

Processing Quality of Pear Selections in the Harrow Breeding Program

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Abstract

Eighteen advance test selections in the Harrow pear breeding program were compared in processing quality as canned halves and as canned puree to that of 'Bartlett'. Processing quality of the selections varied from year to year and selections differed in their relative quality as canned halves and as puree. One selection, HW 606, consistently approached or was better than 'Bartlett' in processing quality of canned halves and puree. Other selections, HW 611, HW 612 and HW 614, were also consistently high in canning quality but only approached that of 'Bartlett'. The selections, HW 613 and HW 614, consistently approached 'Bartlett' in puree quality but did not equal it. All selections were considerably more fire blight resistant than 'Bartlett' on the basis of evaluations of natural infections and artificial fire blight inoculations.

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In Ontario about 50 percent of the pear production is used for processing either as canned halves, puree and in fruit cocktail mixtures (1). 'Bartlett' is the standard of excellence for the processing industry in the USA and Canada (2). 'Bartlett' contains decadienoate esters that are responsible for the 'Bartlett'-type flavor and some seedlings from the Harrow breeding program that equal 'Bartlett' in flavor have high levels of decadienoate esters (7).

The main limiting factor for the production of 'Bartlett' in Eastern Canada and Eastern USA is its susceptibility to the bacterial disease fire blight caused by *Erwinia amylovora* (Burr.) Winslow et al. One of the objectives of the Harrow breeding program is to

develop cultivars which are resistant to fire blight and equal 'Bartlett' in processing quality. Other objectives are to develop fire blight resistant cultivars for the early fresh market and to develop good storage cultivars. As a routine procedure all selections in the program are tested for their processing quality as canned halves and canned puree. The purpose of this paper is to report the progress made in the Harrow pear breeding program toward selecting cultivars resistant to fire blight and also similar to 'Bartlett' in processing quality.

Materials and Methods

Each year, fruit harvested from 'Bartlett' and a number of seedling selections were stored, ripened, and canned as halves according to accepted practice in the industry. Twenty percent sucrose syrup (w/v) was added during the canning process. Fruit were also processed as a puree by peeling the skin before processing. In 1985 some selections were also processed for puree without removing the skin.

Taste panels were conducted with 4 panelists three months after canning. In all taste panels 'Bartlett' was the standard for comparison. Canned halves were assessed for appearance, hue, flavor, aroma, texture, grit, fiber, core size, and syrup clarity. Scoring was from 1 to 5 with 1 = poor and 5 = excellent. A total score was obtained by summing the ratings for appearance, flavor and texture. Canned puree

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was assessed for aroma, viscosity, color and flavor. In 1979, 1982 and 1983 aroma, viscosity, color and flavor were summed for a total score, but in 1984 and 1985 only, viscosity, color and flavor were summed for a total score. All were scored from 1 to 5 with 1 = poor and 5 = very good.

Fire blight resistance was determined by rating natural infection using the USDA fire blight rating system for pear (8) where 1 equals the death of the tree and 10 equals no fire blight and by inoculating actively growing shoots in the field. The procedure was similar to that described previously by Quamme (4). Six strains of the pathogen isolated from diseased orchards near Harrow were grown individually on slants of nutrient-yeast dextrose agar. Eight to 14 actively growing shoots of each clone were inoculated with 10 to 20 μ l of the aqueous suspension (1×10^7 CFU/ml) of a composite of these strains. The inoculum

was injected into the shoot just below the first or second node from the shoot apex with a microsyringe. Fire blight resistance was determined by measuring the length of the visible infection and expressing it as a percentage of the total current season growth. Analysis of variance and mean separation was performed on the arc sine transformed data. The reported means for the fire blight inoculations are the corrected weighted means.

Results and Discussion

The total processing scores of the selections as canned halves varied from year to year but some selections consistently ranked high (Table 1). Two selections which consistently ranked high were HW 606, which had a score similar to 'Bartlett' in all 5 years, and HW 612, which did well 3 out of 4 years (it was not processed in 1985). The total processing scores of 'Harvest Queen' and 'Harrow Delight' were not

Table 1. Taste panel scores^z of canned halves of 'Bartlett' and cultivars/selections from the Harrow pear breeding program for 5 years.

Cultivar/Selection	Total score ^y				
	1979	1982	1983	1984	1985
Bartlett	11.0 a ^x	12.0 a	9.8 abc	12.5 a	12.5 ab
Harvest Queen	10.5 a	9.0 bcde	9.2 abc	8.8 d	8.2 de
Harrow Delight	10.5 a	9.2 abcde	11.5 a	8.8 d	10.5 bcd
HW 604			9.0 abc	11.0 abc	
HW 605			6.2 d	6.2 e	
HW 606	10.2 a	11.8 ab	11.2 a	10.8 abc	13.0 a
HW 607		7.8 de			11.0 abc
HW 608		7.2 e			
HW 609		7.8 de	8.5 bcd	10.0 bcd	9.8 cde
HW 610	9.0 a	8.2 cde	7.5 cd	10.8 abc	11.8 abc
HW 611		10.2 abcd	9.5 abc	10.2 bcd	10.0 bcde
HW 612	10.8 a	10.8 abc	11.0 ab	10.0 bcd	
HW 613		9.2 abcde	8.5 bcd	9.5 cd	8.0 de
HW 614		11.0 abc	10.0 abc	10.0 bcd	10.0 bcde
HW 615					8.0 de
HW 616			9.8 abc		9.8 cde
HW 617					7.5 e
HW 618					9.2 cde
HW 619				11.75 ab	

^zOnly cultivars and advanced selections are reported.

^yTotal score is a sum of the rating for appearance, flavor and texture. All were rated 1 to 5 (1 = poor and 5 = excellent).

^xMean separation within each column is by Duncan's Multiple Range Test, 0.05% level.

consistent. Some years they were high but in others they were low.

The total processing scores of the numbered selections as canned puree also varied from year to year (Table 2) but some were consistently better than others. One selection, HW 613, was equal to 'Bartlett' in 1984 and 1985. Two selections, 'Harvest Queen' and HW 606 approached the puree quality of 'Bartlett'. 'Harrow Delight' did not appear to process as well as a puree as it did as canned halves. Processing pears for puree with the skins in 1985 did not alter the score drastically except for 'Harrow Delight.' Processing with skins caused the puree of 'Harrow Delight' to brown very quickly which was unacceptable.

Scores for canned halves and puree do not appear to be necessarily related. The selection HW 606 did well as canned halves but not as well as puree, whereas HW 613, processed well as puree in 1984 and 1985 but poorly as canned halves those two years.

The selection HW 606 processed as canned halves had a flavor very close to 'Bartlett' (Table 3) but not similar when processed as puree (Table 4). Appearance and texture of HW 606 processed as canned halves were very similar to 'Bartlett.' The flavor of the other selections HW 607, HW 610, HW 611, HW 612 and HW 614 processed as canned halves approached 'Bartlett' (Table 3). The individual components of puree quality, namely flavor, color and viscosity, of HW 613 were similar to that of 'Bartlett' in 1984 and 1985 (Table 4).

In previous tests 'Harvest Queen' and HW 606 were given high flavor ratings and their aromas were indistinguishable from 'Bartlett' in at least half the tests. Both 'Harvest Queen' and HW 606 have similar decadienoate ester levels as 'Bartlett' and decadienoate esters are responsible for the 'Bartlett'-type aroma (5).

Quality ratings varied considerably with year. This variation is probably

Table 2. Taste panel scores^z of canned puree of 'Bartlett' and cultivars/selections from the Harrow pear breeding program for 5 years.

Cultivar/Selection	Total score ^y						
	1979	1982	1983	1984	1985		
Bartlett	18.8 a ^x	16.8 a	15.2 a	13.8 a	11.2 ab	11.0 ab	(S) ^w
Harvest Queen	17.8 a	13.5 b	13.5 ab	10.2 bc	10.5 abc	10.5 abc	(S)
Harrow Delight	15.0 b	11.5 bc	11.2 cd	9.0 cd	10.0 abc	6.8 d	(S)
HW 604			12.5 bc	7.8 d			
HW 605			9.5 de				
HW 606	16.5 ab		13.5 ab	10.0 bc	9.2 bc	10.2 abc	(S)
HW 609		10.8 c	9.0 e	9.8 bc	10.0 abc		
HW 610		12.2 bc	12.8 bc	11.2 b	11.0 ab		
HW 611		11.5 bc	14.2 ab	10.8 bc			
HW 613			12.5 bc	13.8 a	12.2 a		
HW 614		11.0 c	11.0 cde	10.8 bc	10.2 abc		
HW 615				10.5 bc	9.8 bc		
HW 616			6.0 f		10.8 abc		
HW 617					9.5 bc		
HW 618					8.5 cd		
HW 619				9.8 bc	9.5 bc		

^zOnly cultivars and advanced selections are reported.

^yTotal score is a sum of the rating for aroma, viscosity, flavor and color 1979 to 1983 and viscosity, flavor, and color in 1984 and 1985. All were rated 1 to 5 (1 = poor and 5 = very good.)

^xMean separation within each column is by Duncan's Multiple Range Test, 0.05% level.

^wThe (S) denotes that the fruit were processed without peeling skins.

Table 3. Taste panel scores of canned halves of 'Bartlett' and some Harrow selections rated for appearance, flavor and texture in 1984 and 1985.

Cultivar/Selection	Appearance		Flavor		Texture	
	1984	1985	1984	1985	1984	1985
Bartlett	4.2 ^a x	4.5 a	3.8 a	4.2 a	4.5 a	3.8 a
HW 606	4.0 ab	4.8 a	3.2 a	4.2 a	3.5 a	4.0 a
HW 607		4.2 a		3.5 ab		3.2 a
HW 610	4.2 a	4.5 a	3.2 a	3.2 ab	3.2 a	4.0 a
HW 611	3.5 ab	4.0 a	3.2 a	2.5 b	3.5 a	3.5 a
HW 612	2.5 c		3.8 a		3.8 a	
HW 614	3.2 bc	3.0 b	3.2 a	3.2 ab	3.5 a	3.8 a

^xThe canned halves were rated from 1 to 5 (1 = poor and 5 = excellent).

^aMean separation within each column is by Duncan's Multiple Range Test, 0.05% level.

Table 4. Taste panel scores of canned puree of 'Bartlett' and selected selections for flavor, color and viscosity texture in 1984 and 1985.

Cultivar/Selection	Flavor		Color		Viscosity	
	1984	1985	1984	1985	1984	1985
Bartlett	4.8 ^a x	4.0 a	4.8 a	4.2 ab	4.2 b	3.0 b
HW 606	2.8 c	2.8 b	3.8 b	3.0 b	3.5 c	3.5 a
HW 613	4.5 ab	3.0 a	4.2 ab	4.5 a	5.0 a	4.8 a
HW 614	3.8 b	3.8 a	2.5 c	2.0 c	4.5 ab	4.5 a

^xThe canned purees were rated from 1 to 5 (1 = poor and 5 = very good).

^aMean separation within each column is by Duncan's Multiple Range Test, 0.05% level.

Table 5. Natural incidence of fire blight and per cent of shoot blighted from controlled inoculations for 1984 of 'Bartlett' and cultivars/selections from the Harrow pear breeding program.

Cultivar or Selection	Natural Blight		1984 Inoculations % Blight ^y
	No. of Years	Rating (1-10) ^z	
Bartlett	13 ^x	3.7	76.4 a ^w
Harvest Queen	12	9.1	14.5 efg
Harrow Delight	12	9.5	9.7 gh
HW 604	8	8.5	46.5 bc
HW 605	8	8.6	38.8 bcd
HW 606	8	9.6	26.3 def
HW 607	5	9.8	27.9 cdef
HW 608	5	9.4	48.2 b
HW 609	10	9.3	12.7 fg
HW 610	7	8.8	30.6 bcde
HW 611	6	9.7	32.4 bcd
HW 612	4	8.2	2.1 h
HW 613	4	8.4	9.4 gh
HW 614	4	9.6	2.2 h
Kieffer	9	9.2	8.9 gh

^z1 equals death of the tree while 10 equals no fire blight.

$$\% \text{ Blight} = \frac{\text{lesion length}}{\text{total shoot length}} \times 100$$

^xNo. of years that trees were rated for natural fireblight severity using the USDA fireblight rating system.

^wMean separation was performed on transformed data by Duncan's Multiple Range Test 0.05% level and reported means are the corrected weighted means.

due to differences in harvest maturity, storage and ripening conditions. A wealth of information on proper handling of 'Bartlett' to achieve the best quality exists (6), but is lacking for new selections, thus there is a probable bias in these results in favor of 'Bartlett.' Possibly, the quality of some of these selections might compare more favorably to 'Bartlett' with better knowledge of optimum harvest, storage and ripening characteristics.

All the selections reported in this paper have a higher level of resistance to fire blight than 'Bartlett,' either rated on the basis of natural infection or inoculation studies (Table 5). Thus, it seems possible to breed pears with good processing qualities combined with resistance to fire blight if appropriate selection procedures are followed.

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Effect of 'Siberian C' Rootstock, Interstem, and Scion on Foliar Calcium Content in Peach

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Abstract

A study was conducted to investigate the effect of 'Siberian C' when used as a rootstock, interstem, or scion on foliar calcium level in peach [*Prunus persica* (L.) Batsch]. Data from 2 years of field testing revealed that calcium was significantly reduced in leaf tissue only when 'Siberian C' was used as a rootstock. The results suggest that reduced foliar calcium in peach scions propagated on 'Siberian C' is due to reduced calcium absorption by roots of 'Siberian C,' and not to blockage of calcium transport at the graft union.

Introduction

Peach trees grown on 'Siberian C' rootstock have been shown to contain

less foliar calcium as compared to trees propagated on other peach rootstocks (3). Couvillon (1) found that leaves from own-rooted peach trees contained higher levels of Ca than leaves from trees budded to several peach seedling rootstocks, and suggested that the graft union may block Ca transport to the scion. This has also been proposed by others (2). Knowles et al (3) suggested that graft union hinderance of calcium transport may be more pronounced on 'Siberian C' rootstock. The purpose of this study was to investigate the effect of 'Siberian C' when used as a root-

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