

## Midterm Report to the NVDMC

### The Rapid Evaluation Structure (RES)

Fred Gmitter, on behalf of the UF-CREC Citrus Breeding Team

January 2012

**Rapid Evaluation Structure (RES):** The RES concept is based on a system observed in Japan, to hasten the early fruiting of hybrid seedlings and thereby allow early selection of desirable types, using intensive cultivation and management techniques. Construction of the RES was completed in early 2009, and over 1600 seedling trees (diploid and triploid hybrids primarily of mandarin and pummelo-grapefruit origin) were planted in May 2009; these trees mostly came from crosses and other sources generated in calendar year 2008. We continue with one person full time to maintain and manage the planting. The plants were trained to a single stem by removal of all side shoots weekly, as well as thorns. As the originally planted trees have been maintained and their upper portions have expanded and filled in space, we have found it necessary to trim these to minimize shading effects from the more vigorous trees on those that are less so. In addition, we have found that frequent cleanup of trunk sprouts in the lower portions has been needed periodically. The trees are fertigated multiple times a day using a system designed and built in house; in addition, we have been using some experimental time-release fertilizer products to maintain good nutrition. Nearly all of the originally planted trees have now reached the top wire of the trellis (~12' above ground level), and have been bent over to supporting wires to induce flowering and fruiting. We have covered the top and side walls of the structure in early winter 2011 to try and avoid the freeze damage that we saw last season in the upper portions of the trees. The freeze damage during the winter of 2010-11 affected substantial numbers of trees and thereby reduced the numbers flowering and bearing fruit in the 2011-12 season.

Roughly 35% of the trees that flowered in spring 2010 set and held fruit into the maturity season (see photos below). As expected when growing out seedling populations, most of the trees produced fruit of no obvious commercial value. However, it was possible to see distinctly different fruit characteristics among several hybrids, many within the same family; fruit size and shape, peelability, peel appearance and texture, color, and seediness were among the various traits for which differences were clearly noted. No decisions were made to remove any of these trees because we want to acquire more experience with this system of fruiting out new hybrids. We observed many of these same trees plus others that had not flowered previously in the 2011-12 season, to have a better understanding of the consistency of behavior across seasons. Current plans are to observe a third season in 2012-13, and then to remove most trees bearing undesirable fruit, while propagating those with good characteristics for further evaluations and

entry to the PTP. A portion of the first trees planted have been already removed to make space for new families to be planted in spring 2012.

Citrus leafminer and Asian citrus psyllid control has become more difficult as many trees exceeded 12 feet in height. Citrus canker now can be found on the CREC property in Lake Alfred and some in the RES have been infected, so more attention was paid to canker management. Thus far, HLB symptoms have been observed on only a handful of trees; we have not removed any of these trees, because of a substantial level of inoculum in surrounding blocks. Substantially greater numbers of trees bloomed in 2011 compared with 2010. Because of the fact that only 35% of the flowering trees from 2010 actually held onto their fruit to maturity, we applied GA sprays in spring 2011 to increase fruit set. Additionally, we have installed sturdy 10' tall bamboo stakes for each tree, to aid in supporting them better at their size and fruit loads have substantially increased.

It is becoming clear that there are genetic components associated with the early flowering behavior. Certain families exhibit substantially greater proportions of trees with flowers and/or fruit than others. As a group, the mandarin hybrids appear to be more responsive than several pummelo x grapefruit triploid families that we have planted in the RES, although there are some individual hybrids of the latter type that have fruited this year. Some promising seedless mandarin selections have been identified. In addition, two families of diploid crosses made to produce *Alternaria*-resistant breeding lines were developed previously and rigorously screened by direct repeated inoculations to identify resistant individuals. These were planted in the first group, and at least two good potential breeding parents have been selected, to be used in future crosses in the breeding program.

We established another RES-type system in an existing greenhouse structure to grow off families from first generation seedless hybrid selections crossed with superior mandarin breeding parents, to accelerate introgression of the seedless gene from seedless Kishu into commercially acceptable types. These are being grown in artificial media in airpots, and trained using the 10' bamboo stakes. Height limitations may preclude fruiting in the current structure, but it should be possible to capitalize on the reduction of juvenility from this growing method by harvesting budwood for propagation onto rootstocks and field planting, to hasten first fruiting relative to normal field planting approaches.



**Fruit set on one of several trees that flowered 10 months after tree planting (above).  
Several fruit on an individual selection at maturity (below).**



**Bent trees bearing fruit, September 2011. Notice 10' sturdy bamboo stakes to help support the trees.**



**Fruiting trees (left) from pummelo x grapefruit triploid hybrids; these trees came through the 2010-11 freezes better than the less vigorous mandarin hybrids (right), because of more substantial canopies. Note the regrowth of the mandarin hybrids on the right, and some selections bearing early maturing fruit (photo taken late September 2011).**



**Second generation hybrids from crosses of seedless F1s x advanced mandarin breeding parental lines, made in 2010, and planted in June 2011; the photo was taken in late September 2011. This is a second RES system that we have set up to hasten first fruiting and selection of superior selections, for further evaluation and release of new cultivars.**