FINAL REPORT Covering FY2010

Agency: California Citrus Nursery Board **Agreement No.:** R00-10

Fiscal Year: 2010 **Project Completion Percentage:** _____

Project Leader: Mikeal L. Roose

Location/Department: Botany and Plant Sciences, University of California, Riverside, CA 92521

Phone: 951-827-4137 **Fax:** 951-827-4437 **E-Mail:** mikeal.roose@ucr.edu

Project Title: Citrus Scion Breeding and Evaluation

Project Objectives and Timetable:

The objectives of this project are to develop new mandarin, orange, lemon and grapefruit cultivars suitable for California conditions. For mandarin cultivars, important traits are seedlessness, easy peeling, good flavor, high rind color, economic yield and low tendency to alternate bearing. Cultivars maturing from October to July are desirable (and possible). For oranges, a high-yielding, seedless type, which holds well late in the season, is the main objective. A superior seedless Lisbon selection is the major objective with lemon. For grapefruit-type cultivars, the primary objective is to develop unique, low-seeded, deeply red pigmented cultivars with low bitterness suitable for production in desert or inland valley regions.

FY2010 Progress and Findings*:*

The proposal included 11 specific objectives. Progress on each of these is summarized below.

1) New hybridization. As planned, new hybridization focused primarily on early-season mandarin types, mostly production of triploids. Total pollinations made for this objective was 913, exceeding the objective of 500. The tetraploid parents used included a pummelo x blood orange hybrid, Wilking, Temple x Dancy, and Encore, and Rio Red. Diploid parents were Vainiglia (a pink-flesh orange), a Moro x mandarin hybrid, Clementines, Fortune, Lee, W. Murcott, and others. Fruit set appears to be outstanding this year so we anticipate a large number of new hybrid seedlings.
2) Effects of new cultivars on seed content of adjacent varieties. This year, no pollinations to test effects on pollen from new cultivars on seed set of Clementine and W. Murcott were done because of the amount of prior data and a decision to emphasize new crosses this year. Pollen viability of Tango, Encore IR6, DaisySL, Nova IR10 and their parental varieties was tested and found to be consistent with levels found in prior years.
3) Pollinations onto promising irradiated mandarin selections. Pollinations onto low-seeded selections were not done because of the amount of prior data and a decision to emphasize new crosses this year.
4) Induction of seedless mutations by irradiation. As planned, new irradiations included 200 buds each of Clementines (Nules, Sidi Aissa, and Fina Sodea), Walker Lisbon lemon, and Limoneira Fino lemon. Survival of buds varied among varieties. Survival of buds is lower when the bud source is itself an irradiated selection. Trees from prior irradiation still being propagated include Allen Eureka lemon, Lapithiotiki lemon, tetraploid blood orange x pummelo hybrid, Cocktail grapefruit, Ponkan, two mandarin hybrids and re-irradiation of Fremont IR2. At Lindcove, 263 trees from new irradiation were planted: 22 Limonero Fino, 18 Allen Eureka, 7 Lapithiotiki, 38 Walker Lisbon, 7 mandarin hybrid, 6 Ponkan, 5 Clementine Fina Sodea, 35 Clementine Sidi Aissa, 80 Clementine Nules, and 80 Cocktail grapefruit. Additional trees of some varieties are still in the greenhouse because they were not large enough for planting. Planned modifications to a screenhouse at Lindcove have not been completed because we waited for CDFA screenhouse standards to be finalized before proceeding. These modifications should be completed during the current year without additional funding.
5) Propagation of existing hybrids. About 500 new propagations are being held in the greenhouse at UCR pending availability of field space. Additional new hybrids are still being cultured in vitro. Some existing fields have been released but UCR does not have funding to remove trees.
6) Molecular-genetic tests. Marker tests to verify hybridity were not done. We had too many unanticipated issues to address, particularly the seediness problem in DaisySL,that diverted resources from this objective.

7) Initial evaluation of hybrids. About 800 hybrids at UCR were evaluated for fruit quality traits including maturity date, fruit size, fruit shape, fruit color, flavor, seediness, yield, tree size, diseases and other traits. Some promising triploid mandarins were identified.
8) Initial evaluation of trees from irradiated buds. About 380 trees at LC and about 525 trees at UCR from new irradiation were evaluated. Preliminary selections, based on one year of fruit evaluation, include a California Honey and a Cocktail grapefruit. Selections identified at this stage often do not proceed past this first evaluation and many are also discarded during replicated trial evaluations. Additional preliminary selections are likely next year.
9) Advanced trials. Trees in advanced trials were evaluated as planned. A total of 956 fruit samples were collected, evaluated and juiced. Lab analyses of juice quality (solids and acids) and data entry are nearly complete. Lee IR1, Clementina Fina IR1 and Clementina Oroval IR1 were discarded as too seedy, although we will likely irradiate Lee again. Ortanique is also likely to be discarded. During flowering, we screened trees of DaisySL, Tango, FairchildLS, Kinnow IR5, and Encore IR6 at Lindcove. Screened trees of all selections except FairchildLS set moderate to good crops. FairchildLS set few fruit when screened, an observation consistent with the behavior of Fairchild. The rootstock seedlings planted at Lindcove to propagate trees for advanced trials of new selections (and for the replicated trials of imported selections) did not grow well and were discarded. A new set of seedlings have been planted and are growing well, but this means that field planting will be delayed, possibly until spring of 2012. We had planned to propagate trees of imported selections, this year satsumas and Clementines, to be planted with the breeding program trial materials so that comparable data can be collected. The rootstock seedlings for these trials were planted with those for the scion trials, grew poorly, and had to be replanted.

List of varieties and number of selections of each currently being evaluated in replicated trials. This includes varieties already released but still being evaluated for some traits.

Clementina Fina (1)
Clementina Oroval (1)
Clementine x Murcott (2)
Daisy (2)
Encore (3)
Fairchild (2)
Fallglo (1, re-irradiate)
Fremont (1, re-irradiate)
Kinnow (3)
Limoneira 8A Lisbon (1)
Nova (1)
Ortanique (1 likely discard)
W. Murcott (3)
Wilking x Dweet (2)
Wilking x Temple (2)
grapefruit hybrids (2)
mandarin hybrids (4)

10) Release of new selections. As planned Fairchild IR2 was released as 'FairchildLS'. Release of Kinnow IR5 as 'KinnowLS' was approved by UCR, but some budwood source trees at CCPP did not grow well. Our trial trees, propagated from field tree buds, grew normally in the nursery and subsequently in the field. An experiment to evaluate propagation and growth of three different sources of KinnowLS buds, and to compare their behavior with that of two sources of Kinnow was conducted at Lindcove in collaboration with CCPP. This was evaluated in late December and the results showed that trees propagated from screenhouse buds were smaller than those propagated from field bud sources, but KinnowLS did not differ from Kinnow. We will be releasing KinnowLS buds from the CCPP source in January, 2011. Evaluation of Nova IR10 and Encore IR6 continued during the current season. Nova IR10 has very low seed counts and is considered quite promising, but we have only 37 fruiting trees to evaluate, and given the problems observed with DaisySL, we plan to wait for trees at other locations to fruit before deciding on release. We will disclose these varieties to OTC and UCR and protect them in anticipation of release. Encore IR6 may be released in June, 2011.

In 2010 we found that some trial trees of 'DaisySL', which was released in June 2009, produce fruit with high seed content. About 1-2% of all fruit from 83 trial trees have high seed counts. Production of seedy fruit occurs on specific branches and is much more common at the Coachella Valley site than at others. One possible explanation for this behavior is that 'DaisySL' may be a chimera, with seedy fruit developing on branches that arise from normal (Daisy) cells. Considerable research to evaluate the extent of this problem was carried out and more is planned next season. We have found that fruit in the 2010-2011 crop is affected, and the proportion of seedy fruit is similar to that seen in the 2009-10 crop.

A second problem with seediness in a supposed Tango tree was found during 2010. Beginning in January 2008 we distributed Tango budwood from trial trees at W&N because of CTV infection in many trees at Lindcove (not budsource trees). In spring 2010 we noted that one tree at W&N had fruit with higher seed counts (mean 1.14, range 0-6) than expected for Tango. In September we checked the 2011 crop and found the same problem. In October 2011 we informed licensed nurseries about the problem. Although 2009-10 seed counts for this tree were higher than those for Tango (<0.1 seed/fruit), they were still about 10-fold lower than those in comparable W. Murcott. Fruit with higher seed counts were fairly evenly distributed over the tree, not clustered on specific branches as we had seen for DaisySL. In earlier years, this tree had seed

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counts only about 2-3 fold higher than the average of other Tango trees at this site and only somewhat higher than the next highest Tango, so we did not recognize the problem. We believe that the most likely explanation is that this tree is a different low-seeded selection of W. Murcott (also planted at W&N) because its' seed counts are similar to those of that selection, and both selections were propagated and planted at the same time.

A plan to provide CCPP budwood of unreleased selections to nurseries to establish a limited number of registered source trees prior to release was developed. Bud source trees must be grown in an insect-resistant structure that meets CDFA standards. In July 2010 nurseries were offered the opportunity to request budwood of KinnowLS, Encore IR6, NovaIR10, and Limoneira 8A Lisbon IR1 under this program. Trees (rather than budwood) were provided to participating nurseries in November 2010.

11) Demonstration/Rootstock Trials – We planned to establish single rows (~20 trees) of each released selection at Lindcove. 6 trees of each selection will be grown on Rich 16-6, Carrizo, and C35, (or Mac for lemons). For irradiated selections, two additional trees of the seedy parent variety will be included as controls. The Limoneira 8A Lisbon lemon IR1 selection (on Carrizo, C35 and Volk) was planted in 2010. As with the rootstock seedlings for the advanced trials planted at the same time, the rootstock seedlings originally planted at Lindcove for these trials did not grow well and were discarded. A new set of seedlings have been planted and are growing well, but this means that field planting will be delayed until spring of 2012.

Funding:

Carryin Agency Funds 0 **Agency Funds Used** 20,000 **Agency Funding** 20,000

Carryover Agency Funds 0 **Non-Agency Funds Used** 220,000 (UC, CRB, gift)

Signature Michael L. Roose **Date** 1/12/11

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