

‘Valley Red’ Strawberry

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‘Valley Red’ is a new June-bearing (short-day) strawberry (*Fragaria ×ananassa* Duchesne ex Rozier) cultivar from the U.S. Department of Agriculture–Agricultural Research Service (USDA-ARS) breeding program in Corvallis, OR, released in cooperation with the Oregon Agricultural Experiment Station, The Washington State University Agricultural Research Center, and Agriculture and Agri-Foods Canada. ‘Valley Red’ is a high-yielding cultivar that produces medium-sized fruit that are very uniform in size and shape. The fruit is primarily suited to processing with its dark red internal and external color (Fig. 1). ‘Valley Red’ is named for its outstanding performance in the Willamette Valley in Oregon, the Skagit Valley in Washington, and the Fraser River Valley in British Columbia.

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Mention of trade names or commercial products in this manuscript is solely for the purpose of providing specific information and does not imply recommendation or endorsement by the U.S. Department of Agriculture.

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the Pacific Northwest (Moore, 1995; Moore et al., 1995).

‘Valley Red’ was tested at the Oregon State University–North Willamette Research and Extension Center (Aurora, OR), Washington State University Puyallup Research and Extension Center (Puyallup), Washington State University Mt. Vernon Northwest Washington Research and Extension Center (WSU–Mt. Vernon), and Agriculture and Agri-Food Canada, Pacific Agri-Food Research Center (AAFC-PARC Research Substation; Abbotsford, B.C.) and in grower fields in Washington and Oregon. The most thorough commercial testing was with Sakuma Bros. Farms (Burlington, WA). At the public research facilities, ‘Valley Red’ was planted in multiple nonreplicated and replicated trials established in 2001, 2003, 2004, and 2007. In all trials, the plants were grown in a matted row system in eight-plant plots with plants initially set 46 cm apart in the row in Oregon and 38 cm apart in Washington and British Columbia. During the harvest season, fruit were harvested once a week. The average fruit weight for a season was calculated as a weighted mean based on the weight of a randomly selected subsample of 25 fruit from each harvest. In multiple-year trials, yield and average fruit weight were analyzed as a split plot in time with cultivar as the main plot and year as the subplot, whereas in the single-year harvest from the Oregon 2007 planting, they were analyzed as a randomized complete block (Tables 1–4). Fruit firmness was measured in the WSU–Puyallup trial (Table 2) as the force required for a 4-mm-diameter cylinder (Hunter Spring Mechanical Force Gauge Series L; Ametek, Hatfield, PA) to penetrate to a depth of 6 mm in five randomly selected fruit from each harvest. The average fruit firmness for a season was calculated as a weighted mean. The plantings and the analyses (PROC GLM; SAS Institute, Cary, NC)

Origin

‘Valley Red’ was selected in 1996 from the cross ‘Anaheim’ × ‘Puget Reliance’ and was tested as ORUS 1790-1. ‘Anaheim’ (USPP 8659; Irvine × Cal 85.92-602) was released primarily as a short-day cultivar for southern California fresh market production (Voth et al., 1994). ‘Puget Reliance’ (USPP 9310; BC 77-2-72 × WSU 1945) is high-yielding, large-fruited, and well-adapted to



Fig. 1. Fruit from first harvest of ‘Tillamook’ (left) and ‘Valley Red’ (right).

Table 1. Fruit weight, percent fruit rot, and yield for strawberry cultivars planted in 2001 and 2007 in replicated plantings (three replications) at Oregon State University–North Willamette Research and Extension Center (Aurora, OR).

Cultivar	Fruit wt (g) ^z			Fruit rot (%)	Yield (kg·ha ⁻¹)
	2002	2003	2002–2003		
<i>OSU-NWREC, 2001 planted</i>					
Valley Red	15.0 a	9.4 a	12.2 ab	4.0 a	27,349 a
Puget Reliance	16.6 a	10.3 a	13.4 a	5.9 ab	19,519 ab
Redcrest	14.2 a	7.1 b	10.7 bc	11.1 b	11,822 bc
Totem	13.4 b	7.2 b	10.3 c	3.3 a	9,889 c
<i>OSU-NWREC, 2007 planted</i>					
Tillamook	15.0 a			5.7 a	40,748 a
Valley Red	15.3 a			5.5 a	30,514 b
Totem	14.9 a			9.9 a	23,051 b

^zMeans within a column followed by the same lowercase letter are not significantly different, $P > 0.05$, by least significant difference test.

Table 2. Fruit weight, percent fruit rot, fruit firmness, and yield for strawberry cultivars planted in 2001 and 2003 in replicated plantings (three replications) at Washington State University Puyallup Research and Extension Center.

Cultivar	Fruit wt (g) ^z		Fruit rot (%)		Fruit firmness (g)		Yield (kg·ha ⁻¹)
	2002	2003	2002	2003	2002	2003	
<i>2001 planted</i>							
Valley Red	16.2 b	12.2 b–d	0.3 a	2.1 a	220 b	222 b	34,131 a
Tillamook	22.0 a	18.6 a	2.3 a	0.5 a	215 bc	216 bc	32,784 a
Puget Reliance	16.3 b	12.7 b	1.1 a	1.1 a	183 c	202 bc	30,875 ab
Pinnacle	20.0 a	12.5 bc	3.0 a	1.9 a	296 a	307 a	29,864 ab
Puget Summer	14.4 b	10.7 b–d	1.6 a	1.8 a	229 b	204 bc	26,721 ab
Sumas	12.8 b	9.6 d	1.4 a	4.1 a	183 c	193 c	23,802 b
<i>2003 planted</i>							
Valley Red	10.6 c	8.6 a	5.1 ab	61.3 ab	206 a	281 a	20,964 a
Puget Reliance	11.6 c	11.1 a	2.6 b	81.4 a	221 a	303 a	20,880 a
Totem	13.7 b	8.7 a	8.4 a	42.7 b	245 a	249 a	18,583 a
Puget Summer	16.4 a	8.7 a	1.8 b	61.7 ab	222 a	247 a	14,874 a

^zMeans within a column followed by the same lowercase letter are not significantly different, $P > 0.05$, by least significant difference test.

Table 3. Fruit weight, percent fruit rot, and yield for strawberry cultivars planted in 2004 in replicated planting (three replications) at Washington State University Mount Vernon Northwest Washington Research and Extension Center.

Cultivar	Fruit wt (g) ^z		Fruit rot (%)		Yield (kg·ha ⁻¹)
	2005	2006	2005	2006	
Valley Red	13.3 c	11.7 b–d	23.7 bc	18.1 a	29,940 a
Stolo	16.9 bc	13.6 a–c	47.0 ab	17.8 a	27,656 a
Puget Reliance	14.8 c	12.0 b–d	31.5 bc	18.5 a	25,037 a
Pinnacle	21.4 ab	15.1 ab	23.4 bc	27.5 a	22,642 a
Totem	12.1 c	9.6 d	65.7 a	18.5 a	21,481 a
Tillamook	22.3 a	16.1 a	14.6 c	19.6 a	20,509 a
Puget Summer	15.5 c	10.0 cd	31.5 bc	8.2 a	18,750 a
Hood	16.2 bc	8.7 d	34.4 bc	26.4 a	17,327 a

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Table 4. Fruit weight, percent fruit rot, and yield for strawberry cultivars planted in 2004 in a replicated planting (three replications) at Agriculture and Agri-Food Canada (Abbotsford, British Columbia, Canada).

Cultivar	Fruit wt (g) ^z		Fruit rot (%)		Yield (kg·ha ⁻¹)	
	2005	2006	2005	2006	2005	2006
Valley Red	10.9 b	12.5 ab	11.5 b	10.2 ab	15,580 ab	31,000 a
Whonnock	10.4 b	8.7 de	25.3 a	9.8 ab	16,480 a	23,400 a–c
Stolo	10.8 b	9.0 c–e	18.8 ab	15.3 b	15,830 ab	23,300 a–c
Pinnacle	14.0 a	13.6 ab	14.9 ab	10.0 ab	12,120 ab	19,900 b–d
Tillamook	14.8 a	14.3 a	10.7 ab	5.1 a	15,870 ab	11,700 d
Puget Reliance	11.5 b	11.1 b–d	12.1 ab	10.1 ab	10,470 b	15,000 cd
Totem	10.3 b	8.2 e	18.5 ab	7.1 a	13,120 ab	11,400 d

^zMeans within a column followed by the same lowercase letter are not significantly different, $P > 0.05$, by least significant difference test.

included the industry standards ‘Totem’ and ‘Tillamook’ (Finn et al., 2004; Hokanson and Finn, 2000; Moore, personal communication). Plant vigor and fresh fruit characteristics, including appearance, firmness, external

and internal color, capping (ease with which the calyx is removed), and flavor, were rated subjectively at least three times each year in Oregon using a 1 to 9 scale (9 = best expression of each trait, except color where

9 = dark red) and the means for these traits are presented in Table 5. In multiple years, duplicate subsamples of ≈ 200 g each were taken randomly from harvested fruit and were evaluated for Brix, titratable acidity, and pH (Table 6). Analysis of variance was conducted on the fruit chemistry and subjectively evaluated trait data after checking for normality (PROC UNIVARIATE; SAS Institute). Fruit was also evaluated informally as a thawed, individually quick frozen product by growers and processors with the strawberry industry and small fruit researchers (data not shown).

Description and Performance

Although not always significantly different, the yield for ‘Valley Red’ always has been at or near the top when compared with named cultivars in any Pacific Northwest trial. In Oregon, ‘Valley Red’ had a higher mean yield than ‘Totem’ in 2002 to 2003, but, while numerically higher, ‘Valley Red’ was comparable to ‘Totem’ in 2008 (Table 1). In 2008, ‘Valley Red’ was lower-yielding than ‘Tillamook’. In Puyallup, WA, ‘Valley Red’ had the highest cumulative yield in 2002 to 2003; however, it was only significantly greater than ‘Sumas’ (Table 2). In ‘Valley Red’s first harvest season, the yield was larger than that of ‘Puget Reliance’, ‘Pinnacle’, ‘Puget Summer’, and ‘Sumas’. In the 2003 established trial, ‘Valley Red’ had the highest cumulative yield, but it was not significantly different from the other cultivars included in that planting (Table 2). Similarly, further north at WSU–Mount Vernon, ‘Valley Red’ tended to have the highest yield in 2005 and 2006 (data not shown), but it was not significantly different from the other cultivars in either year or over both years (Table 3). Even further north at AAFC-PARC, ‘Valley Red’ was higher yielding than ‘Puget Reliance’ in 2005 and than ‘Pinnacle’, ‘Tillamook’, ‘Puget Reliance’, and ‘Totem’ in 2006 (Table 4).

In all trials except for the 2003 planting at WSU–Puyallup, ‘Valley Red’s’ fruit weight was greater than the standard ‘Totem’ (Tables 1–4). Generally, ‘Tillamook’ and ‘Pinnacle’ have heavier fruit than ‘Valley Red’; however, this was not the case in the 2007 planting in which the first year of harvest for ‘Valley Red’ had larger fruit than ‘Tillamook’. When first observed in the field, ‘Valley Red’ is often perceived to produce fruit that are smaller than desired; however, the data analysis indicates a commercially acceptable size. In an inspection of the change of harvested fruit weight at WSU–Puyallup, ‘Valley Red’ average fruit weight decreased more slowly than ‘Tillamook’ and ‘Puget Reliance’ and similarly to ‘Totem’ (data not shown). This is one of the reasons that ‘Valley Red’ was reviewed favorably in grower trials.

‘Valley Red’ has scored well in subjective evaluations of fresh fruit characteristics (Table 5). The fruit appearance, capping, and flavor were scored similarly to that of ‘Puget Reliance’, ‘Redcrest’, ‘Totem’, and

Table 5. Mean scores for subjectively evaluated characteristics, in the field, of strawberry cultivars planted in 2001 and 2007 at the Oregon State University–North Willamette Research and Extension Center (Aurora, OR).

		Fresh fruit characteristics						
		Plant vigor ^z	Appearance	Firmness	Color		Capping	Flavor
					External	Internal		
2001 planting; evaluated in 2002–2003								
Puget Reliance	7.5 ab ^y	8.0 a	6.3 c	6.8 c	6.7 b	8.3 a	6.5 a	
Redcrest	6.8 b	8.2 a	8.5 a	8.0 a	8.0 a	8.7 a	7.3 a	
Totem	6.5 b	7.5 a	7.0 bc	7.3 b	7.2 b	7.7 a	7.4 a	
Valley Red	8.7 a	8.5 a	8.0 ab	7.8 ab	7.9 a	8.3 a	6.7 a	
2007 planting; evaluated in 2008								
Tillamook	7.0 a	7.0 a	8.3 a	7.0 b	7.0 a	7.7 a	6.3 a	
Totem	7.3 a	7.3 a	7.3 a	7.7 ab	7.3 a	8.0 a	5.7 a	
Valley Red	7.0 a	8.0 a	7.3 a	8.0 a	7.7 a	7.0 a	7.3 a	

^zTraits scored on a 1 to 9 scale: 1 = poor vigor, uneven rough appearance, soft fruit, very light-colored, poor separation of calyx from receptacle, and poor flavor; and 9 = very vigorous, very uniform and attractive, very firm, dark red, calyx separates easily from the receptacle, and intense flavor, respectively.

^yMeans within a column followed by the same lowercase letter are not significantly different, $P > 0.05$, by least significant difference test.

Table 6. Soluble solids, pH, and titratable acidity for fruit purees of nine strawberry cultivars grown at the Oregon State University–North Willamette Research and Extension Center (Aurora, OR) from 2001 to 2008.

	Soluble solids (°Brix) ^z	pH	Titratable acidity (g·L ⁻¹ as citric)
Firecracker	10.76 a	3.42 bc	13.17 b
Hood	10.31 ab	3.56 a	8.51 de
Independence	9.03 cd	3.46 a–c	11.68 c
Pinnacle	7.46 e	3.53 a	7.34 e
Puget Reliance	9.40 bc	3.40 c	9.91 d
Redcrest	11.24 a	3.30 c	15.54 a
Tillamook	7.56 e	3.47 a–c	8.62 de
Totem	9.47 bc	3.52 ab	8.94 d
Valley Red	8.07 de	3.52 ab	8.61 de
Significance (P)			
Year	0.0016	0.0001	0.0271
Cultivar	0.0003	0.0005	0.0001
Year × cultivar	0.6389	0.2045	0.9116

^zMeans within a column followed by the same lowercase letter are not significantly different, $P > 0.05$, by least significant difference test.

‘Tillamook’. Although the scores of ‘Valley Red’ are similar to the other cultivars, the flavor is closer to that of ‘Puget Reliance’, one of its parents, than ‘Redcrest’ or ‘Totem’ that have a more acidic, tart flavor. The combination of our scoring and the repeated general impressions that have been given when ‘Valley Red’ has been informally evaluated at cuttings (evaluations by researchers and industry members of a range of genotypes as processed products) and field days as a processed product is that it has a sweet, mild, pleasant strawberry flavor that is appealing to most evaluators. Fruit firmness in the 2001 planting in Oregon was rated similar to ‘Totem’, firmer than ‘Puget Reliance’, and less firm than ‘Redcrest’. Although there were no differences in the first year firmness score for the 2007 planting, ‘Tillamook’ consistently has been ranked as firmer in many nonreplicated trials. ‘Valley Red’s’ firmness was evaluated at WSU–Puyallup using objective penetrometer measurements. In 2002 and 2003, ‘Valley Red’ was softer than ‘Pinnacle’, firmer than ‘Sumas’, and comparable to ‘Tillamook’ and ‘Puget Summer’. In 2002, ‘Valley Red’ was firmer than ‘Puget Reliance’ but was comparable in 2003. There were no differences among the cultivars in 2004 and 2005;

‘Valley Red’ has fruit that are similar in external color to ‘Redcrest’ and ‘Totem’ and is darker than ‘Tillamook’ (Fig. 1) and ‘Puget Reliance’. The internal color was comparable to ‘Totem’ in the 2007 planting, but in the 2001 planting, it was darker than ‘Totem’ and ‘Puget Reliance’.

Soluble solids, pH, and titratable acidity are three traits of importance, especially for processing quality. Over the years, there were differences resulting from year and cultivar, but no year × cultivar interaction (Table 6). Although ‘Valley Red’ is often described at evaluations by the industry as being sweeter than the standard cultivars, its soluble solids levels in purees made from frozen fruit is lower than ‘Totem’ and ‘Hood’ and comparable to ‘Independence’, ‘Tillamook’, and ‘Pinnacle’. Fruit pH is comparable to most other Northwest cultivars, although it was higher than ‘Puget Reliance’ and ‘Redcrest’. A fruit pH ≈ 3.5 is desirable for processed fruit. The titratable acidity for ‘Valley Red’ was comparable to ‘Totem’ and ‘Hood’ and much lower than that of ‘Redcrest’, ‘Firecracker’, and ‘Independence’. Presumably, the perceived sweetness is the result of the ratio of sugars to acidity and ‘Valley Red’ has neither a high soluble solids level nor a high titratable acidity.



Fig. 2. Plants of ‘Valley Red’.

‘Valley Red’ fruit consistently ripens with its parent ‘Puget Reliance’ and slightly ahead of ‘Totem’ and ‘Tillamook’ (data not shown). ‘Valley Red’ consistently grouped with the other early midseason cultivars 7 to 10 d earlier than ‘Puget Summer’ at test locations in Oregon, WA, and British Columbia (data not shown).

‘Valley Red’ plants are vigorous (Fig. 2; Table 5). The uniformity of plant stature and vigor has been noted repeatedly across seasons and locations. The plants do not have as open a habit as ‘Tillamook’ or ‘Pinnacle’ nor as dense as ‘Totem’, and they were deemed to be commercially acceptable for economical hand-harvesting in commercial trials.

‘Puget Reliance’, a parent of ‘Valley Red’, has been noted for its “durable” plants that have excellent virus tolerance; ‘Valley Red’ seems to have similar virus tolerance. Other than two spray applications during bloom to control botrytis fruit rot (*Botrytis cinerea* Pers.:Fr.), the plantings received no fungicide or insecticide applications. Under this spray program, ‘Valley Red’ did not show any particular susceptibility to pests. The percent fruit rot tended to be low and comparable to that of ‘Totem’ (Tables 1–4). The exception to this was in 2005 in Puyallup and Mt. Vernon in unsprayed plots when fruit rot levels for all genotypes were high (Tables 2 and 3).

‘Valley Red’ should be grown by commercial growers producing berries for processing in perennial, matted-row production systems. This cultivar is high-yielding and vigorous with very uniformly shaped, medium-sized fruit that have excellent processing characteristics.

Availability

‘Valley Red’ is not protected by a plant patent. However, when this germplasm contributes to the development of a new cultivar

or germplasm, it is requested that appropriate recognition be given to the source. The nuclear stock plants for propagation have tested negative for *Tomato ringspot*, *Strawberry mild yellow edge*, and *Tobacco streak* viruses by enzyme-linked immunosorbent assay and have indexed negative when grafted onto *F. vesca* L. and *F. virginiana* Duch. Further information or a list of nurseries propagating 'Valley Red' is available on written request to C. Finn. The USDA-ARS does not have commercial quantities of

plants to distribute. In addition, plants of this release have been deposited in the National Plant Germplasm System, accession number CFRA 1975 (PI 655969), where they will be available for research purposes, including development of new cultivars.

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