

# ‘Cascade Delight’ Red Raspberry

Patrick P. Moore<sup>1</sup>

Washington State University Puyallup Research and Extension Center, Puyallup, WA 98371

Additional index words. *Rubus idaeus*, fruit breeding

‘Cascade Delight’ is a new florican fructing red raspberry (*Rubus idaeus* L.) jointly released by Washington State Univ. (WSU), Oregon State Univ., Univ. of Idaho, and the U.S. Dept. of Agriculture–Agriculture Research Service (USDA–ARS). ‘Cascade Delight’ has been noted for high yields of large, firm, attractive, late season fruit with excellent fresh flavor. The fruit is long conic in shape and glossy. Although the fruit releases very easily from the receptacle, ‘Cascade Delight’ is not suited for machine harvesting. It is very vigorous and has long fruiting laterals that may present problems for machine harvesting. As a result, ‘Cascade Delight’ would be best suited for fresh market. The name Cascade was selected to reflect the region where this cultivar was developed.

## Origin

‘Cascade Delight’ was selected from a cross of ‘Chilliwack’ (Daubeny, 1987) and WSU 994 (Fig. 1) made in 1989 at WSU Puyallup Research and Extension Center (WSU Puyallup). ‘Cascade Delight’ was selected in 1992 and evaluated as WSU 1090. ‘Cascade Delight’ has a diverse background, including cultivars and selections from the Agriculture and Agri-Food Canada Pacific Agri-Food Research Centre, Agassiz, British Columbia; Canada Dept. of Agriculture, Research Station., Ottawa, Ontario; Scottish Crop Research Institute; and WSU Puyallup breeding programs.

## Performance

Fruit of ‘Cascade Delight’ was harvested in several replicated plantings at WSU Puyallup from 1995 through 2002. Plantings were arranged in randomized complete-block designs, with three, 3-plant replications, with 0.9 m between plants and 2.4 m between rows. Fruit was harvested one or two times a week depending on environmental conditions. The average fruit weight for the season is a weighted mean based on the weight of a randomly selected 25 fruit subsample from each plot from each harvest and the yield for each harvest. Fruit firmness was measured as the force required to close

the opening of the fruit and was calculated as a weighted mean based on a randomly selected five fruit subsample from each plot from each harvest. Only ‘Meeker’, ‘Tulameen’, ‘Willamette’ and ‘Cascade Delight’ were harvested in all plantings. In the Pacific Northwest (PNW), ‘Meeker’ is the most widely grown raspberry (Moore, 1993). ‘Tulameen’ is grown worldwide for fresh use (Kempler and Daubeny, 1999). Variables analyzed were yield, fruit rot, fruit weight, midpoint of harvest and length of harvest. Data were analyzed as a factorial using analysis of variance (SAS 8.1, SAS Inst., Cary, N.C.) with cultivar and year as main effects.

There were significant cultivar effects for all variables except for fruit rot (Table 1). There were no significant cultivar × year effects except for fruit rot ( $P \leq 0.05$ ) and midpoint of harvest ( $P \leq 0.01$ ). Yield for ‘Cascade Delight’ was similar to that of ‘Tulameen’ and greater than ‘Meeker’ and ‘Willamette’. The fruit weight and fruit firmness for ‘Cascade Delight’ were greater than for the other cultivars. When ‘Tulameen’ was released, it was considered to have exceptionally large fruit (Daubeny and Anderson, 1991). ‘Cascade Delight’ was 20% larger than ‘Tulameen’ in these harvests. The midpoint of harvest for ‘Cascade Delight’ was similar to ‘Meeker’ and ‘Tulameen’, but the length of the harvest season was slightly shorter than for ‘Tulameen’. No primocane flowers or fruit have been observed on ‘Cascade Delight’ at WSU Puyallup.

‘Cascade Delight’ has performed well at Oregon State Univ. North Willamette Research and Extension Center, Aurora, Ore.

(OSU–NWREC), WSU Vancouver Research and Extension Unit, and WSU Mt. Vernon Research and Extension Unit. In all locations, ‘Cascade Delight’ was productive and large fruited. The only Pacific Northwest cultivar in a 1997 planting at OSU–NWREC was ‘Willamette’. In the 1999 and 2000 harvests at OSU–NWREC, the fruit weight and yield of ‘Cascade Delight’ relative to ‘Willamette’ was the same as at WSU Puyallup (data not shown).

‘Cascade Delight’ has produced excellent quality fruit in test plots at WSU Mt. Vernon Research and Extension Unit, WSU Vancouver Research and Extension Unit, North Willamette Research and Extension Center of Oregon State Univ. (Aurora, Ore.), and in grower plantings in Washington. ‘Cascade Delight’ has not been tested outside of the PNW. There has not been any significant winter damage for any raspberries in any of the plantings at WSU Puyallup when ‘Cascade Delight’ was tested. Therefore, winter hardiness of ‘Cascade Delight’ is unknown.

## Fruit description

Fruit of ‘Cascade Delight’ has an excellent fresh red raspberry flavor. Of currently grown PNW raspberry cultivars, the flavor of ‘Cascade Delight’ is most similar to ‘Chilliwack’, but not as sweet tasting. The fruit is long conic in shape and glossy (Fig. 2). Frozen fruit samples of ‘Cascade Delight’ and other cultivars from the 2000 harvest season at Puyallup, were analyzed for pH, titratable acidity, soluble solids, and total anthocyanins (Table 2). Fruit of ‘Cascade Delight’ was similar in pH to ‘Tulameen’ and ‘Willamette’ and less than ‘Meeker’. Titratable acidity for ‘Cascade Delight’ was less than ‘Tulameen’ and ‘Willamette’. Cultivars did not differ for soluble solids. Total anthocyanins were similar to ‘Tulameen’ and ‘Meeker’ and less than ‘Willamette’.

Red ripe fruit samples were harvested early in the harvest season, on 6 July 2001 at WSU Puyallup. Fruit of ‘Cascade Delight’ were very large, long, with many drupelets per

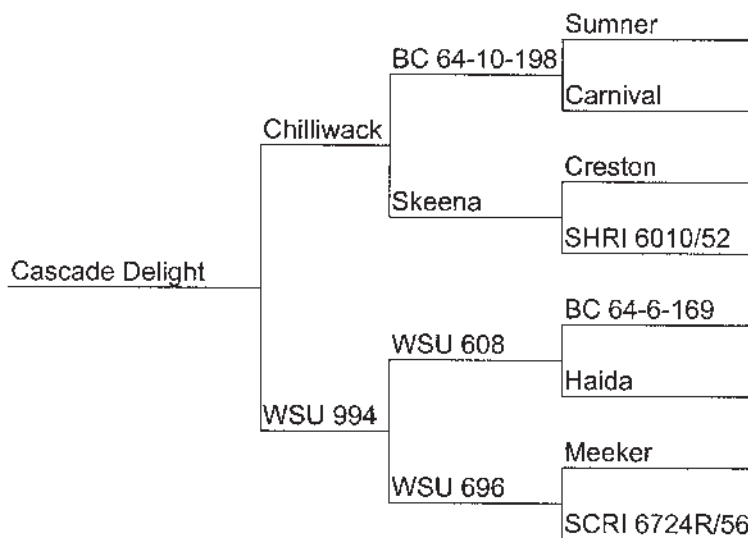


Fig. 1. Pedigree of ‘Cascade Delight’.

Received for publication 30 Dec. 2002. Accepted for publication 16 Apr. 2003. This research was partially funded by the Washington Red Raspberry Commission and the Oregon Raspberry and Blackberry Commission. Washington State Univ., College of Agriculture and Home Economics, Pullman, Wash. Project No. 0640. The assistance of the following persons in testing ‘Cascade Delight’ is gratefully acknowledged: Chad Finn, Bernadine Strik, Steve Klauer, Martin Nicholson, and Gary Moulton.  
<sup>1</sup>Scientist.

Table 1. Raspberry harvest data from six seasons, Washington State Univ. Puyallup.<sup>z</sup>

Cultivars	Yield (kg/hill)	Fruit rot (%)	Fruit wt (g)	Fruit firmness (N)	Midpoint of harvest	Length of harvest (days)
Cascade Delight	3.95 a <sup>y</sup>	13.7	4.90 a	2.07 a	7/22	24 b
Meeker	3.37 b	7.7	3.24 c	1.80 b	7/21	26 b
Tulameen	3.51 ab	9.4	4.06 b	1.77 b	7/21	29 a
Willamette	3.10 b	6.7	3.27 c	1.62 c	7/13	25 b

<sup>z</sup>Harvest data from 1995 and 1996 from 1993 planting; 1999 and 2000 from 1997 planting; and 2001 and 2002 from 1998 planting. Firmness was not measured in 1996.

<sup>y</sup>Means within a column followed by the same letter are not significantly different at  $P \leq 0.05$ , by Tukey's Studentized Range Test (HSD).

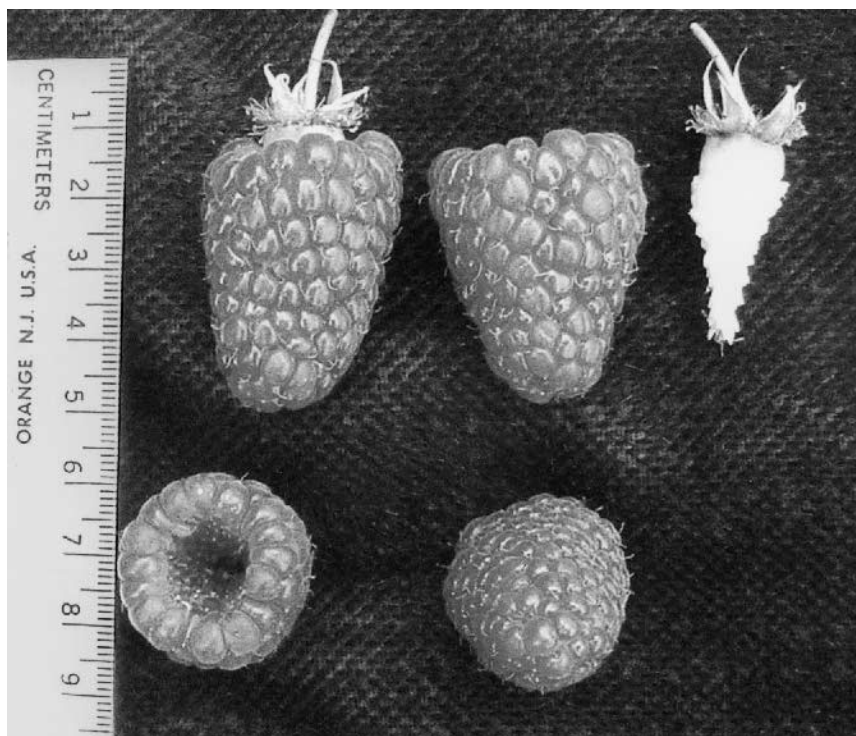


Fig. 2. Fruit of 'Cascade Delight'.

Table 2. Analysis of raspberry fruit harvested July 2000, Puyallup, Wash.<sup>z</sup>

Cultivar	pH	Titrateable acidity (% citric acid)	Soluble solids (%)	Anthocyanins (mg·g <sup>-1</sup> fruit)
Cascade Delight	2.98 b <sup>x</sup>	1.18 b	10.4 a	0.440 b
Meeker	3.18 a	1.05 b	11.8 a	0.468 b
Tulameen	3.00 b	1.48 a	11.3 a	0.406 b
Willamette	2.96 b	1.52 a	11.4 a	0.748 a

<sup>z</sup>Analysis of three replications of 10 g of fruit.

<sup>x</sup>Total anthocyanins determined spectrophotometrically from acidified ethanol extracts and expressed as cyanidin 3-galactoside (Torre and Barritt, 1977).

<sup>y</sup>Means within a column followed by the same letter are not significantly different at  $P \leq 0.05$ , by Duncan's multiple range test.

fruit (Table 3). The average weight of drupelets was similar for 'Cascade Delight', 'Tulameen' and 'Meeker'. Fruit of 'Cascade Delight' were slightly darker than 'Tulameen' and WSU 994 (a parent of 'Cascade Delight').

Fruit of 'Cascade Delight' and 'Tulameen' were harvested at a fresh-market stage and stored at 4 °C for 8 d and then at room temperature ( $\approx 20$  °C) for 4 h. Firmness and color was measured prior to storage and after storage (Table 4). Prior to storage, 'Cascade Delight' was much firmer than 'Tulameen' and similar in color. After storage, 'Cascade Delight' remained much firmer than 'Tulameen'.

'Cascade Delight' had the same firmness after storage as 'Tulameen' did prior to storage. After storage, 'Cascade Delight' was slightly darker and less yellow than 'Tulameen', but both were acceptable in color after storage.

#### Plant description

'Cascade Delight' is very vigorous producing an adequate number of canes, similar to 'Meeker'. The plant is similar in size to 'Meeker', which is a large, vigorous cultivar with long fruiting laterals. Plants have been grown in the hill system with 10–12 canes

retained per hill and the primocanes pruned to 1.2 m in winter. The following summer, fruiting plots were 2.1 m tall with a width of 1.6 m.

Budbreak for 'Cascade Delight' was intermediate between 'Tulameen' and 'Meeker',  $\approx 9$  Mar. 2001. The date of primocane emergence was similar for 'Cascade Delight', 'Meeker', and 'Tulameen' and was  $\approx 20$  Mar. 2001. Basal portions of young canes (<30 cm tall) have 20–40 spines per cm of cane, whereas distal portions of taller canes (over 1 m in height) had spines that were much smaller and many fewer, <5 spines per cm. Spines are straight and pointed toward the base of the canes. There are pigmented spots at the base of the spine that are the same color as the spines. The spine color is similar to 'Tulameen' and much darker than 'Meeker'. The canes are glabrous and have a coating of wax.

The leaflets of the primocane leaves are generally flat in cross section. The petioles are pubescent and also have spines that are similar (but smaller) to those on the canes. The primocane leaves are pinnately compound with five leaflets and the floricanes leaves have three leaflets. Emerging leaves are green with some reddening. The leaves have two stipules. The basal lateral leaflets and the distal lateral leaflets of primocanes overlap slightly. The leaflets are doubly serrated and are generally ovate. The tips of all leaflets are acuminate to acute. The base of the terminal leaflet is rounded to cordate. The basal lateral leaflets of primocane leaves have petiolules >1 mm and the bases of these are rounded and relatively symmetrical. The distal lateral leaflets are sessile with asymmetrical leaf bases.

#### Disease and pest reaction

'Cascade Delight' is susceptible to the large raspberry aphid (*Amphorophora agathonica* Hottes), the vector for the mosaic virus complex and to raspberry bushy dwarf virus (RBDV) via pollen transmission. In some years, this cultivar has shown high levels of fruit rot (primarily *Botrytis cinera* Pers. ex Fr.) in unsprayed plots, but when observed for several years, did not differ significantly from other cultivars (Table 1). In unsprayed plots, the canes had a low incidence of anthracnose [*Elsinoe veneta* (Burkh.) Jenkins] and cane botrytis (*B. cinera*) and moderate incidence of spur blight [*Didymella applanata* (Niessl) Sacc.]. In a test planting that was machine harvested, a few canes of 'Cascade Delight' had cane blight lesions [*Leptosphaeria coniothyrium* (Fuckel) Sacc.]. It may exhibit some degree of field resistance to root rot (*Phytophthora fragariae* var. *rubi* Wilcox & Duncan). In research plots established at WSU Mt. Vernon in 1998, adjacent plots of the PNW cultivars Comox, Meeker, Qualicum, Tulameen, and Willamette all were killed or severely damaged by root rot by 2001; 'Cascade Delight' remained vigorous.

#### Uses

The fruit of 'Cascade Delight' is very large, very firm, and glossy, with excellent

Table 3. Morphological characteristics of fruit harvested 6 July 2001, Puyallup, Wash.<sup>z</sup>

Characteristic	Cascade				
	Delight	Meeker	Tulameen	Chilliwack	WSU 994
Individual fruit wt (g)	8.36 a <sup>y</sup>	4.26 c	5.48 b	3.55 d	5.43 b
Fruit length (cm)	3.3 a	2.1 d	2.6 c	2.1 d	2.8 b
Fruit width (cm)	2.4 a	2.0 c	2.2 b	1.9 d	2.1 c
Length/width ratio	1.37 a	1.01 d	1.19 b	1.11 c	1.36 a
Receptacle diameter (cm)	0.98 a	0.90 b	0.91 ab	0.84 b	0.90 b
Receptacle length (cm)	2.78 a	1.47 d	2.26 b	1.70 c	2.29 b
No. drupelets per fruit	134 a	75 d	87 c	74 d	119 b
Individual drupelet wt (mg)	63 a	59 a	63 a	48 b	47 b
Individual seed wt (mg)	2.16 a	1.99 a	2.09 a	2.10 a	1.72 b
Color <sup>x</sup>					
L*	28.05 b	29.41 ab	29.84 a	29.15 ab	30.06 a
a*	26.90 b	26.21 b	25.25 b	27.41 ab	29.51 a
b*	10.16 ab	8.83 c	8.99 bc	9.44 bc	11.14 a

<sup>z</sup>Analysis of 10 fruit per clone.

<sup>y</sup>Means within a row followed by the same letter are not significantly different at  $P \leq 0.05$ , by Duncan's multiple range test.

<sup>x</sup>Color measured as L\*, a\*, b\* with a Minolta Chroma Meter CR200b (Minolta, Ramsey, N.J.).

Table 4. Storage of raspberry fruit harvested 16 July 2001, Puyallup, Wash.<sup>z</sup>

Cultivar	Fruit characteristics prior to storage				Fruit characteristics after storage			
	Firmness (N)	Fruit color <sup>y</sup>			Firmness (N)	Fruit color		
		L*	a*	b*		L*	a*	b*
Cascade Delight	3.56 a <sup>x</sup>	30.6 a	28.5 a	12.7 a	2.34 a	27.8 b	22.1 a	8.2 b
Tulameen	2.29 b	31.1 a	25.4 b	11.3 a	1.36 b	29.8 a	23.0 a	9.3 a

<sup>z</sup>Thirteen fruit measured for each clone on each date. Fruit stored for 8 d at 4 °C, then room temperature ( $\approx 20$  °C for 4 h).

<sup>y</sup>Color measured as L\*, a\*, b\* with a Minolta Chroma Meter CR200b (Minolta, Ramsey, N.J.).

<sup>x</sup>Means within a column followed by the same letter are not significantly different at  $P \leq 0.05$ , by Duncan's multiple range test.

fresh flavor. These characters would make 'Cascade Delight' ideally suited for fresh use. 'Cascade Delight' does not appear to be suited for machine harvesting even though the fruit releases very easily from the receptacle. It is very vigorous and has long fruiting laterals that may interfere with machine harvesting. Additionally, observations at the end of the harvest season indicated fruiting laterals had broken at the attachment to the cane as a result of machine harvesting. Based on these observations, 'Cascade Delight' would be best suited for hand harvesting for fresh market.

#### Availability

Names of propagators with certified 'Cascade Delight' will be supplied on request. The Washington Agricultural Research Center does not have plants for sale. Plant Patent protection will be sought for 'Cascade Delight'.

#### Literature Cited

- Daubeny, H.A. 1987. 'Chilliwack' and 'Comox' red raspberries. *HortScience* 22:1343-1345.
- Daubeny, H.A. and A. Anderson. 1991. 'Tulameen' red raspberry. *HortScience* 26:1336-1338.
- Kempler, C and H.A. Daubeny. 1999. Development of fresh market raspberry cultivars. *Acta Hort.* 505:121-126.
- Moore, P.P. 1993. 'Meeker' red raspberry. *Fruit Var. J.* 47:2-4.
- Torre, L.C. and B.H. Barritt. 1977. Quantitative evaluation of *Rubus* fruit anthocyanin pigments. *J. Food Sci.* 42:488-490.