‘Florida Beauty’ Strawberry

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Additional index words. *Fragaria* × *ananassa*, fruit breeding, small fruit

The leading strawberry (*Fragaria* × *ananassa*) cultivar grown in Florida is currently ‘Florida Radiance’ (Chandler et al., 2009; U.S. Patent PP20,363) which was commercialized in 2009 and by the 2015–16 season, accounted for ≈70% of the acreage in west-central Florida. This cultivar is preferred for its early and total yields, its uniformly shaped and attractive fruit, and its open plant architecture and long pedicels which allow efficient harvesting. Sweet Sensation® ‘Florida127’ (Whitaker et al., 2015; hereafter referred to as ‘Florida127’; U.S. Patent PP25,574) is currently the second leading cultivar with ≈20% of acreage in 2016–17. This cultivar is preferred for its combination of high yields, large fruit size, excellent eating quality, and long shelf life. However, neither of these current commercial standards are well adapted for early transplanting dates in west-central Florida. High temperatures during transplanting tend to reduce early yields of ‘Florida Radiance’ and cause elongated fruit, which may be unmarketable, and ‘Florida127’ often becomes too vegetative when exposed to high temperatures. The planting window in west-central Florida has shifted earlier in recent years in an attempt to produce higher yields in late November and

December when market prices are highest (Wu et al., 2015).

There is currently a need for additional cultivars with uniformly shaped fruit and harvesting efficiency similar to ‘Florida Radiance’ and flavor characteristics similar to ‘Florida127’. There is also a need for cultivars that are adapted to early planting, between 25 Sept. and 1 Oct., when environmental conditions in west-central Florida are hot and unfavorable for flower initiation and ideal fruit shape.

‘Florida Beauty’ strawberry is the product of a collaborative breeding effort between the University of Florida and the Queensland Department of Agriculture and Fisheries. It has demonstrated adaptation to early planting, maintaining excellent fruit quality, and a yield distribution that complements current commercial standards. Experimental trials have been conducted under the direction of the University of Florida on the research plots

of the Gulf Coast Research and Education Center (GCREC) (Balm, FL), at the Florida Strawberry Growers Association (FSGA) headquarters in Dover, FL, and on several farms in west-central Florida and Southern Spain.

Origin

‘Florida Beauty’ originated from a 2012 cross made by the Queensland breeding program between Queensland Australia selection 2010-119 (female parent) and ‘Florida Radiance’ (male parent) (Fig. 1). Selection 2010-119 was chosen as a parent for its excellent fruit shape and flavor. This selection also had the University of Florida cultivar ‘Strawberry Festival’ (Chandler et al., 2000; U.S. Patent PP14,739) in its pedigree which is outstanding for its firmness and rain tolerance. Seeds from this cross were germinated, and seedlings were evaluated on the research plots of the University of Florida, GCREC. ‘Florida Beauty’ was first selected during the 2012–13 season and was favorably noted again during the 2013–14 season in small-plot observational trials before being advanced to replicated trials.

During the 2014–15, 2015–16, and 2016–17 seasons, yield and fruit quality data were collected from replicated trials conducted at the GCREC. Raised beds were 90 m long, 70 cm wide, 15 cm high at the edges, and 18 cm high in the center and were covered with a single layer of black, high-density polyethylene mulch. Preplant fumigant consisted of a 65:35 mixture of Telone® and chloropicrin. Each bed contained two rows of plants spaced 38 cm apart within rows and 28 cm apart between rows. All trials were conducted using bare-root plants. Randomized complete block designs were used in all 3 years, with four replicate plots (ten plants per plot) of each genotype in 2014–15 and five replicate plots in 2015–16 and 2016–17. The trials were planted between 9 and 11 Oct. (the commercial planting period ranges from ≈25 Sept. to 20 Oct.) in each year. Overhead irrigation was applied for plant establishment for 8–10 d during daylight hours, after which

Fig. 1. Pedigree of ‘Florida Beauty’ strawberry. The female parent is listed on the upper side of each bifurcation.

Received for publication 10 July 2017. Accepted for publication 31 Aug. 2017.

Funding has been provided for this work by the Florida Agricultural Experiment Station, the Florida Strawberry Research and Education Foundation, and the Florida Department of Agriculture and Consumer Services through the USDA Specialty Crop Block Grant program.

The authors acknowledge Tomas Hasing for contributing statistical expertise.

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water and fertilizer were applied exclusively through the drip tape.

All ripe fruit (at least $\frac{3}{4}$ red) were harvested, graded, counted, and weighed twice a week from December through March.

Fruits that were diseased, misshapen, small (<10 g), or rain damaged were considered unmarketable, and the remaining fruit were weighed to determine the marketable yield in grams on a per-plant basis. Fresh fruit were

transported to the USDA ARS, U.S. Horticultural Research Laboratory in Fort Pierce, FL, once each month for flavor evaluations by a trained sensory panel and measurement of soluble solids content (SSC), pH, titratable acidity (TA) (% citric acid equivalents) and firmness on fruit from the same field replicate previously described (Plotto et al., 2013). Two to three hundred fruit of each variety from a separate GCREC field were also transported to the Food Science and Human Nutrition Department of the University of Florida in Gainesville, FL, for consumer sensory evaluation. The ratings of greater than 100 untrained panelists were collected for overall acceptability, texture acceptability, flavor intensity, sweetness intensity, and sourness intensity using the methods and rating scales of Ubeda (2011) and Kalva et al. (2014). Commercially harvested and packed fruit (454 g plastic containers) from experimental, on-farm trials were also transported on three different dates in 2015–16 and in 2016–17 to the Food Quality Laboratory of the University of South Florida in Tampa, FL, for analysis of quality attributes over time during cold storage. Weight loss and visual quality ratings were collected using previously published methods (Nunes and Delgado, 2014; Nunes and Emond, 2007).

Fig. 2. Plants and fruit of ‘Florida Beauty’ strawberry in February, 2016 on a farm in Plant City, FL.

Table 1. Marketable yield and average fruit weight of ‘Florida Beauty’, ‘Florida127’, and ‘Florida Radiance’ at the University of Florida Gulf Coast Research and Education Center at Balm, FL, during the 2014–15, 2015–16, and 2016–17 seasons.

Cultivar	Marketable yield (g/plant)						Fruit size (g) ²
	November	December	January	February	March	Total	
2014–15							
Florida Beauty	7.4 a ³	55.5 b	149.0 b	180.4 b	209.6 a	601.3 b	22.3 c
Florida127	0.0 b	95.8 a	212.7 a	288.4 a	206.6 a	803.6 a	30.8 a
Florida Radiance	1.6 b	60.5 b	152.2 b	327.0 a	210.9 a	749.7 a	25.0 b
2015–16							
Florida Beauty	16.7 b	87.5 a	68.9 a	187.7 a	129.3 a	490.2 a	18.9 b
Florida127	39.6 a	75.3 a	38.2 b	139.4 a	129.4 a	411.9 a	21.5 a
2016–17							
Florida Beauty	22.4 a	98.4 a	177.4 ab	351.3 a	200.4 a	850.0 a	17.8 b
Florida127	14.1 b	115.2 a	211.9 a	428.7 a	197.1 a	967.0 a	23.5 a
Florida Radiance	6.3 b	102.3 a	157.2 b	413.9 a	174.1 a	853.8 a	18.8 b

²Fruit size was determined by dividing total marketable fruit yield per plot by total marketable fruit number per plot.

³Means are based on four replications of 10 plants each in 2014–15 and on five replications of 10 plants each in the other seasons. Mean separations within years and columns are by Tukey’s HSD test, $P \leq 0.05$. ‘Florida Radiance’ plants were not available for trial in 2015–16.

Table 2. Consumer sensory ratings for ‘Florida Beauty’, ‘Florida127’, and ‘Florida Radiance’ based on the ratings of 100 untrained panelists on four harvest dates over two seasons.

Cultivar	Overall acceptability ²	Texture acceptability ²	Flavor intensity ³	Sweetness intensity ³	Sourness intensity ³
23 Feb. 2016					
Florida Beauty	30.2 b ⁴	32.1 b	34.4 b	30.4 b	19.1 a
Florida127	41.3 a	39.5 a	39.5 a	39.3 a	13.9 b
Florida Radiance	32.2 b	35.8 ab	32.9 b	29.4 b	20.7 a
8 Mar. 2016					
Florida Beauty	30.6 b	32.1 ab	33.0 ab	28.6 ab	19.6 b
Florida127	35.3 a	34.9 a	34.0 a	31.4 a	14.6 a
Florida Radiance	27.2 b	30.5 b	30.1 b	26.5 b	19.0 b
7 Feb. 2017					
Florida Beauty	34.1 ab	33.3 a	36.2 a	33.7 a	15.6 ab
Florida127	38.4 a	38.0 a	36.4 a	34.3 a	14.8 b
Florida Radiance	30.2 b	33.6 a	30.0 b	28.5 b	18.4 a
14 Feb. 2017					
Florida Beauty	32.9 a	34.2 ab	31.9 a	28.0 a	18.1 a
Florida127	33.4 a	36.6 a	32.5 a	29.7 a	15.3 a
Florida Radiance	25.4 b	30.9 b	27.3 b	22.5 b	18.6 a

²Acceptability was rated on a –100 to 0 to +100 scale, where –100 = strongest disliking of any kind experienced, 0 = neutral, +100 = strongest liking of any kind experienced.

³Intensity was rated on a 0 to 100 scale, where 0 = no sensation, 100 = strongest sensation of any kind experienced.

⁴Mean separations within dates and columns are by Tukey’s HSD test, $P \leq 0.05$.

Description and early spring production. Slightly lower runner production than ‘Florida Radiance’ was observed, and the presence of fully developed flowers in the summer nursery suggests a weak day-neutral flowering habit. The plant is compact with open architecture, allowing air movement and easy visualization of the fruit (Fig. 2).

‘Florida Beauty’ is adapted to annual plasticulture growing systems for winter

Table 3. Trained sensory panel ratings (0 to 10 linear scale, with increasing intensity) for ‘Florida Beauty’, ‘Florida127’, and ‘Florida Radiance’ on eight harvests over three seasons. Fruit samples from the same harvest and field replication were measured for fruit chemical attributes shown in Table 4.

Cultivar	Firmness	Sweetness	Sourness	Strawberry flavor	Green/unripe flavor
January 2015 (<i>n</i> = 10)					
Florida Beauty	5.7 a ^z	5.9 a	4.5 a	5.1 a	1.8 a
Florida127	5.6 a	5.2 a	4.7 a	4.1 b	1.8 a
Florida Radiance	4.9 a	4.9 a	4.5 a	4.4 ab	1.6 a
Feb. 2015 (<i>n</i> = 12)					
Florida Beauty	6.6 a	5.2 a	4.8 a	4.3 ab	2.6 a
Florida127	5.5 a	5.4 a	4.2 a	4.8 a	1.9 a
Florida Radiance	5.6 a	3.9 b	5.0 a	3.6 b	2.4 a
Mar. 2015 (<i>n</i> = 11)					
Florida Beauty	3.6 b	4.3 a	4.5 a	3.9 a	1.8 a
Florida127	4.5 b	5.0 a	4.5 a	4.3 a	1.8 a
Florida Radiance	5.6 a	3.1 b	4.7 a	3.0 b	2.5 a
Feb. 2016 (<i>n</i> = 9)					
Florida Beauty	5.1 a	5.4 a	5.4 a	4.1 a	2.2 a
Florida127	4.7 ab	5.2 a	4.8 a	4.1 a	2.1 a
Florida Radiance	4.0 b	4.8 a	5.4 a	4.1 a	2.2 a
Mar. 2016 (<i>n</i> = 9)					
Florida Beauty	5.3 a	3.9 a	6.3 a	3.8 a	2.6 ab
Florida127	5.4 a	4.7 a	5.0 b	3.6 a	2.0 b
Florida Radiance	5.9 a	2.8 b	6.9 a	2.0 b	4.0 a
Jan. 2017 (<i>n</i> = 12)					
Florida Beauty	5.0 a	4.2 a	4.4 a	4.0 a	1.6 a
Florida127	5.8 a	3.8 a	5.2 a	3.4 ab	2.2 a
Florida Radiance	5.3 a	3.6 a	4.8 a	3.1 b	2.0 a
Feb. 2017 (<i>n</i> = 10)					
Florida Beauty	4.1 a	3.7 ab	5.7 a	3.0 b	1.9 a
Florida127	4.4 a	4.5 a	4.4 b	3.7 a	1.5 a
Florida Radiance	3.9 a	2.8 b	4.8 ab	2.4 b	1.9 a
Mar. 2017 (<i>n</i> = 10)					
Florida Beauty	4.4 b	5.5 a	4.3 a	4.7 a	1.2 a
Florida127	5.5 a	5.2 a	4.2 a	4.5 a	1.1 a
Florida Radiance	4.7 b	3.5 b	4.8 a	2.9 b	1.9 a

^zMean separations within harvest dates and columns are by Tukey’s HSD test, *P* ≤ 0.05.

Table 4. Soluble solids content (SSC), pH, titratable acidity (TA), SSC/TA and firmness for ‘Florida Beauty’, ‘Florida127’, and ‘Florida Radiance’ fruit for seven harvests over three seasons.

Cultivar	SSC (%)	pH	TA (%)	SSC/TA	Firmness (N·m ⁻¹)
Feb. 2015					
Florida Beauty	10.3 a ^z	3.5 b	0.95 a	10.8 ab	195.1 b
Florida127	9.5 ab	3.7 a	0.75 b	12.7 a	239.4 ab
Florida Radiance	8.4 b	3.6 ab	0.80 b	10.5 b	249.9 a
Mar. 2015					
Florida Beauty	7.7 a	— ^y	—	—	197.1 b
Florida127	7.3 a	—	—	—	224.3 ab
Florida Radiance	5.4 b	—	—	—	233.0 a
Feb. 2016					
Florida Beauty	9.4 a	3.7 b	0.97 a	9.8 b	251.0 a
Florida127	9.3 a	3.8 a	0.74 b	12.5 a	267.8 a
Florida Radiance	7.8 b	3.7 b	0.96 a	8.2 b	231.8 a
Mar. 2016					
Florida Beauty	7.2 a	3.7 a	0.84 a	8.5 b	182.0 a
Florida127	8.0 a	3.7 a	0.72 a	11.2 a	170.1 a
Florida Radiance	5.5 b	3.6 a	0.72 a	7.7 b	176.9 a
Jan. 2017					
Florida Beauty	8.0 a	3.6 b	0.78 a	10.4 b	213.8 b
Florida127	8.0 a	3.7 a	0.67 b	12.0 a	246.5 a
Florida Radiance	7.1 b	3.6 b	0.77 a	9.3 c	254.9 a
Feb. 2017					
Florida Beauty	7.6 a	3.7 a	0.78 a	9.8 ab	194.8 b
Florida127	8.1 a	3.7 a	0.73 a	11.1 a	233.7 a
Florida Radiance	6.2 b	3.7 a	0.67 a	9.3 b	205.2 ab
Mar. 2017					
Florida Beauty	7.7 a	3.6 a	0.74 a	10.4 ab	242.3 a
Florida127	7.9 a	3.7 a	0.73 a	11.0 a	264.2 a
Florida Radiance	6.5 b	3.6 a	0.72 a	9.0 b	240.0 a

^zMean separations within harvest dates and columns are by Tukey’s HSD test, *P* ≤ 0.05.

^yData not available.

Moderately long pedicels allow the fruit to be easily harvested. ‘Florida Beauty’ produces moderately firm and juicy fruit that are broad-conic in shape with a medium-green ($L^* = 44.8$, $a^* = -16.1$, $b^* = 26.5$) calyx that is slightly reflexed. The redness of the fruit is medium externally ($a^* = 39.1$), with medium internal redness ($a^* = 17.4$), similar to ‘Florida Radiance’. The achenes are slightly recessed, similar in depth to those of ‘Florida Radiance’. Fruit size is medium, with average fruit weight similar to or slightly less than ‘Florida Radiance’ (Table 1).

In 2016, two consumer panels with over 100 untrained panelists gave similar ratings to ‘Florida Beauty’ and ‘Florida Radiance’ (Table 2). In 2017, ‘Florida Beauty’ typically had ratings intermediate to ‘Florida Radiance’ and ‘Florida127’ with some ratings not different from ‘Florida127’. In trained sensory panels conducted on eight harvest dates over three seasons, significant differences were clearly apparent (Table 3). ‘Florida Beauty’ exhibited higher sweetness and strawberry flavor ratings

than ‘Florida Radiance’ on all the harvests evaluated and had similar ratings to ‘Florida127’ on some harvest dates. This is consistent with higher SSC for ‘Florida Beauty’ when compared with ‘Florida Radiance’ on all harvest dates (Table 4).

Rankings of fruit weight loss for the three cultivars varied with harvest date when cold stored for 8 to 10 d. Overall, ‘Florida Beauty’ tended to have similar weight loss to the commercial standards of $\approx 8\%$ to 9% after 9 d storage at 4°C and 95% relative humidity (data not shown).

Field Performance

In the replicated trials, total yields of ‘Florida Beauty’ were less than ‘Florida127’ in 2014–15 and not different from ‘Florida127’ in both 2015–16 and 2016–17 (Table 1). Temperatures during the October–December period in 2015–16 were higher on average than in 2014–15, contributing to overall lower yields during that year. Thus, the fall temperatures in the second year of testing were more

similar to what would be experienced on an earlier planting date. A trial with a planting date of 24 Sept. was established in 2015–16 to test the suitability of ‘Florida Beauty’ for early planting, showing that it complemented the yield distribution of ‘Florida Radiance’ with higher early yield in December (Fig. 3). While elongated, unmarketable fruits were observed for ‘Florida Radiance’ in November and December of 2015, ‘Florida Beauty’ maintained an exceptionally consistent conical shape throughout the entirety of the season.

Field trials were conducted during the 2015–16 and 2016–17 seasons to determine resistance to fruit, foliar, and crown pathogens. Inoculation and rating methods for angular leaf spot (caused by *Xanthomonas fragariae*), anthracnose fruit rot (caused by *Colletotrichum acutatum*), charcoal rot (caused by *Macrophomina phaseolina*), Phytophthora crown rot (caused by *Phytophthora cactorum*) and Colletotrichum crown rot (caused by *Colletotrichum gloeosporioides* species complex) were described in Seijo et al. (2011), Mertely et al. (2014a, 2014b), and MacKenzie et al. (2006). Foliar powdery mildew (caused by *Podosphaera aphanis*) was evaluated in a high tunnel with increased relative humidity, and percent leaf area with mycelia was visually estimated. Natural disease incidence was determined for powdery mildew and Botrytis fruit rot (caused by *Botrytis cinerea*) (Table 5). Most notably, ‘Florida Beauty’ was more susceptible to Anthracnose fruit rot than both commercial standards in both seasons but showed greater resistance to Phytophthora crown rot than ‘Florida Radiance’ in 2016–17 (Table 5).

Commercialization

‘Florida Beauty’ was approved for release by the Florida Agricultural Experiment Station in 2016. A plant patent for ‘Florida Beauty’ has been filed by Florida Foundation Seed Producers, Inc. Plant breeder’s rights applications will be filed in foreign territories. Information on nurseries licensed to propagate this cultivar can be obtained from the Florida Foundation Seed Producers, Inc. (<http://ffsp.net>).

Fig. 3. Marketable yield of ‘Florida Beauty’ and ‘Florida Radiance’ in a replicated, on-farm trial (two replications with 250 plants/rep) in the Plant City, FL, area during the 2015–16 season, with a planting date of 24 Sept. 2015.

Table 5. Disease incidence and plant mortality for ‘Florida Beauty’, ‘Florida127’, and ‘Florida Radiance’ from naturally or artificially inoculated field trials over two harvest seasons.

Cultivar	Incidence (%)			Mortality (%)		
	Anthracnose fruit rot	Botrytis fruit rot	Powdery mildew	Colletotrichum crown rot	Phytophthora crown rot	Charcoal rot
2015–16						
Florida Beauty	36.2 a ^z	5.8 a	7.1 b	— ^y	—	—
Florida127	6.7 c	7.6 a	26.3 a	14.9 A	—	9.6 ab
Florida Radiance	18.9 b	6.2 a	16.3 a	22.4 A	—	17.0 a
2016–17						
Florida Beauty	22.0 a	7.5 a	17.4 b	—	5.0 b	42.4 ab
Florida127	3.0 c	6.4 a	37.2 a	—	14.6 b	19.6 b
Florida Radiance	7.5 b	6.2 a	7.2 c	—	55.0 a	50.1 a

^zMeans are based on four replications of 10–12 plants. Mean separations within columns are by Tukey’s HSD test, $P \leq 0.05$.

^yData not available.

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