'Santina', 'Sumpaca Celeste', and 'Sumnue Cristalina' Sweet Cherries

Frank Kappel, W. David Lane, Richard MacDonald, Karlis Lapins, and Hans Schmidt

Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, Summerland, BC, V0H 1Z0, Canada

Additional index words. *Prunus avium*, fruit breeding, self-fertile, cultivars

'Santina', 'Sumpaca Celeste', and 'Sumnue Cristalina' sweet cherries (*Prunus avium* L.) were released to provide a range of early- to mid-early-season, productive sweet cherry cultivars. 'Santina', 'Sumpaca Celeste', and 'Sumnue Cristalina' mature $\approx$ 8, 6, and 4 d, respectively, before 'Van'. These cultivars were recommended for naming by our cooperators in Canada and around the world. They are attractive, large, firm, and have good flavor characteristics. 'Sumpaca Celeste' and 'Sumnue Cristalina' have two-part names because they were first registered in Europe as 'Sumpaca' and 'Sumnue' in 1995.

Origin

'Santina' originated at Summerland from a cross between 'Stella' and 'Summit' made in 1973 by Lapins and Schmidt. It was first selected in 1981 and given the seedling designation 13S-5-22. It was repropagated on *P. avium* F12/1 rootstock and planted in second test trials in 1984. Budwood was provided to cooperators beginning in 1985 and was tested in Canada, the United States, and Europe. 'Santina' was named to provide an early-season (8 d before 'Van') sweet cherry cultivar with good fruit size and quality.

'Sumpaca Celeste' resulted from a cross between 'Van' x 'Newstar' made in 1974 by Lane and Schmidt. It was planted into the seedling orchard in 1976 and first selected in 1981, receiving the seedling designation 13S-24-28. It was repropagated for second test on *P. avium* (mazzard) rootstock in 1982. Cooperators received budwood for testing beginning in 1983 and it has been tested in Canada, the United States, and Europe. 'Sumpaca Celeste' was released because of its ripening period (6 d before 'Van'), large fruit size, good fruit quality, and compact growth habit.

'Sumnue Cristalina' was from a cross between 'Star' x 'Van' made in 1962 by Lapins and Schmidt and was planted in the seedling orchard in 1964. It was first selected in 1968 and given the designation 2C-61-22. (The

fields were renumbered in the early 1970s, and since then 'Sumnue Cristalina' may have been released for testing as 2N-61-22.) It was planted for second test in 1973 using *P. avium* (mazzard) as the rootstock. It has been distributed to cooperators for testing both locally and internationally. 'Sumnue Cristalina' was released to provide a mid-early-season sweet cherry cultivar with large fruit size and good fruit quality. Fruit of 'Sumnue Cristalina' also has the interesting trait of detaching from the stem at maturity with a dry stem scar without tearing of the skin. This may be useful for those fresh markets interested in stemless sweet cherries.

Description

Trees of 'Santina' are vigorous, with a semi-open growth habit. The leaves are medium to large and elliptical and the margins are serrate. The nectaries are kidney-shaped and pink in color. 'Sumpaca Celeste' trees are spur-type with an upright growth habit, and 1-year-old shoots have short to medium internodes. The leaves are medium to large and elliptical. The leaf margins are serrate. There are two or three orange-red, kidney-shaped nectaries at the base of the leaf. Trees of 'Sumnue Cristalina' are vigorous, with an upright growth habit. The leaves are medium to large and elliptical. The leaf margins are serrate with a shallow to medium indentation. There are two orange-red, kidney-shaped nectaries at the base of the leaf.

The flower density of 'Santina' is medium to high compared with 'Van', which has a high flower density. The bloom period is midseason,

$\approx$ 1 d after 'Van'. 'Sumpaca Celeste' has a medium flower density. The bloom period is late, $\approx$ 3 d after 'Van'. Both 'Santina' and 'Sumpaca Celeste' are self-compatible, a trait inherited from 'Stella'. 'Sumnue Cristalina' has a medium flower density. The bloom period is midseason, $\approx$ 1 d after 'Van'. 'Sumnue Cristalina' is self-incompatible, and preliminary data from test crosses suggest that 'Sumnue Cristalina' is in compatibility group II with the sterility genes S_1S_3 .

The fruit of 'Santina' are medium-large, symmetrical, and kidney-shaped to flat-round. The pedicels are medium-long compared to those of 'Van', which has short pedicels. The skin is dark red and the flesh red. Fruit is intermediate to firm, juicy, intermediate in taste (sugar : acid ratio), and has fair to good eating quality. For comparison, 'Van' is considered to be moderately large and juicy, with good fruit firmness and eating quality, intermediate to sweet taste. The fruit of 'Sumpaca Celeste' is large, symmetrical, and kidney-shaped with a moderately short pedicel. The skin is mahogany to black with the juice dark red to black and the flesh dark red. Fruit firmness is medium and the fruit are juicy and moderately sweet with fair to good eating quality. The stone is small to medium, round, and asymmetrical in lateral view. The fruit of 'Sumnue Cristalina' is large, symmetrical, and kidney-shaped with a medium-length pedicel. The skin is mahogany to black, juice is red, and the flesh is dark red. The fruit are firm, have intermediate to sweet taste, and good eating quality. The stone is small, round, and symmetrical in lateral view.

Performance

'Santina' is the earliest maturing sweet cherry released from the Summerland breeding program, maturing $\approx$ 8 d before 'Van'. In France, Edin et al. (1997) reported that it matures $\approx$ 9 to 13 d after 'Burlat', which matures $\approx$ 18 to 26 d before 'Van'. In Belgium it matures $\approx$ 16 d after 'Burlat' (Druart, 1996). 'Santina' has reasonably good fruit size for the season; its average fruit mass is 9.2 g (Table 1). The data in Table 1 are averages over years sampled (number of years in brackets). In each year the number of trees sampled and the number of samples per selection varied. In the

Table 1. Fruit characteristics of 'Santina', 'Sumpaca Celeste', and 'Sumnue Cristalina' sweet cherry compared with those of the standards 'Van' and 'Bing' at Summerland, B.C.

Cultivar	Fruit mass (g)	Total soluble solids (%)	Fruit firmness			
			Durometer ^a	FirmTech ^b (g/cm)	Natural splitting (%)	Cracking Index ^c
Santina	9.2 (16) [*]	16.4 (13)	72 (5)	173 (1)	39 (13)	70 (2)
Sumpaca Celeste	10.3 (17)	16.8 (14)	73 (5)	229 (1)	11 (15)	17 (2)
Sumnue Cristalina	10.0 (13)	16.9 (11)	74 (4)	226 (1)	20 (12)	16 (2)
Van	10.1 (13)	18.9 (12)	79 (4)	225 (1)	43 (12)	42 (2)
Bing	9.6 (8)	18.1 (6)	68 (3)	143 (1)	40 (8)	---

^aFirmTech measures the amount of force required to compress the fruit a constant distance. A 24-fruit sample was used.

^bDurometer provides a dimensionless reading from 0 to 100; the higher the number the firmer the fruit.

^cCracking Index (CI) = [(3a + b)/150] * 100, where a and b = number of fruit split after being immersed in distilled water at room temperature for 2 and 4 h, respectively. A 50-fruit sample was used for the CI determinations.

^{*}The number in brackets indicates the number of years that the quality trait was measured.

Received for publication 30 Dec. 1997. Accepted for publication 20 Apr. 1998. Contribution no. 1063 of the Pacific Agri-Food Research Centre. We thank Marjorie King for assistance with sensory evaluations. The cost of publishing this paper was defrayed in part by the payment of page charges. Under postal regulations, this paper therefore must be hereby marked advertisement solely to indicate this fact.

Table 2. Characteristics of 'Santina', 'Sumpaca Celeste', and 'Sumnue Cristalina' sweet cherry compared with a standard cultivar ('Van') as reported in Belgium^a, Denmark^b, and France.^c

Cultivars	Avg fruit mass (g)			Fruit firmness			Sensitivity to cracking			Productivity		
	Belgium	Denmark	France	Belgium	Denmark	France	Belgium	Denmark	France	Belgium	Denmark	France
Santina	8.5	---	7.5 to 8.5	11 ^w	---	firm	33% ^x	---	sensitive	medium	---	good to v. good
<i>Sumpaca Celeste</i>	8.7	8.2	8.5 to 11	13	3.9 ^u	medium	13%	21 ⁱ	v. sensitive	good to v. good	4.3 ^v	medium
<i>Sumnue Cristalina</i>	9.4	7.5	8 to 9	14	3.6	firm	30%	32	sensitive	good	4.6	good to v. good
Van	8.7	8.1	7.5 to 9	15	4.9	firm	53%	37	medium	v. good	7.1	v. good

^aDruart, 1996.^bChristensen, 1997.^cEdin et al., 1997.^wFirmness class developed based on resistance to compression by a Stanhope-Seta penetrometer. The smaller the number, the firmer the fruit.^uAverage for 3 years.^vA subjective firmness rating with 1 = very soft and 5 = very firm.^xCracking Index determined over a 6-h period. An index of 100 indicates that all fruits cracked within 2 h after immersion in distilled water and an index of 0 means that no fruits cracked within 6 h of immersion.^yRated from 1 = no or single fruits to 9 = very heavy crops over 4 years when trees were 3 to 6 years old.

first years after finding the selection in the seedling row only one tree was sampled, but as more trees were propagated sample size increased. The following numbers of fruit per sample were used for each trait: average fruit mass, 100; total soluble solids concentration, 20 to 25; durometer firmness, 20 to 25; FirmTech firmness, 24; natural splitting, 100; and Cracking Index, 50. Average fruit mass in cooperators' plots is slightly lower than at Summerland (Table 2). The protocol at Summerland is to harvest the fruit at a more mature stage, (i.e., the fruit are darker than those of the European cooperators), which may account for some of the difference in fruit size. Total soluble solids concentration is slightly lower than that of the midseason 'Van' and 'Bing' but still acceptable (Kappel et al., 1996). Durometer (Shore Instrument, Jamaica, N.Y.) readings indicate that firmness was highly acceptable. The durometer provides a dimensionless measure of firmness, from 0 to 100 (the higher the number, the firmer the fruit), closely related to people's perception of firmness (Kappel et al., 1996). A durometer measurement of 73 was determined to be "Just Right" (Kappel et al., 1996) on the Just Right scale (Meilgaard et al., 1991) used in determining the relationship between firmness and perception. The durometer reading for 'Santina' was 72. FirmTech (BioWorks, Stillwater, Okla.) firmness measurements also indicate 'Santina' has a good level of firmness compared with the standards. The tolerance of 'Santina' to rain-induced cracking is similar to standard cultivars (Table 1). Our results were similar to those of our cooperators for sensitivity to cracking. Productivity under conditions at Summerland (subjective assessment) has been good and cropping has been consistent each year. For comparison, the cropping of 'Van' is considered to be good to very good. Belgian (Druart, 1996) testers rate 'Santina' as having medium productivity whereas the French (Edin et al., 1997) rate the productivity good to very good. Both testers rate the productivity of 'Van' as very good.

'Sumpaca Celeste' has good fruit size as measured by average fruit mass (10.3 g). We

consider the fruit moderately large, similar to 'Van' (Table 1). Testers in Belgium (Druart, 1996) and Denmark (Christensen, 1997) also report that fruit size is similar to 'Van' (Table 2). Total soluble solids concentration is below that of the midseason standard cultivars but still adequate. The fruit of 'Sumpaca Celeste' are rated firm under conditions in Summerland (Table 1), and medium in Europe (Table 2). At Summerland, 'Sumpaca Celeste' is considered to be quite tolerant to cracking. Over the years we have observed very low cracking in the field and the Cracking Index (CI) (Christensen, 1996) has also been low. The CI is calculated by storing fruit at room temperature overnight, then immersing them in distilled water at room temperature for 2 and 4 h and counting the number of cracked fruit. The lower the number, the more tolerant the fruit to cracking. In Belgium (Druart, 1996) and Denmark (Christensen, 1997) 'Sumpaca Celeste' had low sensitivity to cracking, whereas in France (Edin et al., 1997) it was very sensitive. The French testers further reported that it was very sensitive to cracking at the beginning of fruit maturity when the fruit began to change color. The productivity under our conditions

using standard rootstocks appears to be low to medium. The growth habit is compact with few side branches being formed, and all the fruit are borne on spurs on these scaffold branches. Therefore, the cropping potential may not be as high as desired. In Belgium (Druart, 1996), productivity is rated good to very good whereas in Denmark (Christensen, 1997) and France (Edin et al., 1997) it is rated as medium. The compact growth habit results in a smaller tree; therefore, closer planting might increase its productivity per unit area.

Fruit mass of 'Sumnue Cristalina' is average in both Summerland (Table 1) and Europe (Table 2). Total soluble solids concentration is below that of the standard cultivars but within the acceptable range. Fruit firmness is good under conditions at Summerland (Table 1). Investigations in both Belgium (Druart, 1996) and Denmark (Christensen, 1997) report medium firmness, whereas those in France (Edin et al., 1997) report that fruit are firm (Table 2). Sensitivity to cracking is low at Summerland, whereas the fruit are sensitive to rain-induced cracking in Europe. Tree productivity at Summerland, based on subjective assessments, is considered to be good. Productivity is con-

Table 3. Sensory characteristics^a of 'Santina', 'Sumpaca Celeste', and 'Sumnue Cristalina' sweet cherries evaluated at Summerland, B.C.

	Santina	<i>Sumpaca Celeste</i>	<i>Sumnue Cristalina</i>	Anchors of attributes
Visual attributes				
Color intensity	9.9 ± 0.1 ^y	7.5 ± 0.2	9.3 ± 0.3	light to dark
Fruit size	8.4 ± 0.4	8.4 ± 0.05	8.4 ± 0.2	small to large
Stem color	7.4 ± 0.3	8.8 ± 0.2	8.8 ± 0.3	brown/green to green/green
Skin glossiness	8.1 ± 0.7	8.4 ± 0.4	8.4 ± 0.4	low to high
Visual liking	7.2 ± 0.1	8.0 ± 0.2	8.1 ± 0.2	low to high
Flavor attributes				
Firmness	7.8 ± 0.5	7.0 ± 0.04	5.9 ± 0.1	soft to very firm
Juiciness	6.9 ± 0.8	7.2 ± 0.5	8.0 ± 0.4	low to high
Sweetness	5.0 ± 0.6	6.3 ± 0.8	7.6 ± 0.5	low to high
Sourness	4.0 ± 0.1	3.1 ± 0.3	4.2 ± 0.1	low to high
Intensity of cherry flavor	4.8 ± 0.3	5.3 ± 0.03	6.3 ± 0.7	low to high
Flavor/texture liking	4.7 ± 0.4	5.3 ± 0.6	6.5 ± 0.8	low to high

^aJudges placed a mark according to their assessment of the attribute on a 11-cm-long line with the anchors placed at 1 cm from either end and a midpoint reference. For example, the anchor "light" for color intensity was at cm 1 and "dark" was at cm 10.

^yMean ± SE of duplicate panels with 10 judges for each panel. The values are actual measurements in centimeters.

firmed by the ratings given by all three European testers (Table 2).

In 1996, these three cultivars were placed in sensory evaluation panels with other early-ripening selections. As there are no suitable standard early-season cultivars at Summerland, no standards were included in the panels. Ten panelists (employees of Agriculture and Agri-Food Canada, Summerland, B.C.) evaluated duplicate samples of the cherry cultivars. The procedure as outlined by Dever et al. (1996) was modified slightly, in that no reference samples for sweetness or sourness were used. All three cultivars had similar appearance except for 'Sumpaca Celeste', which had a lower rating for color intensity (Table 3). The stems of 'Santina' were considered slightly browner. Stems that are green and not shrivelled are preferred. The firmness of 'Sumnue Cristalina' was rated the lowest of the three

cultivars, but it had the highest ratings for intensity of cherry flavor and flavor/texture.

Availability

The Okanagan Plant Improvement Co. (PICO), 4200 Highway 7, P.O. Box 6000, Summerland, B.C. V0H 1Z0, is the agent for these cultivars. 'Sumpaca Celeste' and 'Sumnue Cristalina' were granted Plant Breeders' Rights in Canada in 1997 (certificate nos. 0316 and 0318, respectively). Application for Plant Breeders' Rights in Canada for 'Santina' will be submitted.

Literature Cited

- Christensen, J.V. 1996. Rain-induced cracking of sweet cherries: Its causes and prevention, p. 297-327. In: A.D. Webster and N.E. Looney (eds.). Cherries: Crop physiology, production and uses. CAB International, Wallingford, U.K.
- Christensen, J.V. 1997. Performance in Denmark of 20 Summerland selections of sweet cherry. *Fruit Var. J.* 51:79-83.
- Dever, M.C., R.A. MacDonald, M.A. Cliff, and W.D. Lane. 1996. Sensory evaluation of sweet cherry cultivars. *HortScience* 31:150-153.
- Druart, P. 1996. La cerise, en verger intensif. Centre de Recherches Agronomiques de Gembloux. Gembloux, Belgium.
- Edin, M., J. Lichou, and R. Saunier. 1997. Cerise, les varietes et leur conduite. Centre techniques interprofessionnel des fruits et legumes. Paris.
- Kappel, F., R. Fisher-Fleming, and E. Hogue. 1996. Fruit characteristics and sensory attributes of an ideal sweet cherry. *HortScience* 31:443-446.
- Meilgaard, M., G.V. Civille, and B.T. Carr. 1991. Sensory evaluation techniques. 2nd ed. CRC Press, Boca Raton, Fla.