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Project: METHODS FOR REDUCING SEEDLING JUVENILITY IN CITRUS

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Juvenility in citrus seedlings is a major impediment to rapid selection and utilization of improved citrus cultivars. Seedlings will typically not produce significant amounts of fruit until they are 6+ years of age. This makes it necessary to maintain large numbers of plants for many years before they can be evaluated. The purpose of this project is to implement and refine methods for accelerating flowering and fruiting in citrus to permit earlier evaluation of fruit quality and enhance both efficiency and rapidity of developing improved citrus varieties. Funds were requested from the New Varieties Development and Management Corporation to provide salaries for technical assistance in an effort to expedite the evaluation of promising citrus scion selections with the goal of making them available to the citrus industry as rapidly as possible.

Technicians (3 individuals all less than 0.5 FTE contribute to this project) continue to maintain plants in greenhouses, establish plantings on the seedling juvenility reduction trellis (built using FY08 NVDMC funds), and train plants on the trellis using prescribed methods. In April 2009, over 2500 citrus trees were planted on the juvenility reduction trellis and have been grown with optimal nutrition, microsprinkler irrigation and aggressive weed control. 2300 Swingle liners were planted, to develop "mature" rootstocks for grafting with priority hybrids this coming growing season, and they are thriving. These liners were planted beneath a vertical training wire, were tied to the trellis, and are being allowed to freely grow except that no shoots are permitted in the lower two feet. This strategy should permit growth of the largest plants possible in the shortest time, while still providing clean trunks for budding.

210 plants were established to test components of the reported juvenility reduction system. There is no published report on this system, components have not been tested for their individual contribution to success and some represent very substantial commitments to hand labor and cost. For example, if thorn removal provides little or no contribution to maturation, then elimination of this step would permit inclusion of many more seedlings in the rapid maturation process. This seems promising, since thorns are most likely related to leaves in their anatomical development and are unlikely to be potent sources of PGRs. Plants used are seedling populations of Clementine x Hirado Buntan pummelo and the reverse cross, grafted onto US-812. Also included were seedlings of Sun Chu Sha mandarin, Duncan grapefruit and Ridge Pineapple sweet orange, and mature budwood-sourced Sun Chu Sha and Hirado Buntan pummelo, all

## Treatments

- 1) control, not trained, left with empty space on either side to minimize crowding, will “hedge” when needed to maintain 3’ width in-row
- 2) trained to single shoot upright
- 3) trained to single shoot upright, girdled in Dec of 2009 **and 2010**
- 4) trained to single shoot upright, treated with paclobutrazol at 50 mg /plant in Dec of 2009 **and 2010**
- 5) trained to single shoot upright, all thorns removed 2X/ week
- 6) trained to single shoot upright, all thorns removed 2X/ week, girdled in Dec of 2009 **and 2010**

Plants of each budwood source are adjoining each other in the trellis and individual treatment assignments were randomized within each group. Time required for managing each treatment is being assessed. An additional 59 Clementine x Hirado Buntan pummelo seedlings on US-812, for which there was only one plant of each, are planted onto the trellis and are being managed using the full juvenility reduction treatment.

**Trees that were trained to an upright shoot the previous year were almost completely defoliated in the winter of 2009-10 and following the established protocol were not allowed to create new lateral shoots. In August 2010, 166 triploids of high quality mandarin mothers were newly planted on the juvenility trellis. A cold protection structure was installed over the rows of trees with trained trees prior to the Dec 8 freeze and microsprinklers were run during the hours below freezing. Unfortunately, extreme cold weather (for Central Florida) was experienced at the Whitmore Farm producing new records for early season low temperatures. In Dec 8 through 29, 2010 there were 17 hours in which average temperature was below 24°F and temperatures below 20°F were recorded on 12/29 for one hour. Even trees under the cold structure were damaged, and all upright trained trees were completely defoliated. Most trees maintained using conventional practices, included as controls on the trellis, maintained a core of surviving foliage. A number of Swingle trees were under the cold protection structure and appeared to have received no benefit compared to trees unprotected.**

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Cumulative hours Dec 8-Dec 29, 2010

average temp at 60 cm below indicated T

(Okahumpka Weather Station from FAWN)

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< 32°F	< 28°F	< 24°F	20°F
90	47	17	1

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**Again considerable damage occurred to many citrus trees throughout the farm. Again, trees trained to the upright single shoot showed much more damage than the “control” trees on the trellis.**

**Recent extreme weather conditions make it essential to have more elaborate cold protection for priority plant material at the Whitmore Farm. In coordination with the Citrus Research Foundation, we are exploring installation of a covered house for girdled and cold protection of**

**these production practices with a modest number of plants. Freeze damage from a large scale effort to use this system would have set back our breeding efforts substantially. However, in a new era of cold winters and the threat of HLB even at the Whitmore Farm, we will need to go to high density protected cultivation of new hybrids. The juvenility trellis, within a screenhouse with cold protection, appears to offer the only practical solution for continued generation and testing of new hybrids.**

**Expected benefits of NVDMC-funded effort:**

Methods for rapid evaluation of fruit quality will be established to enhance throughput of the citrus breeding program and accelerate release of useful varieties to the US citrus industry, **even when threatened by widespread HLB and a new pattern of repeated cold winters.**

Swingle rootstock has been established for accelerating maturity of transgenic citrus by grafting.

Hirado Buntan pummelo x Clementine hybrids will be identified for inclusion in advanced replicated evaluations. Hirado Buntan pummelo x Clementine hybrids selected for elimination will be cut, providing US-812 rootstock for the next round of seedlings.

By identifying the contribution of individual cultural practices we can determine what combination will permit maximum efficiency and throughput. Use of paclobutrazol will be far less laborious than thorn removal and/or girdling, and if similarly effective, will be an attractive alternative. This research will permit immediate application of identified procedures, with confidence that the labor expended will be well-invested.