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PECTIN DURING TREE AND ROOM RIPENING OF LOW AND HIGH CHILL, MELTING AND NON-MELTING FLESH PEACH VARIETIES

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Abstract. **Fruit were sampled to compare pectin in peach [*Prunus persica* (L.) Batsch] varieties, and to determine if differences exists between low and high chill, melting (mf) and non-melting (nmf) flesh varieties. Fruit were sampled at 2, 1 and 0 weeks before harvest at maximum background color and at 0 up to 9 days of postharvest softening at room temperature (25°C). Soluble pectin levels (CSP + ASP) decreased for all varieties during the last week of on-tree ripening. There were no differences in the chelate soluble pectin (CSP), alkaline soluble pectin (ASP) and residue (RES) fractions for low vs high chill and mf vs nmf classes at the same harvest date. There were no differences in postharvest storage between low vs high chill or mf vs nmf for grams pectin/100 g mesocarp or /100 g cell walls. However, 'O'Henry' was distinguished from all other peach varieties in postharvest storage with higher grams pectin/100 g mesocarp in the RES fraction; and therefore, a higher TOTAL pectin level indicating an alternate flesh type to mf or nmf.**

Rapid softening of mf fruit occurs during on-tree ripening and postharvest storage while nmf softens more slowly. Softening rates vary among varieties, both for high (temperate zone) and low chill (subtropical zone) varieties (Robertson et al., 1988, 1993; Sherman et al., 1990). Among fresh market peaches, the high chill, later ripening varieties have generally been thought to produce higher firmness than the more recently bred early ripening, low chill varieties. More recently, non-melting flesh has been bred into fresh market varieties to give more "tree ripe" firmness and thus a longer shelf life with maximum flavor. The purpose of this study was to compare low and high chill, mf and nmf peach varieties for pectin during the on tree ripening (the last 2 weeks before maximum background color at harvest) and after 0 to 9 days of postharvest softening at room temperature (25°C).

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Materials and Methods

Fruit material. Five low chill (3 mf and 2 nmf) and 6 high chill (4 mf and 2 nmf) peach varieties (Table 1) were evaluated for mesocarp pectin. Peach varieties were chosen to represent the range of firmness available in low vs high chill, mf vs nmf classes. Fruit were harvested from commercial orchards, the University of Queensland, Gatton orchard or the Queensland Horticulture Institute (QDPI), Stanthorpe orchard, between October 1993 and March 1994.

Preparation for biochemical analysis of tree ripened fruit. For each variety, 30 fruit were harvested at 1) two weeks before maximum background color; 2) one week before maximum background color (ca. commercial harvest date) and 3) time of maximum background color. Background color (yellow, epicarp skin appearing with the red skin) has been a standard harvest maturity index in peaches and other stonefruit for many years. Background color has been quantified through the use of color meters (Delwiche and Baumgardner, 1983, 1985).

Fruit from each harvest and for each postharvest storage date at room temperature were peeled, the mesocarp diced into small pieces, and immediately placed in liquid nitrogen. Only fruit from harvest two were used in postharvest storage at room temperature. Frozen peach mesocarp tissue was stored at -20°C in sealed polyethylene bags for later pectin analyses as adapted by Porter (1999) from Fishman et al. (1993).

Preparation for biochemical analysis of fruit ripened during storage at 25°C. Twenty fruit of each variety were selected from 1 week before maximum background color (harvest 2) and stored at 25°C ± 2°C. The fruit were dipped for 30 sec in triforine fungicide at a rate of 100 mL/100L, air dried, covered with polyethylene film to reduce moisture loss and placed in

Table 1. Winter chilling requirement and flesh texture classes with length of fruit development period (FDP) and stone freeness at harvest for peach varieties used in this study.

Variety	FDP[z]	Stone
Low chill melting flesh		
Earligrande	75	Semi-cling
Flordastar	72	Semi-cling
Flordagold	90	Cling
Low chill non-melting flesh		
Fla. 9-20C	110	Cling
Oro-A	83	Cling
High chill melting flesh		
Correll	92	Cling
Glohaven	134	Free
Mac's Cling	140	Cling
O'Henry	161	Free
High chill non-melting flesh		
Babygold #5	128	Cling
Golden Queen	180	Cling

(Russell, 1998).
[z]*F*ruit *D*evelopment *P*eriod (FDP) in days after 50% bloom to harvest.

Table 2. Mean pectin weight in chelate soluble (CSP), alkaline soluble (ASP), residue pectin (RES) fractions and total pectin in peach mesocarp during harvest at 2, 1 and 0 weeks (harvest 1, 2 and 3, respectively) before maximum background colour for 11 peach varieties (g pectin/100 g mesocarp) that represented *mf* vs *nmf*, low vs high chill classes.

Harvest	CSP	ASP	CSP + ASP	RES	TOTAL
1	0.251 ± 0.028	0.386 ± 0.055	0.637 ± 0.067	1.436 ± 0.185	2.073 ± 0.219
2	0.264 ± 0.052	0.387 ± 0.041	0.651 ± 0.072	1.068 ± 0.111	1.719 ± 0.157
3	0.130 ± 0.015	0.250 ± 0.031	0.380 ± 0.041	0.709 ± 0.057	1.089 ± 0.081

Table 3. Mean weight of chelate soluble (CSP), alkaline soluble (ASP), residue pectin (RES) fractions and total pectin in peach mesocarp variety classes and 'O'Henry' during 6 to 9 days of postharvest storage at room temperature (g pectin/100 g mesocarp).

Varieties (no.)	Class	CSP	ASP	CSP + ASP	RES	TOTAL
3	low chill mf[z]	0.206	0.335	0.541	0.731	1.272
2	low chill nmf	0.209	0.394	0.603	0.895	1.498
3	high chill mf	0.277	0.327	0.599	0.780	1.379
(1)	(O'Henry)	(0.387)	(0.480)	(0.967)	(2.446)	(3.413)
2	high chill nmf	0.262	0.423	0.685	1.206	1.891

[z]mf = melting flesh; nmf = non-melting flesh.

individual holders within a plastic insert in a single layer fruit tray. The fruit were individually numbered within the tray for later removal and analysis.

The low and high chill, mf fruit were stored at 25°C ± 2°C for 1, 2, 4, 6 and 8 days (five fruit were removed and destructively sampled per removal date), but the high chill, mf fruit became impossible to measure at day 8 due to fungal disease problems. The nmf fruit were stored at 25°C ± 2°C for 1, 3, 6 and 9 days (five fruit were removed and destructively sampled per removal day). Fruit were peeled, diced and stored in liquid nitrogen as described above. Pectin analyses were as above.

Results and Discussion

Chelate (CSP) and alkaline soluble (ASP) pectin and the residual fraction (RES) were extracted to determine pectin levels. The residual fraction contains some tightly bound pectin, but the majority of this fraction is cellulose and hemicellulose. Results from these measurements for pectin levels in 11 low chill and high chill peach varieties during tree ripening and storage at 25°C are presented below.

Pectin during tree ripening. There were no differences for grams pectin/100 grams mesocarp between mf and nmf, low and high chill classes in the CSP, ASP, and RES fractions and TOTAL pectin in the same harvest date (data not shown). Due to the lack of differences among varieties, each variety was used as a replication to calculate an overall mean for each fraction and TOTAL pectin to see if there were trends in the various fractions (Table 2). Soluble pectin (grams pection/ 100 g mesocarp) (CSP + ASP) for all varieties decreased during 2, 1 and 0 weeks before harvest at maximum background color. The data were also calculated as g of pectin/100 g cell wall. There were no trends between mf and nmf, low and high chill classes for g pectin/100 g cell wall in the CSP, ASP, CSP+ASP and RES fractions and TOTAL pectin; thus, data was not shown.

Pectin during postharvest storage. Fruit from harvest two were stored at room temperature (25°C) for 6 to 9 days during which they were sampled. Samples of each variety were not replicated, but were averaged for the mf vs nmf, low vs high chill classes to see if there were any class trends. There were no apparent differences between mf and nmf (except O'Henry), low chill and high chill classes for g pectin/100 g mesocarp in the CSP, ASP, CSP + ASP and RES fractions and TOTAL pectin during postharvest storage. Thus, the mean for each chilling and flesh texture class and O'Henry was calculated and presented (Table 3). O'Henry had a higher g pectin/100 g mesocarp in the RES fraction and therefore a higher total pectin level than the other 10 varieties. Thus, O'Henry may have an alternate flesh type, possibly stony hard (Yoshida, 1970).

The data were also calculated as g pectin/100 g cell wall. No trends were found in grams pectin/100 grams cell wall for the low and high chill, mf and nmf classes in the CSP, ASP, CSP+ASP and RES fractions and TOTAL pectin (data not shown).

In summary, pectin was not noticeably different whether measured as g/unit of mesocarp or as g/unit of cell wall in either low chill (short FDP in this study) vs high chill (long FDP in this study) or mf vs nmf classes. Thus, some change in cell wall other than total GA or pectin content has a major influence on fruit firmness, if a major difference does exist in varieties differing in FDP orchilling requirement and mf vs nmf.

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