‘Souvenirs’ Peach

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‘Souvenirs’ is the first yellow-fleshed, fresh-market peach released from the University of Arkansas peach and nectarine [*Prunus persica* (L.) Batsch] breeding program. Prior white-fleshed peach cultivars released include ‘White River’ (2002) (Clark and Moore, 2003), ‘White Rock’, ‘White County’ (2004) (Clark et al., 2005), ‘White Diamond’, and ‘White Cloud’ (2009) (Clark and Moore, 2011). The program began in the 1960s (Clark et al., 1999) and although initially focused on processing peaches, in recent years, it has shifted emphasis to specialty peach and nectarine cultivars for local and shipping markets. ‘Souvenirs’ broadens the cultivar choice profile for peaches in Arkansas and for producers in similar climates.

‘Souvenirs’ is freestone and has low acid flavor with very firm slow-melting flesh. It has also shown excellent postharvest storage potential. This new development also has very good resistance to bacterial spot [caused by *Xanthomonas arboricola* pv. *pruni* (Smith, 1903; Vauterin et al., 1995)] and should provide a high-quality option for growers in areas where bacterial spot disease is a concern.

Origin

‘Souvenirs’ resulted from a cross of Ark. 708 × ‘Winblo’ peaches made in 2001 (Fig. 1). It was selected in 2004 and was designated Ark. 763. All crossing and selection was done at the University of Arkansas Fruit Research Station, Clarksville.

Primary testing of ‘Souvenirs’ and comparison cultivars was conducted at the Fruit Research Station [west-central Arkansas, lat. 35°31′58″ N, long. 93°24′12″ W; U.S. Dept. of Agriculture hardiness zone 7a; soil type Linker fine sandy loam (Typic Hapludult)]. In all testing, trees were either open-center-trained and spaced 5.5 m between trees and rows or trained to a perpendicular V system with trees spaced 1.9 m and rows spaced 5.5 m. Trees were dormant-pruned and fertilized annually with either complete or nitrogen fertilizers and irrigated as needed. Perpendicular V trees also received one summer pruning consisting of

removing inward-growing shoots in mid-June of each year. Pests were managed using a program typical for commercial orchards of the area. No bactericides (including copper compounds) were applied to plantings during testing. Fruits were thinned to a distance of 12 to 15 cm between fruit after shuck split but before pit hardening each year.

A trial consisting of open-center-trained, two-tree observational plots (a single two-tree plot of each cultivar) of ‘Souvenirs’ and comparison peach cultivars Loring, White County, White River, and White Rock, all on ‘Lovell’ rootstock, were maintained at Clarksville and data were collected from these trees or the original selection (own-root) trees from 2005 through 2011 (no data for 2007 as a result of frost); the trees varied in age in this plot and ranged from 3 to 10 years old. Dates for 10% and full bloom (90% of flowers open) and first harvest were recorded (within a range of 5 to 10 lbf) along with ratings of bloom amount (intensity) on a 1 to 5 scale with heaviest bloom receiving a 5 rating. Fruit ratings in the orchard at first harvest were taken from these years for firmness and flavor, whereas trees were rated for vigor, crop, and health with an emphasis on bacterial spot severity on leaves and/or fruit. The rating scale for these fruit and tree variables was 1 to 10 with 10 being most desirable. An exception was a rating of 7 to 8 being most desirable for vigor and a rating of 10 indicated excessive vigor. Additionally, a five-fruit sample was collected each year and average fruit weight and soluble solids content (SSC) using a refractometer (Sper Scientific 300035 digital refractometer; Sper Scientific, Scottsdale, AZ) were determined. Also from this sample, percent blush on fruit skin was estimated.

A replicated trial of perpendicular V-trained trees was also established in 2007 at the Fruit Research Station that included comparison cultivars Winblo and White County. Data collected in this planting were yield and average fruit weight. Data were collected only for the fruiting year 2010 as a result of the planting encountering health

limitations in subsequent years and tree performance not representative of all genotypes after 2010. In this planting, four single-tree replications arranged in a randomized complete block design were used, and data were analyzed by analysis of variance and means separated by least significant difference (SAS Institute, 1989).

An additional component to the peach breeding program was added in 2011, that being cold storage of selections and cultivars for postharvest/storage performance potential. Previously, storage potential was only estimated for releases based on firmness of flesh at harvest. In 2011 and 2012, fruit used in the study were selected from the mid-canopy and only those fruit exhibiting uniform shape and color and lacking any insect, disease, and hail damage were selected. To evaluate storage performance, 15 fruit from two trees from each genotype were harvested at the well-mature stage, determined by skin color showing less than 5% green ground color and a slight decrease in firmness based on finger-feel (≈ 5 lbf). All fruit were hand-harvested directly into 0.24-L corrugated cardboard trays (FormTex Plastics Corp., Houston, TX). After harvest, all fruit were pre-conditioned in room temperature storage (≈ 20 °C) for 24 h. All fruit were then placed in a walk-in cooler for storage. Cooler temperature was maintained between 1 and 4 °C and relative humidity was 90% to 95%. After 1, 2, and 3 weeks, one fruit from both replications from all genotypes was removed from storage. After removal from cold storage, all fruit were held at room temperature (≈ 20 °C) for ≈ 24 h. Skin and flesh quality, skin and flesh color, juiciness, browning, mealiness, and taste were subjectively rated on a scale from 0 (worst) to 10 (best). Photographs were taken of all fruit evaluated in 2011 using a Beseler CS-14 copy stand (Charles Beseler Co., Stroudsburg, PA) and a Nikon D70s digital camera (Nikon Corporation, Tokyo, Japan). Skin and flesh color and quality, browning, juiciness, mealiness, and taste ratings were totaled for each genotype to establish a storage performance score. An overall ranking based on the grouping of performance score was determined for each genotype [0 (0.00–40.99), 1 (41.00–50.99), 2 (51.00–60.99), 3 (61.00–70.99), 4 (71.00–75.99), and 5 (76.00–80.00), with 0 being unacceptable and 5 being exceptional storage performance]. Cultivar performance rankings were presented by weeks as well as averaged to establish an overall ranking for each genotype.

In addition to storage evaluations, fruits from Day 0 of the storage study in 2011 and

Fig. 1. ‘Souvenirs’ pedigree.

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Table 1. Fruit and plant characteristics of ‘Souvenirs’ and four other peach cultivars from two-tree observational plots, University of Arkansas Fruit Research Station, Clarksville 2005–11 (missing 2007 data resulting from frost).^z

		Souvenirs	Loring	White County	White River	White Rock
Fruit	First harvest date	6 July ± 5	20 July ± 5	20 July ± 6	24 July ± 5	3 July ± 6
	Days bloom to harvest ^y	105 ± 6	120 ± 7	119 ± 7	122 ± 9	101 ± 6
	Fruit weight (g)	183 ± 49 ^x	211 ± 56 ^x	179 ± 29	281 ± 53	182 ± 58
	Soluble solids (%)	12.6 ± 1.6 ^x	12.9 ± 1.4 ^x	12.3 ± 1.2	12.7 ± 2.3	10.7 ± 1.6
	Firmness rating ^w	8.3 ± 0.8	7.0 ± 0.0	8.2 ± 0.8	7.0 ± 0.0	9.0 ± 0.3
	Percent blush	90 ± 3	71 ± 11	81 ± 2	70 ± 13	56 ± 9
Plant	10% bloom date ^y	20 Mar. ± 6	19 Mar. ± 7	20 Mar. ± 6	22 Mar. ± 6	21 Mar. ± 7
	Full bloom date	23 Mar. ± 6	22 Mar. ± 7	22 Mar. ± 7	24 Mar. ± 7	24 Mar. ± 7
	Bloom amount rating ^{y,v}	3.4 ± 0.9	2.8 ± 0.4	3.5 ± 0.5	2.8 ± 0.8	2.8 ± 0.4

^zData for fruit weight, soluble solids, firmness, and percent blush based on a five-fruit sample collected each year at first harvest date. Data are mean values ± SD.

^yAll cultivars missing 2009 data.

^xMissing 2005 data.

^wFirmness rating based on a 1 to 10 scale with 10 being very firm.

^vBased on observation of mature trees at full bloom using a scale of 1 to 5 with 5 being very heavy bloom.

2012 were used to measure SSC, pH, and titratable acidity (TA). Two fruit from each of two trees (four fruits total) for each genotype were included in the measurements. Juice from the fruits was extracted by hand-squeezing and filtered through a metal kitchen strainer. Soluble solids content was measured using a Sper Scientific 300035 digital refractometer (Sper Scientific) and pH and TA were measured using a Metrohm 877 Titrino Plus automatic titrator with a LL Unitrode combination pH (Metrohm AG, Herisau, Switzerland). Titratable acidity was expressed as percent malic acid.

Description and Performance

‘Souvenirs’ was first ripe on average 6 July at Clarksville (average 105 d after full bloom) in observational plots (Table 1). It should be noted that first ripe date varied for all peach genotypes by 5 to 6 d reflecting seasonal variation for harvest date. This harvest date is ≈3 d after ‘Redhaven’ peach (data not shown).

Cropload rating on a 10-point scale on observational trees for ‘Souvenirs’ averaged 8.5 for the 6 years of observation (data not shown). This rating was higher than most comparison cultivars, which were: ‘White River’ (6.7), ‘Loring’ (7.8), ‘White Rock’ (8.2), and ‘White County’ (9.5). Yield for ‘Souvenirs’ in the replicated trial was similar to ‘Winblo’, a high-quality, yellow, freestone peach, but both of these cultivars were lower than ‘White County’ (Table 2).

Average fruit weight for ‘Souvenirs’ was 183 g and was similar in weight to ‘White Rock’ and ‘White County’ but smaller than ‘Loring’ and ‘White River’ (Table 1). In the replicated trial, ‘Souvenirs’ was similar in weight to ‘White County’ but smaller than ‘Winblo’ (Table 2).

Fruits of ‘Souvenirs’ are freestone when fully ripe to semifreestone when early ripe and have slow-melting flesh of the same type as ‘White County’ and ‘White Diamond’. This type of flesh remains firm longer on the tree and when fully mature softens similar to a standard melting-flesh peach. This characteristic allows more mature fruit to be harvested and still be handled compared with

Table 2. Production characteristics of a 2007-established replicated ‘Souvenirs’, ‘Winblo’, and ‘White County’ peach cultivars, University of Arkansas Fruit Research Station, Clarksville, 2010.

Cultivar	Yield/tree (kg)	Fruit wt (g)
Souvenirs	9.1 b ^z	155.5 b
Winblo	7.1 b	228.4 a
White County	18.9 a	165.8 b

^zMean separation by least significant difference, 0.05.

Table 3. Average of 2011 and 2012 soluble solids content, pH, and titratable acidity (% acid) for ‘Souvenirs’ and three comparison peach cultivars.^z

Cultivar	SSC (%)	pH	Percent acid ^y
Souvenirs	14.10 ± 0.10	4.45 ± 0.07	0.26 ± 0.04
White County	15.25 ± 0.35	4.19 ± 0.24	0.26 ± 0.07
Redhaven	14.05 ± 0.45	3.63 ± 0.04	0.64 ± 0.01
White Rock	14.05 ± 0.75	4.47 ± 0.29	0.24 ± 0.03

^zData are mean values ± SD.

^yPercent acid expressed as malic acid.

SSC = soluble solids content.

Fig. 2. Fruit of ‘Souvenirs’ peach on the tree showing high levels of red skin color.

Table 4. Peach storage performance^z overview ranking for ‘Souvenirs’ and two standard cultivars for 3 weeks of cold storage 2011.

Cultivar	Week 0	Week 1	Week 2	Week 3	Overall ranking
Souvenirs	5	5	3	3	3.7
Loring	5	4	2	1	2.3
White County	5	5	4	2	3.7

^zTotal ranking is based on the grouping of total score on a scale of 0 (0.00–40.99), 1 (41.00–50.99), 2 (51.00–60.99), 3 (61.00–70.99), 4 (71.00–75.99), and 5 (76.00–80.00), with 0 being unacceptable and 5 being exceptional storage performance.

standard melting-flesh peaches. Flavor of ‘Souvenirs’ is low acid with a mild yellow peach flavor. Flavor rating averaged 7.2 for ‘Souvenirs’, the same as ‘White Rock’ and

near that of ‘Loring’ and ‘White County’ (7.5) (data not shown). Soluble solids for ‘Souvenirs’ averaged 12.6% in the observational tree samples (Table 1) and was 14.1%

Table 5. Storage performance of ‘Souvenirs’ peach for 3 weeks of cold storage in 2011 including all ratings means of two replicates, which had an overall performance score^z of 211.50 and group 3.7 ranking.^y

Week	Skin color ^x	Skin quality ^x	Flesh color ^x	Flesh quality ^x	Browning ^x	Juiciness ^x	Mealiness ^x	Taste ^x	Total score ^w	Weekly total ranking ^y
0	10.0	10.0	10.0	10.0	10.0	9.0	10.0	10.0	79.00 ± 0.00	5
1	10.0	9.0	10.0	10.0	10.0	8.5	10.0	9.0	76.50 ± 2.50	5
2	8.0	7.0	8.0	9.0	9.0	10.0	10.0	9.0	70.00 ± 0.00	3
3	6.0	6.0	7.0	8.0	9.0	10.0	10.0	9.0	65.00 ± 0.00	3

^xPerformance score is the sum of Week 1, 2, and 3 total score.

^yGroup ranking is the average of Week 1, 2, and 3 total ranking.

^zRatings are on a scale from 0 (worst) to 10 (best).

^wTotal score is the sum of ratings of all variables (± SD).

^yTotal ranking is based on the grouping of total score on a scale of 0 (0.00–40.99), 1 (41.00–50.99), 2 (51.00–60.99), 3 (61.00–70.99), 4 (71.00–75.99), and 5 (76.00–80.00), with 0 being unacceptable and 5 being exceptional storage performance.

Fig. 3. Whole and half-fruit images of slow-melting flesh peach ‘Souvenirs’ before cold storage and after 3 weeks in storage in 2011.

Table 6. Peach storage performance^z overview ranking for ‘Souvenirs’ and two standard cultivars for 3 weeks of cold storage in 2012.

Cultivar	Week 0	Week 1	Week 2	Week 3	Overall ranking
Souvenirs	5	5	4	3	4.0
Redhaven	5	5	3	2	3.3
White County	5	5	4	3	4.0

^zTotal ranking is based on the grouping of total score on a scale of 0 (0.00–40.99), 1 (41.00–50.99), 2 (51.00–60.99), 3 (61.00–70.99), 4 (71.00–75.99), and 5 (76.00–80.00), with 0 being unacceptable and 5 being exceptional storage performance.

Table 7. Storage performance of ‘Souvenirs’ peach for 3 weeks of cold storage in 2012 including all ratings means of two replicates which had an overall performance score^z of 211.00 and group 4.0 ranking.^y

Week	Skin color ^x	Skin quality ^x	Flesh color ^x	Flesh quality ^x	Browning ^x	Juiciness ^x	Mealiness ^x	Taste ^x	Total score ^w	Weekly total ranking ^y
0	10.0	10.0	10.0	10.0	10.0	9.5	10.0	10.0	79.50 ± 0.50	5
1	10.0	9.0	9.0	9.5	10.0	9.5	10.0	9.5	76.50 ± 1.50	5
2	8.0	8.0	9.0	9.0	8.5	10.0	10.0	9.0	71.50 ± 0.50	4
3	7.0	7.0	7.0	7.5	10.0	10.0	9.0	8.5	63.00 ± 0.00	3

^xPerformance score is the sum of Week 1, 2, and 3 total score.

^yGroup ranking is the average of Week 1, 2, and 3 total ranking.

^zRatings are on a scale from 0 (worst) to 10 (best).

^wTotal score is the sum of ratings of all variables (± SD).

^yTotal ranking is based on the grouping of total score on a scale of 0 (0.00–40.99), 1 (41.00–50.99), 2 (51.00–60.99), 3 (61.00–70.99), 4 (71.00–75.99), and 5 (76.00–80.00), with 0 being unacceptable and 5 being exceptional storage performance.

in the samples collected with the storage-study fruits (Table 3), comparable to that of ‘Redhaven’, a yellow flesh peach. Juice pH was higher and TA was distinctly lower for ‘Souvenirs’ along with ‘White County’ and ‘White Rock’ compared with ‘Redhaven’ (Table 3). Firmness rating for ‘Souvenirs’ averaged 8.3 and was firmer than the standard melting-flesh ‘Loring’ and ‘White River’ and similar to ‘White County’ (Table 1).

Fruit blush for ‘Souvenirs’ averaged 90%, higher than any comparison cultivar. This is a distinct positive feature of ‘Souvenirs’ in that it is a very high red color peach and of an appearance in high demand in the shipping industry (Fig. 2). Finish rating of ‘Souvenirs’ was high, averaging 7.7 (data not shown).

In 2011 postharvest evaluations, overall ranking for ‘Souvenirs’ was 3.7, the same as

‘White County’ and higher than ‘Loring’ (Table 4). Notably, after 3 weeks of storage, ‘Souvenirs’ developed negligible mealiness (dry, gel texture) and maintained a high level of juiciness (Table 5; Fig. 3). When compared with the standard-melting peach cultivar Loring, ‘Souvenirs’ fruit were substantially superior after 3 weeks of storage in terms of skin and flesh quality (data not shown). In 2012 postharvest evaluations, overall ranking for ‘Souvenirs’ was 4.0, the same as ‘White County’ and higher than ‘Redhaven’ (Table 6). Although ‘Souvenirs’ developed slight mealiness after 3 weeks storage in 2012, juiciness increased throughout storage (Table 7).

Flowers of ‘Souvenirs’ are showy and self-fertile. ‘Souvenirs’ had an average 10% bloom date of 20 Mar. with a 23 Mar. average full bloom date, similar to comparison peach cultivars (Table 1). Bloom amount (intensity) rating averaged 3.4 for ‘Souvenirs’, higher than all comparison cultivars other than ‘White County’ (Table 1). ‘Souvenirs’ leaf glands were reniform and located near the base of the leaf blade on the top of the petiole. Size of the glands was 0.7 mm wide and 1.1 mm long.

Tree vigor ratings on observational trees averaged 6.8 for ‘Souvenirs’, considered an optimum vigor on a 10-point scale (data not shown). Tree health rating for ‘Souvenirs’ averaged 8.0 on a 10-point scale, comparable to the comparison cultivars (data not shown). A major component of the tree health rating is resistance to bacterial spot, a disease that can be severe at the primary testing location. ‘Souvenirs’ was noted to be free of bacterial spot in all but 1 year of observations and infection was very light when observed. Comparison cultivars varied in incidence of bacterial spot occurrence, and some showed more infection than ‘Souvenirs’ (data not shown). The other disease seen in the research orchard was occasional brown rot [caused by *Monilinia fructicola* (G. Wint.) Honey] but was observed only on overripe fruit of ‘Souvenirs’. This cultivar is not anticipated to differ in susceptibility to brown rot compared with most peach cultivars, however. A commercial fungicide program is required for disease control on all Arkansas peach cultivars in areas where brown rot occurs.

Chilling requirement of ‘Souvenirs’ has not been determined but is probably near

800 h below 7 °C based on observations of budbreak and bloom in comparative plantings with test cultivars of known chill requirement. ‘Souvenirs’ has not been tested in colder locations than Arkansas; thus, ultimate bud hardiness has not been determined. However, good flower bud survival was experienced with midwinter lows of –16 and –17 °C in 2010 and 2011, respectively.

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