Proc. Fla. State Hort. Soc. 97:320-322. 1984.

PROGRESS IN LOW-CHILL PEACHES AND NECTARINES FROM FLORIDA[1]

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Additional index words. Prunus persica (L.) Batsch, plant breeding, chilling requirement.

Abstract. **Eighteen peach and nectarine cultivars have been released from the University of Florida fruit breeding program. Only 'Flordaprince', 'Flordagold', and 'Flordaking' peaches and 'Sunfre' nectarine are currently recommended for commercial trial in Florida. Other cultivars and selections show promise in other areas of the world. Progress made in breeding for fruit with larger size, rounder shape, red over-color and earlier ripening has culminated in selections with high potential for becoming commercial cultivars. These selections and cultivars are characterized for chilling requirement, days from bloom to maturity, and fruit quality. Limited trials show promise of commercial success from central through north Florida.**

Low chilling peaches, *Prunus persica* (L.) Batsch, which originated in south China have been available to the plant breeder for many years. Pioneer breeding work to produce high fruit quality, low chilling peaches began in California in the early 1900's even before the problem of delayed foliation was recognized as a symptom of insufficient winter chilling (1). Peach breeding for low chill types was later initiated in South Africa prior to 1950, in Brazil in 1950, and in Florida in 1952 (2, 3). The nectarine gene was introduced into the Florida breeding program in 1956 (4).

The University of Florida has to date released 11 peach and 7 nectarine cultivars. These cultivars with their selection test numbers and date of official release are listed in Table 1 because many selections were publicly tested before release by the University of Florida and some have been distributed from original test sites with the cultivar name unknown. The dates for cultivar releases reflect the programs continuous activity. Some of these cultivars were never intended for commercial cropping. 'Sunripe' and 'Sunhome' nectarines and 'Flordawon' and 'Flordahome' peaches were for home gardens and 'Okinawa' was for a root-knot nematod (*Meloidogyne* spp.) resistant rootstock. Other cultivars have become obsolete. For example, 'Sungold', 'Sunrich', and 'Sunlite' nectarines and 'Flordared', 'Fordasun', and 'Flordabelle' peaches have either been replaced by superior cultivars or their fruit qualities are not sufficient to meet current market standards. Currently, 'Sunfre' nectarine and 'Flordagold', 'Flordaking', and 'Flordaprince' peaches are grown for commercial cropping in Florida and 'FlordaGrande' peach is grown in south Texas.

Florida peach and nectarine cultivars and selections have been tested with growers and experiment stations in Florida and in over 60 countries (7). Most cultivars and some selections have been found to be adapted to low chill areas representing most of the world's subtropics and tropical highlands. In fact, some selections discarded from our testing program have been propagated and named by others. One reason for this is that fruit standards in other countries often differ from those of U. S. markets where fruit size over 5 cm diameter is demanded, fruit overcolor and shape are critical, and high fruit firmness is mandatory. Further, there are often different genotype responses in other climates such as higher red overcolor in desert climates, lack of need for cold hardiness in buds and flowers in the absence of spring frosts, smoother fruit shape with uniformly cool winters, and larger fruit size with soils of higher water holding capacity. Florida selections which have been given cultivar names in other parts of the world have been made available to local nurserymen and growers but are not grown commercially in Florida because of serious defects (Table 2). Most of these cultivars have been used in our breeding program and some have been discarded because they have been replaced by superior selections.

The University of Florida peach and nectarine breeding

Table 1. Peach and nectarine cultivars named by the University of Florida and their selection number at the time of release.

Cultivar	Selection no.	Year released
Peach		
Okinawa	Seed Int.	1957
Flordawon	Fla. L1-58	1961
Flordaqueen	Fla. 4-26	1961
Flordahome	Fla. H97	1962
Flordasun	Fla. 16-33W	1964
Flordared	Fla. L27-12	1970
Flordabelle	Fla. W68-1	1970
Flordagold	Fla. 15-39	1976
Flordaking	Fla. 15-34	1978
Flordaprince	Fla. 5-2	1982
FlordaGrande	Fla. 10-64	1984
Nectarine		
Sunred	Fla. 68-72	1964
Sungold	Fla. Q303-4	1969
Sunrich	Fla. Q303-24	1971
Sunlite	Fla. 44-28	1975
Sunripe	Fla. 7E-62	1979
Sunfre	USDA C73-40	1982
Sunhome	Fla. 9-13NR	1985

Table 2. University of Florida selection numbers that have given cultivar names elsewhere and remarks on potential for commercial growing in Florida.

Selection number	Cultivar	Country where named	Remarks
Peaches			
Fla. L8-112	McRed	USA	Lacks firmness
Fla. 13-72	Maravilha	Brazil	Lacks size
Fla. 26-31	Flordabeauty	USA	Green ground color
Fla. 16-33	San Pedro	Argentina	Suture bulge
Fla. 2-2	Shermans Red	Australia	Lacks size
Fla. 3-1	Shermans Early	Australia	Lacks size and firmness
Fla. 1-3	Opodepe	Mexico	Long tip
Fla. 1-11	Rayon	Mexico	In evaluation
Fla. 7-1	Flordagem	Mexico	Lacks size and shape
Nectarines			
Fla. A5-107	K-gold	USA	Cracks badly
Fla. 19-19-375	Columbina	Brazil	Lacks firmness

[1]Florida Agricultural Experiment Stations Journal Series No. 5870. This research was supported by a grant from the United States-Israel (Binational) Agricultural Research and Development Fund (BARD).

program developed the high-density fruiting nursery system (6) to make initial selections based on fruit quality (stage 1). Initial selections from hybrid progenies are propagated onto root-knot nematode resistant rootstock (5) and 2 to 6 trees of each selection are planted in the field for evaluation under simulated commercial conditions and are fruited 3 to 4 years (stage 2). Selections that continue to show cultivar potential are further tested with growers and other cooperating agencies under a memorandum of agreement (stage 3). Florida's peach and nectarine selections and comparative cultivars that are currently being put into stage 3 evaluation tests are listed in Table 3. This table also contains a rating for the characteristics of each entry and the following is a description of how the characteristics were rated.

Chilling requirements were determined from many years of observations of the amount of low winter temperatures needed for normal flower and leaf bud break on a few "key" cultivars. Comparing bloom and leaf dates of new selections with "key" cultivars gave estimates of chilling needs in new selections. For example, 'Sunred' has been assigned a chilling requirement of 250 chill units through years of observation in various locations that produced more and less chilling than needed for normal bloom and foliation. Thus, a clone that consistently bloomed a day after 'Sunred' but 4 days before 'Flordagold' (325 chill units) would be assigned a value nearer 'Sunred' or about 275 chill units. Estimates of chilling units are for Florida conditions and may change in other climates, but the order of bloom dates should remain about the same with the lowest chilling cultivars blooming earliest and the highest chilling latest.

Days from full bloom to maturity varies with temperatures during the period of fruit development. Days to maturity is longer with lower than with high temperatures. Fruit generally ripens later in cool springs or as in mountain areas where temperatures are lower during fruit development than warm springs or in areas of low elevations where temperatures are higher during fruit development.

Fruit size is a function of genetic potential, days from bloom to maturity, crop load, and cultural management. It is easier to breed larger fruit in late-ripening than in early-ripening cultivars. Fruit size, was determined from a representative sample of fruit taken from several years under normal fruit thinning of 10 to 15 cm apart on the limb.

Fruit red overcolor, shape, firmness, taste, and resistance to flesh browning and resistance to bacterial spot are each classified subjectively from 1 = lowest or least desirable to 10 = highest or most desirable rating. Red overcolor is desirable in U.S. markets and must be an attractive bright red for best retail prices. Fruit shape is made less desirable by protruding tips and sutures. Highest ratings indicate round fruit without proturberances or large suture bulges and are the most desirable. Fruit are given low scores if they either prematurely on the tip- suture, or shoulder, or if over-all firmness is lacking at the time of color break for commercial harvest. Fruit taste is very subjective, but selections with high aroma, high acid, high sugar and a balanced sugar-acid ratio receive the highest rating. Cuts and bruises on the ripe fruit will brown and the degree of browning varies with the cultivar. Selections that brown readily and darkly are discarded. Those with the highest score brown the least.

Bacterial spot [caused by *Xanthomonas campestris* (Pamm.) Dows. pv. prini (E. F. sm.) Dye] has proven to be the only disease in peach which has shown improved resistence with breeding and selection. Resistance in this paper refers to leaf resistance as the disease does not as consistently appear on the fruit under Florida's climatic conditions.

Table 3. Peach and nectarine cultivars and selections from the University of Florida breeding program stage 2 that show promise for advanced tests.

Cultivar	Observations (years)	Estimated chill Units	Fruit								Bacterial[z] spot resistance
			FDP[z] (days)	Size (g)	Stoney freeness	Red color[x]	Shape[x]	Firm[x]	Taste[x]	Flesh browning[x]	
Peach											
FlordaGrande	11	75	104	98	SF	6	8	7	7	10	10
Flordaprince	7	150	78	88	SC	8	9	8	7	8	4
Flordagold	12	325	88	89	SC	6	7	10	9	9	5
Flordaking	13	400	68	92	SC	5	7	7	7	9	9
Fla. 7-11	5	375	96	101	F	8	7	10	9	8	7
Fla. 1-8	6	350	97	115	SF	8	9	9	8	10	9
Fla. 1-11	6	150	105	109	SF	8	8	9	8	10	9
Fla. 1E-138	3	200	106	120	F	8	9	9	9	9	9
Fla. 5-12	8	175	94	111	F	8	10	9	10	10	8
Fla. 8-1	4	200	69	72	SC	7	8	8	6	8	10
Fla. 8-6	4	275	78	86	SC	8	9	8	7	8	8
Fla. 8-14	5	300	109	146	F	5	8	7	8	9	8
Fla. 9-10	4	175	89	101	SF	9	9	8	8	8	5
Fla. 9-14	3	200	101	104	F	7	7	9	9	8	9
Fla. 9-20C	3	225	111	85	C	7	9	10	9	10	7
Nectarine											
Sunred	15	250	94	74	F	10	10	7	9	8	10
Sunlite	8	450	88	82	F	8	8	8	8	9	10
Sunfre	4	525	90	101	SF	8	9	9	8	9	9
Fla. 7-4N	6	425	70	82	SC	9	9	8	8	10	10
Fla. 5-15N	8	325	101	93	F	8	8	8	9	10	9
Fla. 8-2N	4	425	70	79	SC	7	9	8	8	9	10
Fla. 9-6N	4	225	89	87	SC	10	9	9	8	8	9
Fla. 9-8N	4	250	89	104	SC	8	9	9	8	7	7
Fla. 9-11N	4	200	95	92	SC	10	9	9	8	8	9
Fla. 9-12N	3	275	91	85	SC	10	9	8	8	7	10
Fla. 9-15N	3	275	88	97	SF	10	9	8	8	9	10
Fla. M9-7N	2	400	90	86	SC	8	8	9	8	6	10

[z]FDP = Fruit development period.
[y]C = cling, SC = semicling, SF = semifree and F = free.
[x]Ratings of 1 = poorest or least desirable to 10 = best or most desirable.

Peach and nectarine cultivars and selections mostly developed in the last 10 yr are promising for supporting commercial production in central and north central Florida (100-350 chill units) and in north Florida (350-650 chill units) as well as other areas around the world with similar low winter chilling climates (Table 3). The selections described in Table 3 were chosen because they possess characteristics most acceptable in U. S. markets and because they ripen in Florida between late April and the start of the rainy season in early June.

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Proc. Fla. State Hort. Soc. 97:322-325. 1984.

BREEDING EARLY-RIPENING BLUEBERRIES FOR FLORIDA[1]

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Additional index words. Vaccinium ashei Reade, *V. corymbosum* L.

Abstract. **The early-season fresh blueberry market appears to offer the greatest potential profits for Florida growers, especially as blueberry plantings increase in other states in the southeastern U.S. To take full advantage of Florida's potential for producing early blueberries, cultivars are needed that are specifically selected to flower early, ripen as quickly as possible after flowering, and fruit well after mild winters. The University of Florida breeding program is attempting to meet the needs of the Florida blueberry industry by developing earlier-ripening rabbiteye blueberry (**Vaccinium ashei **Reade) cultivars, rabbiteye cultivars that will fruit reliably south of Ocala, and vigorous, well-adapted highbush (**V. corymbosum **L.) cultivars.**

Approximately 3000 acres of rabbiteye blueberries were cultivated in north Florida in 1928. These plantations were established by digging wild rabbiteye blueberry bushes from the river swamps of west Florida and transplanting them to upland sites (4, 7, 15). Although these plants usually grew well, the unimproved rabbiteyes were highly variable in productivity, time of ripening, and fruit quality. Low quality, lack of handling and marketing expertise, and the advent of the economic depression resulted in the early demise of Florida's first blueberry industry.

During the past 20 yr, blueberries have again been planted in Florida, this time with improved cultivars. Current state acreage is approaching 1000 acres. This paper attempts to evaluate the potential for growth of the Florida blueberry industry and to describe how new blueberry cultivars could facilitate this growth.

If blueberry cultivation is to be successful in Florida, growers must be able to obtain high yields, and they must be able to market the crop at profitable prices. Blueberry markets can be divided broadly into 2 types: fresh and processed. Worldwide, about 30% of the total annual blueberry production goes to the fresh and 70% to the processed market. Processed blueberries can be stored for several years. This makes early, midseason, and late blueberries about equal in value for processing. On the other hand, fresh blueberries must be marketed quickly, usually within 2 weeks after harvest. Thus, the market requires an orderly supply of fresh blueberries throughout the season. Underproduction during one part of the season results in high prices, while overproduction results in low, usually unprofitable, prices.

At present, the first fresh blueberries produced in commercial volumes in North America are available about May 20 and come from southeastern North Carolina (18, 23). This production area is near the Atlantic coastline where the climate is considerably moderated by the waters of the Gulf Stream, which make the season substantially earlier than it would otherwise be at that latitude. The North Carolina blueberry industry was started primarily to produce early, fresh blueberries that could be marketed before harvest of the large New Jersey crop (1, 18). This has led North Carolina growers to select early-ripening cultivars for planting. These cultivars also flower early and in many years yields are reduced by spring freezes. Total producing acreage in North Carolina is about 3100 acres (21) and production averages about 6 million lb. per year.

The next major production area is New Jersey, which begins to harvest about June 15 with about 8000 acres and production of about 26 million lb. Perkins (23) found that of the blueberries marketed fresh from the U.S. and Canada in a typical year, only 7% were marketed in May, compared to 24% in June, 40% in July, and 26% in September. As might be predicted from these statistics, prices for fresh blueberries are typically quite high before May 20, fall somewhat by June 1, and then decline substantially after June 15.

Florida's best market opportunities for fresh blueberries lie with early-season production because competition from established production areas farther north reduces prices for late-season production.

Breeding Cultivars for Early-ripening in Florida: General Considerations

Two main components determine the ripening date of a blueberry cultivar: time of flowering and interval from flowering to ripening. Both components are affected

[1]University of Florida Journal Series No. 5989.