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Short Communication

Pectin Methylesterase and Polygalacturonase in Avocado Fruit at Various Stages of Development[1]

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GIORA ZAUBERMAN AND MINA SCHIFFMANN-NADEL
Division of Fruit and Vegetable Storage, The Volcani Institute of Agricultural Research, Bet Dagan, Israel

A number of studies have shown that PME[2] increases during the process of fruit ripening. This increase was observed for the banana during the stage of color change from green to yellow by Hultin and Levine (4) and in tomato at color "turning" stage by Dennison *et al.* (2) and by Hobson (3). PME activity apparently has not been studied in avocado fruit. An increase in PG activity in avocado at fruit ripening and softening was described by McCready and McComb (6), McCready *et al.* (7), Reymond and Phaff (8), and, recently by Barash and Khazzan (1). Our study is concerned with PME and PG in Fuerte avocado, not only in mature fruit but also at various stages of development and ripening.

PME and PG activities were measured in avocado (*Persea americana* Mill.) over the period of June to March. November to March is the normal picking season for avocado of the Fuerte variety in Israel.

Determination of PME was carried out according to the method of Rouse and Atkins (9). The fruit was ground in an Osterizer blender with 1 M NaCl for 3 min. The filtered extract was incubated with pectin substrate at the ratio of 1:10. Citrus pectin (Yachin, Israel) at 1% was used. PME units were expressed in milliequivalents of ester hydrolyzed per min per g of fruit extract. Measurement was carried out at pH 7.5 for 30 min at 30 C. PG was determined on the basis of substrate viscosity loss caused by action of the enzyme (5). Determination was made at pH 5.0 and at 30 C. PG activity was expressed as percentage loss of viscosity during 30 min.

PME activity on picking day was found to decrease with the stage of fruit development (Fig. 1, Table I); in young fruit at intensive growth stage during June and July, PME activity decrease was pronounced, while in nearly mature and mature fruit (September to March) the decrease was moderate, more so in 1967 than in 1969 (Fig. 1). Fruit maturation was relatively early in 1969 and late in 1967. The data on these experiments, as well as unpublished data from 1970, show that, when the fruit has almost attained normal commercial picking size (about September), PME activity is lower than 10^5 units. This finding may be considered as a possible indicator for determination of fruit maturity at the beginning of the commercial picking season.

PME activity in stored fruit was high at the start and declined steeply till the beginning of softening (Fig. 2). Fruit more developed at picking time showed a steeper decline in PME activity. No PG activity was detected in firm fruit at various stages of development immediately after harvest; only after a few days were measurable activities observed (Fig. 3). PG activity started when fruit was still firm (although at cutting some softening was felt) and reached maximum at complete softening. There were no significant differences between PG activity values for young and mature fruits; after 30 min the loss in substrate viscosity was 25 to 35% (Fig. 3). However, PG activity started earlier in more developed fruits.

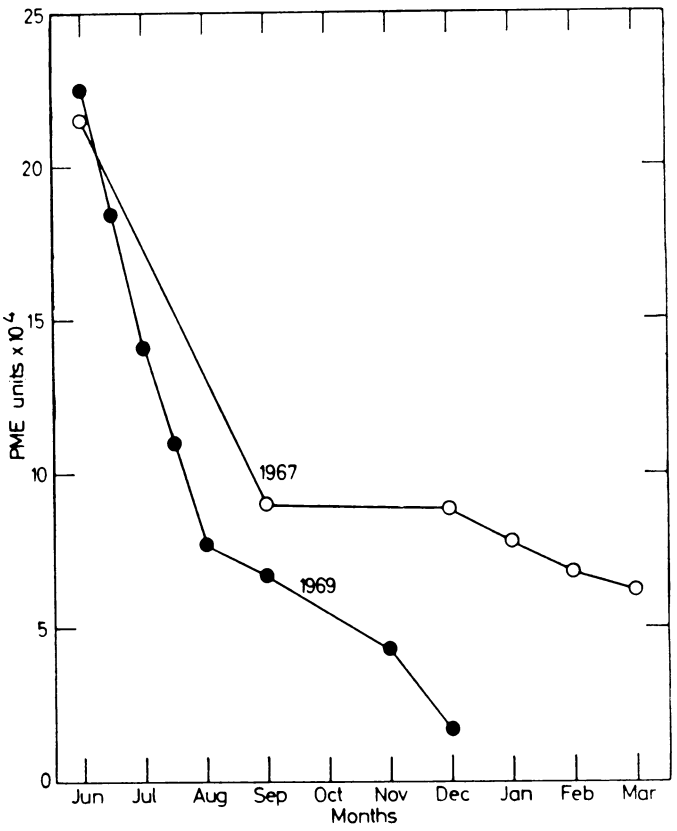

FIG. 1. The activity of PME at picking time in fruits at various stages of development.

The absence of measurable PG activity in firm avocado fruit has also been noted by other investigators (1, 6, 8); Reymond and Phaff (8) explained this finding on the basis of a PG inhibitor being present.

Summarizing, PME and PG activities were basically similar in young and in mature fruit; however, with fruit develop-

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[2] Abbreviations: PG: polygalacturonase; PME: pectin methylesterase.

Table I. *General Characteristics of Avocado*
The picking period was 1968 to 1969.

Month	Avg Fresh Wt of Fruit	Avg Oil Content of Fruit
	g	%
June	61	1.3
July	165	1.7
August	225	6.5
September	227	7.2
November	227	11.5
December	236	14.9
January	234	16.2
February	235	19.0
March	260	21.7

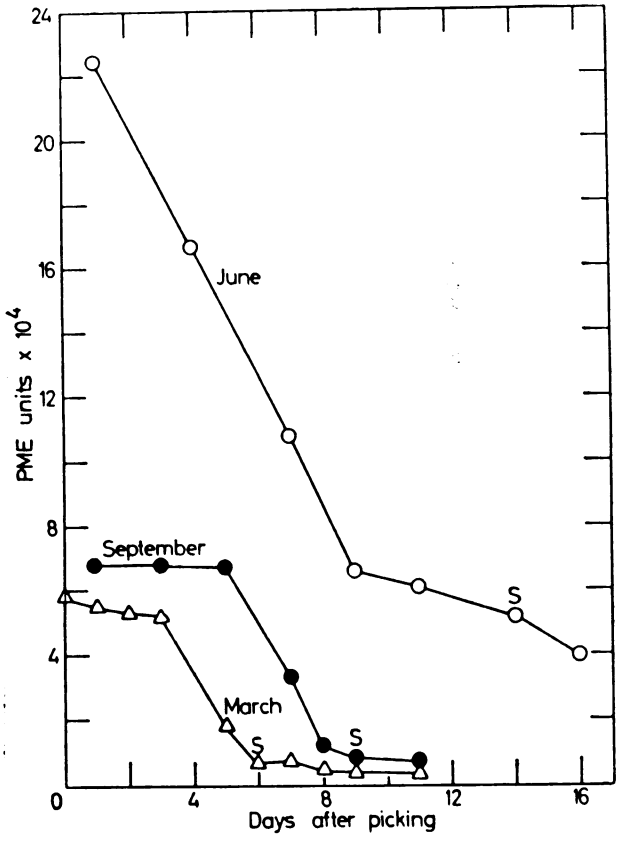

FIG. 2. PME activity during storage in fruits at various stages of development. S: Softening. Fruits were stored at 20 C.

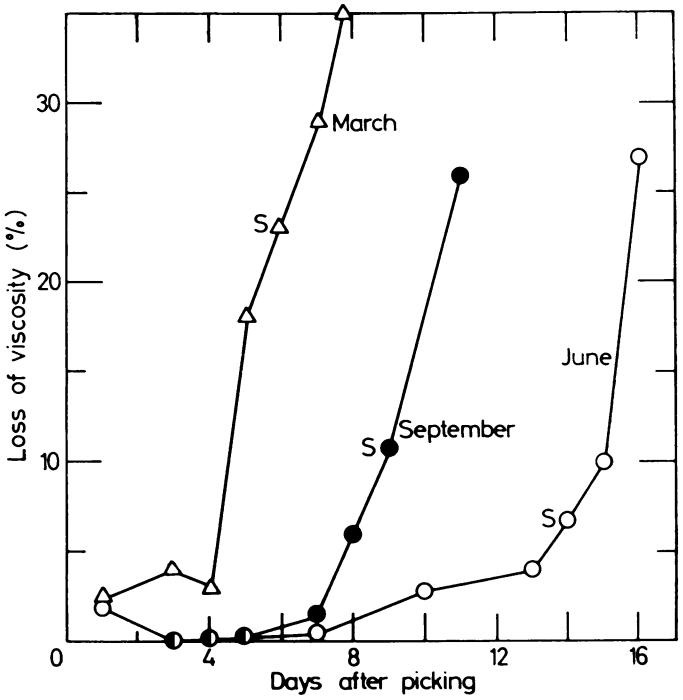

FIG. 3. PG activity during storage in fruits at various stages of development, stored at 20 C. S: Softening.

ment, the period during which PME activity reached its minimum and PG its maximum became shorter. Fruit softening occurred in young and mature fruit when PME activity was minimal and PG activity maximal.

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