Cowiche™ ('PC 7903-2') Sweet Cherry

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Additional index words. fruit breeding, fruit quality, *Prunus avium*

'PC 7903-2', more commonly known under the trademarked name, Cowiche™, is a sweet cherry variety released in 2007 by the Washington State University Sweet Cherry Breeding Program for fresh market production. In Pacific Northwest production areas of North America, Cowiche™ blooms moderately late, generally 4 to 7 d after 'Bing' (midseason industry standard), whereas harvest timing is usually 3 to 7 d later than 'Bing'. Cowiche™ is vigorous and has an open canopy with a more pendant growth habit and slightly higher precocity than 'Bing'. Its productivity on Gisela® 5 rootstock is similar to Chelan™'s but higher than that of 'PC 7417-9'. Cowiche™ produces very large red-purple fruit that are firm and have excellent eating quality characterized by high soluble solids and acidity. Consumer taste panels have described its flavor as "intense." Cowiche™ is not self-fertile, but its uncommon S-allele combination, S₅S₉, currently places it in the same incompatibility group with only one cultivar, Krupnoplodnaya, making it cross-compatible with any moderately late-blooming commercial cultivar.

Origin

'PC 7903-2' sweet cherry (*Prunus avium* L.) was developed at the Washington State University Irrigated Agriculture Research and Extension Center (WSU-IAREC) in Prosser, WA. The goal of the breeding program is to develop new high-quality cultivars adapted to the Pacific Northwest growing regions. The specific objective of the program apart from improving texture and flavor is to extend the harvest window of sweet cherries through development of a range of early-, mid-, and late-season varieties that fit into different target market classes. 'PC 7903-2' was selected from among several seedlings that resulted from a controlled cross of 'PC 7147-4' (female parent, not patented) and 'PC 7146-11' (male parent, not patented)

(Fig. 1) made in 1979 by Tom Toyama, the former stone fruit breeder at WSU. The original seedling tree located in block D 40 at the Roza experimental farm (lat. 46.2° N, long. 119.7° W), WSU-IAREC, Prosser, was first asexually propagated by grafting onto a 'Mazzard' (*P. avium*) rootstock at Prosser in 1985. Additional test trees were propagated on various clonal rootstocks in 1995 and again in 1998 and planted in a variety trial as five tree plots in a completely randomized fashion for evaluation of yield and fruit quality in Prosser, WA, and at The Dalles, OR (lat. 45.6° N, long. -121.2° W). 'PC 7903-2' subsequently was released in Oct. 2007 by the Washington State University Agricultural Research Center and patented (USPP 21, 073) on 22 June 2010.

Description

The objective descriptors were provided by WSU as part of the patent application for

'PC 7903-2'. This information can be found online at <<http://www.freepatentsonline.com/PP21073>>. A summary of the important characteristics is presented below. All color descriptions are based on the Royal Horticultural Society (RHS) color chart (RHS, 1995) unless otherwise stated. On a 'Mazzard' (*Prunus avium*) rootstock, Cowiche™ is a vigorous, moderately precocious, and moderately productive cherry with a growth habit similar to 'Bing' but slightly more spreading. It has a tremendous capacity to set fruiting spurs near the tip of 2-year-old fruiting wood. Leaves are medium to long, elliptical with an acute tip, a rounded base, and serrated margins. The ratio of petiole length to blade length is 0.38. Both the upper and lower surface of the petiole are light red (166A/B) in color. There are two large kidney-shaped, grayed purple (185A) nectary glands at the base of each leaf. Flower buds are conical in shape, four to eight per spur, and grayed orange (177A) in color. Cowiche™ is not self-fertile (the S-locus genotype is S5S9) and generally blooms 4 to 7 d after 'Bing'. Fruits of Cowiche™ are large (≈12 g), cordate in shape, asymmetrical, have a pointed pistil end, and an indistinct suture (Fig. 2). Pedicel length is short (≈21 mm) with a very thin diameter. Fruit skin is red-purple (59A) in color at maturity, thin, smooth, tenacious to flesh, has abundant lenticels, and a moderate tendency to crack after rain. The flesh is firm, slightly fibrous, melting, very juicy, dark red (53A) in color, and has excellent eating quality. The stone is large, broad elliptical, and grayed yellow (161D) in color. No resistance to common Pacific Northwest diseases such as powdery mildew and bacterial canker has been noted.

Fig. 1. Pedigree of Cowiche™ sweet cherry. Note that the female parent is on the upper side of the bifurcation.

Received for publication 5 May 2014. Accepted for publication 21 Aug. 2014.

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Fig. 2. Fruit of Cowiche™ sweet cherry.

Table 1. Comparisons of fruit characteristics between Cowiche™ and 'Bing' grown on 'Gisela® 6' rootstock at The Dalles, OR, cemetery block.^{z,y}

Cultivar	PFRF (g)	TSS (%)	Fruit diam (mm) ^x	Firmness (g·mm ⁻¹)	Harvest date	Full bloom date	Skin/flesh color ^w
Cowiche™	^a 1,481 ± 1.9	^a 22.2 ± 1.2	^a 32.0 ± 0.02	^a 299 ± 0.9	^a 13 July ± 1.6	^a 20 April ± 2.3	5.8/5.0
Bing	^b 1,017 ± 2.2	^a 18.6 ± 0.3	^a 29.9 ± 0.01	^a 286 ± 0.4	^b 6 July ± 1.0	^a 17 April ± 1.5	5.5/5.0

^zTrees were in the fourth leaf at the beginning of evaluation and trait values were based on samples of 25 fruit from three Cowiche™ trees and five 'Bing' trees averaged over 5 years from 2009 to 2013.

^yData presented are means ± SE. Means were separated by Tukey's honest significant difference test at $\alpha = 0.05$. Means with the same letter (within columns) are not significantly different at $P < 0.05$.

^xTwenty-nine millimeter diameter or greater is the desired marketable fruit size for Pacific Northwest fresh sweet cherries. Fruit were treated with 20 ppm gibberellic acid at Bing straw color.

^wCTIFL color categories: 1 = pink, 2 = red, 3 = red mahogany, 4 = light mahogany, 5 = mahogany, 6 = dark mahogany, 7 = black.

PFRF = pedicel-fruit retention force; TSS = total soluble solids.

Table 2. Comparisons of average pedicel fruit retention force (PFRF), total soluble solids (TSS) content, titratable acidity (TA), fruit mass, firmness, harvest date, full bloom date, and fruit skin/flesh color for Cowiche™ and 'Bing' sweet cherries grown on 'Mazzard' rootstock at WSU-IAREC Prosser, WA.^{z,y}

Cultivar	PFRF (g)	TSS (%)	TA (%)	Fruit mass (g)	Firmness (g·mm ⁻¹)	Harvest date	Full bloom date	Skin/flesh color ^x
Cowiche™	^a 1609 ± 1.7 ^w	^a 23.5 ± 0.3	^a 0.98 ± 0.02	^a 14.6 ± 0.3	^a 310 ± 0.2	^a 11 July ± 1.0	^a 15 April ± 1.6	5.5/4.2
Bing	^b 900 ± 0.3	^a 21.0 ± 0.5	^b 0.67 ± 0.02	^b 10.4 ± 0.1	^a 298 ± 0.2	^b 3 July ± 1.0	^b 8 April ± 1.6	5.8/4.5

^zTrees were 15 years old at the beginning of evaluation and trait values were based on samples of 25 fruit from five trees of each cultivar averaged over 10 years from 2002 to 2006 and 2009–13. Note that PFRF was only evaluated from 2009 to 2013^y.

^yData were based on fruit with no gibberellic acid sprays.

^xCTIFL color categories: 1 = pink, 2 = red, 3 = red mahogany, 4 = light mahogany, 5 = mahogany, 6 = dark mahogany, 7 = black.

^wData presented are means ± SE. Means were separated by Tukey's honest significant difference test at $\alpha = 0.05$. Means with the same letter (within columns) are not significantly different at $P < 0.05$.

PFRF = pedicel-fruit retention force; TSS = total soluble solids; TA = titratable acidity.

Table 3. Comparisons of yield attributes of Cowiche™ and genotypes including Chelan™, Cashmere™, and 'PC 7147-9' (representing early-, mid-, and late-season maturity classes, respectively) on Tabel® Edabriz, Gisela® 5, and Gisela® 6 rootstocks at WSU-IAREC, Prosser.^z

Cultivar	Bloom date	Harvest date	TCA ^y (cm ²)	Yield (kg/tree)	Yield efficiency (kg·cm ⁻²)
Tabel® Edabriz					
Chelan™	^a 15 Apr. ± 0.2 ^x	^a 18 June ± 0.3	^a 400.0 ± 2.6	^a 54.9 ± 1.4	^a 0.14
Cashmere™	^b 19 Apr. ± 0.2	^b 25 June ± 0.3	^b 268.3 ± 2.1	^b 23.7 ± 0.7	^{ab} 0.11
Cowiche™	^c 25 Apr. ± 0.2	^c 9 July ± 0.3	^b 266.6 ± 2.0	^c 17.8 ± 1.1	^b 0.07
PC 7147-9	^c 23 Apr. ± 0.3	^c 12 July ± 0.2	^c 172.4 ± 1.8	^c 13.8 ± 0.7	^b 0.09
Gisela® 5					
Chelan™	^a 15 Apr. ± 0.2	^a 19 June ± 0.3	^a 292.1 ± 2.9	^a 31.5 ± 1.1	^{ab} 0.11
Cashmere™	^b 20 Apr. ± 0.3	^a 21 June ± 0.2	^c 362.8 ± 2.6	^c 48.3 ± 1.21	^a 0.13
Cowiche™	^c 25 Apr. ± 0.2	^b 10 July ± 0.3	^b 210.0 ± 1.8	^a 30.8 ± 0.90	^a 0.15
PC 7147-9	^c 24 Apr. ± 0.3	^b 12 July ± 0.2	^d 431.3 ± 2.0	^b 20.0 ± 0.80	^b 0.08
Gisela® 6					
Chelan™	^a 15 Apr. ± 0.2	^a 20 June ± 0.2	^a 616.6 ± 3.1	^a 37.5 ± 1.5	^a 0.07
Cashmere™	^b 19 Apr. ± 0.2	^a 22 June ± 0.3	^b 512.4 ± 3.3	^a 41.7 ± 1.49	^a 0.08
Cowiche™	^c 25 Apr. ± 0.2	^b 11 July ± 0.2	^c 439.6 ± 2.4	^b 29.6 ± 1.0	^a 0.07
PC 7147-9	^c 23 Apr. ± 0.3	^b 13 July ± 0.3	^c 459.8 ± 3.0	^b 29.1 ± 0.8	^a 0.08

^zMeans are based on 2011, 2012, and 2013 data combined and five trees of each genotype planted as five-tree plots in a completely randomized design. Trees were 13 years old at the beginning of evaluation in 2011. Trees were thinned to three to four fruit per cluster to achieve a balanced cropland.

^yTrunk cross-sectional area taken 30 cm aboveground.

^xData presented are means ± SE. Means were separated by Tukey's honest significant difference test at $\alpha = 0.05$. Means with the same letter (within columns) are not significantly different at $P < 0.05$.

Performance

Twenty-five fruit samples harvested annually at commercial maturity from each of five trees of Cowiche™ and 'Bing', grafted on 'Mazzard', were evaluated in Prosser between 2002 and 2006, and in 2009 to 2013, for fruit quality attributes including fruit mass, total soluble solid (TSS) content, titratable acidity (TA), firmness, skin and flesh colors, and for production traits including bloom date and harvest date. Twenty-five fruit from three trees of Cowiche™ and five of 'Bing' grafted on Gisela® 6 also were evaluated for the same attributes between 2009 and 2013 in The Dalles, OR. Commercial maturity was

determined by a combination of fruit skin color, taste, and TSS in consultation with commercial fruit packing house representatives. Fruit weight was measured with a weighing scale (Ohaus Corporation, Pine Brook, NJ), whereas fruit size was subjectively classified into small (24.2 mm in diameter or less or 11 row or greater), medium (25.4 to 26.50 mm in diameter or 10 to 10 half row), large (28.2 mm in diameter or 9 half row), and very large (29.2 mm in diameter or greater or 9 row or greater); TSS was measured with a refractometer (Atago PAL-1, Tokyo, Japan) and TA with an auto-titrator (Mettler Toledo DL 12, Schwerzenbach, Switzerland) titrating 10 mL of juice and 40 mL of distilled water with

0.1 M NaOH to a pH endpoint of 8.1. Firmness, measured as the force required to compress the fruit a constant distance, was evaluated using a FirmTech machine (BioWorks Inc., Stillwater, OK), whereas pedicel-fruit retention force (PFRF; the force required to remove the pedicel from the fruit) was measured with a mechanical force gauge (Imada DPS-11; Imada Co., Northbrook, IL) with a custom-fitted polyvinylchloride hook attachment to detach fruit. Skin and flesh color were observed visually and recorded as the number of fruit per color designation according to the Centre Technique Interprofessionnel des Fruits et Legumes (2002) (<<http://www.fruits-et-legumes.net>>; Paris, France) color chart.

The results indicate that Cowiche™ blooms after, but within a few days of, ‘Bing’ in The Dalles (Table 1) and later than ‘Bing’ by ≈7 d in Prosser (Table 2). Harvest timing also was delayed by 7 to 8 d compared with ‘Bing’. The fruits of Cowiche™ had higher TA and PFRF than that of ‘Bing’, whereas firmness and TSS were similar (Tables 1 and 2). Fruit size was also similar in The Dalles, whereas fruit weight was larger in Cowiche™ at the Prosser site only. The similarity in fruit size between Cowiche™ and ‘Bing’ in The Dalles could be attributed to different rootstocks, crop load management, and smaller sample size (in terms of fewer Cowiche™ trees) than in Prosser.

Yield comparisons between Cowiche™ and other genotypes on rootstocks such as Tabel® Edabriz, Gisela® 5 (*P. cerasus* × *P. canescens*), and Gisela® 6 (*P. cerasus* × *P. canescens*) planted in 1998 (Table 3) were based on five trees of each individual. Combined yield data collected in 2011, 2012, and 2013 suggest that the yield of Cowiche™ can vary significantly depending on rootstock; while moderate yields were obtained on ‘Gisela® 6’ and ‘Tabel® Edabriz’, yield efficiency was maximized on ‘Gisela® 5’.

The yield of Cowiche™ was similar to Chelan™’s but higher than that of ‘PC 7147-9’ on ‘Gisela® 5’.

Cowiche™ is not self-fertile as indicated by the *S*-locus genotype (Haldar et al., 2010) and productivity can be promoted by interplanting with pollenizers having similar bloom timing, including ‘Kordia’, Benton™, Skeena™, and ‘Sylvia’ at a standard ratio of 10%. Cowiche™ is further distinguished from ‘Bing’ and other midseason and/or dark red cherries by its propensity to develop numerous fruiting spurs near the terminal junctions of 2-year-old and older fruiting wood. Being harvested 3 to 7 d after ‘Bing’ is convenient for growers who wish to keep harvest crews employed until the mid-late-maturing cultivars (e.g., Skeena™ or ‘Lapins’) are picked. The harvest timing, combined with its outstanding flavor including balanced sweetness and sourness (Ross et al., 2010), places Cowiche™ in a unique position in the marketplace. Pitting problems during storage (Long, 2012), however, could potentially affect prolonged storage and limit shipping for off-shore destinations.

Availability

Cowiche™ is licensed exclusively by the Washington State University Research Foundation to the Northwest Nursery Improvement Institute (<<http://nniifruittrees.org/inmdex.php>>). Contact member nurseries for tree availability.

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