



*Figure 1. UC Master Gardener volunteers pruning trees in the low-chill peach cultivar trial.*

## **Evaluation of Low-Chill Deciduous Tree Fruit Cultivars (Part I): Peaches**

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A few breeding programs (Olmo, 1965; Sharpe, 1961; Sharpe, 1969; Sherman and Rodriguez-Alcazar, 1987) have reported the development and release of low-chill peach cultivars that require only 250 or less Chill Units. One chill unit is equal to one hour at temperatures between 36.01°F and 48°F. We hypothesized that some of the cultivars touted anecdotally as promising may, indeed, be adapted to the subtropical climates of coastal Southern California. If these promising cultivars can be identified and their adaptability and productivity quantified, then they may make peach growing sustainable in the home garden, and for U-pick, local road stand and farmers market operations in this region.

### **Goals and Objectives**

The primary objectives of this study were to evaluate the adaptability, productivity and fruit quality of 10 low-chill peach cultivars, monitor and evaluate the susceptibility of the cultivars to pests and diseases and disseminate recommendations derived from the study. Secondary goals included the provision of hands-on training for Master Gardeners and other volunteers from the California Rare Fruit Growers (Figure 1). These volunteers would contribute significant labor

hours in conducting various aspects of the trial. Furthermore, the peach planting would serve as a demonstration block for the general public.

To realize these objectives, we used ten low-chill peach cultivars that had been planted in January 1996 in a trial at UC South Coast Research and Extension Center in Irvine, California (Table 1). The trees were arranged in 3-tree plots replicated 4 times in a completely randomized design. Trees were spaced 6 m between rows and 3 m in-row. We managed the trial orchard following recommended cultural practices for peaches (LaRue and Johnson, 1989). About 3 weeks after fruit set, we hand-thinned fruits to approximate a distance of 15 cm between fruits on a branch. Tree trunk diameters were measured on a painted area 5 cm above the graft union in October of each year and the measurement converted to trunk cross sectional area (TCSA). Using fruit flesh pressure, background color and total soluble solids (TSS) concentration as the main determinants of fruit maturity, we harvested each plot two times within a 14-day period. Fruit TSS was determined with a hand refractometer (Sper Scientific, Ltd., Arizona) while powdery mildew disease index was determined by a visual rating system. The visual rating was based on evaluating tree canopy whereby the number 1 was assigned to trees without powdery mildew symptoms while the number 6 was assigned to trees showing the severest symptoms. Tree trunk growth, yield and disease index measurements were recorded on a per tree basis while TSS measurements were recorded from a random sample of fruits from each tree. All the data were analyzed by the standard ANOVA procedure of the CoStat Statistical Software and mean separation by the Duncan's Multiple Range Test.

### **Discussion**

Tree TCSA measurements are a good indicator of tree fruit cultivar growth and adaptability in a given area. In the first 3 years of this study (1996-1999) the increase in tree TCSA growth for 'August Pride' and 'Flordaprince' cultivars was very significantly greater than for all the other cultivars except for 'Tropic Snow' (Table 1). The increase in TCSA growth for 'Southern Rose' was very significantly lower than for all the other cultivars.

Crop load data in 1998 (Table 1) indicated that 'Flordaprince' produced very significantly greater marketable fruit number per tree than 'Double Jewel', 'Bonita' and 'Southern Rose'. It did not differ significantly from the other remaining 6 cultivars. In 1999

Table 1. Tree trunk cross sectional area (TCSA) growth increase (1996-1999) and total marketable per tree fruit number and fruit weight of 10 low-chill peach cultivars<sup>2</sup>.

Cultivar	TCSA growth, cm <sup>2</sup>	Total fruit no./tree		Total fruit wt./tree, Kg	
		1998	1999	1998	1999
August Pride	109.96a	258abc	634a	45.11a	70.92a
Flordaprince	106.75a	460a	622a	46.71a	44.71bc
Tropic Snow	93.92ab	344ab	608a	46.36a	55.44ab
Eva's Pride	80.37bc	412ab	519a	43.53a	44.64bc
Mid-Pride	79.95bc	296ab	420a	52.34a	59.19ab
Red Baron	77.95bc	277ab	477a	40.52a	58.61ab
Double Jewel	59.74c	217bc	394ab	36.29a	46.91bc
Bonita	54.95c	44c	152c	8.93bc	19.07d
Saturn/Lovell	53.95c	269ab	182bc	31.63ab	25.17cd
Southern Rose/ Lovell	17.14d	52c	71c	7.08c	7.25d

<sup>2</sup>Mean separation within a column by Duncan's multiple range test, P < 0.0001.

'Bonita', 'Southern Rose' and 'Saturn' produced very significantly lower marketable fruit number than all the others except for 'Double Jewel' which was similar to 'Saturn' in this respect. This trend was repeated with respect to total fruit weight per tree in 1998 when 'Bonita' and 'Southern Rose' produced very significantly less fruit weight than all the other cultivars except for 'Saturn' which did not differ significantly from 'Bonita'. Similarly in 1999 'Bonita', 'Saturn' and 'Southern Rose' did not differ significantly in total fruit weight per tree. Except for 'Saturn', which did not differ from 'Double Jewel', 'Eva's Pride' and 'Flordaprince', they produced per tree total fruit weights that were very highly significantly lower than the other cultivars.

Total soluble solids (TSS) concentrations are a good barometer of peach fruit quality. In 1998 'Red Baron', 'Saturn', 'Bonita' and 'August Pride' produced fruit with very significantly higher TSS concentrations than 'Southern Rose', 'Flordaprince' and 'Tropic Snow' (Table 2). These last 3 cultivars did not, however, differ from 'Mid-Pride', 'Eva's Pride' and 'Double Jewel' in this regard. In 1999, these 3 cultivars continued to produce fruit with very significantly lower TSS while, as in 1998, 'Red Baron', 'Saturn', 'Bonita' and 'August Pride' continued to produce fruit with very signifi-

cantly higher TSS values.

There were 2 instances of powdery mildew outbreak which allowed us to obtain data in 1997 and 1999. In 1997, the disease was mild (Table 2) but we could detect that 'Red Baron', 'Saturn' and 'Bonita' had very significantly greater disease indices than all the other cultivars save 'Eva's Pride'. Powdery mildew infection was more severe in 1999 when these same cultivars also had very significantly larger disease index values compared to the other cultivars that did not differ among themselves. The disease was adequately controlled with Rally (Myclobutanil) in both years.

This project has received widespread publicity and support from four Chapters of the California Rare Fruit Growers and from Master Gardeners. Since the initiation of the project, 10 volunteers have provided free labor every year for tree training, pruning and thinning of fruit. In the past two years, the Project Leader conducted 10 individual or group tours of the trial orchard in which peach cultivar performance and other findings were discussed. On May 25, 2000, the Project Leader presented an invited talk to CAPCA (the California Association of Pest Control Advisors) on the performance of low-chill peach cultivars at the South Coast Research and Extension Center. Over 100 people attended the event.

Table 2. Total soluble solids (TSS) concentration of tree-ripened fruits and powdery mildew disease index of 10 low-chill peach cultivars<sup>z</sup>.

Cultivar	<u>TSS concentration, %</u>		<u>Powdery mildew disease index<sup>y</sup></u>	
	<u>1998</u>	<u>1999</u>	<u>1997</u>	<u>1999</u>
Red Baron	14.42a	15.10a	1.6a	3.5ab
Saturn/Lovell	13.29a	14.01abc	1.5a	4.4a
Bonita	13.17ab	14.86ab	1.4ab	4.6a
August Pride	12.91abc	15.11a	1.1c	1.6bc
Double Jewel	12.21abcd	12.46abc	1.1c	1.2c
Eva's Pride	12.04bcd	12.08bcd	1.2bc	1.7bc
Mid-Pride	10.82cd	12.89abc	1.0c	1.4bc
Tropic Snow	10.17d	11.58cd	1.1c	1.6bc
Flordaprince	10.10d	9.37d	1.1c	1.0c
Southern Rose/ Lovell	9.92d	12.07bcd	1.0c	1.0c

<sup>z</sup>Mean separation within a column by Duncan's multiple range test, P <0.0001.

<sup>y</sup>No powdery mildew symptoms =1; severest powdery mildew symptoms =6.

### Conclusions

We conclude that the 10 cultivars tested are well adapted to this region. However, three cultivars ('August Pride', 'Flordaprince' and 'Tropic Snow') experienced more vigorous growth while 'Southern Rose' showed the least growth. The rest were mostly intermediate in vigor. As expected, these vigorous cultivars produced the most fruit number and weight per tree compared to the less vigorous cultivars such as 'Bonita', 'Saturn' and 'Southern Rose'.

Unlike the tree growth and yield data, cultivars that were least vigorous and productive so far ('Red Baron', 'Saturn', 'Bonita') generally produced fruit with significantly higher TSS values. These cultivars were also harvested later in the season than the others. It is, therefore, hard to explain if the higher TSS values are a true measure of the cultivar or if they reflect the impact of an unknown factor or a longer growing period. The setback, however, is that these same cultivars were more susceptible to powdery mildew infection.

We have only obtained 2-3 years' data for this project which are not sufficient to draw definitive conclusions. For example, since we harvested fruit only 2 times per season, it would be useful to continue the study over several seasons in order to account for vari-

ability due to year or due to tree pruning and fruit thinning by different workers.

### Literature Cited

- LaRue, J.H. and R.S. Johnson. 1965. Editors. **In:** Peaches, Plums and Nectarines—Growing and Handling for Fresh Market. University of California. Division of Agriculture and Natural Resources. Publication 3331.
- Olmo, H.P. 1965. Peach and nectarine varieties and new variety trends. Peach Cong., Verona, Italy.
- Sharpe, R.H. 1961. Developing new peach varieties for Florida. Proc. Fla. State Hort. Soc. 74:348-352.
- Sharpe, R.H. 1969. Sub-tropical peaches and nectarines. Proc. Fla. State Hort. Soc. 82:308-306.
- Sherman, W.B. and J. Rodriguez-Alcazar. 1987. Breeding low-chill peach and nectarine for mild winters. HortScience 22(6):1233-1236.

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