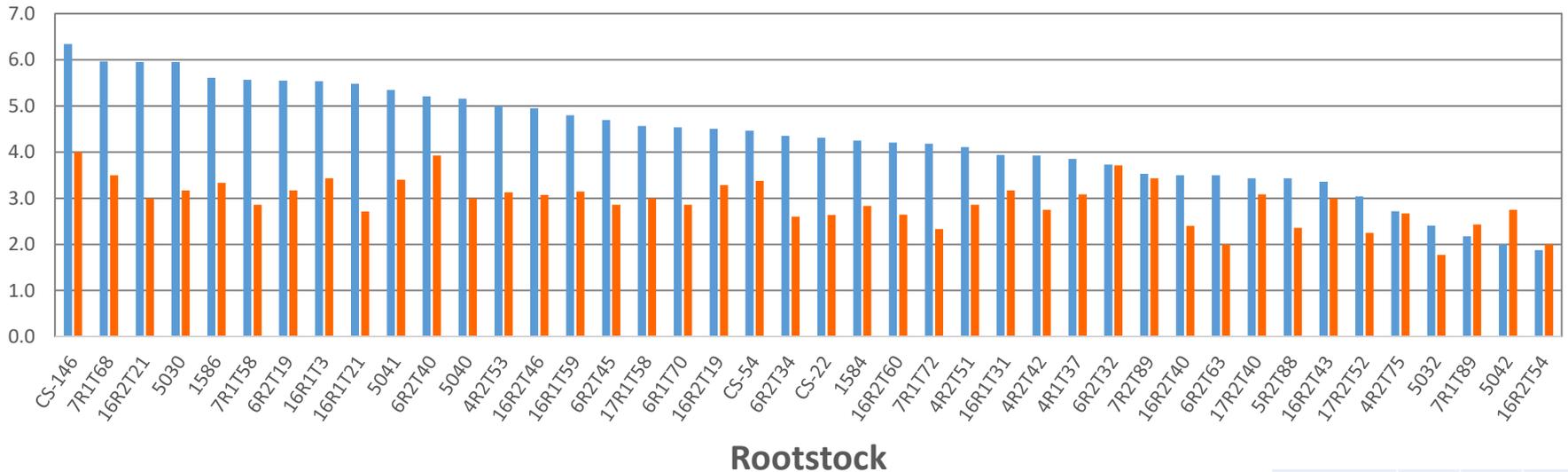
Tetraploid Rootstocks: UFR 1-6; 17 (from somatic hybridization and 4x breeding)
Citranges: UFR 7-12
Ichangensis hybrid: UFR 13
Sour orange types: UFR 14-16



**Premier Grapefruit Rootstock Trial – Fort Pierce
Several new citranges performing well!**

Premier Citrus Trial

Premier Marsh Rootstock Trial - Cum 3-year yield 2010-11, 2011-12, 2015-16
[box/tree] and HLB rating 2017



HLB ratings

■ cum 3-year yield ■ HLB Rating [2017]

HLB rating scores			
0-0.5	=	no HLB symptom or few leave symptoms	
1-1.5	=	10%-20% HLB symptomatic canopy	
2-2.5	=	25%-50% HLB symptomatic canopy	
3-3.5	=	more than 50% HLB symptomatic canopy	
4	=	decline to death	

NEW STRATEGY: BREEDING SOMATIC HYBRID ROOTSTOCKS AT THE TETRAPLOID LEVEL – CREATION OF **‘TETRAZYGS’**

- Use of allotetraploid somatic hybrid breeding parents allows the mixing of genes from 3-4 diploid rootstocks at once.
- Progeny can be screened at the seed/seedling level for wide soil adaptability and Phytophthora resistance.
- Products can have direct rootstock potential including adequate polyembryony, ability to control tree size due to polyploidy, and improved disease resistance.



Candidate
for ACPS

Valquarius on Orange #15 tetrazyg rootstock - just < 5 years at
St. Helena, Dundee FL - released as UFR-3

St. Helena Project 2019 Top 30 Data – Rootstock Recovery Contest under Improved Nutrition

Scion/Rootstock Combination 10-year old trees						PS/Acre	Boxes/Acre	cum PS/acre
	PS/Box [2019]	Boxes/Tree [2019]	PS/tree [2019]	Optimum Trees/Acre	Optimum Sq ft/tree [2019]	Projected [2019] (% increase 2019/2018)	Projected [2019] (% increase 2019/2018)	[projected] 2011-19 (9 years of data)
Vernia:Orange1804	6.5	3.0	19.1	207	210	3951 (150)	611 (114)	16509 (9)
Vernia:KCZ	6.9	2.6	17.7	212	205	3756 (119)	543 (87)	13466 (9)
Valquarius:Orange1804	5.9	3.3	19.6	189	230	3713 (121)	629 (95)	13479 (8)
Vernia:Yel1800	6.5	2.4	15.4	235	185	3619 (136)	559 (122)	13516 (9)
Vernia:Blue1	6.5	2.5	16.0	223	195	3573 (NA)	546 (173)	18278 (9)
Vernia:MG-11	6.8	2.3	15.6	229	190	3571 (113)	527 (72)	16081 (9)
Vernia:Orange21	6.6	1.9	12.5	281	155	3518 (129)	534 (83)	14550 (9)
Vernia:Purple2	6.1	2.0	12.1	281	155	3411 (46)	556 (21)	17951 (8)
Vernia:Volk	5.6	3.5	19.7	171	255	3362 (104)	604 (84)	14339 (9)
Valquarius:FG1793	6.1	3.0	18.1	185	235	3341 (150)	551 (139)	13651 (8)
Valquarius:Orange13	6.6	2.0	12.9	256	170	3312 (127)	502 (93)	16746 (9)
Vernia:Aqua1803	6.6	2.3	15.4	203	215	3131 (114)	473 (73)	16612 (9)
Vernia:Cleo+CZO	6.9	1.8	12.4	249	175	3097 (NA)	448 (39)	18089 (9)
Vernia:Chang+50-7 [UFR 6]	7.3	1.4	10.3	300	145	3079 (249)	420 (156)	13902 (9)
Valquarius:Amb+HBJL-2B	6.4	2.3	14.8	207	210	3067 (223)	482 (177)	15128 (8)
Valquarius:681G26F4P6	6.2	2.5	15.1	198	220	2993 (70)	485 (53)	15716 (8)
Valquarius:Aqua1803	6.2	2.3	14.4	207	210	2971 (145)	482 (112)	14538 (8)
Valquarius:White1805	6.1	2.8	17.2	171	255	2942 (138)	484 (112)	15380 (8)
Vernia:Wgft+50-7	6.7	1.9	12.3	235	185	2891 (NA)	435 (104)	16168 (9)
Valquarius:Pink1802	6.4	1.7	10.5	272	160	2868 (73)	449 (53)	12977 (9)
Vernia:White1805	6.9	1.4	9.9	290	150	2866 (101)	415 (69)	13868 (9)
Valquarius:MG-11	6.0	2.1	12.4	229	190	2834 (109)	476 (69)	13885 (8)
Valquarius:FG1707	6.8	1.9	13.2	212	205	2790 (72)	409 (45)	14208 (8)
Vernia:Orange19 [UFR 4]	6.4	1.9	12.2	223	195	2730 (147)	426 (102)	14720 (9)
Valquarius:FG1733	6.3	1.8	11.4	229	190	2609 (172)	412 (110)	15233 (8)
Vernia:Orange18	6.7	1.5	10.1	256	170	2573 (NA)	384 (49)	13824 (9)
Vernia:Orange3 [UFR 1]	6.8	1.6	10.8	235	185	2542 (127)	376 (86)	12726 (9)
Vernia:SWC	6.7	1.8	12.1	207	210	2513 (114)	377 (88)	12500 (9)
Vernia:Purple4	7.5	1.1	7.9	311	140	2466 (NA)	330 (42)	15659 (9)
Valquarius:Orange3 [UFR 1]	6.5	1.8	11.5	212	205	2445 (93)	377 (82)	16295 (8)

St. Helena Project -Top 15 Among 8-year old trees – 2019 Data Rootstock Recovery Contest under Improved CRF Nutrition

Scion/Rootstock Combination 8-year old trees	PS/Box [2019]	Boxes/Tree [2019]	Optimum Trees/Acre	Optimum Sq ft/tree [2019]	PS/Acre	Boxes/Acre	cum PS/acre
					Projected [2019] (% increase 2019/2018)	Projected [2019] (% increase 2019/2018)	[projected] 2011-19 (Years of data)
Vernia:46x31-02-13 (UFR-16)	6.4	2.1	280	155	3751 (109)	582 (89)	9823 (5)
Valquarius:White1	6.2	3.1	189	230	3615 (238)	586 (212)	9682 (6)
Valquarius:6058-2071-01-02	5.9	1.7	311	140	3048 (41)	513 (32)	7467 (5)
Vernia:46x31-02-S3	6.3	1.8	264	165	3046 (129)	486 (104)	9613 (6)
Vernia:Amb+Volk	6.5	1.4	293	180	2666 (136)	410 (75)	9909 (6)
Vernia:Nova+7-2-99-2	6.6	1.4	272	160	2548 (139)	389 (108)	8203 (6)
Valquarius:SO+RPxSH99-5	6.9	1.1	323	135	2414 (70)	349 (50)	10139 (6)
Vernia:46x31-02-S9	6.9	1.1	317	137	2366 (13)	342 (-2)	8783 (6)
Vernia:Green2 (UFR-17)	6.3	1.8	203	215	2314 (173)	367 (125)	8341 (5)
Vernia:6058x6056-002	5.9	1.7	218	200	2104 (92)	360 (67)	6070 (5)
Vernia:Amb51992	6.5	1.0	300	145	1855 (69)	285 (48)	8372 (6)
Vernia:6058-2071-01-02	6.4	1.1	264	165	1771 (99)	277 (86)	7271 (6)
Vernia:A-Mac	6.2	1.1	242	180	1674 (-10)	269 (-23)	7135 (6)
Vernia:SO+RPxSH99-4	6.1	1.0	281	155	1665 (88)	273 (91)	3989 (5)
Vernia:Wmur+HBJL-7	6.7	1.0	235	185	1500 (13)	223 (10)	6837 (6)

New Rootstocks being considered for commercial release: Cleo+Carrizo; Blue 1, Orange 1804 (Argentina), Orange 16, Orange 14 & Amb+HBJL-2B.

UFR-17 Emerging as good HLB-tolerant rootstock for higher-density plantings.



Valencia on UFR-17, February 2018



July 2018



February 8, 2019

6-year old Valencia/UFR-17 resets at Ori Lee Alligator Grove; HLB+ over 4 years, grown with no psyllid control; picked 2.13 boxes/tree in 2018 season; 2.5 in 2019. UFR-17 is [Nova+HBPummelo x sour orange+Carrizo].

Best of 125 hybrid rootstock selections
originally being tested against blight.



9-year old Valencia on 46x20-04-6 (HB Pummelo x Cleo) grown at Lee Alligator Grove (St. Cloud) with no psyllid control and no special nutrition.

Plant species have thrived for thousands of years in the presence of evolving, hostile pathogens – HOW? They have created their own genetic diversity, and through the process of natural selection, tolerant or resistant genotypes overcome the threat and allow the species to evolve.

In Citrus, this process has been largely interrupted by man, with Citriculture now approaching monoculture – leading to the problem that has brought us all together.

Facilitated by biotechnology, citrus breeders have the opportunity to artificially reinstate this process by creating broad and unique genetic diversity from elite parents, followed by robust screening. Maybe this is the answer for solving the HLB and other disease problems!

The New Gauntlet in the HLB world

High Throughput Screening Method

>12,000 hybrids screened to date

1. Crosses of superior parents made at diploid and tetraploid levels
2. Seed harvested from crosses planted in bins of calcareous soil (pH=8), inoculated with *P. nicotianae* and *P. palmivora* (JH Graham)
3. Selection of robust seedlings based on growth rate, health and color (most don't make it!)
4. Transfer to 4x4 pots in commercial potting soil
5. Top of new tree goes for seed source tree production; remaining liner to the HLB screen
6. Hybrid liner is grafted with HLB-infected budstick of Valencia sweet orange; remaining rootstock top removed, forced flushing from HLB-infected sweet orange budstick
7. Trees monitored for HLB symptoms – healthy appearing trees entered into 'hot psyllid' house for 4 weeks, followed by field planting at Picos Farm (under DPI permit).



Rootstock cross with good Phytophthora resistance.



Gauntlet trees are produced by 'stick' grafts. HLB-infected Valencia budsticks wrapped in parafilm are grafted into selected rootstock candidates. Rootstock tops are used to produce rooted cuttings for seed trees on their own roots.



Quite often the first flush is symptom free, selection is based on the 2nd flush, which usually shows symptoms.



2016 Field Planting will include trees on left; featuring 3 superior crosses:
C2-5-12 pummelo x papeda; A+HBP x White 1 and A+HBP x sour orange+rangpur.
Candidates on left already passed through the 'hot psyllid' house.



Gauntlet Survivor at Picos Farm
-Valencia on Milam+HBP x Orange #14-09-14



Gauntlet Survivor at Picos Farm
-Valencia on Milam+HBP x Orange #14-09-14

1. Genetic Patterns Emerging! Gauntlet trees showing promise – complex tetraploids, combining phloem regeneration capacity from the lemon group with the feeder root preservation trait of Orange 19 (and sibling Orange 14).

A+Volk x Orange 19-11-23

A+Volk x Orange 19-11-9

A+Volk x Orange 19-11-26

A+Volk x Orange 19-11-8

A+Volk x Orange 19-11-31

A+Volk x Orange 19-11-1

A+Volk x Orange 19-11-5

A+Volk x Orange 19-11-13

Milam+HBP x Orange 14-09-3

Milam+HBP x Orange 14-09-19

Milam+HBP x Orange 14-09-12

Milam+HBP x Orange 14-09-9

Milam+HBP x Orange 14-09-4

Milam+HBP x Orange 14-09-6

Milam+HBP x Orange 14-09-14

Milam+HBP x Orange 14-09-10

Milam+HBP x Orange 14-09-11

2. Genetic Patterns Emerging! Gauntlet trees showing promise from rootstock hybrids stacked with abiotic stress tolerance genes (HLB is a stress reactive disease).

Sour orange types:

S10xS11-11-S20 (salt tolerant Shekwasha/pummelo)

S10xS15-12-25 (salt tolerant Shekwasha & Cleo/pummelo)

S10xS15-12-48 (salt tolerant Shekwasha & Cleo/pummelo)

S10xS15-12-35 (salt tolerant Shekwasha & Cleo/pummelo)

S10xS15-12-32 (salt tolerant Shekwasha & Cleo/pummelo)

S10 x x639-12-16 (salt tolerant Shekwasha/Cleo/trifoliolate orange)

S10 x x639-12-31 (salt tolerant Shekwasha/Cleo/trifoliolate orange)

46x31-00-S10 x US812-11-2 (salt tolerant Shekwasha, Sunki,
trifoliolate orange)



S10xS15-12-25 (Shekwasha/Cleo/pummelo)



Several hybrids of 8-1-99-2B x C22 (pummelo x citrandarin)

GAUNTLET rootstock screening (Final stage at USDA-Picos Farm, Fort Pierce, FL); HLB+ Valencia trees grown from the get-go with Clas-infected budsticks; also passed through a hot psyllid house. More than 10,000 hybrids screened to date. Some now in large-scale trials!

Is HLB-Resistance in the Scion Possible from a Rootstock?

<u>CLas Non-Detected</u>	<u>NR</u>
1. S10xX639-12-4	4
2. S10xS15-12-25	4
3. S10xS15-12-33	3
4. 8-1-99-2BxC-22-12-32	4
5. A+VolkxOrange19-11-24	3
6. B11-R5-T25-11-6 (FD hybrid)	3
7. Milam+HBPxOrange14-09-19	4
8. B11-R5-T4-11-2 (FD hybrid)	4
9. S10xS15-12-29	4
10. A+HBPxCH+50-7-12-57	4
11. S10xX639-12-7	3

Table 3. Grosser/Gmitter: 2019 qPCR (Cano) older 'gauntlet' trees showing non-active CLas infection – potential resistance being transmitted to the Valencia scion? Trees 4-6 years old at USDA-Picos Farm.

Top 'Gauntlet' rootstock trees in Row 13 at USDA Picos Farm;
planted with HLB+ Valencia scion – January 2020.

Sample code	Row	Tree	Rootstock	Height	Health	Fruit	Cal_ct	Diagnosis
1	13	57	MILAM-HBP x Orange 4	6	4	3	30.61	Questionable
2	13	58	C-2-5-12 x C. Latipes-13-75	5.5	4	2	27.71	HLB Positive
3	13	62	A-HBP x SORP-13- 72	5	4	2	31.68	Questionable
4	13	64	C-2-5-12 x C. Latipes-13-54	7	4	2	26.51	HLB Positive
5	13	68	C-2-5-12 x C. Latipes-13- 44	6	4	2	30.10	Questionable
6	13	71	A-HBP x White 1-13- 25	6	4	2	27.20	HLB Positive
7	13	72	A-HBP x White 1-13- 13	6.5	4	3	33.17	No HLB Found
8	13	76	C-2-5-12 x C. Latipes-13- 5	7	4	2	30.22	Questionable
9	13	91	A-HBP x White 1-13- 37	6	3	3	28.16	HLB Positive
10	13	102	A-HBP x White 1-13- 1	5.5	3	3	26.26	HLB Positive
11	13	109	C-2-5-12 x C. Latipes-13-1	5.5	3	3	27.52	HLB Positive
12	13	116	A-HBP x SORP-13- 79	6	4	2	37.28	No HLB Found
13	13	129	A-HBP x White 1-13- 20	6	4	1	33.67	No HLB Found
14	13	138	A-HBP x SORP-13- 12	5	3	3	25.08	HLB Positive
15	13	141	Orange 15 mutation 16-2X	5	4	1	25.64	HLB Positive
16	13	146	A-HBP x SORP-13- 50	5.5	4	3	27.18	HLB Positive
17	13	156	C-2-5-12 x C. Latipes-13- 53	6	3	3	26.48	HLB Positive
18	13	160	Orange 15 mutation 25-4X	5.5	3	3	34.00	No HLB Found
19	13	167	Orange 15 mutation 34-4X	7	4	3	40.00	No HLB Found
20	13	172	C-2-5-12 x C. Latipes-13- 74	3.5	4	2	30.95	Questionable
21	13	173	A-HBP x SORP-13- 48	4.5	3	3	33.30	No HLB Found
22	13	180	C-2-5-12 x C. Latipes-13- 11	7	4	2	31.85	Questionable
23	13	183	A-HBP x SORP-13- 10	6.5	4	3	40.00	No HLB Found
24	13	184	A-HBP x SORP-13- 20	4	3	3	40.00	No HLB Found
25	13	192	C-2-5-12 x C. Latipes-13- 77	6.5	4	3	40.00	No HLB Found
26	13	193	A-HBP x SORP-13- 60	4	3	3	40.00	No HLB Found

PCR performed at Southern Gardens diagnostic lab, c/o Mike Irey



Sour+Rangpur Seed Tree

HLB+Valencia/ A+HBPxSORP-13-29

Genetic Pattern 3. Gauntlet HLB+ Valencia on a complex rootstock hybrid of Amblycarpa+HBPummelo x Sour orange+Rangpur. The Sour orange+Rangpur parent seed trees are planted at 3 locations, and all are exceptionally tolerant of HLB. However, it does not make a good rootstock itself due to slow growth and excessive zygotic seed production. Hybridizing it with the tolerant A+HBP parent has corrected the vigor problem!



3-year old Valencia on gauntlet rootstock A+HBPxSORP-13-60 at USDA Picos Farm, planted HLB+, now HLB-negative (photo from October, 2019).

Sugar Belle (LB8-9) Rootstock Hybrid Cuttings Inventory

Hybrid*	Number	Hybrid*	Number	Hybrid*	Number
LB8-9 X S10-15-5	5	LB8-9 X S13-15-1	8	Sugar Belle LB-Zyg x 50-7-16-25	11
LB8-9 X S10-15-7	10	LB8-9 X S13-15-2	5	Sugar Belle LB-Zyg x 50-7-16-26	12
LB8-9 X S10-15-9	6	LB8-9 X S13-15-4	6	Sugar Belle LB-Zyg x 50-7-16-23	13
LB8-9 X S10-15-10	6	LB8-9 X S13-15-6	12	Sugar Belle LB-Zyg x 50-7-16-6	22
LB8-9 X S10-15-11	8	LB8-9 X S13-15-8	9	Sugar Belle LB-Zyg x 50-7-16-12	15
LB8-9 X S10-15-12	7	LB8-9 X S13-15-9	5	Sugar Belle LB-Zyg x 50-7-16-7	21
LB8-9 X S10-15-14	5	LB8-9 X S13-15-10	4	Sugar Belle LB-Zyg x 50-7-16-5	8
LB8-9 X S10-15-17	5	LB8-9 X S13-15-11	8	Sugar Belle LB-Zyg x 50-7-16-4	33
LB8-9 X S10-15-18	13	LB8-9 X S13-15-12	5	LB8-9 x 50-7-16-4	4
LB8-9 X S10-15-19	10	LB8-9 X S13-15-13	8	LB8-9 x 50-7-16-2	8
LB8-9 X S10-15-20	9	LB8-9 X S13-15-14	6		
LB8-9 X S10-15-21	4	LB8-9 X S13-15-15	8		
LB8-9 X S10-15-25	11	LB8-9 X S13-15-16	6		
LB8-9 X S10-15-28	5	LB8-9 X S13-15-18	4		
LB8-9 X S10-15-29	7	LB8-9 X S13-15-22	6		
LB8-9 X S10-15-30	11	LB8-9 X S13-15-23	4		
LB8-9 X S10-15-41	11	LB8-9 X S13-15-24	7		
LB8-9 X S10-15-47	4				
LB8-9 X S10-15-15	5				
LB8-9 X S10-15-16	2				
	144		111		147

*Name: Sugar Belle X OP Pummelo + Trifoliolate 50-7-XX-X (The Last Number is designates the sibling #. LB-ZYG = Lime Block Zygotic Or LB8-9 X OP Pumelo + Trifoliolate 50-7-XX-X

SugarBelle Rootstock Hybrids – Moving Through the ‘Gauntlet’



No stone unturned! Left: 1-year old HLB+Valencia on SugarBelle x 46x20-04-S15-15-16, under heavy psyllid pressure; Right: HLB+Valencia on various SugarBelle rootstock hybrids prepared for ‘Gauntlet’ field screen at USDA-Picos Farm in Fort Pierce.



UF/CREC-Germplasm into MAC Trials

1. Rogers MAC Project – CREC Lake Alfred (planted)

- 70 sweet orange/rootstock combinations (19 early orange; 51 late orange); SugarBelle on 4 rootstocks; all new rootstock candidates from the UF/CREC citrus improvement program.
- Plot size: 50 trees/plot; >12,000 trees, four plots for most combinations; 70+ acres

2. Grosser/Gmitter/Bowman MAC Rootstock Project (planted)

- Vernia/Valencia B9-65 and OLL-8 on 48 rootstocks (24 from UF)
- 12 trials, 12 4-tree replications, nearly 16,000 trees all planted

3. Vidalakis/McCollum MAC Project – CA/FL- Experiment 1 – HLB Tolerant Rootstock Effects on Fruit Quality (first planting underway)

- 5 standard scions on 12 improved rootstocks (6 from UF); 3 Sites in Florida, 7 replications per site, 3780 trees

4. Vidalakis/McCollum MAC Project – CA/FL - Experiment 2 – Evaluation of Putatively HLB Tolerant Scions

- Four Control Scions: Valencia, Hamlin, Tango & SugarBelle; 6 UF and 7 USDA mandarins (13 total selections); 7 UF and 5 USDA sweet orange/sweet orange-like (12 total selections); includes several true sweet oranges, 3 sites, 18,900 trees on US-942



New Lykes Trials: Camp Mack and Basinger

Working with John Gose and the Lykes Nursery, two major sister 40-acre rootstock trials replicated at two sites: Camp Mack and Basinger. 11/12 replications per rootstock.

Hamlin on 57 rootstocks

Valencia on 52 rootstocks

Rootstocks included from UF, USDA, CA and Spain

We have collected 2 years of young tree data, and will work with colleague Dr. Ute Albrecht (PI on the Trial Evaluation Project) to continue robust data collection and analysis.



Improving delivery of trial information to growers

- Citrus Improvement Team Website Now Online – one stop shopping for growers/processors, packers. Data from 16 trials at present:
- <https://citrusresearch.ifas.ufl.edu/rootstock-field-data/>
- Website will eventually have tabs to General Information, CRDF supported trials, MAC trials, and NIFA grant progress.
- Website will also provide links to FFSP, NVDMC, etc. for information on scion and rootstock access/licensing, etc.

Rootstock improvements regarding HLB are like likely to come in stages:

First stage: Rootstocks that reduce the frequency of HLB infection, and reduce the severity of the disease once infected – already proven to work with mid- and late-season oranges when grown with optimized nutrition programs focusing on root health.

Second stage: Potential rootstock mitigation of the disease – research is underway to possibly identify rootstocks that can protect the entire tree – regardless of the scion. Psyllid control may not be necessary. No horticultural performance data would be available on such selections initially, but the hybrids would have good rootstock pedigree, and can be mass-propagated by tissue culture (Ruck’s Nursery, Agristarts, Agromillora, Citrific, etc.).

Many of the most promising hybrids have been entered into expanded field trials via MAC grants. The first MAC grant (w/ Kim Bowman @ USDA) is testing 48 new rootstocks (24 from UF and 24 from USDA) with industry cooperators at 9 locations. The 2nd ‘Rogers’ MAC grant is testing 79 scion/rootstock combinations in LA. A third MAC grant will test putatively tolerant scions and rootstocks in Florida and California (w/ Vidalakis and McCollum, USDA). Numerous other trials are also planned and underway.

The Ticket For the Immediate Future

Improved Scion Genetics for HLB Tolerance

Plus

Improved Rootstock Genetics for HLB Tolerance

Plus

Improved Affordable Production Systems w/ Enhanced Root Nutrition

\$\$ Success \$\$



Combination of good scion genetics, good rootstocks genetics and evolving nutrition (McKenna nitrate program): OLL-8 sweet orange/UFR-4 rootstock, 4 year old trees – Working!

To HALL OF FAME CITRUS GROWER-RESEARCHER
And Outstanding Industry Collaborator Mr. Orie Lee

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Thanks!

UF-CREC Citrus Genetic Improvement Team
2020

