try to flee southward. Varieties that would thrive on hilltop soils in Florida would allow growers to abandon frosty, low areas. Use of pine-bark growing medium is a step in this direction, but pine bark itself makes the air much colder in the field on calm nights. Grafted blueberry plants, using the upland-adapted sparkleberry (Vaccinium arborescens) as rootstock for highbush blueberry scions may be feasible, but would greatly increase plant costs. Development of varieties that require more heat to induce flowering and have a shorter flowering-to-ripening interval should yield progress. At present, however, growers must consider overhead irrigation and occasional crop losses among the risk factors that increase the cost of producing early blueberries in Florida.

Literature Cited


FRUIT FIRMNESS AND PECTINMETHYLESTERASE ACTIVITY DURING ON-TREE RIPENING OF PEACH

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Abstract. Fruit firmness and pectinmethylsterase (PME) activity were determined at 3 harvest dates over 2 weeks for 11 low chill and 5 high chill peach (Prunus persica) varieties of which 11 were melting flesh (mf) (excluding O’Henry) and 4 were non-melting flesh (nmf) varieties. Firmness decreased in all classes as fruit became more tree ripe. However, there was no apparent relationship between PME activity and major changes in firmness for low vs high chill, or mf vs nmf classes. Thus, on-tree initiation of ripening and softening in peach fruit was not related to PME activity. Levels of PME activity did not fully explain the softening differences between varieties. ‘O’Henry’ had a slower softening rate than mf varieties and lower PME activity than found at each harvest date in either mf or nmf varieties indicating that it has a different flesh type.

Rapid softening of mf fruit occurs during on-tree ripening while nmf soften more slowly. Both high and low chill varieties have different softening rates (Robertson et al., 1988, 1993; Sherman et al., 1990). PME activity has been shown during the early ripening period (Chopra, 1991; Huber and Lee, 1986; Huber and O'Donoghue, 1993; Pressley et al., 1971) as PME activity is required to initiate pectin degradation. Polygalacturonase cannot degrade pectin until PME has de-esterified the pectin molecule (Abu-Sarra and Abu-Goukh, 1992; Fischer and Bennett, 1991; Fogarty and Kelly, 1983; Nagar, 1994; Kays, S. J., 1991). In our work, PME was expected to be higher in less ripe fruit than in softer ripe fruit on the tree as Glover and Brady (1995) report high PME activity before peach fruit soften. Within mf genotypes, the Florida low chill peach varieties are earlier ripening and are often thought to have softer fruit than high chill varieties, and mf softens more rapidly than nmf. Thus, the following work was conducted to quantify peach fruit firmness and pectinmethylsterase (PME) activity during tree ripening of low and high chill, mf and nmf peach varieties.

Materials and Methods

Fruit material. Eleven low chill (9 mf and 2 nmf), 4 high chill (2 mf and 2 nmf) and ‘O’Henry’ peaches were evaluated for mesocarp firmness and PME activity. Peach varieties were chosen to represent the range of firmness available in low chill and high chill, mf and nmf classes. Fruit were harvested from southern Queensland commercial orchards, the University of Queensland, Gatton Campus orchard, or the Queensland Horticulture Institute (QDPI), Stanthorpe orchard, between October 1996 and March 1997.

Preparation for biochemical analysis of tree ripened fruit. For each variety, 5 to 10 fruit were selected 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, epidermal skin appearing with the red skin) has been a standard har-
vest maturity index in peaches and other stonefruit for many years. Background color has been quantified through the use of color meters (Delwiche and Baumgardner, 1985, 1985).

Fruit were peeled and measured on two sides for firmness using a hand held penetrometer with a 7.9 mm tip and the measurements converted to Newtons (N). The mesocarp was diced into small pieces and immediately placed in liquid nitrogen. Frozen peach mesocarp tissue was stored at -20°C in sealed polythene bags for later PME analysis. PME analysis was adapted (Porter, 1999) from Hagerman and Austin (1986) for the extraction of PME from crude extracts of peach mesocarp. PME was expressed as umoles galacturonic acid.min⁻¹.g fresh mesocarp⁻¹.

**Results and Discussion**

All varieties decreased in fruit firmness as fruit became more tree-ripe, but variety variability for PME activity was high. Thus, we combined and averaged firmness and PME activity for all varieties in low vs high chill, mf vs nmf classes. The averages were for each of the 3 harvest dates in the 4 classes of chilling and flesh types.

There was little firmness difference at each harvest date between low vs high chill, mf vs nmf classes, with the exception of ‘O’Henry’, which maintained a higher firmness over all harvest dates (Fig. 1).

In this study, PME activity either increased or did not change during on-tree ripening (Fig. 2), contrary to Glover and Brady (1995). Thus, fruit softening as it increased in background color on the tree was not attributed solely to changes in PME activity. The level of PME activity was lower for ‘O’Henry’ at any harvest date than for any other variety. Furthermore, because ‘O’Henry’ did not soften on the tree as it ripened, it is proposed that ‘O’Henry’ has an alternative flesh, possibly the stony hard type (Yoshida, 1970). In summary, levels of PME activity did not fully explain the fruit softening differences between varieties. This indicates other influences such as genotype differences in cell wall structure or other cell wall enzymes such as polygalacturonase (perhaps even levels of endo- and exo-) that are involved in softening.

![Graphs showing changes in peach fruit firmness at harvest 1, 2 and 3 for low chill mf (avg. 9 varieties), low chill nmf (avg. 2 varieties), high chill mf (avg. 2 varieties), ‘O’Henry’ and high chill nmf (avg. 2 varieties).](image)

*Figure 1. Changes in peach fruit firmness at harvest 1, 2 and 3 for low chill mf (avg. 9 varieties), low chill nmf (avg. 2 varieties), high chill mf (avg. 2 varieties), ‘O’Henry’ and high chill nmf (avg. 2 varieties).*

Figure 2. Changes in peach fruit PME activity (galacturonic acid) at harvest 1, 2 and 3 for low chill mf (avg. 9 varieties), low chill nmf (avg. 2 varieties), high chill mf (avg. 2 varieties), 'O’Henry' and high chill nmf (avg. 2 varieties).

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