of the world but are not recommended here. Among these are 'Desertred' whose fruit are too small and trees are too susceptible to bacterial spot. Cultivars 'Rayon', 'Hermosillo', 'Flordabelle', 'Flordabeauty', and 'Newbelle' have acceptable fruit size but ripen in late May. Cultivars 'McRed', 'Early Amber', and 'San Pedro' are too soft for commercial shipment or have high chilling requirements. Recent cultivar releases are superior to 'Flordagem' which has a large suture bulge in years when chilling is inadequate. Another recent release, 'Flordacrest', requires 400 chilling units making it better suited to north Florida (9). 'Gulfqueen', a patented cultivar, has also been evaluated and found to require more chilling than normally occurs in the Lower Rio Grande Valley and central Florida, resulting in an unacceptable fruit tip in both south Texas and central Florida.

Marketing of fruit from the Lower Rio Grande Valley has been mostly out-of-state sales to cities in the Midwest and Northeast United States. In contrast, most central Florida fruit are marketed within the state through one packinghouse, roadstands, and U-pick operations. The cultivars in Table 1 are recommended for commercial production in the Lower Rio Grande Valley, central Florida, and areas with similar subtropical climates. Fruit of 'Flordaglo' and 'TropicSnow' have firm white flesh with commercially acceptable size and high quality, but may be limited to local markets until commercial markets in the United States accept white peaches.

The peach cultivars in Tables 1 and 2 are recommended for grower trials in central Florida based on experience in the Lower Rio Grande Valley of south Texas. These recently released cultivars represent a major achievement in developing a continuous ripening sequence in low-chill peaches requiring approximately 250 or less chill units. The cultivars released in the past 5 years are being commercially produced in the Lower Rio Grande Valley and are promising for a parallel industry to be developed in central Florida. These cultivars were developed for commercial size and firmness, attractiveness, excellent taste, non-browning flesh and short fuzz for fresh market sales.

Literature Cited

1. Bowen, H. H. 1980. 'EarliGrande' peach. HortScience 15:207.
2. Gurdian, R. J. and R. H. Biggs. 1964. Effect of low temperatures on terminating bud dormancy of 'Okinawa', 'Flordawon', 'Flordahome', and 'Nemaguard' peaches. Proc. Fla. Hort. Soc. 77:370-379.
3. Rouse, R. E. 1985. Peach cultivars for the subtropical Lower Rio Grande Valley of Texas. J. Rio Grande Valley Hort. Soc. 38:31-35.
4. Rouse, R. E. and W. B. Sherman. 1987. 'TropicSweet': A freestone peach for subtropical climates. HortScience 22:169-170.
5. Rouse, R. E., W. B. Sherman and R. H. Sharpe. 1984. 'FlordaGrande': A peach for subtropical climates. HortScience 20:304-305.
6. Rouse, Robert E. and Wayne B. Sherman. 1989. 'TropicSnow': A freestone, white-flesh peach for subtropical climates. HortScience 24:164-165.
7. Rouse, Robert E. and Wayne B. Sherman. 1989. 'TropicBeauty': A low-chilling peach for subtropical climates. HortScience 24:165-166.
8. Sauls, J. W. 1985. Potential for commercial peach production in the Lower Rio Grande Valley. J. Rio Grande Valley Hort. Soc. 38:27-30.
9. Sherman, W. B. and P. M. Lyrene. 1989. 'Flordacrest' peach. HortScience 24:394.
10. Sherman, W. B. and P. M. Lyrene. 1989. 'Flordastar' peach. HortScience 24:395.
11. Sherman, W. B. and P. M. Lyrene. 1989. 'Flordaglo' peach. HortScience 24:3964.
12. Sherman, W. B., R. J. Knight, Jr. and T. E. Crocker. 1978. Peach and nectarine breeding and testing in parts of the world. Proc. Trop. Reg. Amer. Soc. Hort. Sci. 22:103-117.
13. Sherman, W. B., J. Rodriguez and E. P. Miller. 1984. Progress in low-chill peaches and nectarines from Florida. Proc. Fla. State Hort. Soc. 97:320-322.
14. Sherman, W. B., J. Soule and C. P. Andrews. 1977. Distribution of Florida peaches and nectarines in the tropics and subtropics. Fruit Var. J. 31(4):75-78.
15. Sherman, W. B., P. M. Lyrene, J. A. Mortensen and R. H. Sharpe. 1982. 'Flordaprince' peach. HortScience 17:988.
16. Sherman, W. B., P. M. Lyrene, N. F. Childres, F. G. Gmitter, and P. C. Andersen. 1988. Low-chill peache and nectarine cultivars for trial in Florida. Proc. Fla. State Hort.Soc. 101:241-244.
17. Topp, B. L. and W. B. Sherman. 1989. The relationship between temperature and bloom-to-ripening period in low-chill peach. Fruit Var. J. 43(4):155-158.

Proc. Fla. State Hort. Soc. 102:195-199. 1989.

LOCATION INFLUENCES ON FRUIT TRAITS OF LOW-CHILL PEACHES IN AUSTRALIA

B. L. Topp and W. B. Sherman[1]
University of Florida, IFAS
Fruit Crops Department
Gainesville, FL 32611

Additional index words. cultivars, fruit quality, *Prunus persica*, temperature.

Abstract. **Twenty two cultivars, most originating in Florida but some in South Africa and Australia were evaluated at 13 locations in Australia, some with climates similar to those found in Florida production areas. Fruit size was significantly correlated with mean growing season temperature of the test location (r = −0.83**) as were firmness (0.62*) and flavor (0.72**), but the amount of red blush, attractiveness, fuzz, suture bulge, and juiciness were not correlated across locations. Stylar tip increased in warm locations for some but not all cultivars (r = −0.65*). 'Flordagold' peach and 'Sundowner' nectarine were the most widely recommended cultivars and were recommended in both low and high-chill environments. 'Flordabelle', 'Flordared' and 'Flordaprince' were recommended only for low-chill locations.**

Low-chill peaches and nectarines from Florida, South Africa and Australia are grown in low-chill regions of Australia, but also are grown in high-chill regions where their early ripening is commercially advantageous (3). The adaptation of new cultivars must be well tested for each location prior to recommendation. The blossom date changes with location less than does the fruit development

Florida Agricultural Experiment Station Journal Series No. N-00044.

[1]Graduate Assistant and Professor, respectively. The authors acknowledge the assistance of J. Baker, R. Engel, D. Firth, F. Gathercole, A. George, C. Higham, G. Kenna, B. Kauffman, B. Morrison, B. Patten and M. Sweetman in cultivar evaluations at the various locations and R. Mayer in statistical analysis

period (FDP) with the FDP increasing by 5 days for every *1°C drop in mean* temperature during the growing season (6). The amount of change of other fruit traits across environments also is of interest to horticulturists. This paper reports on nine other fruit traits evaluated for 22 cultivars across 13 locations in an attempt to determine which traits are influenced by location. Cultivar recommendations are also provided for each location, some of which resemble Florida production areas.

Materials and Methods

The 13 sites represent a diverse array of climatic conditions and geographic locations in Australia (Fig. 1). Cultivar evaluations are a mean of 3 or more years observations at each site except Swan Hill (1 year), Loxton (1 year) and Nambour (2 years). The monthly mean temperature for each of the 13 sites represents a minimum of 10 years data. Winter chilling based on the coldest month (July) mean temperature (5) varies from about 200 chill units (cu) at Carnarvon to over 1000 cu at Bathurst and Applethorpe (6).

The cultivars used in this study originated from the University of Florida (UF) breeding program with the exception of 'China Flat', a chance peento-type seedling from Australia and the white-fleshed cultivars 'Albatros', 'Culemborg', 'Earlibelle' and 'Orion' from the Fruit and Fruit Technology Research Institute, South Africa (2). The chilling requirement of the UF cultivars varies from 100 to 550 cu (1), and based on relative blossoming time the chilling requirements of the remaining cultivars are 'China Flat' 125 cu, 'Albatros' 450 cu, 'Culemborg' 500 cu, 'Earlibelle' 350 cu, and 'Orion' 350 cu.

Fruit characteristics were rated on a 1 (least desirable) to 5 (most desirable) scale except for fruit size. Fruit size measurements were available as average fruit weights (g) and average fruit diameters (mm) from a few of the locations but the most common measurement was range of fruit diameters and the midpoint of this range was used to estimate average fruit size. The midpoint of the range would be a misleading estimate of the mean when individual fruit diameters were not normally distributed; however, high positive correlations were obtained between

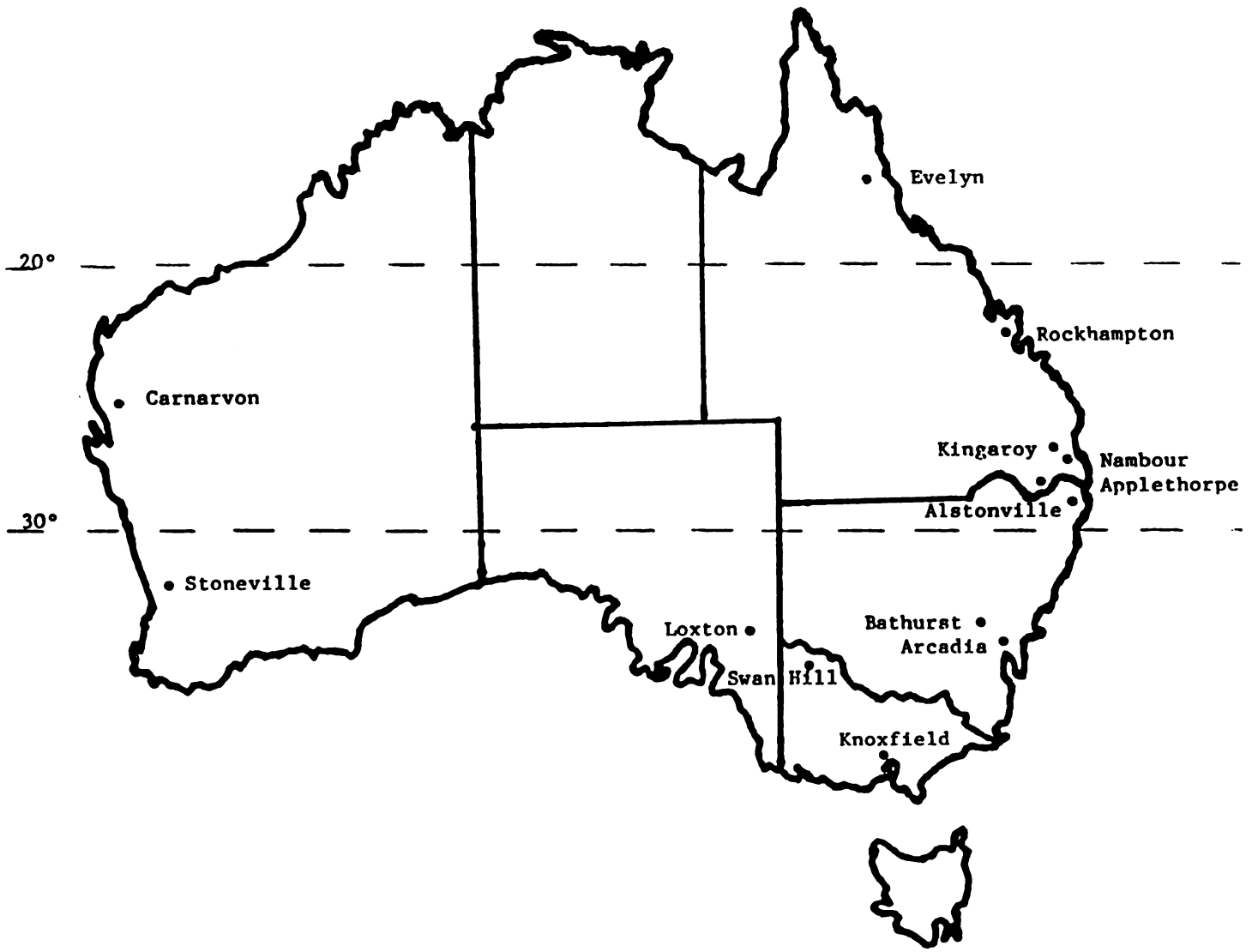

Fig. 1. Geographic location of 13 test locations for low-chill peach and nectarine cultivars in Australia.

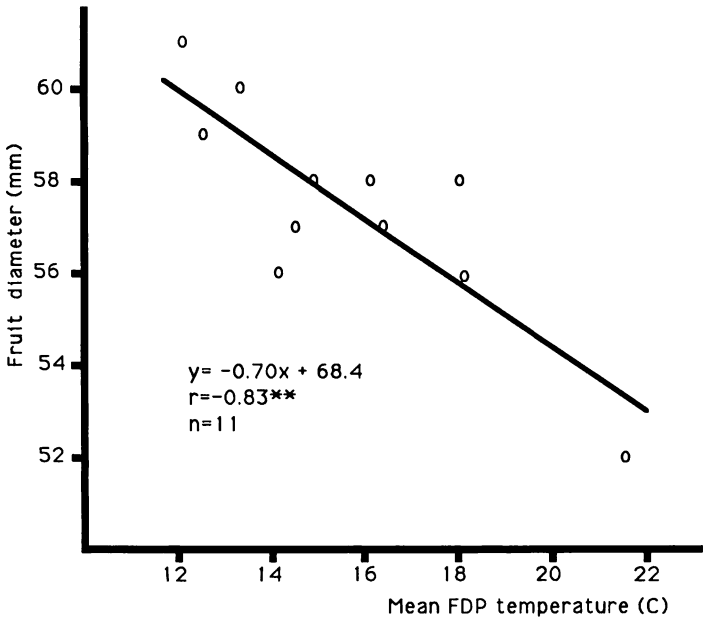

Fig. 2. Relationship between mean midrange fruit diameter of 22 cultivars and mean FDP (fruit-development period) temperature (August - November) for 11 test sites.

midrange diameter and average fruit diameter (r = 0.96**) and between midrange diameter and average fruit weight (r = 0.94**). It therefore seems that midrange diameter is a good estimator of average fruit size in this case.

There was an uneven representation of cultivars across locations and so all cultivar and location means are based on least squares analysis.

Results and Discussion

The regression of midrange fruit diameter site mean (over 22 cultivars) on mean monthly temperature during the FDP (August to November) shows a decrease of 0.7 mm in diameter for every 1°C increase in mean monthly FDP temperature (Fig. 2). The smaller fruit size of a cultivar grown in warmer locations would correspond with the reduced FDP with warmer temperatures previously documented (4,6,7). For example, the midrange diameter of 'Flordabelle' decreased from 75 mm at Applethorpe to 70 mm at Nambour to 65 mm at Rockhampton and the FDP's were 145, 107, and 87 days, respectively. There were significant correlations for firmness and flavor (Fig. 3) with flavor increasing an average of 0.17 units (1 to 5 scale) for each 1°C increase, and firmness increasing only 0.09 for each 1°C increase indicating the rate of change for firmness across locations was about half that of flavor. Evaluations were made by different horticulturists at each location, so evaluator and location effects are confounded. Obviously, fruit size, firmness and flavor are all dependent on stage of maturity. Fruit at warmer locations were possibly picked at a less advanced stage of maturity due to earlier change in ground color (which is the primary indicator of

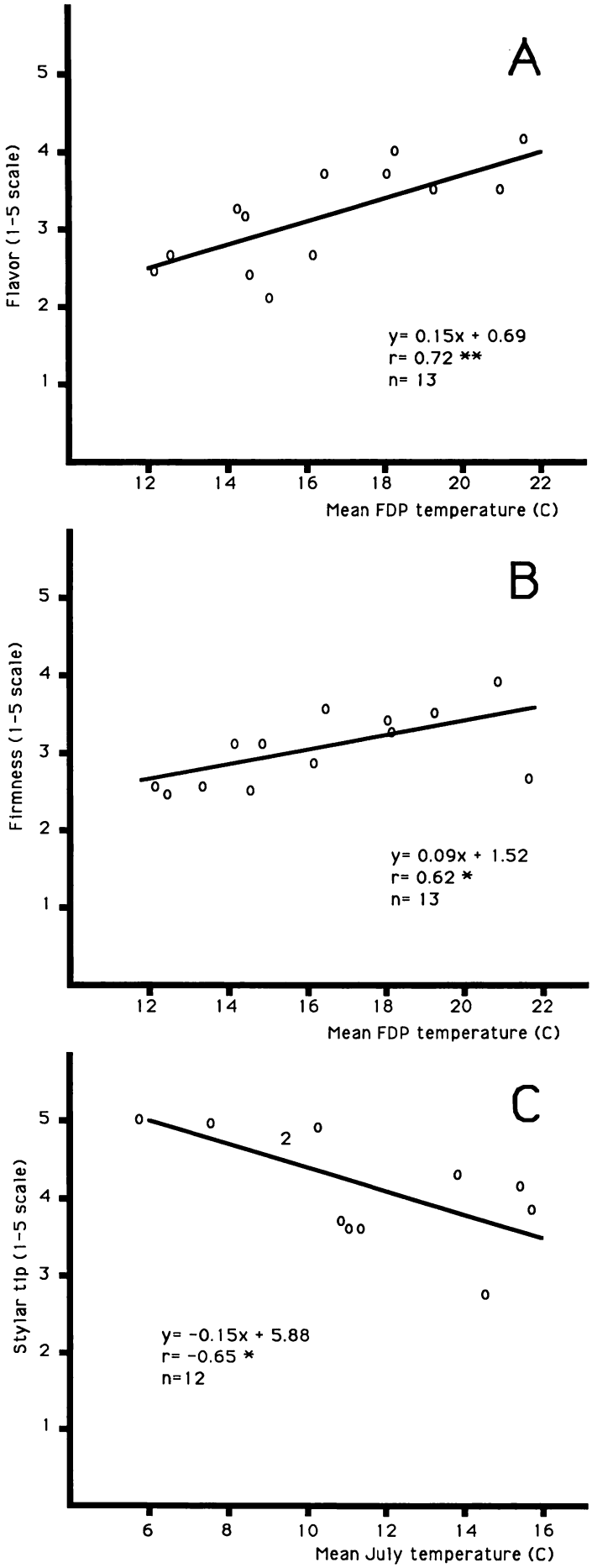

Fig. 3. Regressions of mean fruit quality (A. flavor; B. firmness; C. stylar tip) for 22 cultivars rated on a 1 (least desirable) to 5 (most desirable) scale with the mean FDP (August-November) temperature or mean coldest month (July) temperature.

readiness for commercial harvest). This would contribute to differences in size and firmness between locations (smaller and firmer fruit at warm locations). This possibility cannot be tested unless a physiological maturity index other than skin color (i.e. time before ethylene release by softening fruit) is used to determine harvest date. The fact remains that, using commercial harvest procedures, the fruit at warmer locations were rated as smaller, firmer and better flavored. Increased flavor would not be expected with earlier harvest and indicates that fruit were not harvested earlier at warmer locations or that the flavor increased despite an earlier harvest. Red blush, attractiveness, fuzz, suture bulge and juiciness were not significantly correlated with mean FDP temperature across locations. These traits would not be expected to change across locations other than due to experimental error or differences in management or measurement technique.

The correlation of stylar tip with mean FDP temperature was nonsignificant, but when stylar tip was correlated with mean July (coldest month) temperature, the correlation was -0.65* and the regression coefficient was -0.15 (Fig. 3). So fruit shape changes across locations, with the more pointed fruit occurring at warmer locations. For example, 'Flordagold' produces a round fruit with no tip at the high-chill locations of Bathurst, Applethorpe and Knoxfield but has a distinct tip when grown at low-chill locations such as Nambour, Alstonville and Rockhampton. A corollary of cultivar × location interaction is that some cultivars, such as 'Floraprince', with no tip at low-chill locations produce fruit with an indented stylar end at high chill locations. The significant correlation of stylar tip with July temperature rather than FDP temperature may indicate that fruit shape is determined prior to flowering. Cultivar characteristics may be stable or may change across locations. Those that change may change for all cultivars, or they may change more for some cultivars than for others (i.e., genotype × location interaction). Cultivar evaluators need not study traits that are stable across locations and can predict the performance of traits with no genotype × location interaction by comparison to a standard or by adjusting for location effects, however, the traits affected by genotype × location interaction require careful testing at all locations. Stylar tip appears to be a trait which exhibits interaction effects. For example, some cultivars that are round in cool locations become pointed when grown in warm areas while others, such as 'Sunlite', remain relatively tip-free at all locations, thus contributing to some cultivar changes in ranking across locations.

Cultivar recommendations based on evaluations by the horticulturist at each of the 13 locations are presented in Table 1. 'China Flat', 'Culemborg', 'Earlibelle' and Fla. 5-13 were not recommended at any location because of insufficient red skin color and soft flesh and for Fla. 5-13 because of susceptibility to bacterial spot. The only South African cultivars recommended were 'Orion' and 'Albatros'. 'Orion' was recommended at three high-chill locations because of its relatively large fruit size for an early ripening peach, but it will be replaced when firmer cultivars are developed. 'Albatros' was recommended in Victoria because it was the best available white flesh peach in its slot

Table 1. Peach and nectarine cultivar recommendations and July (coldest month) mean temperatures for 13 locations.

Cultivar	Location[z] Carnarvon	Rockhampton	Evelyn	Nambour	Alstonville	Stoneville	Arcadia	Kingaroy	Loxton	Swan Hill	Knoxfield	Applethorpe	Bathurst
Peach													
Albatros	–	–	–	D	D	–	–	D	–	R	R	D	D
China Flat	–	–	–	D	–	D	–	–	–	–	D	D	–
Culemborg	–	–	–	D	–	D	–	–	–	–	D	D	–
Earlibelle	–	–	–	D	D	F	D	D	–	F	D	D	D
Flordabelle	R	R	–	D	D	F	D	R	–	–	D	D	D
Flordagold	R	D	R	R	R	F	R	R	F	R	R	R	D
Flordaking	–	–	–	F	–	F	D	R	–	R	D	F	D
Flordaprince	R	F	R	R	R	F	D	D	F	–	D	D	D
Flordaqueen	–	–	–	D	–	F	D	R	–	D	D	D	D
Flordared	R	R	D	D	D	D	D	D	–	D	D	D	D
Flordasun	D	–	D	D	D	–	D	R	–	D	D	D	D
Maravilha	–	–	D	D	D	F	–	D	–	R	–	D	D
Orion	–	–	–	D	–	–	D	–	–	R	R	R	D
Sherman's Early	–	–	–	D	D	D	R	R	–	R	D	D	D
Sherman's Red	–	–	–	F	D	F	R	R	F	–	R	D	D
Nectarine													
Fla. 3-4	–	–	–	F	D	F	R	–	F	–	–	D	D
Fla. 5-13	–	–	–	F	D	F	D	–	F	–	–	–	D
Fla. 5-14	–	–	–	R	R	F	R	F	F	–	–	D	D
Sundowner	R	–	R	R	R	F	R	R	F	R	D	R	D
Sunlite	–	–	–	R	R	F	R	R	–	R	D	R	D
Sunred	D	D	D	D	D	R	R	D	–	R	R	R	D
Sunripe	–	–	–	F	R	D	R	–	–	R	–	F	D
Mean July Temp. (°C)	17.0	15.8	15.5	14.6	13.8	11.3	11.2	10.9	10.3	9.4	9.4	7.5	5.8

[z]D = Discard
F = Further observation
R = Recommend

but is also likely to be replaced. The older Florida cultivars 'Flordasun' and 'Flordaqueen' have been largely superceded, but 'Sunred' nectarine (released from Australian quarantine in 1972) is still recommended at 5 locations. 'Sundowner' (tested as Fla. 6-3) has replaced 'Sunred' in most low-chill locations and is likely to replace 'Sunred' in all areas because of superior fruit size.

'Flordagold' (325 cu) and 'Sundowner' (300 cu) were the most widely tested and recommended cultivars (Table 1) and appear to be adapted to a wide range of environments. 'Flordagold' was recommended because of its size, firmness and attractive skin color as a mid- to late-season peach in low-chill areas or an early- to mid-season cultivar in high-chill areas. 'Flordagold' obtained the highest firmness rating (4.5) averaged over all locations. 'Sunlite' nectarine was also recommended at both high- and low-chill locations as an early and late ripening cultivar, respectively. Its chilling requirement of 450 cu precluded its use in very low-chill areas, such as Carnarvon, Rockhampton and Evelyn.

'Flordabelle', 'Flordared' and 'Flordaprince' were recommended only at low-chill sites. 'Flordared' (100 cu) and 'Flordabelle' (150 cu) were recommended at Carnarvon and Rockhampton, but were of little value in other areas. 'Flordaprince' (150 cu) peach produces moderate size, attractively colored, early ripening fruit but is recommended only in low-chill areas because the fruit cracks and russets on the stylar end when it is grown at high-chill *locations,* such as Bathurst and Applethorpe.

Literature Cited

1. Crocker, T. E. and W. B. Sherman. 1984. Peaches and nectarines in Florida. Fla. Coop. Ext. Ser. Cir. 299C.
2. Evans, E. P., G. M. M. Evasmas and K. G. Zwahlen. 1977. Commercial peach cultivars for the Transvall, Middleveld and Highveld areas. Farming in South Africa. Peaches C.2/1977.
3. Loebel, R. 1987. Low-chill stonefruit industry around Australia. p. 39-54. In: Skinner, I. (ed.). Proc. First National Low-chill Stonefruit Conf., Exotic Fruit Growers Assn. Lismore, NSW, Australia.
4. Munoz, C., G. Sepulveda, J. Garcia-Huidobro, and W. B. Sherman. 1986. Determining thermal time and base temperature required for fruit development in low-chilling peaches. HortScience 21(3):520-522.
5. Sherman, W. B., R. J. Knight and T. E. Crocker. 1978. Peach and nectarine breeding and testing in warm parts of the world. Proc. Trop. Reg. Amer. Soc. Hort. Sci. 22:103-117.
6. Topp, B. L. and W. B. Sherman. 1989. The relationship between temperature and bloom-to-ripening period in low-chill peach. Fruit Varieties J. 43(4):155-158.
7. Weinberger, J. H. 1948. Influence of temperature following bloom on fruit development period of Elberta peach. Proc. Amer. Soc. Hort. Sci. 51:175-178.

Proc. Fla. State Hort. Soc. 102:199-202. 1989.

PERFORMANCE OF NON-ASTRINGENT PERSIMMONS (*DIOSPYROS KAKI* L.) IN FLORIDA

E. P. MILLER
Fruit Crops Department
University of Florida, IFAS
Gainesville, FL 32611

Additional index words. cultivars, culture, freeze damage, fungal diseases, insects.

Abstract. **Eleven non-astringent persimmon cultivars were evaluated for their performance in central and north Florida. The cultivars, listed in ripening order, 'Izu', 'Matsumoto Wase Fuyu', 'Ichikikei Jiro', and 'Suruga' have the best commercial potential. 'Gailey' is the recommended pollinator. These cultivars are the most adapted and the least susceptible to fruit problems. Control of *Cercospora* leaf spot and other fungal pathogens is important. White peach scale, the most damaging insect pest, and persimmon psylla can be controlled with insecticides. Three to 4 cover sprays for fungal pathogens and insects are timed at full bloom, 1 month later, in late August and frequently in late September.**

The performance of oriental persimmons as a deciduous fruit crop in Florida parallels that of blueberries, chestnuts, figs, grapes, peaches, pears, and pecans. The persimmon adapts well to a variety of soil conditions and will crop lightly in the absence of horticultural care. The tree is attractive with large, dark-green leaves and a spreading form.

Persimmons are desirable for their beauty around the home, in the dooryard garden and in the fruit bowl as well as for consumption. The fruit are sweet and have an attractive, bright-orange color. Firm, non-astringent types have a crisp, pleasing texture and can be stored without refrigeration. Fruit are harvested in autumn along with chestnuts and pecans. They are prized in oriental societies. A small persimmon volume is marketed in Florida and because of limited availability they bring up to $1.00 per pound at the farm.

Persimmons are classified into non-astringent types, which can be eaten firm and soft or astringent types, which must be soft-ripe before the astringent tannins coagulate and the fruit are suitable for eating (4,6). Persimmons are also divided into pollination variant types, which are dark fleshed when seeded, and pollination constant types which are clear fleshed regardless of seed (6).

The non-astringent, pollination constant types have distinct advantages in marketing and consumer acceptance (6). Picked hard, they are easy to handle and will have at least a 5 to 15 day shelf life. Soluble solids vary between 13 and 24% from the early to late cultivars. The flesh is orange, crisp, and moderately juicy. The fruit do not have to be eaten in the "gooey-drippy" state which is objectional to many Americans. Further, and perhaps most important, is the lack of astringency which has adversely affected many people's opinion of the fruit.

Performance is affected by a number of factors including cultivars (6), crop load (3), seed set (1,3), fungal diseases (2,4,6,8), insects (5,6), and freezing temperatures (7). This report discusses fruit quality in persimmons and factors that affect production.

Florida Agricultural Experiment Station Journal Series No. N-00072.