

‘White River’ Peach

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‘White River’ is the first white-flesh peach released from the Univ. of Arkansas peach [*Prunus persica* (L.) Batsch] breeding program. The program began in the 1960s (Clark et al., 1999) and included an objective to develop adapted white-flesh peach cultivars for on-farm, local, and shipping sales.

‘White River’ is mid- to late-season maturity with melting flesh that is firm when ripe, with large fruits of excellent quality and attractive skin color. It is high yielding and has very good resistance to bacterial spot [caused by *Xanthomonas campestris* pv. *pruni* (Smith) Dye]. This cultivar should provide a high-quality option for peach growers in areas where bacterial spot disease is a concern. It expands options for growers in the mid- to the upper-southern United States and other areas of the world with similar climatic conditions.

Origin

‘White River’ resulted from a cross of ‘Loring’ x NJ 257 (the white-flesh parent) (Fig. 1) made by Dr. Fred Hough, Fruit Germplasm International. Dr. Hough sent seeds from this cross to the Univ. of Arkansas Fruit Substation, Clarksville, in Fall 1982, and seedlings were field-planted in Spring 1983. The original seedling tree of ‘White River’ was selected in 1986 by J.N.M. and tested thereafter as Ark. 376.

Primary testing of this selection and comparison cultivars was at the Fruit Substation [west-central Arkansas, lat. 35°31’58’’N and long. 93°24’12’’W; U.S. Dept. of Agriculture (USDA) hardiness zone 7a; soil type Linker fine sandy loam (Typic Hapludult)]. It was also tested at the Southwest Arkansas Research and Extension Center, Hope [southwest Arkansas, lat. 33°42’30’’ and long. 93°33’0’’; USDA hardiness zone 8a, soil type Bowie fine sandy loam (Fragic Palendult)]. In all testing, trees were spaced 5.5 m between trees and rows, and were trained to an open-center system and pruned annually, fertilized annually with either complete or nitrogen fertilizers, and irrigated as needed. Pests were managed using a pest management program typical for commercial orchards of the area. No bactericides were ap-

plied to evaluation plantings during testing of ‘White River’ or comparison cultivars. Fruits were thinned to a distance of 12 to 15 cm between fruit prior to pit hardening but after shuck split each year that a crop was present.

A trial consisting of two-tree observational plots of ‘White River’ and comparison cultivars Carolina Belle, Summer Pearl, and Redhaven (Okie, 1998) on ‘Lovell’ rootstock was maintained at Clarksville and data were collected from these trees or the original selection tree of ‘White River’ from 1987 through 2001, except in 1989 when the crop was lost due to frost. Dates for 10% and full bloom and first harvest were recorded, along with ratings of bloom intensity on a 1 to 5 scale, with heaviest bloom = 5 rating. Fruit ratings in the orchard at first harvest were taken from 1992 to 2001 for size, shape, firmness, skin color, flesh color, finish, and flavor. Trees were rated for vigor, crop, and health, with an emphasis on bacterial spot severity on leaves or fruit. 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 from 1987 to 2001 and average fruit weight, firmness (using a model FT327 fruit pressure tester, 11-mm diameter probe on peeled fruit, McCormick Fruit Tree Co., Yakima, Wash.), and soluble solids using a bench refractometer were determined. Also from this sample, split pit percentage was recorded and percent blush on fruit skin was estimated. Finally in 1997–2000, from this same five-fruit sample, fruit diameter and length were measured along with fruit skin (blush and ground color) and flesh color using a Minolta model CR-200 chroma meter (Minolta, Ramsey, N.J.). Also, fruit skin and flesh colors were assigned Royal Horticul-

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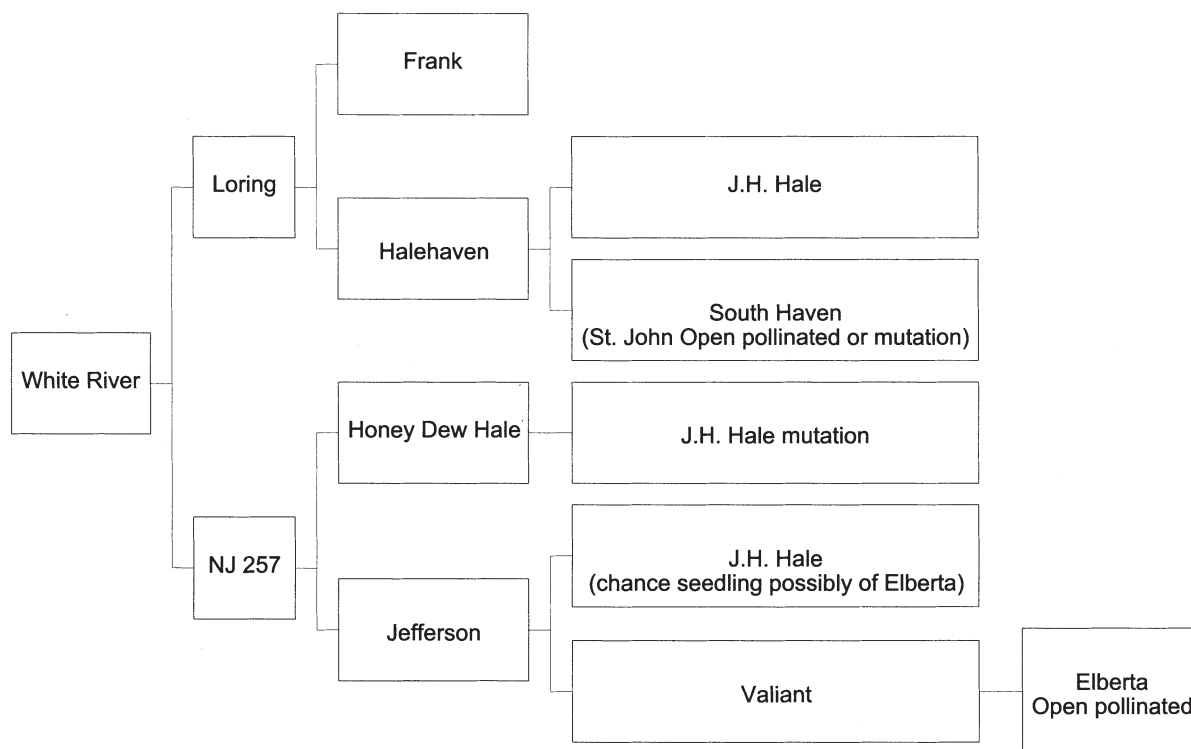


Fig. 1. Pedigree of ‘White River’ peach.

tural Society (RHS) Colour Chart designations (Royal Horticultural Society, 1966).

A replicated trial of 'White River' and the standard cultivar Carolina Belle on 'Lovell' rootstock was established at the Fruit Substation in 1995. Data collected were full bloom and first harvest date, yield, average fruit weight, and rating for bacterial spot incidence on fruit and leaves in 1997–99. Bacterial spot ratings in this planting were based on a six-point scale, with 0 = no bacterial spot and 5 = severe bacterial spot infection. A replicated trial at Hope including 'White River', 'Cresthaven' (Okie, 1998), and 'Redhaven' on 'Lovell' rootstock was established in 1992; data were collected for full bloom and first harvest date, yield, and fruit weight in 1994 through 2001 (crop was lost or reduced because of spring frost in 1996). Four single-tree replications arranged in a randomized complete-block design were utilized, and data for each year were analyzed separately by analysis of variance and means separated by LSD (SAS Institute, 1989).

Description and performance

Flowers of 'White River' are showy and self-fertile. Average 10% bloom date for 'White River' was 16 Mar. for 1987 through 2001, within 1 d of the average for 'Summer Pearl' and 'Redhaven', and 3 d later than 'Carolina Belle' (Table 1). Average full bloom date was 22 Mar. (Table 1). 'White River' also bloomed 2 to 9 d later than 'Carolina Belle' in the replicated trial at Clarksville (Table 2), and with or near 'Cresthaven' and 'Redhaven' most years at Hope (Table 3). The most noteworthy exception was at Hope, where in 1999 'White River' bloomed 9 to 13 d earlier than 'Redhaven' and 'Cresthaven', but this was caused by delayed and extended bloom due to insufficient chilling of 600 to 700 h below 7 °C. Bloom intensity ratings for 'White River' at Clarksville were slightly lower than comparison cultivars (Table 1).

Tree vigor ratings on observational trees averaged 8.6 (on a 10-point scale; data not shown), slightly more vigorous than optimum; however, this cultivar has wider crotch angles of main scaffold branches than some cultivars and this should be an asset in tree training. Tree health ratings for 'White River' were exceptional, averaging 9.6 on a 10-point scale (data not shown). A major component of the tree health rating is resistance to bacterial spot, and 'White River' was observed to have only slight infections in any years in the observational plots or in the replicated trial at Clarksville (Table 2). 'White River' has been among the most resistant genotypes to bacterial spot in the breeding program and no economic damage has been observed to the crop in any year. 'White River' trees have also been noted to maintain excellent leaf health, with deep-green leaf color along with excellent tree survival in all plantings compared to other genotypes. Diseases seen on 'White River' have been occasional brown rot [caused by *Monilinia fructicola* (G. Wint.) Honey] and peach scab (at Hope only) (caused by *Cladosporium carpophilum* Thuem.) A commercial fungicide

Table 1. Fruit and plant characteristics of three white-flesh peach cultivars and 'RedHaven' (yellow-flesh) peach from two-tree observational plots, Univ. of Arkansas Fruit Substation, Clarksville, 1987–88, 1990–95, and 1997–2000. Data for fruit weight, soluble solids, firmness, split pits, and percent blush based on a five-fruit sample collected each year at first harvest date. Data are mean values ± the standard deviation.

	White River ^z	Carolina Belle ^y	Summer Pearl ^x	Redhaven ^w
Fruit				
First harvest date	20 July ± 7	12 July ± 7	28 July ± 6	24 June ± 5
Fruit wt (g)	201 ± 43	205 ± 60	155 ± 43	149 ± 39
Soluble solids %	12.9 ± 1.0	12.9 ± 0.8	15.2 ± 1.9	12.4 ± 1.5
Firmness measure ^v (kg)	5.0 ± 1.1	4.6 ± 1.5	4.0 ± 1.8	5.0 ± 1.1
Split pits %	0 ± 0	2.5 ± 7	0 ± 0	5 ± 9
Percent blush	68 ± 17	75 ± 17	68 ± 16	74 ± 12
Plant				
10% bloom date	16 Mar. ± 9	13 Mar. ± 9	17 Mar. ± 7	15 Mar. ± 7
Full bloom date	22 Mar. ± 6	19 Mar. ± 8	24 Mar. ± 7	21 Mar. ± 7
Bloom amount rating ^u	3.2 ± 1.1	3.7 ± 1.1	3.8 ± 1.0	3.7 ± 0.8

^zMeans of 10–14 years.

^yMeans of 8–10 years.

^xMeans of 8–13 years.

^wMeans of 9–14 years.

^vFirmness measured using a model FT327 fruit pressure tester on peeled fruit, 11-mm-diameter probe, McCormick Fruit Tree Co., Yakima, Wash.).

^uBased on observation of mature trees at full bloom, using a scale of 1 to 5 with 5 = very heavy bloom.

Table 2. Production characteristics of replicated 'White River' and 'Carolina Belle' white-flesh peach cultivars, Univ. of Arkansas Fruit Substation, Clarksville, Ark., 1997–2000.^z

Cultivar	Full bloom date	Harvest date (first)	Yield/tree (kg)	Fruit wt (g)	Bacterial spot rating ^y	
					Leaves	Fruit
1997						
White River	24 Mar. a ^x	24 July	8.6 a	173.9 a	1.0 b	0.0
Carolina Belle	15 Mar. a	18 July	5.2 a	169.5 a	3.0 a	1.3 a
1998						
White River	28 Mar. b	17 July	35.3 a	181.4 a	1.5 a	1.0 a
Carolina Belle	25 Mar. a	14 July	14.1 b	211.2 a	2.3 a	1.0 a
1999						
White River	24 Mar. b	13 July	49.0 a	197.0 a	1.0 b	1.5 b
Carolina Belle	20 Mar. a	6 July	33.9 a	160.5 b	3.5 a	2.8 a
2000						
White River	16 Mar. a	15 July	54.6 a	186.1 a	---	---
Carolina Belle	14 Mar. a	9 July	52.7 a	200.0 a	---	---

^zPlanting established in 1995; crop lost in 1996 due to spring frost.

^yScale of 0–5: 0 = no bacterial spot lesions observed on leaves or fruit; 5 = severe infection.

^xMean separation by LSD, *P* < 0.05.

program is required for disease control for 'White River' in areas where these diseases are present. Chilling requirement of 'White River' has not been measured, 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. Although good budbreak and some crop were produced following 600–700 h of chilling at Hope in 1999, this amount of chilling did not appear adequate for full crop production as yield was low for that year at that location (Table 3). 'White River' has not been tested in colder locations than Arkansas; thus, bud hardness has not been determined. Leaf glands for 'White River' are reniform and range from none to two per leaf.

'White River' ripened on average 20 July at Clarksville in observational plots (Table 1), and ranged from 13 to 24 July in 1997 to 2000 in the replicated trial (Table 2). At Hope, it ripened on average 10 July (Table 3). Ripening date was 25 d later than 'Redhaven', 8 d later than 'Carolina Belle', and 8 d earlier than 'Summer Pearl' at Clarksville. At Hope, 'White River' ripened closer to 'Redhaven', on average 13 d

later, and 9 d earlier than 'Cresthaven'.

Crop ratings on observation trees had a mean rating for 9 years of 9.3, among the highest for any genotypes in the program during this time (data not shown). Yields for 'White River' were usually very good in replicated trials. At Clarksville, 'White River' exceeded or equaled yield of 'Carolina Belle' (Table 2), while at Hope 'White River' outyielded 'Cresthaven' and/or 'Redhaven' in 5 of 7 years (Table 3). In only one year (1997) was yield of 'White River' poor, and the reason for this poor performance is not known. Noteworthy were mean yields exceeding 90 kg/tree at Hope in 2000 and 2001. Average fruit weight at Clarksville for 'White River' was 201 g, similar to 'Carolina Belle' and heavier than 'Summer Pearl' and 'Redhaven' (Table 1). In replicated trials, 'White River' was similar in fruit weight compared to 'Carolina Belle' (Table 2), and was similar to or heavier than 'Cresthaven' or 'Redhaven' at Hope (Table 3). Ratings for fruit size were 8 or above for 'White River' in orchard observations (data not shown).

Fruit of 'White River' are round and aver-

Table 3. Yield and fruit weight of 'White River' (white flesh) and 'Redhaven' and 'Cresthaven' (yellow flesh) fresh-market peach cultivars grown at the Southwest Research and Extension Center, Hope, Ark.^z

Cultivar	Full bloom date	Harvest date (first)	Yield/tree (kg)	Fruit wt (g)
1994				
White River	17 Mar. a ^y	4 July	8.5 a	159 a
Cresthaven	20 Mar. b	10 July	8.7 a	116 b
Redhaven	18 Mar. ab	20 June	6.7 a	159 a
1995				
White River	20 Mar. a	11 July	65.3 a	146 a
Cresthaven	21 Mar. a	19 July	37.8 b	131 a
Redhaven	21 Mar. a	27 June	47.8 b	139 a
1997				
White River	29 Mar. a	18 July	17.6 b	245 a
Cresthaven	1 Apr. a	8 Aug.	47.7 a	135 c
Redhaven	1 Apr. a	3 July	39.4 a	172 b
1998				
White River	20 Mar. a	13 July	63.9 ab	165 a
Cresthaven	21 Mar. a	22 July	40.0 b	120 a
Redhaven	22 Mar. a	29 June	80.3 a	112 a
1999 ^x				
White River	16 Mar. a	11 July	3.2	242
Cresthaven	25 Mar. b	---	---	---
Redhaven	29 Mar. b	---	---	---
2000				
White River	8 Mar. a	4 July	92.1 a	211 a
Cresthaven	17 Mar. b	17 July	58.0 b	254 a
Redhaven	12 Mar. b	28 June	31.7 c	145 a
2001				
White River	14 Mar. a	10 July	93.1 a	191 a
Cresthaven	15 Mar. a	18 July	27.7 b	204 a
Redhaven	12 Mar. a	25 June	19.9 c	104 b

^zPlanting established in 1992; crop lost in 1996 due to spring frost.

^yMean separation within columns and years by LSD, $P \leq 0.05$.

^xChilling in the winter of 1998–99 was ≈ 600 –700 h; this lack of sufficient chilling resulted in extended bloom, and no crop set for 'Cresthaven' and 'Redhaven', and only a small crop for 'White River'.

aged 7.4 cm in length and 7.7 cm in diameter, but occasionally had a slight bulge at the fruit suture but were without a pronounced tip. Fruit shape ratings ranged from 7 to 9 (data not shown). Split pits were never observed on any fruit of 'White River' at Clarksville, while in one year (1997) split pits were commonly seen at Hope. Fruit skin color and finish ratings were very good for 'White River', usually 8 or 9 (data not shown). Percent blush on the fruit skin averaged 68%, the same as 'Summer Pearl' (Table 1), although in many years was 80% or more. It was observed that fruit exposed to sunlight had substantially higher red on the skin surface; thus, management practices, including summer pruning, should substantially enhance this characteristic. The average ground color values (background color) for 4 years for 'White River' were: L = 74.8 (the lower the L value, the darker the sample); a = 2.7 (the

higher the a value, the redder the sample); b = 29.8 (the higher the b value, the more yellow the sample); with the RHS designation of Yellow-Orange Group (20D). The red blush or over color of the skin averaged: L = 38.5; a = 35.5; b = 16.8; and RHS designation of Red Group (53B). The background color at early maturity was usually observed to be a cream color, rather than green as seen on some white-flesh peaches. Fruit were observed to mature evenly, although firmness and sugar levels were not measured on various locations on fruits to verify this observation. Finish ratings reflect the uniformity of the surface of the fruit and higher ratings indicate smooth fruit surface free of cracking, freckling, and bacterial spot lesions. 'White River' had excellent finish ratings, averaging 8.7 on a 10-point scale (data not shown).

Fruit firmness rating for 'White River' av-

eraged 7.7 over 9 years, and it had a 10-year average pressure test value on peeled fruit of 5.0 kg on early-mature fruits (pressure-test data in Table 1 but rating data not shown). Firmness was comparable to or exceeded that of comparison cultivars (Table 1). The flesh of 'White River' is melting and does soften at full maturity although is very firm when early mature. However, shipping and storage evaluations have not been conducted on this cultivar. 'White River' is a freestone-type fruit. Flesh color of 'White River' is white, with red in the flesh around the pit but not substantial red color throughout the flesh. Average flesh color values for 4 years were: L = 75.3; a = 2.8; b = 16.3; and RHS designation Yellow-White (158B). Flesh color ratings averaged 7.8, indicating an attractive flesh lacking defects such as green in the flesh or excess presence of red. Flavor has been consistently rated high by the authors for 'White River', averaging 7.7 over 9 years (data not shown). The aromatic fruit has a distinct white peach flavor and is considered a "high-acid" flavored peach but maintains a good balance of acidity and sweetness. Soluble solids averaged 12.9% (Table 1).

The outstanding characteristics of 'White River' are its high yields of high-quality, attractive, freestone, white-flesh fruits. Additionally, it has very good bacterial spot resistance. This cultivar is recommended for trial where other medium- to high-chill peaches developed in the eastern United States are grown.

Availability

An application for U.S. plant patent has been filed for 'White River' peach. A list of nurseries licensed to propagate and sell this cultivar is available from J.R.C., 316 Plant Science, Dept. of Horticulture, Univ. of Arkansas, Fayetteville, AR 72701. A limited amount of virus-tested budwood is available for research and evaluation purposes; requests can be sent to J.R.C., 316 Plant Science, Dept. of Horticulture, Univ. of Arkansas, Fayetteville, AR 72701 or jrclark@uark.edu.

Literature Cited

- Clark, J.R., J.N. Moore, C.R. Rom, K.R. Woodburn, B. Blackburn, and A. Allen. 1999. Arkansas fruit breeding update: New cultivars of small and tree fruits. Proc. 18th Ann. Hort. Ind. Show 8–10.
- Okie, W.R. 1998. Handbook of peach and nectarine varieties. U.S. Dept. of Agr. Hdbk. No. 714.
- Royal Horticultural Society. 1966. Royal Horticultural Society Colour Chart. Royal Hort. Soc., London.
- SAS Institute. 1989. SAS/STAT user's guide, version 6, vol. 2. SAS Inst., Cary, N.C.