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‘Malahat’ Red Raspberry

Chaim Kempler and Hugh A. Daubeny
Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, P.O. Box 1000, Agassiz, B.C., Canada V0M 1A0

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‘Malahat’ (Fig. 1) is a new floricane-fruiting red raspberry (*Rubus idaeus* L.) cultivar from the breeding program at the Pacific Agri-Food Research Centre (PARC) of Agriculture and Agri-Food Canada (AAFC), Agassiz, B.C. ‘Malahat’ produces high yields of large, relatively firm fruit that ripens early and is well suited to the fresh market.

‘Malahat’, a British Columbia native Indian word that translates as “place where one gets bait,” is a mountain located north of Victoria on Vancouver Island. The Island Highway, which is part of the Trans Canada Highway system, traverses this mountain. The choice of the name is in keeping with the tradition of choosing British Columbia native Indian words for the berry cultivars developed by the PARC.

Origin

‘Malahat’, which was tested as BC 85-5-24, was selected by H.A. Daubeny from a 1985 cross of ‘Meeker’ x BC/SCRI 7853/116 (Fig. 2). In recent years, ‘Meeker’ has replaced its ‘Willamette’ parent as the most widely planted red raspberry cultivar in the Pacific Northwest (PNW) (Moore and Daubeny, 1993). BC/SCRI 7853/116 was selected from a population of seedlings grown in the PARC program from a cross made by D.L. Jennings at the Scottish Crop Research Institute (SCRI), Dundee. The parents of the cross were ‘Nootka’, released from the PARC program in 1978 (Daubeny, 1978), and SCRI 7269/67, a firm-fruited selection derived from both the black raspberry (*Rubus occidentalis* L.) and the Japanese wineberry (*R. phoenicolasius* Maxim). The *R. occidentalis* derivative was originally obtained from the breeding program at Horticulture Research International at East Malling in England, where the species has been used primarily as a source of fruit firmness (Daubeny, 1996). The *R. phoenicolasius* derivative came from the SCRI program, where the species was primarily used as a possible source of cane beetle [*Byturus tomentosus* (Deg.)] resistance. The diverse origin of ‘Malahat’ clearly demonstrates the international nature of modern-day raspberry breeding programs and the concerted efforts being made to broaden the genetic base for new cultivars.

Performance and description

Performance data for ‘Malahat’ and several other PNW cultivars were obtained from five replicated plantings set in 1989, 1992, 1993, 1994, and 1995 at PARC’s Substation in Abbotsford, B.C. (Tables 1–2). The first three plantings were evaluated for 3 years, while the latter two were evaluated for 2 and 1 years, respectively. In each planting, a cultivar was represented by three plants replicated three times. Yield, fruit weight, fruit firmness, dates of harvest, and postharvest fruit rot (caused primarily by *Botrytis cinerea* Pers. ex. Fr.) were measured each season from 1991 to 1997. Soluble solids concentration (SSC), firm-

Fig. 1. Fruiting lateral of ‘Malahat’ red raspberry.

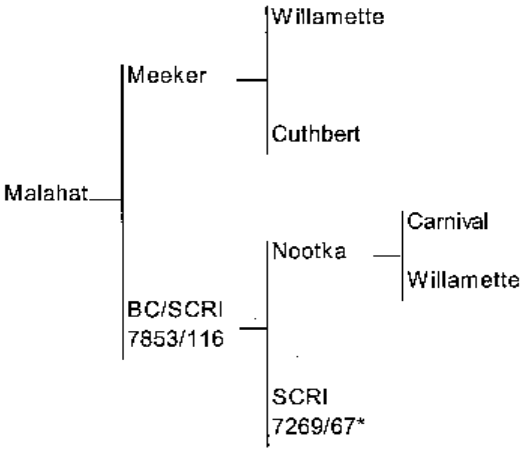

Fig. 2. Pedigree of ‘Malahat’ red raspberry. *Selection SCRI 7269/67 has a complex parentage, including ‘Burnetholm’, ‘Devon’, ‘Lloyd George’, ‘Malling Jewel’, ‘Malling Landmark’, ‘Newburgh’, ‘Preussen’, *Rubus occidentalis*, and *R. phoenicolasius* in its ancestry.

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Table 1. Yield, fruit weight and harvest season of 'Malahat' and other Pacific Northwest red raspberry cultivars.[z]

			Early harvest years[y]			Late harvest years[x]		
Cultivar	Yield per plant (kg)	Wt/fruit[w] (g)	First harvest (date)	50% Harvest (date)	Harvest duration (d)	First harvest (date)	50% Harvest (date)	Harvest duration (d)
Malahat	3.06	3.5	17 June	1 July	38	3 July	17 July	32
Chilcotin	2.93	2.8	---	---	---	7 July	24 July	36
Chilliwack	2.39	2.8	27 June	13 July	36	9 July	24 July	38
Meeker	2.90	2.8	25 June	12 July	39	9 July	24 July	34
Qualicum	4.06	3.9	25 June	12 July	40	8 July	24 July	40
Skeena	3.26	2.9	---	---	---	8 July	22 July	32
Tulameen	3.75	3.9	25 June	12 July	43	9 July	24 July	41
$LSD_{0.05}$[v]	0.50	0.2	2	1	2	3	3	4

[z]Yield, fruit weight, and harvest dates are means from five plantings made in 1989, 1992, 1993, 1994, and 1997 (see text for details).
[y]The years when harvesting began before 1 July (1992, 1994, 1995, and 1997).
[x]The years when harvesting began after 1 July (1991, 1993, and 1996).
[w]Fruit weight was based on the mean of 50 fruit/harvest.
[v]LSD is significant at $P \leq 0.05$.

Table 2. Fruit traits of 'Malahat' and other Pacific Northwest red raspberry cultivars.

				Botrytis-incited fruit rot after 48 h[x] (%)		
Cultivar	Firmness[z] (N)	Soluble solids concn[z] (%)	Titratable acid[y] (% citric acid)	1993	1994	1997
Malahat	1.84	10.8	1.55	45.0	70.8	33.3
Chilcotin	1.15	8.1	---	70.1	60.4	---
Chilliwack	1.83	11.7	1.55	41.0	41.0	51.7
Comox	1.50	10.5	---	42.4	68.1	---
Meeker	1.43	11.3	1.37	41.0	70.1	55.0
Qualicum	1.90	11.0	1.72	28.3	53.5	53.3
Skeena	1.22	10.5	---	64.6	83.3	---
Tulameen	1.83	11.5	1.67	52.8	77.1	51.7
$LSD_{0.05}$[w]	0.40	1.1	0.16	15.3	15.7	NS

[z]Means for 10 fruit from each of three harvests in 1991–93, 1995–97. Firmness = force in newtons required to close the opening of individual fruit with a mechanical force gauge (Hunter Spring, Ametek).
[y]Means for 10 fruit from the 1992 harvest.
[x]Means for five tests in 1993, three tests in 1994, and one test in 1997. Each cultivar was represented by 12 to 15 fruit from each of four replications.
[w]LSD is nonsignificant (NS) or significant at $P \leq 0.05$.

ness, titratable acidity, and postharvest fruit rot tests were determined according to Barritt et al. (1980) and Daubeny and Pepin (1974). Fruit were harvested from 9 to 14 times a season, depending on the length of a cultivar's harvest period and temperature effects on fruit ripeness. 'Malahat' was also evaluated at Mt. Vernon and Puyallup, Wash.; Aurora, Ore.; and in grower fields in British Columbia, Washington, and Oregon.

'Malahat' yielded significantly less than 'Qualicum' and 'Tulameen', significantly more than 'Chilliwack' and about the same as 'Chilcotin' and 'Skeena' (Table 1). Its fruit weight was significantly less than that of 'Tulameen' and 'Qualicum' and significantly greater than that of the other cultivars. 'Malahat' was the earliest fruiting cultivar, especially in years when harvest started before 1 July.

'Malahat' proved to be one of the firmest cultivars, and its SSC and titratable acidity were within the range of fresh and processed cultivars (Table 2).

In a trial planted in 1994 at the Washington State Univ. (WSU) Research and Extension Center at Puyallup, 'Malahat' yields were similar to those of 'Meeker', 'Comox', 'Willamette', 'Chilliwack', and 'Tulameen' (data not presented). Fruit weight of 'Malahat' was greater than any of these cultivars with the exception of 'Tulameen'. 'Malahat' and 'Willamette' had the earliest 5% and 50% harvest dates of any of the cultivars. Since 'Willamette' is unsuited to the fresh market (Daubeny et al., 1989), 'Malahat', with its superior fruit qualities, will be particularly useful for this market. In a trial planted at WSU Mt. Vernon Research and Extension Center in 1994, 'Malahat' fruit was ripe 7 d earlier in both 1996 and 1997 than fruit of either 'Meeker' or 'Comox' (data not presented). Yield of 'Malahat' was similar to that of each of the other varieties but fruit weight was greater than that of 'Meeker' and similar to that of 'Comox'.

In a trial planted at Aurora, Ore., in 1994, 'Malahat' yielded less than either 'Comox' or 'Chilliwack' and the same as 'Tulameen', 'Willamette', 'Meeker', and 'Chilcotin' (data not presented). 'Comox' has been recognized for its high yield (Daubeny and Anderson, 1991). Fruit weight of 'Malahat' was greater than that of all of the other cultivars except 'Tulameen', which is recognized for its heavy fruit.

We consider 'Malahat' fruit, which is conic in shape, to be attractive and appealing. It is medium red and not quite as glossy as 'Tulameen'. Fresh flavor, while not as sweet as that of 'Chilliwack', is considered good. 'Malahat' fruit releases readily from the receptacle, making it suitable for both machine and hand harvesting.

'Malahat' flowers are self-fertile, and percentage of drupelet set under field conditions appears to be similar to that of 'Meeker', 'Tulameen', 'Qualicum', and 'Chilliwack', each of which is recognized for high percentage of set (Daubeny, 1971, 1987; Daubeny and Anderson, 1991; Daubeny and Kempler, 1995).

The moderately vigorous primocanes appear as vigorous as those of 'Meeker' and 'Comox', are green with purple spines that occur throughout the length, but are denser at the base. Production of primocanes is considered sufficient. Floricanes are brown with gray overlay and show basal cracking. Spines occur throughout the length but are not considered excessive. 'Malahat' fruiting laterals are shorter than that of 'Meeker', 'Qualicum', and 'Tulameen'.

Information on relative winter hardiness is limited to visual observations in the unusually cold Winter 1996. In PARC plots at the Abbotsford Substation, B.C., 'Malahat' appeared to be damaged as much as 'Meeker' and 'Willamette' and more than 'Chilliwack', 'Comox', 'Qualicum', and 'Tulameen'. In WSU plots at Prosser, 'Malahat' was damaged less than 'Tulameen', 'Chilcotin', 'Meeker', and 'Willamette' and more than 'Comox', 'Algonquin', 'Qualicum', 'Skeena', and 'Chilliwack'. Thus, 'Malahat' is considered to be similar to other PNW cultivars in hardiness.

'Malahat' (BC85-5-24) has been characterized by isoenzyme analysis (Cousineau et al., 1993). The patterns obtained are as follows, with the letters indicating the banding patterns: malate dehydrogenase, B; phosphoglucomutase, C; phosphoglucoisomerase, A; triosephosphate isomerase, B; isocitrate dehydrogenase, A; shikimate dehydrogenase, A.

Disease and pest reactions

Reaction of 'Malahat' to postharvest fruit rot caused by *B. cinerea* has been variable over the 3 years that it has been determined (Table 2).

'Malahat' was selected in greenhouse screening trials for resistance conferred by the gene Ag_1 to the common biotype of *Amphorophora agathonica* Hottes, the North American aphid vector of the raspberry mosaic virus (RMV) complex. Since 1990, aphid colonization has been noted on plants of the cultivar in the PARC Substation, Abbotsford, trials. We assume that this is a resistance-breaking biotype of the aphid, which has been found on other cultivars with Ag_1 gene (Daubeny and Anderson, 1993; Daubeny and Kempler, 1995). The RMV complex has not been found in yearly (1991–97) indexing of plants in the trials using the double-stranded RNA technique (Kurppa and Martin, 1986). 'Malahat' plants, growing at PARC Abbotsford, have been indexed for raspberry bushy dwarf virus (RBDV), using the enzyme-linked immunosorbent assay technique, at least once a year since the genotype was selected for promising fruit characteristics in 1988. It tested positive for the first time in 1996 in plots that were established in 1992 at PARC's Abbotsford Substation.

Exposure to *Phytophthora fragariae* Hickman var. *rubi* Wilcox & Duncan (syns. *P. erythroseptica* Pethyp., *P. megasperma* Drechs.) in greenhouse pot tests showed that 'Malahat' was as susceptible as its parent 'Meeker' and less susceptible than 'Willamette' (Levesque and Daubeny, 1999). In field trials at the WSU Research and Extension Center at Puyallup, and at the Mt. Vernon Research and Extension Center, Washington, 'Malahat' was very susceptible to root rot (unpublished data). We recommend that 'Malahat' be planted on well-drained soil that is free of *P. fragariae* var. *rubi*–incited root rot.

At the PARC Substation, 'Malahat' has been moderately susceptible to spur blight [*Didymella applanata* (Niessl) Sacc.], to cane *Botrytis* (*B. cinerea*), and to cane spot (*Elsinoe veneta* Burkh.).

Adaptability and uses

'Malahat' is well adapted for early fresh-market production in the PNW. It is suitable for machine harvesting and therefore used for processing. Because 'Malahat' ripens earlier than 'Meeker', it allows Oregon growers a longer harvest season and better utilization of harvesting equipment.

'Malahat' is also well adapted to off-season, fresh-market production in Huelva, Spain. Floricanes are produced at high elevation nurseries and transplanted in the fall into plastic greenhouses. 'Malahat' produces large, high-quality fruit starting in February, ≈2 to 3 weeks earlier than 'Tulameen', which is the standard for this production method.

Availability

Certified 'Malahat' plants are being propagated under royalty agreements with propagators in the PNW. For licensing information contact Okanagan Plant Improvement Company (PICO), P.O. Box 6000, Summerland, BC, Canada, V0H 1Z0 (e-mail address: PICO@em.agr.ca).

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