Pummelo interstocks could improve performance of HLB trees

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All commercially cultivated citrus scion varieties are grafted onto rootstocks before being planted in the field. The rootstocks are selected based on specific desirable qualities (abiotic/biotic stress resistance) and the ability to produce a good crop in a specific location. The ideal rootstock confers disease resistance, hardiness, tolerance of environmental stresses, enhanced nutritional uptake, soil adaptation and improved yield.

ROOTSTOCKS AND INTERSTOCKS

Rootstocks can influence fruit quality, affect the Brix and soluble solids in the fruit, or affect the texture of the rind in some cases. In Florida, prior to the advent of HLB, many popular rootstocks, including Swingle or Kuharske/Carrizo, have been used in most locales and have resulted in supporting successful citriculture. Rootstocks support the scion, and there is a constant rootstock-scion interaction. Imparting HLB tolerance to the aboveground scion has become the primary trait of interest, and newer cultivars like US-942 and X-639 have gained in popularity.

The interstock, as the name suggests, is a bridge between the rootstock and the scion and is grafted in between the rootstock and scion (Figure 1). Interstocks are widely used in apple cultivation, where they have been used to regulate tree size and improve production and fruit quality. Interstocks can be used to compensate for scion/rootstock incompatibility, preventing decline of the tree, or to regulate the growth when one grafted element is more vigorous than the other. The interstock may prevent a bulge that can slow sap and stunt the growth of the tree.

Additionally, interstocks may increase the lifespan of the tree while improving production and fruit quality. Using interstocks that are tolerant to huanglongbing (HLB) may be able to confer this tolerance to the scion and the rootstock. Using an interstock may allow citrus growers to topwork a grove with a new interstock/scion combination, perhaps saving a grove that would otherwise be destroyed.

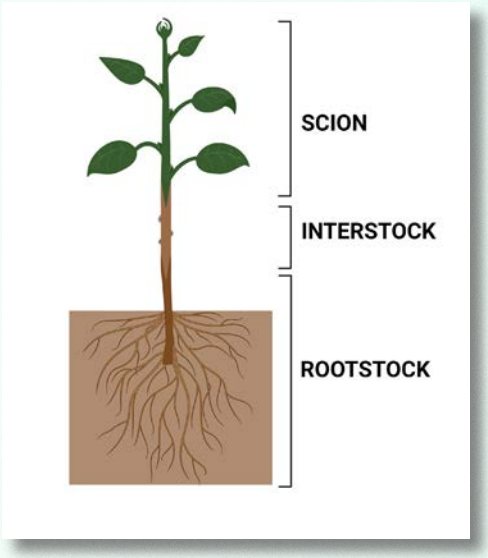

Figure 1. Schematic representation of the interstock grafting process

RESEARCH: THEN AND NOW

In the citrus breeding program, somatic fusion techniques have been used to generate new hybrids with the main goal of producing disease-resistant rootstocks or seedless triploid scions. In 1999, the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) initiated a project

to select superior pummelo seedlings that demonstrated good horticultural performance and potential tolerance to disease. In this study, seeds were collected from fruits of pummelo (*Citrus maxima*) trees planted at the Department of Plant Industry (DPI) Citrus Arboretum in Winter Haven, Florida, and at the home of a private individual.

Beginning in spring 2015, defoliated interstock sticks, selected from open pollinated pummelo seedling trees that had shown enhanced tolerance to HLB and tested negative for the presence of *Candidatus* Liberibacter asiaticus (*C*Las), were grafted onto Swingle rootstocks using a cleft graft. Valencia sweet orange, used as the scion, was selected from HLB-infected, field-grown trees from a UF/IFAS Citrus Research and Education Center grove in Lake Alfred (Figure 2). All trees were tested for HLB and tested positive for *C*Las. Subsequently, these infected trees were planted in the field under a permit from DPI to plant infected trees.

Four-year-old trees were then sampled for the presence of *C*Las, and other physiological and fruit parameters were studied. Trees appeared to be healthy and vigorous and were fruiting. The trees were evaluated for the presence of HLB using the qPCR method in spring 2021. Ct values between 29.7 and 33.5 were recorded, indicating that all trees were still infected with *C*Las. However, most of the trees did not exhibit visual HLB symptoms during the winter and spring.

When fruits were evaluated in late spring 2021, most of the parameters were similar to the control. However, several of the interstock combination trees had higher pound solids per box when compared to the control. It is interesting to note that trees with Swingle interstocks on Swingle rootstocks had higher pound solids than trees without an interstock (Figure 3). While it is not known at this time if these results will be consistent in the next few years, fruit quality will continue to be evaluated for several more years before drawing conclusions.

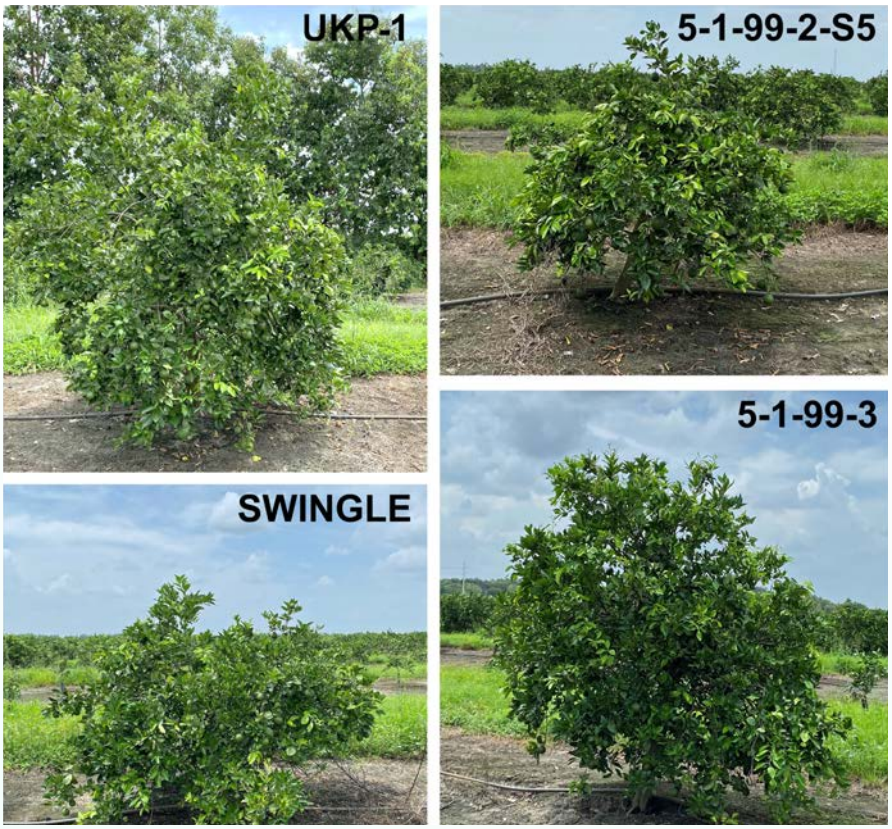

Figure 2. Valencia Sweet orange trees on selected pummelo interstocks and Swingle rootstock

GROWER IMPLICATIONS

While it is currently unknown what is occurring by using the pummelo interstocks, there is definitely a positive interaction. The interstock is conferring an amount of tolerance to the trees and shows a pronounced effect over the Swingle control. What is happening or how this occurs is still being investigated.

If a grower is paid $2.50 per pound solids and the grove produces 400 boxes to the acre, an interstock increasing the pounds solids per box by 1 pound will bring in $1,000 more per acre.

Interstock trees take a few months longer to grow in the nursery and would be slightly more expensive than conventional scion/rootstock trees. Two of the more promising pummelos used as interstocks in this study, namely UKP-1 and 5-1-99-3 (Monster), are in the DPI Parent Tree Program and will be tested in a larger interstock trial.

Sample ID	Acid	Total Brix	Ratio	Lbs. Solids Per Box	Juice Color
VALENCIA/UKP-1/SWINGLE	0.88	10.68	12.14	6.15	36.7
VALENCIA/HBJL-1/SWINGLE	0.70	9.06	12.94	4.76	36.0
VALENCIA/HBJL-4/SWINGLE	0.92	9.92	10.78	5.55	35.5
VALENCIA/7-2-99-11/SWINGLE	0.66	10.40	15.76	5.75	36.1
VALENCIA/5-1-99-2-S5/SWINGLE	0.60	8.11	13.52	3.97	35.6
VALENCIA/5-1-99-3/SWINGLE	0.91	11.00	12.09	5.97	37.3
VALENCIA/5-4-99-7/SWINGLE	0.75	10.08	13.44	5.52	36.9
VALENCIA/8-1-99-1B/SWINGLE	0.72	9.52	13.22	5.15	36.1
VALENCIA/SWINGLE/SWINGLE	0.77	9.82	12.75	5.35	35.7
VALENCIA/SWINGLE	0.70	8.86	12.66	4.63	36.6

Figure 3. Selected juice parameters of Valencia sweet orange fruits obtained from trees on selected pummelo interstocks and Swingle rootstock (scion/interstock/rootstock)

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