

Changes in Pectic Substances During Ripening of Avocados¹

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Abstract. Changes in pectinesterase activity and in the 3 pectic fractions of avocados (*Persea americana* Mill. cv. Lula) during ripening were investigated at 21.1° and 10°C storage. Decrease in pectinesterase activity just prior to softening was very rapid, and when softening occurred, this activity became minimal. Tissue softening during storage was accompanied by a general increase in water-soluble pectin and a drop in ammonium oxalate- and sodium hydroxide-soluble pectins.

Few studies have been carried out on changes in pectic substances of ripening avocados (1, 2). An increase in soluble pectin and decreases in protopectin and in the degree of esterification of the soluble pectin were associated with the climacteric rise in the respiration rate of avocados (1). Recently, Zauberman and Schiffmann-Nadel (6) described the role of pectinesterase (PE) and polygalacturonase (PG) in avocados at various stages of ripeness; the PE activity decreased during ripening while the PG activity increased.

The primary objective of this study was to determine the changes in PE activity and in the 3 pectic fractions during ripening of avocados at 10°C and 21.1°C storage. Pectins were also extracted from unripe and ripe avocados for determination of anhydrogalacturonic acid (AGA), methoxyl content, and viscosity.

Mature but unripe 'Lula' avocados were harvested in south Florida during Feb. 1973 and stored at 10° and 21.1°C. PE activity and the 3 pectic fractions extracted from alcohol-insoluble solids were measured periodically (3, 4). Units of PE are expressed in milliequivalents of ester hydrolyzed/min/g on fresh tissue basis. Pectin was divided into water-, ammonium oxalate-, and sodium hydroxide-soluble fractions and each was determined as AGA and reported as percentage pectin on fresh tissue basis.

Pectin was extracted from samples of the dried alcohol-insoluble solids from unripe (control) and ripe (7 days at 21.1°C) avocados. The samples were extracted with Zeo Karb H ion exchange resin (Permutit Corporation, Paramus, New Jersey) for 1 hr at 90°C, the extract filtered, and the filtrate was precipitated in isopropyl alcohol and then vacuum dried at 60° (5). Methoxyl content, AGA, and relative viscosity (3, 4) were determined on the dried precipitates.

As the fruit ripened in storage at the 2 temperatures, the patterns for PE and pectic fractions curves were similar (Fig. 1). Softening occurred within 3 days at 21.1°C and was associated with a rapid decrease in PE activity, whereas, at 10° storage the fruit required

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11 days to soften and the PE declined rapidly only after 7 days.

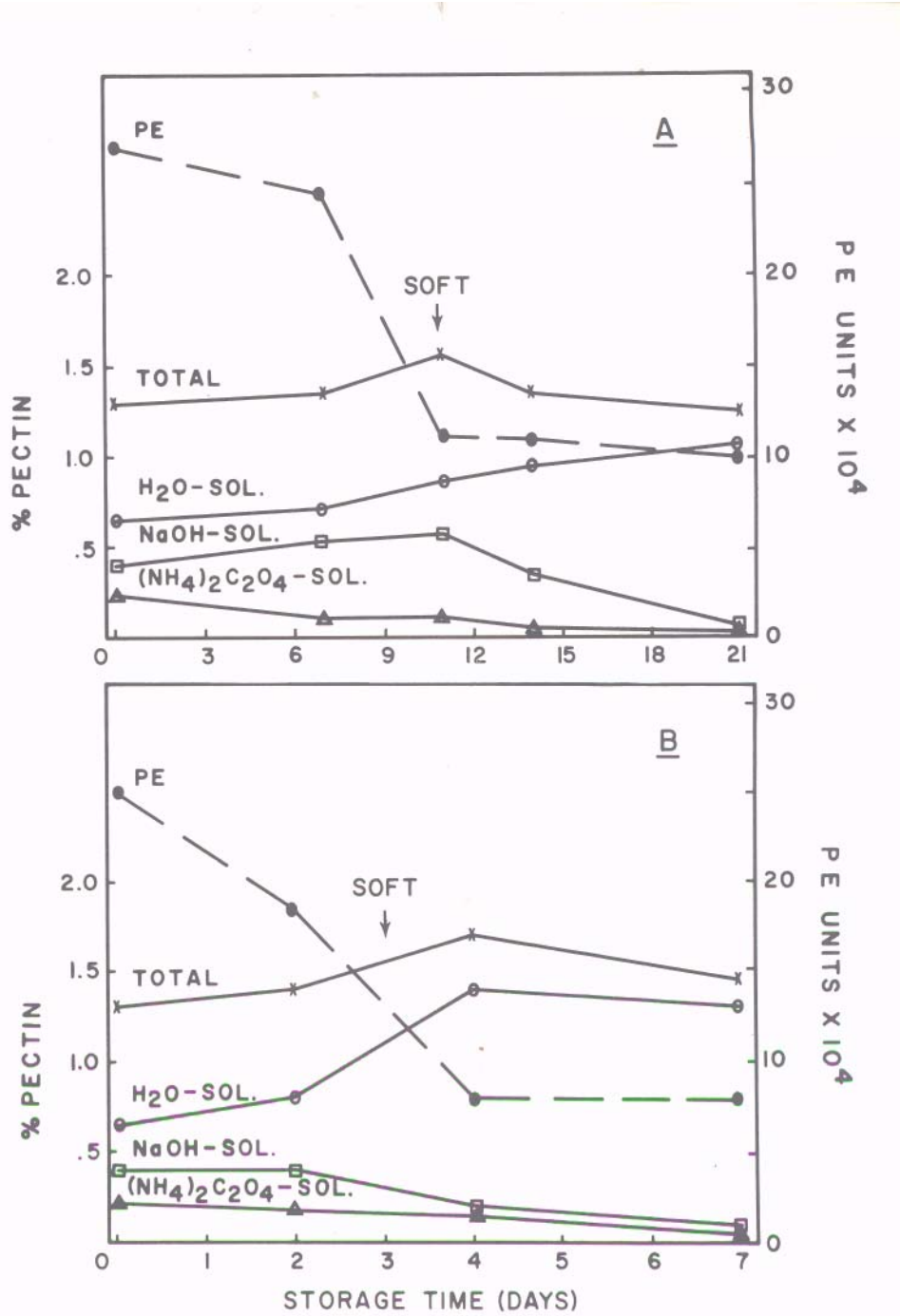


Fig. 1. Pectinesterase (PE) activity and pectic fractions in avocados at various stages of ripeness at (A) 10°C storage and (B) 21.1°C storage. Values are expressed on fresh tissue basis.

Generally, the water-soluble pectin increased with ripening, while the ammonium oxalate-soluble and the sodium hydroxide-soluble (protopectin) fractions decreased. At 21.1°C, total pectin reached a maximum after 4 days storage and at 10° after 11 days, following which there was a slight decrease. This slight loss in pectin is attributed to the noncolloidal water-soluble galacturonic acid that is formed from the activity of PG. This;

enzyme in avocados is very active during the last days of softening and reaches a maximum at complete softening of the fruit (6). Thus, during the preparation of the alcohol-insoluble solids, the galacturonic acid is lost and not precipitated in alcohol.

The pectins (expressed as AGA) of unripe and ripe avocados, respectively, had purities of 51.1 and 44.8%, methoxyl contents of 11.2 and 9.2% and relative viscosities of 2.3 and 1.2 at 26°C in a 0.25% dispersion. The results of this study indicate a degradation of the pectin molecule in avocados during fruit ripening and this information is being applied to measure ripening of avocados in storage.

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