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'Tulameen' Red Raspberry

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'Tulameen' (Fig. 1) is a new floricanefruit-
ing red raspberry (*Rubus idaeus* L.) cultivar
from the breeding program at the Agriculture
Canada Research Station, Vancouver, British
Columbia (BC). 'Tulameen' produces high
yields of exceptionally large fruit with excel-
lent quality. Although the cultivar appears well
suited to both processing and fresh market, it
will be of particular interest for the latter since
the harvest season begins relatively late and
lasts longer than that of the widely grown Pa-
cific Northwest (PNW) cultivars. Its season-
overlaps that of several early primocane-fru-
iting cultivars. Thus, there is a greater chance
of a continuous supply of fruit to meet fresh-
market demands.

'Tulameen' is a BC native Indian word
that translates as red earth. It is the name of
a river in the interior of the province that has
bluffs of red soil above it. The choice of the
name is in keeping with the tradition of
choosing appropriate BC native Indian words
for cultivars developed by the breeding pro-
gram at the Vancouver Research Station.

Origin

'Tulameen', which was tested as BC 80-28
53, was selected from a 1980 cross of 'Nootka'
x 'Glen Prosen'. 'Nootka', released from the
BC breeding program in 1978, is from the
cross of 'Carnival' x 'Willamette' (Daubeny,
1978b). Despite being well suited to machine
harvesting, the cultivar has not been widely
grown in the Pacific Northwest. 'Glen Pro-
sen', released from the Scottish Crop Research
Inst. (SCRI) breeding program in 1981, is from
the cross of SCRI selections whose parentage
includes 'Cumberland' black raspberry (*R. oc-
cidental* L.), 'Malling Jewel', 'Burnetholm',
'Lloyd George', and 'Malling Landmark'
(Jennings, 1982). It is now widely planted in

Great Britain and is noted for its firm fruit
texture (Jennings, 1988).

'Tulameen' is the first floricanefruit-
ing red raspberry cultivar released in North
America that has the black raspberry cultivar
Cumberland in its ancestry. 'Cumberland' has
been used extensively in breeding programs
in Great Britain and is in the ancestry of most
recent red raspberry cultivars from there
(Jennings, 1988; Keep, 1984, Keep and
Knight, 1968). 'Tulameen' fruit traits, ap-
parently derived from the black raspberry,
include late ripening and relatively firm fruit
texture.

Performance and description

Performance data over 4 years for 'Tula-
meen', in comparisons with each of six other
PNW cultivars planted in 1984, were ob-
tained in an unreplicated trial at Abbotsford,
B.C. (Tables 1-3). The recently released
'Centennial' was not included in the com-
parisons since it lacks cold hardiness at Ab-
botsford (Moore et al., 1990). Over the 4
years, 'Tulameen' produced higher yields than
the other cultivars, excluding 'Comox' (Ta-

ble 1), which has been noted for its high
yields (Daubeny, 1987).

The fruit of 'Tulameen' was heavier than
any of the other cultivars, including 'Comox'
(Table 1), which has been noted for its large
size (Daubeny, 1987). 'Tulameen' fruit
weighed nearly 2 g more than that of 'Wil-
lamette', which was, until recently, the most
widely planted cultivar in the PNW (Dau-
beny et al., 1989).

The first harvest date for 'Tulameen' was
later than that of 'Skeena' and 'Willamette'
and similar to that of the other cultivars (Ta-
ble 2). The 50% harvest date for 'Tulameen'
was later than the other cultivars, with the

Table 1. Yield and fruit weight of 'Tulameen'
and other Pacific Northwest red raspberry cul-
tivars.^z

Cultivars	Yield ^y (kg/plant)	Wt ^x (g/fruit)
Tulameen	6.00 a	5.38 a
Chilcotin	4.07 bc	3.43 de
Chilliwack	3.77 c	3.69 cd
Comox	6.60 a	4.35 b
Meeker	4.58 b	3.48 de
Skeena	4.18 bc	3.63 de
Willamette	3.75 c	3.40 e

^zMean separation within columns by Duncan's
multiple range test, $P = 0.05$.

^yYields were taken in 1986, 1987, 1988, and 1989
from single plots of five plants established at Ab-
botsford, B.C., in 1984. The plants were main-
tained in stool beds, each containing six canes.
The number of harvests varied from nine to 14,
depending on cultivar and year. Years were used
as replication in the analysis of variance.

^xFruit weight was based on the mean weight of 50
fruit/harvest.

Fig. 1. Fruit of 'Tulameen' red raspberry.

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be hereby marked *advertisement* solely to indicate
this fact.

Table 2. Season of 'Tulameen' and other Pacific Northwest red raspberry cultivars."

Cultivars	First harvest date	50% Harvest date	Harvest duration (days)
Tulameen	1 July b	21 July e	50 a
Chilcotin	28 June ab	18 July cd	44 b
Chilliwick	2 July b	15 July abc	35 c
Comox	1 July b	16 July bc	36 c
Meeker	1 July b	19 July de	37 c
Skeena	25 June a	13 July ab	39 c
Willamette	27 June a	12 July a	37 c

Season data were taken in 1986, 1987, 1988, and 1989 from single plots of five plants established at Abbotsford, B.C., in 1984. Years were used as replication in the analysis of variance.

Mean separation within columns by Duncan's multiple range test, $P = 0.05$.

Table 3. Fruit traits of 'Tulameen' and other Pacific Northwest red raspberry cultivars."

Cultivar	Soluble solids concn ^y (%)	Titrateable acidity ^x (% citric)	Fruit firmness ^w (N)
Tulameen	9.9 b	1.88 a	1.53 ab
Chilcotin	8.5 cd	---	1.09 c
Chilliwick	11.3 a	1.72 b	1.54 ab
Comox	9.2 bc	1.82 a	1.61 a
Meeker	9.4 bc	1.51 c	1.09 c
Skeena	9.7 b	---	1.23 bc
Willamette	8.1 d	---	1.12 c

Mean separation within columns by Duncan's multiple range test, $P = 0.05$.

Means of 10 fruit from each of two harvests in 1989, three harvests in 1986 and 1988, and four harvests in 1987.

Means of 10 fruit from each of three harvests in 1988 and two harvests in 1989. No determinations were made for 'Chilcotin', 'Skeena', and 'Willamette'.

Fruit firmness is given in newtons (N), which is the force required to close the opening of the fruit (compression).

Table 4. Winter damage, yield, and fruit weight of 'Tulameen' and other Pacific Northwest red raspberry cultivars in a 1987 planting at Abbotsford, B.C., in 1989."

Cultivar	Winter damage ^y (% dead buds)	Yield ^x (kg/plant)	Wt ^w (g/fruit)
Tulameen	26 a	7.54 a	5.1 a
Chilcotin	21 ab	4.37 b	3.3 d
Chilliwick	19 ab	4.89 b	3.9 b
Comox	14 ab	7.33 a	4.0 b
Meeker	23 a	4.18 b	3.3 d
Skeena	9 b	6.15 ab	3.4 cd
Willamette	25 a	3.92 b	3.8 bc

Mean separation within columns by Duncan's multiple range test, $P = 0.05$.

Winter damage was recorded as percentage of dead buds in two canes selected at random in each of three replications of a cultivar.

Mean of three replications, each containing three plants with six canes per stool. The number of harvests varied from nine to 14, depending on cultivar.

Fruit weight was based on the mean weight of 50 fruit/harvest.

exception of 'Meeker', and the harvest duration of 50 days was longer than that of all the other cultivars. The 'Tulameen' season overlapped that of several early primocane-fruited cultivars, including 'Amity', 'Summit', and 'Malling Autumn Bliss' (data not presented).

The soluble solids content (SSC) of 'Tulameen' fruit was lower than that of 'Chilliwick', which has been noted for its high SSC (Daubeney, 1987), but was higher than that of 'Chilcotin' and 'Willamette' and similar to that of the other cultivars (Table 3). Titrateable acidity, determined by titration with 0.1 N NaOH to pH 8.1, was compared with only three of the other cultivars: it was the same as that of 'Comox' and higher than that of 'Chilliwick' and 'Meeker'. Fruit firmness of 'Tulameen', determined by the method described by Barritt et al. (1980), was similar to that of 'Comox', 'Chilliwick', and

'Skeena' and higher than that of 'Willamette', 'Meeker', and 'Chilcotin'.

In 1987, 'Tulameen' was placed in replicated trials at Abbotsford and at Puyallup, Wash., and in unreplicated trials at Aurora, Ore., and Simcoe, Ontario. Data and observations from these trials were obtained in 1989 and 1990.

In the 1987-planted trial at Abbotsford, the 1989 performance of 'Tulameen' was of particular interest since minima of -16C were recorded in early February, which resulted in fairly extensive winter damage, recorded as percentage of dead buds (Table 4). 'Tulameen' showed about the same amount of damage as the other PNW cultivars, with the exception of 'Skeena', which showed less. Compared to the standard cultivars Chilcotin, Chilliwick, Comox, Meeker, Skeena, and Willamette, 'Tulameen' outyielded all but 'Comox' and 'Skeena' and produced the

heaviest fruit (Table 4). The performance of 'Tulameen' in that trial was consistent with that observed the same year in the 1984-planted trial at this location.

At Puyallup, after minima of -12C recorded in early Feb. 1989, 'Tulameen' outyielded 'Willamette', but not 'Meeker', 'Comox', or 'Chilliwick', the other standard cultivars in the trial, and produced the largest fruit (data not presented).

We consider 'Tulameen' fruit, which is long and conic in shape, glossy, and medium red, to be particularly attractive and appealing. Fresh flavor, while not as sweet as that of 'Chilliwick', is, in our judgment, similarly pleasant and slightly aromatic. The fruit appears to have a good shelf life and maintains an attractive appearance for 8 days at 4C. It appears to be well suited to processing, both as an individual quick-freeze (IQF) product and as a dessert pack. In the trials planted at Puyallup, Aurora, and Simcoe, 'Tulameen' has been noted for its large, firm, and attractive fruit. At Puyallup, it was considered the best suited of 20 cultivars and selections examined for fresh-market quality.

In 1990, when maxima >30C were recorded for several days during the harvest season at Abbotsford, we observed that 'Tulameen', along with 'Meeker', showed less sunscald than the other PNW cultivars.

Fruit of 'Tulameen' releases readily from the receptacle, a trait that is desirable for machine-harvesting. However, the long ripening season is not ideally suited to this type of harvesting since it means that more machine runs may be needed and, thus, there would be more chance of plant damage and soil compaction.

Flowers of 'Tulameen' are self-fertile, and percent drupelet set under simulated monoculture conditions has been high and similar to that of 'Meeker' and 'Skeena', both of which are recognized for high percent set (Daubeney, 1971, 1978a) (data not presented).

Primocanes of 'Tulameen' are vigorous, nonpubescent, and green with an irregularly distributed purple overlay that is more concentrated at the base than the top. Spines are purple, sharp, though not objectionable or dense, and largely restricted to the basal portions. The cultivar is not a prolific producer of primocanes, but the numbers produced are sufficient after plant establishment. The lower production may be an advantage with the increasing restrictions being placed on the use of chemicals for primocane control.

Floricanes of 'Tulameen' are sturdy, fairly upright, and grayish-yellow with general basal cracking. Fruiting laterals are strongly attached, relatively long, and more upright than those of 'Meeker' and 'Comox', but less upright than those of 'Chilliwick' and 'Skeena'. Lateral length and habit are not considered detrimental to machine-harvesting. Fruits are well spaced and do not present a bunched or clustered appearance. They have relatively long pedicels that aid in giving excellent exposure for hand-harvesting.

'Tulameen' has been characterized by

isozyme analysis using the procedures described by Cousineau and Donnelly (1989). The patterns obtained are as follows, with the letters indicating the banding patterns: malate dehydrogenase, D; phosphoglucosyltransferase, C; phosphoglucosyltransferase, A; triosephosphate isomerase, A; isocitrate dehydrogenase, A (J.C. Cousineau, personal communication).

Disease and pest reactions

Plants of 'Tulameen' have been indexed for raspberry bushy dwarf virus (RBDV), using the enzyme-linked immunosorbent assay technique, at least once a year since being placed in the field at Abbotsford in 1984. In 1990, for the first time, two of the six plants tested positive for RBDV infection. Throughout this period, initially virus-free clones of known RBDV-susceptible cultivars have become infected. From these results it was concluded that 'Tulameen' has some resistance to pollen transmission of the virus. However, in the 1987 planting at Puyallup, where there is a particularly high frequency of RBDV transmission in the breeding plots (Moore et al., 1990), infection was found in 1989.

'Tulameen' was selected as resistant to *Amphorophora agathonica* Hottes, the aphid vector of the raspberry mosaic virus (RMV) complex. Field observations in 1990 indicated that aphid colonization occurred on some previously resistant cultivars, including 'Tulameen'. The existence of a resistance-breaking biotype of the aphid is a possible explanation for this occurrence, but needs to be confirmed. To date, plants that supported aphid colonies have not been infected by any of the components of the RMV complex, as indicated by the double-stranded RNA technique (Kurppa and Martin, 1986).

'Tulameen' is relatively susceptible to preharvest fruit rot caused by *Botrytis cinerea* Pers. ex Fr, possibly due to its long flowering and fruiting season increasing the chance of exposure to the conditions conducive to *B. cinerea* infection. In contrast, 'Tulameen' has been no more susceptible to postharvest fruit rot, caused by *B. cinerea* and *Rhizopus* spp., than any of the other PNW cultivars (data not presented).

'Tulameen' is susceptible to spur blight [*Didymella applanata* (Niessl) Sacc.] and moderately susceptible to cane *Botrytis* (*Botrytis cinerea*) and to cane spot (*Elsinoe veneta* Burkh.).

Reaction to *Phytophthora*-incited root rot, as determined in greenhouse pot tests, showed that 'Tulameen' was less susceptible than 'Skeena', which has been highly susceptible in other greenhouse screening trials and under field conditions (Barritt et al., 1981; Bristow et al., 1988). In the field at Puyallup, where there is a relatively high incidence of *Phytophthora*-incited root rot, 'Tulameen' has shown resistance comparable to that of 'Centennial' (Moore et al., 1990; P.P. Moore, personal communication).

'Tulameen' is resistant to powdery mildew [*Sphaerotheca humuli* (DC) Barr.]. Reactions to crown gall [*Agrobacterium*

tumefaciens (Smith and Towns) Conn], bacterial blight [*Pseudomonas syringae* Van Hall], and root lesion nematode [*Pratylenchus penetrans* (Cobb) Fillip and Stek] are unknown.

Adaptability and uses

'Tulameen' appears to be well adapted to the northern portions of the PNW, and preliminary information suggests it will be adapted to the southern portions of the region. It is being tested in other red raspberry production regions, including those in eastern Canada, Great Britain, Australia, and New Zealand. Its large, firm, attractive fruit, which ripens over a long season, makes it appealing for fresh market. However, it also appears well suited to processing, particularly for the high-value IQF market.

Availability

The names of growers with certified 'Tulameen' plants will be supplied upon request.

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