

Quote: . . . three (fire blight resistant cultivars) have been named, Harvest Queen, Harrow Delight, and Harrow Sweet.

Update on Harrow Fire Blight-resistant Pear Selections and Cultivars

Dr. David M. Hunter, Pear Breeder
Agriculture and Agri-Food Canada, Southern Crop Protection and Food Research Center
Vineland Station, Ontario Canada L0R 2E0

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Most commercial pear cultivars are susceptible to the bacterial disease fire blight (*Erwinia amylovora*). The major objective of the pear breeding program at Harrow was to incorporate fire blight resistance into high quality pear cultivars primarily for the fresh market. In order to allow fruit production in areas where fire blight is present, a level of field resistance similar to, or greater than, that of Kieffer is required.

The Harrow program, established in 1963, was a traditional breeding program involving controlled hybridizations between selected parents. The resistance of advanced selections and cultivars introduced from the program is derived from cultivars such as Seckel, Waite, Maxine, Old Home, Farmingdale and Kieffer, or from species selections such as *Pyrus ussuriensis* 76 and *P. pyrifolia* NJ-1. When species selections were used, desirable fruit characteristics of *P. communis* were recovered by back-crossing to selected *P. communis* cultivars, especially Bartlett (syn. William's Bon Chretien). Harrow seedling selections were first used as pollen parents in 1972, and as seed parents in 1973. Several seedling populations have been generated using Harrow selections as both pollen and seed parents.

Screening techniques were developed to identify fire blight-resistant seedlings. In the greenhouse, the fire blight organism was injected into the shoot tip of actively growing seedlings 30-40 cm tall, and only the more resistant seedlings (i.e., those where the lesion extended less than 25-30% of the total shoot length) were planted out in seedling orchards for field evaluations. With the onset of fruiting, usually 5-7 years (sometimes up to 10 years) after planting out, seedlings with desirable fruit characteristics were again screened for fire blight resistance by inoculating actively growing shoot tips and assessing disease development. Natural fire blight infections were also assessed in the field using the USDA rating system, in which 10 indicates no infections while 1 indicates that the tree has been killed by fire blight. In general, a rating of 8 (equivalent to Kieffer) or higher is required for further evaluation. With ratings of 8 or 9, infections which do not extend beyond current season's growth can be expected, while ratings below 7 indicate infections into previous season's growth and older wood. On this scale, the average rating for Bartlett at Harrow has been 3.9, indicating that severe infections leading to limb or trunk damage can be expected most years.

Seedlings were evaluated for a number of fruit characteristics including flavor, texture, color, fruit size and shape and ripening season, as well as for tree growth habit and productivity. Shelf life, storage quality and processing capability were assessed in the laboratory. Winter hardiness levels were determined following test winters or through controlled freezing tests, and all

Harrow advanced selections have a level of cold hardiness equal to or greater than Bartlett, though few of the selections are as hardy as the fire blight-susceptible cultivar Flemish Beauty.

Selections placed in regional trials under a test number (prefixed by HW) are also evaluated in advanced test orchards at Harrow and by other researchers. Grower members of the Ontario Fruit Testing Association (OFTA) [formerly the Western Ontario Fruit Testing Association (WOFTA)] have exclusive rights to test HW-numbered selections, subject to propagation-restriction agreements, in commercial orchards. Data collected from all these sources are used to determine whether a numbered selection is introduced, tested further or discarded. Virus testing of advanced selections has been conducted at the Center for Plant Health in Saanichton, BC, and true-to-name virus-indexed stock has been placed in repositories to provide a source of propagating material.

With the implementation of the Plant Breeder's Rights Act of Canada (1990), introductions are first protected and subject to commercialization contracts. In the European Union, the agents are Domaine de Castang S.A., St-Laurent-des-Vignes, 24100 Bergerac, France (for Harrow Sweet pear only) and Star Fruits, 84430 Mondragon, France (other pear introductions). In North America, Australia, New Zealand and Japan, commercialization rights to all pear introductions have been granted to Inter-Plant Patent Marketing Inc., R.R. 2, Niagara-on-the-Lake, ON Canada L0S 1J0.

To date, 25 selections have been placed in advanced trials. Of these, three (fire blight resistant cultivars) have been named, Harvest Queen, Harrow Delight, and Harrow Sweet; three are in the final stages of testing prior to naming, and nine selections require further evaluation. Other selections have been discarded at Harrow because of unsuitability for local conditions, but some are still being evaluated in other areas. All these selections have good to excellent resistance (but not immunity) to natural fire blight infections, with ratings greater than 8.5 on the USDA scale. Picking dates range from about 2 weeks before to 4 weeks after Bartlett, thus providing growers with the opportunity to plant fire blight-resistant pears which fit into their own particular harvest system.

Regional trials initiated in 1992 at 5 sites in Ontario provided important data for several selections. A new regional trial will be planted in 1999 to further evaluate a number of Harrow cultivars and selections on different rootstocks. This collaborative project involves the Ontario Tender Fruit Producers Marketing Board, the Ontario Ministry of Agriculture, Food and Rural Affairs, Nabisco Limited, Agriculture and Agri-Food Canada, and the University of Guelph, Horticultural Research Institute of Ontario, and is being funded by the CanAdapt Program of the Agricultural Adaptation Council.

Hybridizations and seedling evaluations at Harrow were directed by the following breeders: R.E.C Layne (1963-1968), H.A. Quamme (1968-1980), F. Kappel (1983-1987) and D.M. Hunter (1988-1995). The program was transferred to Vineland Station following the 1995 reorganization in Agriculture and Agri-Food Canada, and D.M. Hunter is continuing the development of fire blight-resistant pear selections using biotechnological methods. It is anticipated that transgenic plants will be available for field evaluations by 2005.

The following are brief notes on the named introductions and numbered selections currently being evaluated, presented in order of picking date.

HARROW DELIGHT

Bartlett x Purdue 80-51 (Early Sweet x Old Home). Harvested about August 10 at Harrow, 2 weeks before Bartlett. Fruit color is greenish-yellow with a red blush. Because it tends to drop heavily as it matures, fruit should be picked while still green. If left on the tree until the background color changes to yellow, shelf life is also greatly reduced. The tree consistently produces good crops. Fruit size which is similar to Bartlett on unthinned trees is improved by thinning. Even when the skin color is more green than yellow, flesh texture is very good, very juicy and free of stone cells. Fruit flavor is rated as high as Bartlett. When processed as halves or puree, Harrow Delight has had better-than-average ratings, but not as high as for Bartlett. Mature trees have excellent resistance to fire blight (9.5 rating on the USDA scale), but this cultivar is susceptible to pear psylla. Harrow Delight is pollen compatible with Harvest Queen, Bartlett, Bosc and Anjou. This cultivar was released in 1981 and therefore there are no propagation restrictions.

HW616

Harvest Queen x Harrow Delight. Fruit are picked about 10 days before Bartlett, between Harrow Delight and Harvest Queen. An attractive yellow fruit, with good size (larger than Harvest Queen, similar to Bartlett), smooth skin, fine texture, very good flavor, and exceptionally juicy. The fresh fruit quality rating for HW616 is similar to that of Bartlett. As with many other early season pears, the fruit will not keep for very long (probably no more than 4-6 weeks) in cold storage, but it is an excellent selection for fresh market and roadside stands. This selection is fire blight resistant (9.5 rating). HW616 does not appear to pollinate Bartlett, but Bartlett may pollinate HW616. In a second test planting, precocity appears to be similar to that of Bartlett with trees coming into production about 4 years after planting.

HW621

H6720-1.001 (Anjou x Farmingdale) x Harrow Delight. The fruit ripen in mid-August, about 10 days before Bartlett and slightly ahead of Harvest Queen. The fruit, slightly larger than Bartlett, have an attractive, green-yellow ground color with a light blush on the exposed side. The cream-colored flesh has excellent flavor and is very juicy. The fruit tends to be produced in clusters of 4-5 fruit and thinning probably will be required. The tree has excellent resistance to fire blight (9.7 rating). Some russetting of the fruit has been observed. Fruit of this selection have been kept in cold storage for 8 weeks with no deterioration in fruit quality.

HW622

HW601 (Maxine x Beierschmidt) x Harrow Delight. Produces medium to heavy crops, consistent from year to year with no evidence of biennial bearing. It is picked about 10 days before Bartlett, between Harrow Delight and Harvest Queen. The medium-sized fruit are produced in clusters of 3-4 fruit, so thinning may improve fruit size. When ripened, fruit have a yellow background color with an attractive red blush. Fruit are typically pear-shaped with a somewhat flattened calyx end. Flesh is white to cream-white with some small grit around the core and just under the skin, and the texture is juicy, melting or buttery. Fruit have received good to excellent ratings and can be kept in storage for about 6 weeks without severe breakdown. Evaluations of processed product (as halves or puree) have been acceptable but ratings have been lower than for Bartlett. The tree is tall, upright to spreading. Although there is an old fire blight strike on the seedling tree, inoculations do not induce a severe disease response. Preliminary data suggest that HW622 is reciprocally pollen incompatible with Bartlett.

HARVEST QUEEN

Bartlett x Michigan 572 (Bartlett x Barseck [Bartlett x Seckel]). Picked the third week of August, 1 week before Bartlett. Fruit keep on the tree very well and will increase in size with later picking. Fruit size is usually smaller than Bartlett, even with thinning which improves fruit size and reduces the tendency for biennial bearing. When grown on OHF333 rootstock, fruit size is further reduced, so that a higher proportion of fruit is unmarketable. For both fresh fruit and processed pear halves, ratings of fruit quality, texture and flavor have been as good as or better than Bartlett. The tree has very good fire blight resistance (9.1 rating). Harvest Queen is pollen compatible with Harrow Delight, Bosc and Anjou, but not with Bartlett. This cultivar was released in 1981 and therefore there are no propagation restrictions.

HW617

H6516-2.046 (Bartlett x Purdue 80-51) x Harvest Queen. The fruit mature just after Harvest Queen and about 5 days before Bartlett. Flavor and texture are good, but fruit size is slightly smaller than Bartlett. Fruit may ripen unevenly in some years. Background color of the skin is yellow with an attractive red blush. However, when processed as halves or puree, the fruit can develop a pink color. Precocity and productivity are similar to Bartlett. It has a good level of resistance to fire blight (9.2 rating).

HW611

Bartlett x US56112-146. A high quality fruit, roundish to ovate, medium size, picked about the same time as Bartlett. The green skin tends to be rough with blemishes of russet, but superimposed with highlights of bright red. Appearance can be affected greatly by climatic conditions. The fruit does not store well. It has received better than average ratings when processed as halves or as puree. The tree is fire blight resistant (9.6 rating). Precocity and productivity are similar to Bartlett.

HW610

Bartlett x US56112-146. A very attractive pear with red blush on smooth yellow skin. The cream-white flesh is smooth, grit-free, firm even when fully ripe, with a mild sweet flavor. The fruit matures at the end of August or early September, about the same time as Bartlett. It can be picked over a 2-week period. Early picked fruit can be stored for about 2 months, but storage life is reduced with later picking. If kept too long or picked too late, it will deteriorate internally without external signs. Fruit size on unthinned trees is slightly larger than Bartlett. It has a good to very good rating for quality of both fresh and processed fruit. Tree is medium in size, conical and upright, annually productive and hardy. It is a poor pollinator and will not pollinate Bartlett, but Bartlett will pollinate HW610 to a limited extent. The tree has very good fire blight resistance (9.4 rating), similar to Harrow Sweet and Harvest Queen. Precocity of HW610 is similar to Bartlett with trees coming into production about 4 years after planting.

HW615

Bartlett x H6516-2.046 (Bartlett x Purdue 80-51). The fruit ripens about 1 week after Bartlett. Fruit shape tends to be variable, but size is good (similar to Bartlett). The fruit has a fine russet over a golden yellow ground color which can be very attractive, but fruit flavor has received only average ratings. The original seedling tree is small and has good fire blight resistance (8.7 rating). It is pollinated by Bartlett but does not appear to pollinate Bartlett. In a second test planting, it has come into production in the third or fourth year after planting, 1 year earlier than Bartlett.

HW624

Harrow Sweet x NY-10353. The fruit, which ripen about 7-14 days after Bartlett, have a light yellow background color when ripe, with a very attractive bright red blush on the exposed side. Flavor and texture are very good. The original seedling had a good first crop in 1997, and yield was also good in 1998. This selection was advanced in 1998 and propagated for testing through OFTA in 2000.

HW619

Bartlett x HW601 (Maxine x Beierschmidt). The fruit ripen about 10 days after Bartlett. Fruit size is similar to or slightly smaller than Bartlett. Appearance, flavor and texture are good. The tree is vigorous, has a good level of resistance to fire blight (9.7 rating) but *Fabraea* leaf spot has been observed in some years. It will not pollinate Bartlett. It is less precocious than Bartlett, requiring one extra year in the orchard before coming into production.

HW614

Bartlett x US56112-146. The fruit ripen about 3 weeks after Bartlett. The original seedling tree has been a good perennial yielder since being selected in 1982. Fruit shape is ovate to ovate-pyriform, and fruit size is large (on unthinned trees) to very large (when thinned). The fruit have a smooth yellow-green skin with a light russet in some years. The flesh is cream-white with good texture. While flavor is generally good, there can be some astringency which is usually reduced by storage. This pear will store very well for about 10 to 12 weeks. The tree is fire blight resistant (9.6 rating). It tends to produce secondary flower clusters which can lead to the development of a late-ripening second crop. Secondary flowering has not resulted in increased fire blight infections. It does not appear to pollinate Bartlett well, but HW614 is pollinated by Bartlett. In second test plantings, precocity has been similar to Bartlett, while productivity is greater than that of Bartlett.

HARROW SWEET

Bartlett x Purdue 80-51 (Early Sweet x Old Home). Harrow Sweet produces annual heavy yields of fruit ripening about 23-25 days after Bartlett. Fruit have yellow ground color with red blush, and fruit size is comparable to Bartlett. The fruit are very sweet and juicy, with excellent taste, and keep well in cold storage for about 10 weeks. It can be gritty around the core but this does not detract from overall quality. It has received acceptable ratings in processing trials at Harrow. The tree is medium in size, pyriform, upright spreading, hardy, with fire blight resistance (9.3 rating) similar to Harvest Queen and Harrow Delight. Harrow Sweet is more precocious than Bartlett, producing fruit from lateral buds on one-year wood as well as on spurs, thus coming into production in the second or third year after planting. Consistently very productive, Harrow Sweet should be thinned to maintain productivity and fruit size, especially on young trees. Named in 1990, Harrow Sweet has been commercially available since 1996. It is the first release from the Harrow pear breeding program to be protected under Plant Breeder's Rights legislation in Canada and Europe, and a US Plant Patent has been issued.

HW620

Devoe x US62537-48. Attractive greenish-yellow fruit with no blush, ripening about 4 weeks after Bartlett. Fruit shape is similar to Bartlett. The original seedling, which was not thinned, may have a tendency to biennial bearing. In the lighter crop years, fruit size is larger than Bartlett, while in heavier crop years, fruit size is similar to or slightly smaller than Bartlett. Appropriate orchard management practices, especially pruning and thinning, have reduced this tendency in

the early years of a second test orchard. Fruit texture is smooth and buttery with a mild pleasant flavor. Fruit will store well for about 12 weeks. The tree has very good fire blight resistance (9.3 rating) but pear scab has been a problem in some years.

HW623

Harrow Sweet x HW605 (Seckel x NJ6). Medium-sized fruit picked about 4 weeks after Bartlett. The fruit are yellow with a medium blush where exposed to the sun and have an elongated neck, similar to Bosc. The skin is medium to thick. Flesh is cream to cream-white, melting or buttery, juicy, with good to excellent flavor. There is some grit around the medium-sized core. It has consistently produced heavy crops, which in some years have been heavy enough to cause some limb breakage on the seedling tree. The tree has been severely crowded by neighboring trees and has developed an upright form. There have been no natural blight infections on the seedling tree, and results from controlled inoculations indicate a high level of blight resistance. In pollen compatibility studies, early indications are that HW623 will not pollinate Bartlett.