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'Harrow Sweet' Pear

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'Harrow Sweet' pear (*Pyrus communis* L.) is a high-quality, late-season pear for the fresh market. It is precocious, productive, hardy, and has excellent resistance to fire blight [*Ewinia amylovora* (Burr.) Winslow et al.]. This new cultivar, developed by the Agriculture Canada Research Station at Harrow, Ont., is recommended by the Ontario Tender Fruit Producers Marketing Board for trial planting in Ontario. It is also recommended for commercial culture in France (Masseron and Trillot, 1991).

Origin

'Harrow Sweet' originated from a cross of 'Bartlett' × 'Purdue 80-51' (Fig. 1) made in 1965 by R.E.C.L. Also originating from this cross was 'Harrow Delight', released in 1981 (Quamme and Spearman, 1983). 'Harrow Sweet' was selected by H.A.Q. and propagated for a second test at Harrow in 1980. Trees were propagated in cooperation with the Western Ontario Fruit Testing Assn. (WOFTA) and, under the designation HW-609, placed in regional trials with cooperating growers beginning in 1983. 'Harrow Sweet' was also propagated, under an agreement with WOFTA, by the New York State Fruit Testing Cooperative Assn. (NYSFTCA), Geneva, and distributed for advanced test beginning in 1988. 'Harrow Sweet' is being tested in Canada, the United States, Europe, and New Zealand.

Description

The fruit matures 18 Sept. at Harrow, 23

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days after 'Bartlett' (Table 1). Preharvest fruit drop is not a problem. The medium to large fruit are slightly smaller than 'Bartlett' on unthinned trees (Table 1). Fruit weight is improved by fruit thinning, since it is comparable to 'Bosc' (Table 2). Fruit are pyriform in shape, with a shallow medium basin and an open calyx (Fig. 2). Fruit shape has

been rated 5.2 using International Board for Plant Genetic Resources descriptors (Thibault et al., 1983); individual fruits have received ratings of 3.2, 3.4, 5.4, and 7.2. Following ripening at 20C, the skin has an attractive, yellow ground color (color code 11A; Royal Horticultural Soc., 1966) with visible lenticels and a red blush where fully exposed to the sun. There may also be some russetting. At Harrow, trained panelists have rated the appearance of ripened fruit of 'Harrow Sweet' slightly lower than 'Bartlett' and 'Harrow Delight' and equal to 'Harvest Queen' (Table 1). However, in blind sensory evaluations at Summerland, using untrained or semitrained panelists, 'Harrow Sweet' scored better in general appearance than 'Aurora', 'Bartlett', and 'Cornice' and equal to 'Conference' (Table 3). The flesh is cream-white, very sweet, and juicy, with excellent flavor. Trained panelists at Harrow have rated the flavor as good as that of 'Bartlett', but worse than 'Harrow Delight' and 'Harvest Queen' (Table 1). At Summerland, using the "just right" scale (Robertson et al., 1990), the flavor was rated as "slightly intense," texture was "slightly soft," and the sweet/

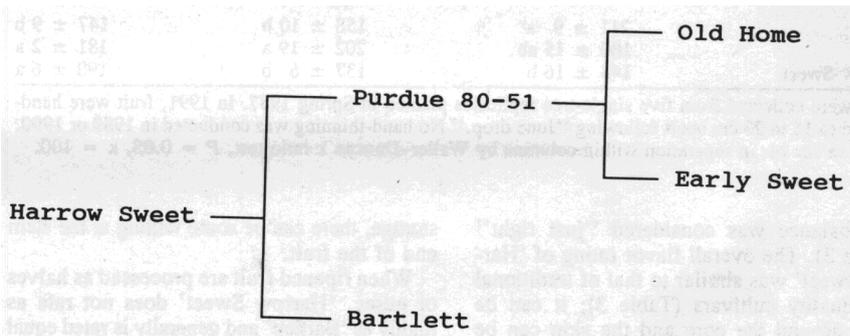


Fig. 1. Pedigree of 'Harrow Sweet' pear.

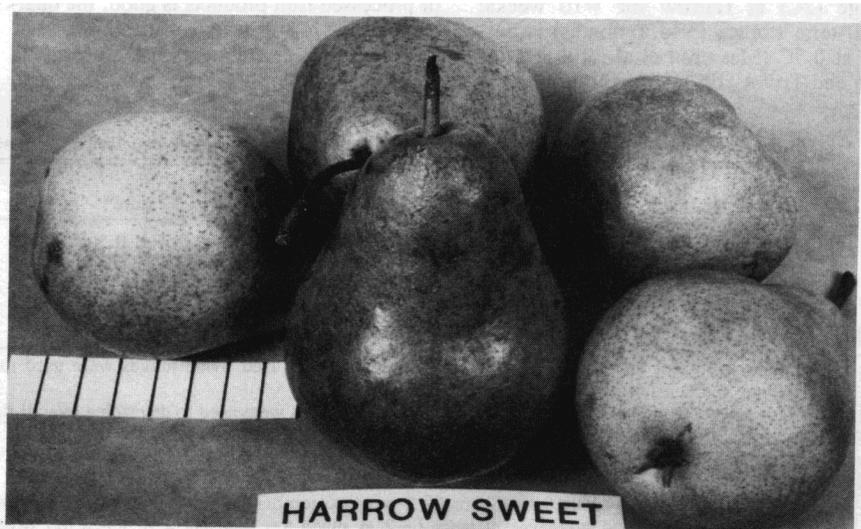


Fig. 2. Fruit of 'Harrow Sweet' pear (scale in centimeters).

Table 1. Fresh fruit performance of 'Harrow Sweet' pear in comparison to 'Bartlett', 'Harrow Delight', and 'Harvest Queen' at Harrow, Ont.

Characteristic	Cultivar			
	Bartlett	Harrow Delight	Harvest Queen	Harrow Sweet
Years evaluated (no.)	17	18	19	16
Harvest dates				
Avg	26 Aug.	11 Aug.	18 Aug.	18 Sept.
Earliest	16 Aug.	5 Aug.	6 Aug.	30 Aug.
Latest	9 Sept.	16 Aug.	31 Aug.	8 Oct.
Size (mm)*				
Length	82 ± 1 ^y	80 ± 1	73 ± 1	84 ± 2
Diam	64 ± 1	59 ± 1	58 ± 1	62 ± 1
Ratings				
Appearance ^x	8.0 ± 0.1	7.9 ± 0.2	7.4 ± 0.2	7.4 ± 0.2
Flavor ^x	8.0 ± 0.2	8.2 ± 0.1	8.2 ± 0.1	7.8 ± 0.2
Texture ^x	7.8 ± 0.1	7.9 ± 0.2	8.5 ± 0.2	6.8 ± 0.1
Grit ^w	3.8 ± 0.1	3.9 ± 0.1	4.5 ± 0.1	3.2 ± 0.1
Juiciness ^v	3.9 ± 0.1	4.4 ± 0.1	4.2 ± 0.1	4.3 ± 0.1
Core size ^u	3.1 ± 0.1	3.1 ± 0.1	2.4 ± 0.1	3.8 ± 0.2
Weighted score ^t	79.6 ± 1.1	80.7 ± 1.2	80.6 ± 1.3	75.2 ± 1.7

*Fruit produced from unthinned trees. A random sample of two to three fruit per year was measured.
^yMean ± SE.
^xAppearance, flavor, and texture ratings are on a 1 (poor) to 10 (excellent) scale, as determined by trained panelists.
^wGrit is on a 1 (undesirable, i.e., large and/or many grit cells) to 5 (desirable, i.e., very small and/or few or no grit cells) scale.
^vJuiciness is on a 1 (dry) to 5 (very juicy) scale.
^uCore size is on a 1 (small) to 5 (large) scale.
^tWeighted score = (3 × appearance) + (5 × flavor) + (2 × texture).

Table 2. Mean fruit weight of 'Anjou', 'Bosc', and 'Harrow Sweet' pear grown at Summerland, B.C.

Cultivar	1989	1990	1991
		<i>g/fruit</i>	
Anjou	211 ± 9 a ^y	158 ± 10 b	147 ± 9 b
Bosc	180 ± 15 ab	202 ± 19 a	181 ± 2 a
Harrow Sweet	148 ± 16 b	137 ± 6 b	190 ± 6 a

^yData were collected from five single-tree replicates planted in Spring 1987. In 1991, fruit were hand-thinned to 15 to 20 cm apart following "June drop." No hand-thinning was conducted in 1989 or 1990.
^yMean ± SE. Mean separation within columns by Waller-Duncan k ratio test, *P* = 0.05, *k* = 100.

sour balance was considered "just right" (Table 3). The overall flavor rating of 'Harrow Sweet' was similar to that of traditional high-quality cultivars (Table 3); it can be gritty around the core and the skin can be tough, but these do not detract from its overall quality. The fruit has been kept in cold storage (2C) at Harrow for ≈ 10 weeks; longer-term storage (3 to 4 months) is possible at 0.5C (Masseron et al., 1991; Masseron and Trillot, 1991). If kept too long in

storage, there can be some wilting at the stem end of the fruit.

When ripened fruit are processed as halves or puree, 'Harrow Sweet' does not rate as highly as 'Bartlett' and generally is rated equal to or lower than 'Harrow Delight' and 'Harvest Queen' (Table 4). While acceptability of processed fruit products is good, the quality is probably not sufficiently high for 'Harrow Sweet' to have potential as a processed pear in the present market.

The tree is medium-sized, upright to spreading, and consistently very productive, even following exposure to winter minima of -28C. There has been no evidence of biennial bearing. The bark of dormant shoots is reddish-brown (166B; Royal Horticultural Soc., 1966), and the diameter of shoots is similar to that of 'Bartlett'. The leaves are elliptic with acuminate tips. Leaf serrations are small but distinct. The flowers are white with pink to red anthers.

'Harrow Sweet' has excellent resistance to fire blight. Using natural fire blight infection scores (van der Zwet et al., 1970), resistance of 'Harrow Sweet' is between that of 'Harvest Queen' and 'Harrow Delight', while the response to artificial inoculation is similar to that of 'Harrow Delight' (Table 5). Fire-blight resistance of 'Harrow Sweet' is much greater than that of 'Bartlett', 'Bosc', or 'Anjou'. Based on field observations, 'Harrow Sweet' appears to be less susceptible to pear psylla (*Cacopsylla pyricola* Foerster) than other cultivars, especially 'Harrow Delight'.

Table 3. Perception of pear fruit quality by untrained and semitrained panelists at Summerland, B.C.

Cultivar	General appearance ^x	Flavor ^w	Texture ^w	Sour/sweet balance ^w	Overall flavor rating ^x
Aurora	2.4 ± 0.3 b ^y	-0.1 ± 0.3 a	-0.7 ± 0.3 c	0.0 ± 0.2 ab	1.9 ± 0.4 b
Bartlett	2.6 ± 0.2 b	-0.6 ± 0.5 a	-0.8 ± 0.3 c	-0.8 ± 0.2 b	3.0 ± 0.3 a
Comice	3.3 ± 0.4 a	-0.3 ± 0.4 a	0.1 ± 0.3 ab	0.0 ± 0.3 ab	3.2 ± 0.4 a
Conference	1.6 ± 0.2 c	-0.6 ± 0.3 a	0.6 ± 0.2 a	0.3 ± 0.2 a	2.9 ± 0.3 a
Harrow Sweet	1.3 ± 0.2 c	0.4 ± 0.2 a	-0.3 ± 0.3 bc	0.0 ± 0.3 ab	2.4 ± 0.4 ab

^yJudges were not familiar with rating scales or procedures used. Nine judges were used to determine general appearance, flavor, texture, and sour/sweet balance.

^yJudges were familiar with rating scale used. Twelve judges were used to determine overall flavor, and tasting was done in individual booths.

^xScale for general appearance and overall flavor rating is a five-point hedonic scale where 1 = like very much and 5 = dislike very much.

^w"Just Right" scale was used for flavor (-2 = much too bland and 2 = much too intense), texture (-2 = much too soft and 2 = much too hard) and sour/sweet balance (-2 = much too sour and 2 = much too sweet). A rating of 0.0 is considered "Just Right" (Robertson et al., 1990).

^yMean ± SE. Mean separation within columns by Waller-Duncan k ratio test, *P* = 0.05, *k* = 100.

Table 4. Ratings of pear halves^z and pear puree^y processed from ripened fruit of 'Harrow Sweet' pear in comparison with 'Bartlett', 'Harrow Delight', and 'Harvest Queen'.

Type	Sweetener (%)	Bartlett	Harrow Delight	Harvest Queen	Harrow Sweet
Halves	Syrup, 30%	3.9 ± 0.1 ^x (18) ^w	3.4 ± 0.2 (12)	3.5 ± 0.2 (15)	3.3 ± 0.1 (9)
	Syrup, 15% ^v	4.2 ± 0.2	4.1 ± 0.2	3.8 ± 0.3	3.8 ± 0.2
Puree	Sugar, 4%	4.0 ± 0.1 (18)	3.2 ± 0.2 (10)	3.4 ± 0.1 (13)	3.2 ± 0.2 (9)
	Sugar, 0% ^u	4.0 ± 0.0	3.4 ± 0.2	3.8 ± 0.2	3.5 ± 0.2

^zDetermined with masked identity taste panels involving four trained panelists. Samples were compared to Bartlett (which was used as the standard of excellence). Processing rating is the average of ratings for flavor, texture, and appearance on a 1 (least desirable) to 5 (most desirable) scale.

^yDetermined with masked identity taste panels involving four trained panelists. Samples were compared to Bartlett (which was used as the student of excellence). The processing rating for puree is the average of ratings for viscosity, flavor, and color on a 1 (least desirable) to 5 (most desirable) scale.

^xMean ± SE.

^wNumbers in parentheses are number of years of evaluations.

^vData from 1989, 1990, and 1991 pack only.

^uData from 1990 and 1991 pack only.

Table 5. Ratings of natural and artificial (inoculated) fire blight infections of 'Harrow Sweet' pear in comparison with 'Bartlett', 'Harrow Delight', and 'Harvest Queen'.

Fire blight	Bartlett	Harrow Delight	Harvest Queen	Harrow Sweet
Natural ^z	3.9 ± 0.3 ^y	9.5 ± 0.1	9.1 ± 0.1	9.3 ± 0.2
Inoculation (%) ^x	61.6	16.0	23.4	15.9

^zNatural blight ratings, on a scale of 1 (tree dead) to 10 (no blight), are means of 15 to 20 years. For 'Harrow Delight', 'Harvest Queen', and 'Harrow Sweet' pear, ratings were made on the seedling tree. For 'Bartlett', ratings were made on trees in a cultivar evaluation orchard.

^yMean ± SE.

^xDetermined in late July, ≈ 5 weeks after inoculating 10 actively growing shoots with 0.02 ml of a cocktail of six isolates of *Erwinia amylovora* (10⁻⁸ cfu/ml). Inoculation (%) = inoculated lesion length/shoot length. Ratings are means of 9 to 12 years for Harrow selections and 19 years for 'Bartlett'.

Table 6. Annual and cumulative yields of 'Harrow Sweet' pear and standard cultivars grown at Harrow, Ont., and Summerland, B.C.^y

Year	Harrow (kg/tree)		Summerland (kg/tree)		
	Bartlett ^x	Harrow Sweet	Anjou	Bosc	Harrow Sweet
1986	0.0 b ^w	2.0 ± 0.0 a ^v			
1987	0.2 ± 0.0 b	5.7 ± 1.5 a			
1988	3.8 ± 1.4 a	4.6 ± 1.0 a	0.0 b	0.1 ± 0.1 b	2.5 ± 0.3 a
1989	5.6 ± 1.4 b	13.3 ± 2.2 a	1.2 ± 0.3 b	3.2 ± 0.8 b	7.7 ± 1.4 a
1990	0.4 ± 0.1 b	17.5 ± 3.5 a	2.4 ± 0.7 a	4.5 ± 1.2 a	8.1 ± 2.7 a
1991	4.3 ± 0.3 a	8.8 ± 1.8 a	9.4 ± 1.4 a	16.5 ± 4.6 a	16.4 ± 4.9 a
Cumulative yield to 1991	14.3 ± 2.4 b	51.9 ± 9.2 a	12.9 ± 2.0 a	24.3 ± 5.7 a	34.7 ± 9.0 a
TCSA ^u (cm ²)	42.9 ± 6.8 b	68.1 ± 13.8 a	18.3 ± 1.7 a	16.6 ± 2.8 a	17.2 ± 3.6 a
Yield efficiency ^t	0.35 ± 0.11 b	0.80 ± 0.15 a	0.70 ± 0.08 b	1.41 ± 0.18 a	1.92 ± 0.20 a

^zData collected from four single-tree replicates planted in 1984, first cropped in 1986.

^yData collected from five single-tree replicates planted in 1987, first cropped in 1988.

^xFor 'Bartlett', n = 2. Two of four trees were lost to fire blight; surviving two trees are also affected.

^wMean separation within locations and years by Waller-Duncan k ratio test, P = 0.05, k = 100.

^vMean ± SE.

^uTCSA = trunk cross-sectional area (cm²) measured in Fall 1991 at Harrow and in Spring 1991 at Summerland.

^tYield efficiency = cumulative yield to 1991/cm² TCSA.

'Harrow Sweet' is reciprocally pollen-compatible with 'Bartlett'. It will also pollinate 'Harrow Delight' and, to a lesser extent, 'Harvest Queen'. 'Harrow Sweet' blooms slightly ahead of 'Bartlett'; at Harrow, first bloom is 1 day before 'Bartlett', while information from France indicates bloom is 2 to 4 days earlier than 'Bartlett' (Masseron et al., 1991).

In Ontario, 'Harrow Sweet' has been compatible with *P. communis* rootstocks, such as 'Bartlett' seedling and 'Old Home' × 'Farmingdale' (OHF) clones 69 and 87. 'Harrow Sweet' is also compatible for direct grafting onto quince (*Cydonia* clones BA29 and EMC)

and OHF clone 333 (Brokmal; Masseron et al., 1991).

Because of its resistance to fire blight, 'Harrow Sweet' has performed better than 'Bartlett' in a replicated trial planted at Harrow in 1984 (Table 6). Fire blight has resulted in the loss of 50% of the 'Bartlett' trees, and surviving trees of 'Bartlett' are also affected by fire blight. 'Harrow Sweet' is more precocious than 'Bartlett', producing fruit from lateral buds on first-year wood and on spurs, thus coming into production in the 2nd or 3rd year after planting. In Summerland, 'Harrow Sweet' produced significantly higher yields in the 2nd and 3rd years after

planting than 'Anjou' or 'Bosc'. By the 5th year after planting, annual and cumulative yields of 'Harrow Sweet' were higher, but not significantly so, than those of 'Bosc' and 'Anjou' (Table 6). 'Harrow Sweet' appears to be adapted to regions where 'Bartlett' and 'Bosc' have been successfully grown and can be considered a replacement for 'Bosc' in areas where fire blight has presented serious problems.

Availability

This is the first release from the Harrow pear-breeding program to be subject to Plant

Breeders Rights legislation. Limited numbers of trees propagated from virus-tested budwood are available, subject to propagation restriction agreements, only to members of WOFTA and may be obtained from WOFTA, Agriculture Canada Research Station, Harrow, Ont. NOR 1G0, Canada. Inquiries regarding the licensing of commercial propagation of 'Harrow Sweet' pear and the availability of budwood from virus-tested trees may be addressed to the director of Agriculture Canada at the same address. 'Harrow Sweet' is protected and patented in the European Economic Community with Domaine

de Castang S.A., St. Laurent-des-Vignes, 24100 Bergerac (Dordogne), France, as the exclusive agent.

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