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The Response of Avocado Fruits to Different Storage Temperatures[1]

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Abstract. **The response of fruits of avocado *(Persea americana* Mill.) to various temperatures was found to differ in the range 0° to 25°C. This temperature range was divided into 3 groups: 1) between 10° and 25°, the fruit softened at a rate which increases with increasing temperature; 2) between 5° and 8°C, fruit softening was inhibited and the fruit softened only after transfer to a higher temperature; and 3) between 0° and 4° storage life without the occurrence of chilling injury was limited.**

Avocado fruit does not soften while on the tree, but only after it is picked. The period which elapses from picking to softening is a function of the metabolic activity of the fruit, which in turn depends on various factors, one of the most influential being storage temp. The response of the fruit to temp, particularly its susceptibility to low temp, including preharvest conditions (3), varies among avocado cultivars and may be influenced by their geographic origin. There is a general impression that West Indian cultivars are more sensitive to low temp than are Guatemelan and Mexican. Climatic conditions may also play an important role in cultivar susceptibility. For example, various Florida avocado cultivars showing differences in tolerance to low temp are cited by Mustard (8), Hatton et al. (6) and Spalding and Reeder (10), Tai (11) observed such differences in Trinidad-grown fruit, Pennock (9) in Puerto Rican fruit and Abou Aziz (2) in avocado grown in Egypt. The present authors (12) have observed such variations in Israeli avocado and data of this kind have also been reported from South Africa (1).

Cooper et al. (4) cited differences in susceptibility to chilling injury at 5°C in some avocado cultivars which was correlated with higher ethylene evolution in the more cold sensitive fruits.

We have studied the response of 3 avocado cultivars grown in Israel to postharvest temp. The susceptibility to low temp was evaluated by 1) determining the maximum period that the fruits could be stored without injury at different cold storage temp, 2) assessing the effect of different cold storage temp on shelf life, and 3) determining the time till fruit softening at different ripening temp without prior cold storage.

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'Fuerte,' 'Nabal' and 'Hass' fruits were stored between 0° and 35°C for different periods as follows: between 10° and 35° the fruit was kept until it softened; between 0° and 8°, the fruit was kept for 1 to 6 weeks only and samples were then transferred weekly to shelf-life tests at 25° until the fruit softened. These trials, carried out over a period of 3 years, were repeated 3 times during each picking season for each cultivar.

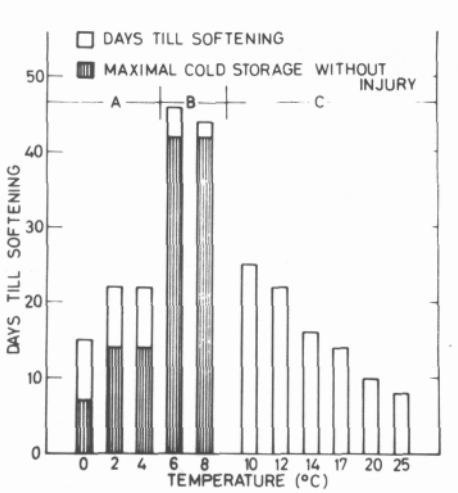

Fig. 1. Effect of different storage temp on the softening time of 'Fuerte' avocado fruit.

Differences in the duration of time between picking and softening were relatively small between years and within each picking season. The time till softening in different cultivars was fairly similar; the times for 'Nabal' and 'Hass' were only slightly longer than that for 'Fuerte.' Therefore, the data presented for 'Fuerte' fruit picked at the middle of the harvest season can be regarded as representative.

The response of the fruit to temp varied, as follows:

1. In the range 10-25°C, the fruit softened, the time till softening being a function of temp. For example, at 10°, 14° and 25°, softening occurs after 25, 16 and 8 days, respectively (Fig. 1).
2. At 6° and 8°C, metabolic activity was reduced and fruit ripening inhibited; the fruit did not soften until transferred to a higher temp. Storage of the 3 cultivars at 6° and 8° did not cause any chilling injury for 6 weeks. The shelf life at 25° after storage at these temp was shorter than for fruits with out previous cold storage.
3. In the range 0-4°C, the storage period without chilling injury was limited: 0° for 1 week only, at 2° for 2 weeks, and at 4° for 2 to 4 weeks, depending on cultivar. 'Nabal' and 'Hass' were more resistant to chilling injury than 'Fuerte.' Symptoms of chilling injury caused by prolonged cold storage at 0 - 4° did not appear during cold storage but only during subsequent shelf life tests. Evidence that the metabolic activity of fruit at these temp was very low is provided by the observation that fruit storage at these temp did not affect the duration of shelf life following storage. The shelf life was similar to that of fruit without previous cold storage. For example, the shelf life (at 25°) of fruits stored previously at 0 - 4° and fruits kept at 25° without prior cold storage was 8 days.

Eaks (5) found that exposure of 'Fuerte' and 'Hass' grown in California for 1 - 2 weeks at 0°C, or 1 - 4 weeks at 5°, shortened the period until softening and ripening at 20° compared with storage at 20°C without prior cold storage.

At extremely high storage temp of 30°C and 35°, fruit was damaged and did not soften normally; at 30° fruit did not soften satisfactorily but became leathery, while at 35° no softening occurred and peel shrinkage and browning appeared.

Our data refer to fruits that were placed in storage the day after picking, e.g. before the onset of the climacteric rise of respiration. Fruit that has started the process of ripening and softening responds differently (7, 13).

Under our conditions within the range 10 - 25°C, the fruit was able to soften without

being damaged, but storage at lower temp (0 - 8°) inhibited fruit softening. The appropriate storage temp for the avocado cultivars grown in Israel depends on the response of avocado fruit to different storage temperatures. For the longest postharvest life, storage at 6 - 8° was best, and for the fastest ripening, storage at 25° was best.

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