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‘Cascade Dawn’ Red Raspberry

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‘Cascade Dawn’ is a new floricane fruiting red raspberry (*Rubus idaeus* L.) jointly released by Washington State University (WSU), Oregon State University, University of Idaho, and the U.S. Dept. of Agriculture–Agriculture Research Service (USDA–ARS). ‘Cascade Dawn’ has been noted for high yields of large, early season fruit with excellent fresh flavor. The fruit is long conic in shape and glossy. The fruit of ‘Cascade Dawn’ does not release easily from the receptacle until almost fully ripe. Therefore, ‘Cascade Dawn’ is recommended for local fresh market uses. It has a moderate level of root rot tolerance and may be resistant to raspberry bushy dwarf virus. The name Cascade was selected to reflect the region where this cultivar was developed.

Origin

‘Cascade Dawn’ was selected from a cross of WSU 991 and WSU 608 (Fig. 1) made in 1988 at WSU Puyallup Research and Extension Center (WSU Puyallup). ‘Cascade Dawn’ was selected in 1991 and evaluated as WSU 1068. ‘Cascade Dawn’ has a diverse background, having cultivars and selections from five different breeding programs represented in three generations: the Agriculture and Agri-Food Canada Pacific Agri-Food Research Centre, Agassiz, B.C.; Canada Department of Agriculture, Research Station, Ottawa, Ontario; Hort. Res. Intl., East Malling, Kent, U.K.; USDA–ARS Corvallis, Oregon and WSU Puyallup breeding programs.

Performance

Fruit of ‘Cascade Dawn’ was harvested from six replicated plantings at WSU Puyallup, one at WSU Vancouver Research and Extension Unit and one at WSU Mt. Vernon Research and Extension Center planted from 1992 through 2000. These plantings represent 13 harvest seasons. Plantings were arranged in randomized complete-block designs, with three, three-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 and the weight of sound fruit and fruit with rot determined at each harvest. 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 using a Hunter Spring Mechanical Force Gauge (Series L; Ametek, Hatfield, Pa) 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 Dawn’ were included in all plantings. ‘Meeker’ is the most widely grown raspberry in the Pacific Northwest (PNW) (Moore, 1993). ‘Tulameen’ is grown worldwide for fresh use (Kempler and Daubeny, 1999). ‘Willamette’ was the primary early season processing raspberry cultivar for many years in the PNW (Daubeny et al., 1989). Variables analyzed were yield, fruit rot, fruit weight, midpoint of harvest and length of harvest. For four of the harvest seasons, there were plants of other cultivars that showed obvious root rot symptoms. The data from the four seasons where plants showed obvious root rot symptoms were analyzed separately from the nine seasons without obvious root rot symptoms. Data were analyzed as a randomized block design using ANOVA (SAS 8.1, SAS Inst. Inc., Cary, N.C.).

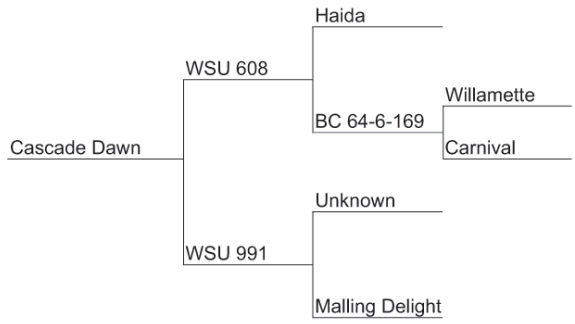

Fig. 1. Pedigree of ‘Cascade Dawn’. The grandparent identified as “unknown” is a plant that was mislabeled as SHRI 6280/41. It was later discovered that this plant was not SHRI 6820/41, and its actual identity remains unknown.

On sites with no obvious symptoms of root rot, ‘Cascade Dawn’ did not differ from ‘Meeker’ and ‘Tulameen’ for yield. On these sites the fruit weight for ‘Cascade Dawn’ was larger than ‘Meeker’ and ‘Willamette’ and was similar to ‘Tulameen’ (Table 1). The harvest season for ‘Cascade Dawn’ started before the other cultivars and the midpoint of harvest was earlier than for the other cultivars. On sites with obvious symptoms of root rot, ‘Cascade Dawn’ had significantly greater yield than the other cultivars (Table 2). ‘Malahat’ is a PNW fresh market raspberry cultivar that ripens fruit at a similar time as ‘Cascade Dawn’. ‘Malahat’ was included in three of the plantings with obvious symptoms of root rot. ‘Malahat’ did not survive in any of these plantings. ‘Cascade Dawn’ was also subjectively evaluated in plots established in 2003 that were machine harvested at Burlington, Wash. In these plots, fruit of ‘Cascade Dawn’ did not release from the receptacle until overripe. ‘Cascade Dawn’ does not appear to be suited to machine harvesting. No primocane flowers or fruit have been observed on ‘Cascade Dawn’ at WSU Puyallup. Data from each harvest season were analyzed separately and the results of these analyses were similar to the two combined analyses.

‘Cascade Dawn’ has performed well at Oregon State University North Willamette Research and Extension Center, Aurora, Ore. ‘Cascade Dawn’ was early, productive and large fruited (data not shown).

There has not been any significant winter damage for any raspberries in any of the plantings at WSU Puyallup when ‘Cascade Dawn’ was tested. Therefore, winter hardiness of ‘Cascade Dawn’ is unknown.

Fig. 2. Fruit of ‘Cascade Dawn’.

Fruit Description

Fruit of ‘Cascade Dawn’ has an excellent mild fresh red raspberry flavor. Fruit samples of ‘Cascade Dawn’ were compared to ‘Meeker’, ‘Willamette’ and other fresh market cultivars for pH, titratable acidity, soluble solids, and total anthocyanins (Table

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Table 1. Harvest data comparing CASCADE DAWN with three Pacific Northwest cultivars from sites with no obvious symptoms of root rot.[z]

Cultivar	Yield (t/a)	Fruit[y] firmness (N)	Fruit rot (%)	Fruit wt (g)	Harvest season 5%	50%	95%	Length of season (d)
Cascade Dawn	8.1 a[y]	1.65 a	7.9 a	4.09 a	26 June c	6 July c	20 July c	24 ab
Meeker	8.5 a	1.74 a	4.9 a	3.25 b	4 July a	17 July a	31 July a	26 ab
Tulameen	7.7 ab	1.59 a	6.9 a	4.37 a	4 July a	15 July a	31 July a	27 a
Willamette	6.2 b	1.63 a	5.0 a	3.24 b	30 June b	9 July b	23 July b	23 b

[z]Data from the following harvest seasons and plantings are included. All plantings at Puyallup, Wash. unless noted; 1994 and 1995 harvests in 1992 planting; 1997 harvest in 1995 planting; 1998 harvest in 1996 planting; 1999 and 2000 harvests in 1997 planting; 2002 and 2003 harvests in 1999 planting; and 2000 harvest in 1998 planting at Mt. Vernon, Wash.
[y]Means within a column followed by the same letter are not significantly different at $P \leq 0.05$, by Duncan's multiple range test.

Table 2. Harvest data comparing 'Cascade Dawn' with three Pacific Northwest cultivars on sites with obvious symptoms of root rot.[z]

Cultivar	Yield (t/a)	Fruit[y] firmness (N)	Fruit rot (%)	Fruit wt (g)	Harvest season 5%	50%	95%	Length of season (d)
Cascade Dawn	7.6 a[y]	1.79 a	1.2 a	3.67 a	22 June c	3 July b	17 July b	25 a
Meeker	3.8 b	1.62 a	0.8 a	3.50 a	6 July a	16 July a	26 July a	20 b
Tulameen[x]	0.7 b	1.62	0.7	3.60	8 July	17 July	29 July	21
Willamette	3.1 b	1.72 a	0.2 a	2.70 a	26 June b	6 July b	17 July b	21 b

[z]Data from the following harvest seasons and plantings are included. All plantings at Puyallup, Wash. unless noted; 1998 harvest in 1995 planting; 1999 harvest in 1996 planting; 2003 harvest in 2000 planting; and 2001 harvest in 1999 planting at Vancouver, Wash. Only yield data collected from Vancouver planting.
[y]Means within a column followed by the same letter are not significantly different at $P \leq 0.05$, by Duncan's multiple range test.
[x]No plots survived in the 1995 and 2000 plantings for Tulameen. Tulameen only included in yield analyses. Values from 1996 planting for comparison.

Table 3. Analysis of raspberry fruit harvested July 2003, Puyallup, Wash.[z]

Cultivar	Soluble solids (%)	pH	Titratable acidity (% citric acid)	Anthocyanins[y] ($mg \cdot g^{-1}$ fruit)
Cascade Dawn	10.65 bc[x]	2.69 a	0.77 b	0.38 b
Cascade Delight	11.50 bc	2.76 a	1.33 ab	0.63 a
Chemainus	10.37 c	2.41 a	1.55 a	0.58 a
Meeker	12.07 ab	2.70 a	0.85 b	0.46 ab
Tulameen	12.77 a	2.59 a	0.97 ab	0.48 ab
Willamette	11.20 bc	2.52 a	0.96 ab	0.54 ab

[z]Analysis of three replications of 10 g of fruit.
[y]Total anthocyanins determined spectrophotometrically from acidified ethanol extracts and expressed as cyanidin 3-galactoside (Torre and Barritt, 1977)
[x]Means within a column followed by the same letter are not significantly different at $P \leq 0.05$, by Duncan's multiple range test.

Table 4. Fruit morphological characteristics of red ripe fruit harvested 3 July 2002, Puyallup, Wash.[z]

Parameter	Malahat	Prelude	Cascade Dawn
Fruit weight (g)	4.65 b[y]	3.91 b	5.99 a
Length (mm)	25.5 b	20.2 c	28.1 a
Width (mm)	20.6 a	20.7 a	21.8 a
Length to width ratio	1.24 a	0.98 b	1.29 a
Receptacle diameter (mm)	8.5 b	8.1 b	10.0 a
Receptacle length (mm)	18.4 b	13.1 c	21.5 a
Drupelet length (mm)	5.86 a	5.32 b	5.48 ab
Drupelet width (mm)	4.50 a	4.00 a	4.24 a
Number of drupelets	94.8 b	95.0 b	135.4 a
Drupelet weight (mg)	49.2 a	41.4 b	44.4 ab
Total seed weight (mg)	136 b	171 a	178 a
Individual seed weight (mg)	1.43 b	1.79 a	1.33 b
Color[x]			
L*	30.34 a	29.10 a	28.28 a
a*	24.82 a	25.48 a	25.62 a
b*	9.5 a	8.98 a	9.94 a

[z]Analysis of 10 fruit per clone.
[y]Means within a column followed by the same letter are not significantly different at $P \leq 0.05$, by Duncan's multiple range test.
[x]Color measured as L*, a*, b* with a Minolta Chroma Meter CR200b (Minolta, Ramsey, N.J.).

3). The fruit of 'Cascade Dawn' had among the lowest soluble solids and had the lowest values for titratable acidity and anthocyanins. The combination of moderate soluble solids and low titratable acidity results in a mild, well balanced flavor.

Fruit of 'Cascade Dawn' is long conic in shape and glossy (Fig. 2). Fruit characters of red ripe fruit samples of 'Cascade Dawn' were compared to the early season fresh market cultivars 'Prelude' and 'Malahat' from early in the harvest season (Table 4). 'Prelude' is a very early ripening raspberry developed at Cornell University (Weber et al., 2004) and 'Malahat' is an early season fresh market raspberry grown in the PNW (Kempler and Daubeny, 1999). The fruit of 'Cascade Dawn' is large and long, with many drupelets per fruit and relatively small seeds.

Fruit of 'Cascade Dawn', 'Malahat' and 'Prelude' were harvested at a fresh market stage and stored at 4 °C for 6 d and then at room temperature (about 20 °C) for 4 h. Firmness and color were measured before storage and after storage (Table 5). Before storage, fruit of 'Cascade Dawn' was similar to 'Malahat' in firmness and slightly darker. 'Prelude' was softer than both 'Cascade Dawn' and 'Malahat' and lighter in color than 'Cascade Dawn'. After storage, fruit of 'Cascade Dawn' was slightly firmer than 'Malahat' and both were firmer than 'Prelude'. After storage, 'Cascade Dawn' was slightly darker than 'Malahat'.

Plant Description

'Cascade Dawn' is very vigorous, producing more canes per hill than either 'Malahat' or 'Willamette' and 'Cascade Dawn' produced canes that were longer than 'Malahat' (data not shown). Plants have been grown in the hill system with 10 to 12 canes retained per hill and the primocanes pruned to 1.2 m in winter. The following summer, fruiting plots were 1.8 m tall with a width of 1.2 m.

Basal portions of young canes (<30 cm tall) have 20 to 40 spines per cm of cane. Spines are straight and point toward the base of the canes. There are pigmented spots at the base of the spine that are the same color or slightly lighter than the spines. The spine color is similar to 'Malahat' and 'Willamette'. The canes are glabrous.

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 floricane leaves have three leaflets. 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 primocane leaves of 'Cascade Dawn' were compared to two early season PNW cultivars ('Malahat' and 'Willamette') and both parents (Table 6). The basal lateral leaflets of primocane leaves of 'Cascade Dawn' have petiolules longer than the other

Table 5. Storage of fruit harvested 5 July 2002, Puyallup, Wash.[z] Color[y]

	Fruit firmness	Color		
	(N)	L*	a*	b*
Fruit characteristics before storage				
Prelude	1.21 b[x]	34.1 a	32.6 a	14.3 a
Malahat	2.57 a	33.5 a	27.6 b	13.0 a
Cascade Dawn	2.42 a	29.4 b	24.3 c	10.5 b
Fruit characteristics after storage				
Prelude	0.79 c	30.0 ab	27.2 a	10.4 a
Malahat	1.78 b	31.6 a	22.5 b	8.4 b
Cascade Dawn	1.89 a	29.0 b	22.0 b	8.5 b

[z]Twelve fruit measured for 'Malahat' and 'Cascade Dawn' and six fruit for 'Prelude' on each date. Fruit stored 6 d at 4 °C, then room temperature (20 °C) for 4 h.
[y]Color measured as L*, a*, b* with a chromameter (CR200b; Minolta, Ramsey, N.J.).
[x]Means within a column followed by the same letter are not significantly different at $P \leq 0.05$, by Duncan's multiple range test.

Table 6. Primocane leaves measured at 1.2 m height on 19 June 2003, Puyallup, Wash.[z]

	Malahat	Willamette	Cascade Dawn	WSU 608	WSU 991
Petiole length (mm)	71.2 b[y]	65.6 b	66.6 b	76.4 b	99.0 a
Rachis length (mm)	42.6 b	37.4 b	42.8 b	45.4 ab	51.6 a
Stipule length (mm)	7.0 a	7.5 a	5.6 a	5.8 a	6.1 a
Terminal leaflet					
Length (mm)	111.6 a	80.2 b	88.8 b	113.8 a	111.8 a
Width (mm)	77.6 ab	54.8 c	58.2 c	72.4 b	88.0 a
Petiolule length (mm)	19.6 bc	14.4 c	22.3 b	15.1 c	33.5 a
Distal lateral leaflet					
Length (mm)	85.2 a	65.2 c	71.8 bc	81.6 ab	87.4 a
Width (mm)	44.0 b	32.6 c	35.6 c	37.0 bc	54.0 a
Petiolule length (mm)	0.0 c	0.0 c	2.4 a	0.0 c	1.2 b
Basal lateral leaflet					
Length (mm)	100.4 ab	80.2 c	81.6 c	110.6 a	97.2 b
Width (mm)	69.4 a	52.0 b	53.2 a	66.8 a	62.8 a
Petiolule length (mm)	2.2 c	3.2 c	14.1 a	11.6 b	4.3 c
Color[x]					
Upper surface of leaflet					
L*	33.8 c	37.8 a	35.3 b	34.4 bc	35.7 b
a*	–11.7 a	–16.5 a	–15.8 a	–13.3 a	–9.1 a
b*	14.9 c	23.4 a	22.2 ab	16.6 c	19.7 b
Lower surface of leaflet					
L*	54.0 c	58.1 ab	59.8 a	53.4 c	56.8 b
a*	–7.1 a	–7.7 ab	–7.4 a	–8.4 b	–7.9 ab
b*	10.3 a	11.7 a	11.9 a	12.2 a	11.1 a

[z]Five leaves were measured for each clone.
[y]Means within a column followed by the same letter are not significantly different at $P \leq 0.05$, by Duncan's multiple range test.
[x]Color measured as L*, a*, b* with a chromameter (CR200b; Minolta, Ramsey, N.J.).

raspberries to which they were compared and much longer than most. The leaflet bases were rounded and asymmetrical. The distal lateral leaflets of 'Cascade Dawn' had petiolules longer than WSU 991 (one of the parents) and the other raspberries had sessile leaflets. Most cultivars have sessile distal lateral leaflets. The bases of the distal lateral leaflets are rounded and relatively symmetrical.

Disease and Pest Reaction

'Cascade Dawn' is susceptible to the large raspberry aphid (*Amphorophora agathonica* Hottes), the vector for the mosaic virus complex. Plants of 'Cascade Dawn' have been tested repeatedly for raspberry bushy dwarf virus (RBDV) using ELISA and have not tested virus positive. 'Cascade Dawn' may be resistant to pollen transmission of RBDV. In unsprayed plots, the canes had a moderate incidence of spur blight (*Didymella applanata* [Niessl] Sacc.), somewhat more than 'Cascade Delight'. It may exhibit some degree of field resistance to root rot (*Phytophthora fragariae* var *rubi* Wilcox & Duncan). A sample from a nearby selection was collected from a field where plants showed severe root rot symptoms and the sample tested positive for *Phytophthora fragariae* var *rubi* via PCR. 'Cascade Dawn' has been planted in areas with high levels of root rot and has survived well and had good yields (Table 2). The yield differences for 'Cascade Dawn' may overstate the root rot tolerance, because they are based on relatively short duration plantings. However, it is more root rot tolerant than the cultivars to which it was compared.

Uses

The fruit of 'Cascade Dawn' is large and glossy with excellent fresh flavor. These characters would make 'Cascade Dawn' ideally suited for fresh use. The fruit of 'Cascade Dawn' does not release from the receptacle until almost fully ripe. Based on these observations, 'Cascade Dawn' would be best suited for hand harvesting for local fresh market.

Availability

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

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