Field Testing to Identify Elite Rootstocks that can Mitigate or Prevent HLB in Scions Commercially Important to US Citriculture

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Year 2 of 5 (35% Complete)

Objectives

1. Identification of best possible HLB-tolerant rootstocks for profitable citriculture for commercially important scions in US citriculture (Florida, California, Texas).
2. Monitor tree health and bacterial titers (years 3-5)
3. Plant seed trees of elite rootstock candidates (Years 2-4)
4. Identify best rootstocks for each scion (Years 4-5)
5. Initiate seed and tissue culture propagation with commercial companies as necessary for largescale movement of best rootstocks into commercial plantings in all 3 states (years 4-5)

Problem and Significance

Citrus Greening Disease or HLB (huanglongbing) is the most devastating disease known to citrus and threatens the entire US citrus industry. The disease is now endemic in Florida and Texas and is present in California. The disease is vectored by psyllid insects that are now spreading throughout US citrus growing regions, and expensive psyllid control has not been effective in Florida. All important commercial scions are susceptible, and the disease causes significantly reduced yields, and can also cause diminished fruit quality. Numerous approaches, including thermotherapy and the application of antibiotics, have thus far not proven to be successful. Identification and validation of a rootstock that can mitigate or prevent the disease is the ultimate non-GMO solution, and could work for all scions. Such a new rootstock could be used for new trees but could also be inarched into existing trees.

Benefit to Industry

Successful commercialization of rootstocks that can mitigate or prevent HLB can save the entire US citrus industry from this devastating disease and contribute substantially to sustained, profitable citriculture into the distant future. This can be a permanent solution that doesn't require additional expensive inputs after tree planting. This project also has potential to match tolerant rootstocks with the different categories of citrus scions, which should contribute to identification of HLB-tolerant (or resistant) scion/rootstock combinations that maximize fruit quality.

Progress Summary

This is a continuous project, and elite new rootstock candidates from the UF-CREC and USDA breeding programs are being entered into the project as propagations become available. Rootstocks are being tested in the HLB-endemic environment using the 6 following scions representing the USA citrus industry: 1. Rio Red grapefruit; 2. Lisbon Lemon; 3. EV-1 (Early Valencia); 4.Glenn Navel; 5.Low-seeded Murcott 18A-10-47 (highly susceptible); and 6. Tango (or W. Murcott). The trial block is located in a CREC research grove in Eagle Lake, FL, approximately 10 miles south of the CREC. Many of the new rootstock candidates are emerging from direct HLB screening as an initial step in new rootstock development, and thus seed source trees are not available. Liners are therefore being propagated often by rooted cuttings or via tissue culture with the help of commercial rootstock tissue culture propagation companies.

The first cohort of 479 trees (the 6 selected scions above on 15 elite rootstock candidates) were planted in spring of 2020. Trees have established

well and are all showing healthy growth with no HLB symptoms. Of the first half of Cohort-2 (18 additional rootstock candidates selected for potentially improved HLB tolerance), approximately 500 trees were grafted with the 6 scions and planted this summer, and 700 more trees of Cohort-2 (from AgriMasters Citrus Nursery) are expected to be planted later this year Assembly of Cohort-3 rootstock liners is in progress, with propagations coming from seed, rooted cuttings, and tissue culture (TC) from Agromillora, Florida Inc. Cohort-3 includes the top (to date) 'gauntlet' rootstock selection S10xS15-12-25 (a hybrid of two salinity-tolerant pummelo x mandarin hybrids), and the first 'gauntlet' SugarBelle-rootstock hybrid LB8-9xS13-15-16 ([salinity tolerant pummelo x Cleopatra] x SugarBelle) that continues to show great promise. Rooted Cuttings were initiated from both of these, and two other promising 'gauntlet' rootstocks, including the Milam+HBPxOrange 4 hybrid that tested PCR negative or questionable for '*Candidatus* Liberibacter asiaticus' over 5 consecutive months this past winter. Cohort 3 will also include two of Dr. Gmitter's new University of Florida Rootstock (UFR) citranges, and 10 selections from Dr. Bowman (USDA), along with a total of 10 selections from Dr. Grosser (22 total selections). Himrod and Himrod Citrus Nursery is propagating most of the trees for Cohort 3, the remainder being propagated at the UF-CREC.

Recovery of vegetative materials of Cohort 4 rootstocks is also underway as necessary to initiate propagations. Table 1 provides a list of the rootstocks planted to date along with those under propagation for future planting. As mentioned, this is a progressive project, and genetic patterns for HLB tolerance, and possibly even resistance, are emerging. Efforts are being made to quickly include the most promising rootstocks in the project as they become available.

Note: This project is jointly supported by UF-CREC, CRB and Texas Citrus Mutual.

Publications and Presentations

Grosser, Jude, Fred Gmitter and Kim Bowman. New Rootstocks in the Citrus Breeding Pipeline. (2020) Citrus Industry Magazine, July. https://citrusindustry.net/2020/07/15/new-rootstocks-in-the-citrus-breeding-pipeline/

Grosser, Jude (2020). Improved Genetics and Nutrition – The Way Forward. The 2020 Florida Citrus Growers' Institute. https://citrusagents.ifas.ufl.edu/archived-presentations/2020/grosser/

Grosser, Jude, Bill Castle and Fred Gmitter (2020). Varieties and Rootstocks for an HLB-Endemic Florida. Citrus Expo. https://citrusexpo.net/aiovg_videos/varieties-and-rootstocks-for-an-hlb-endemic-florida/

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Cohort 1	Cohort 2	Cohort 3	Cohort 4
A+VolkxOr19-11-8	Murcott+Rubidoux	S10xS15-12-25	LB8-9 (SugarBelle)xS10-15-9
Afghan sour orange	A+VolkxOr19-11-8	LB-9-14	LB8-9 (SugarBelle)xS13-15-16
46x20-04-6	Cleopatra+Carrizo	US-802 (Bowman)	UFR-2
2247x2075-02-26	2247x2075-01-2	US-942 (Bowman)	UFR-14 (Gmitter)
2247x6070-02-2	UFR-6	US-812 (Bowman)	A+HBJL-2B
Milam+HBPxOr14-9-10	UFR-5	SuperSour 2 (Bowman)	S11z x 50-7-16-6
UFR-1 clone #55	UFR-4	US-1516 (Bowman)	S10xX639-12-31
UFR-1 clone #28	UFR-7 (Gmitter)	US-897 (Bowman)	S11z x 50-7-16-4
UFR-1 clone #02	UFR-8 (Gmitter)	SuperSour 3 (Bowman)	LB8-9 (SugarBelle)xS13-15-15
UFR-1 original clone	UFR-9 (Gmitter)	UFR-10 (Gmitter)	LB8-9 (SugarBelle)xS10-15-18
UFR-6 clone #1	UFR-15	UFR-13 (Gmitter)	46x20-04-9-WJ
SG-2-P	UFR-16	Blue 1	A+HBPxCH+50-7-12-39
SG-6-50	UFR-17	White 1	A+HBPxCH+White 1-12-29
A+VolkxOr19-11-31	2247x6070-02-2	Orange 14	S10xS15-12-34
	A+HBPx6058x2071-2-8-16	Orange 16	Milam+HBPxOrange 4
	Green 6 x Orange 14-9-6	US-1279 (Bowman)	
	A+HBPxOrange14-9-16	US-1280 (Bowman, requires Material Transfer Agreement)	
	Farr Trifoliate	US-1281 (Bowman)	
	46x20-04-S15	US-1282 (Bowman)	
	46x20-04-29	US-1283 (Bowman)	
	2247x2075-02-7	US-1284 (Bowman)	

Table 1 Rootstocks for the Tri-State Project (Note: Cohort 1 and part of Cohort 2 trees have been planted and selection is in progress for Cohort 4).