TREE FRUIT RESEARCH IN CALIFORNIA

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This paper provides a brief overview of three tree fruit projects currently underway in my laboratory at UCDavis. The first project is an evaluation of several high colored strains of Gala apples grown in the Northern Central Valley of California. The second is an investigation of the use of silicone surfactants for control of surface pests on sweet cherries for export. And finally, I will present some preliminary data from a project related to apple bitter pit and mineral nutrition.

GALA STRAIN EVALUATION

A five to six year old Fuji apple orchard on M111 in San Joaquin County was top-worked to eleven different strains of Gala in 2001 (Table 1). There were 4 trees of each strain. A preliminary quality evaluation was conducted in 2003 and 2004. In 2003, the percent of red color in Magnum, Big Red and Grand was lower than for Royal Gala (Figure 1). The highest percentage of red color was seen in Buckeye, Gale and Brookfield with more than 80% of the surface showing red color. Royal Gala had less than 60% of the surface showing red color. In 2004, an overhead cooling system was installed and used to enhance red color development. All of the Gala strains showed a significant increase in red color as compared with 2003, and all except Grand and Big showed 90 to 100% red color.

Table 1. Highly colored strains of Gala evaluated in California.

Strain	Source
Crimson (Walliser cv. PP#8673)	Brandt's Fruit Trees
Grand Gala (Caitlin cv	Stark Brothers
Brookfield	Willow Drive Nursery
Gale (PP#10114	Van Well Nursery
Magnum (PP#11182)	ProTree Nursery
Big Red (PP#10458)	ProTree Nursery
Buckeye (Simmons cv PP#10840)	ProTree Nursery
Galaxy (PP#6955)	Agri-Sun Nursery
Pacific	Olsen Bros. Nursery
Ultra Red	Olsen Bros. Nursery
Royal	Brandt's Fruit Trees

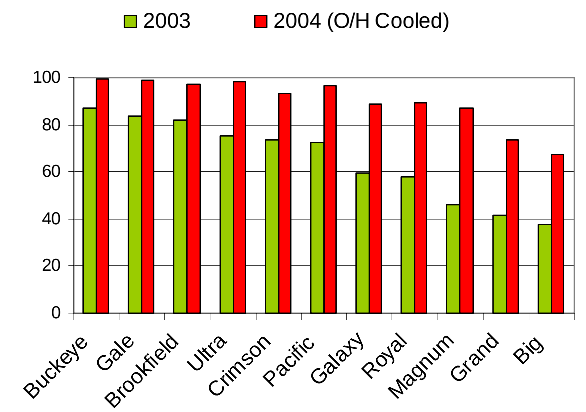

Figure1. Average surface color of Gala strains in 2003 and 2004. Fruit were overhead cooled in 2004.

In 2005, trees were harvested on July 13, July 25 and August 3. The average red color increased significantly with each progressive harvest. Brookfield showed higher firmness for the first two harvests compared with the other strains. Royal Gala was among the softest of the strains. Our informal sensory panel found Ultra and Pacific somewhat crisper, but the differences among strains was not great. Apple flavor was ranked highest in Ultra and off-flavors were ranked lowest for this strain as well for all three harvests. In several strains, the second harvest was ranked significantly higher in apple flavor.

SILICONE-BASED SURFACTANTS FOR SURFACE PEST CONTROL

A variety of insect and mite pests can be found on harvested sweet cherries. Many of these pests are of little to no economic significance for the production and quality of the fruit. However, for export of sweet cherries, these pests can become an issue. Sweet cherries must be fumigated with methyl bromide prior to shipment to Australia to control various mite and thrips pests. In recent years, approximately 25% of these shipments from California were required to be re-fumigated with methyl bromide in Australia because live spider mites were found on the fumigated fruit. This re-fumigation is costly and also damaging to fruit quality. For the export market in Japan, methyl bromide fumigation is required for codling moth control. There have been active negotiations in recent years regarding the non-host status of sweet cherry fruit with regard to codling moths. If these negotiations are successful, an alternative treatment for control of surface pests is desirable.

My laboratory has been cooperating with Jim Hansen at USDA-ARS in Wapato, Washington to investigate the use of silicone-based surfactants for control of surface pests in sweet cherries. We had previously shown that Silwet-L-77 kills a variety of insect and mite pests. In this recent study, we tested a number of surfactants and defoamers provided through Jim Hansen. Our research in 2005 involved two-spotted spider mites that were reared in a laboratory colony on cotton cotyledons. Fresh sweet cherry fruit were incubated overnight with cotton leaves heavily infested with mites and the mites were allowed to walk onto the cherry fruit. Infested fruit were placed into a beaker containing a solution of the surfactant at various concentrations and swirled for one minute. The fruit were then removed and blotted dry on tissue paper before transfer to a deli cup surrounded by Tanglefoot to prevent mites from leaving. The solution was gently filtered and the mites removed from the fruit were counted. Mites remaining on the fruit were also counted. In addition to observing the number of mite eggs and other life stages removed, we determined mortality of the life stages other than eggs. Mortality with water alone was 40% and with the various surfactants mortality ranged from 75 to 97%.

Cherry fruit tolerance to treatment with the surfactant solutions was also tested. Three replications of 25 cherries of excellent condition were placed into a beaker containing the surfactant solutions of various concentrations. The fruit were swirled in the solution for one minute before removal and blotting on paper towels. The fruit were placed into vented cherry consumer bags and stored under one of two regimes, air shipment simulation (2 days at 41 ºF) or sea shipment simulation (13 days at 32 ºF). Fruit were evaluated immediately after each storage regime and again after 15 hours of shelf life at 68 ºF in the bags. The only quality parameter affected by the surfactant treatments was berry pitting. Pitting damage was only higher in fruit treated with 0.5 or 1.0% Silwet L-77.

We feel that these results are very encouraging and will continue to investigate to determine the lowest concentration that would be effective, to determine mortality of mite eggs following treatment, and to explore efficacy for removal and kill of thrips.

BITTER PIT OF APPLES

Bitter pit is a variable problem for California apples, causing serious losses in some seasons and manageable losses in other seasons. The past three seasons have been serious for bitter pit incidence in California apples, especially for Granny Smith. In 2005, we began a small study to collect baseline data on mineral nutrition in California Granny Smith and Gala apples. We chose Gala as an apple with low bitter pit susceptibility and Granny Smith as a high susceptibility apple. Apple fruit were collected from three different locations: Contra Costa, San Joaquin and El Dorado Counties in California. Both varieties were located within each county in proximal or the same orchard under similar field practices. San Joaquin County had an additional Granny Smith orchard. After full bloom, samples were collected weekly for 4 weeks, then monthly until four weeks before commercial harvest when samples were collected weekly again. During the time period from full bloom until four weeks before commercial harvest, samples were collected from the orchard, and sent overnight to be analyzed for mineral composition. Apples were acid washed before collecting two wedges of flesh and skin from opposite sides of the fruit. During the four weeks before commercial harvest, larger apple samples were brought directly to the lab for mineral analysis and storage to determine bitter pit incidence. The stored fruit were cooled to 33 ºF within a few hours of harvest. Gala apples were stored for 2 months and Granny Smith apples were stored for 3 months before evaluated for bitter pit incidence.

Gala apples increased in calcium content per fruit (mg Ca/fruit) at a faster rate than Granny Smith and showed a slower increase in nitrogen content per fruit. The nitrogen to calcium ratio for Gala remained below 12 while for Granny Smith the values increased steadily over the season to a value of 20 or higher by harvest. It is thought that this ratio should best remain below 10 for best fruit nutrition. The magnesium + potassium to calcium ratio had also been thought to be indicative of bitter pit susceptibility. This ratio increased rapidly and steadily in Granny Smith as the fruit increased in size and was higher than 35 more than one month before harvest. Alternatively, for Gala, this ratio increased slowly over the season and remained below the recommended maximum value of 35. It is interesting that these two cultivars that have a difference in susceptibility to bitter bit show related differences in their patterns of mineral nutrition.

We also tested the efficacy of postharvest dips in Opti-cal (calcium chloride, 12.1% calcium ion) for their ability to reduce bitter pit. Granny Smith apples from Contra Costa and San Joaquin Counties were dipped in Opti-cal at either 0.2% (the label rate) or 1.0% (above the label rate) for 5 minutes at room temperature. For Granny Smith treated at the label rate, bitter pit was reduced by 50%. The higher rate of 1% reduced bitter pit incidence a few percent further, but the difference was not great. The fruit calcium concentrations did not indicate an increase in calcium content in the dipped apples despite the decrease in bitter pit incidence. More research will be done in this area to determine the effects on bitter pit incidence and calcium concentrations.

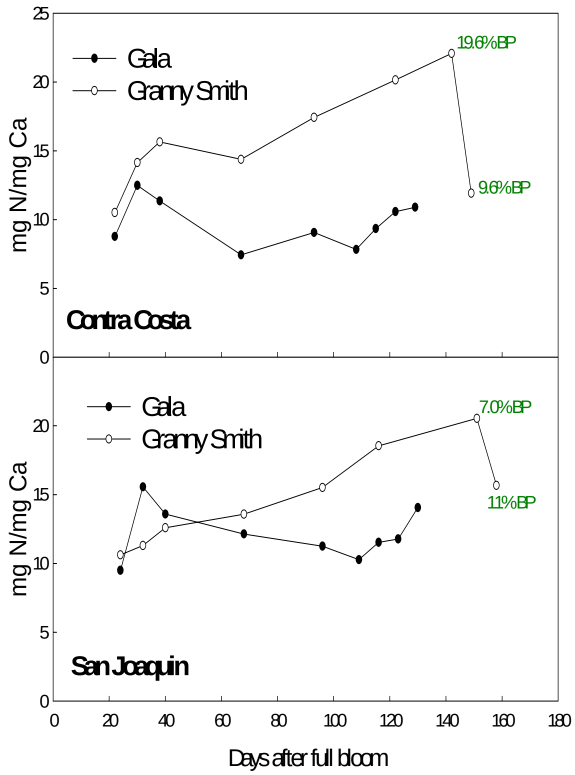

Figure 3. Changes in the ratio of nitrogen to calcium in Gala and Granny Smith apples over the season. Apples were grown in Contra Costa or San Joaquin Counties.

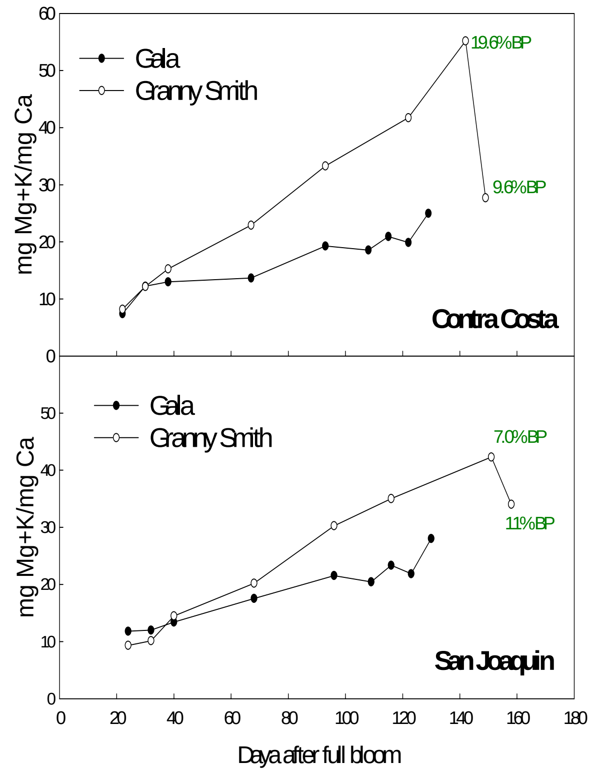

Figure 4. Changes in the ratio of magnesium and potassium to calcium in Gala and Granny Smith apples over the season. Apples were grown in Contra Costa and San Joaquin Counties.