Association of Calcium in Chilling Injury Susceptibility of Stored Avocados

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Abstract. Visible injury in chilled avocados (Persea americana Mill.) was observed first in the distal end of fruit. The proximal end remained apparently unaffected unless exposure to chilling temperature was prolonged. In contrast, the concentration of endogenous Ca of individual fruit was always highest in the proximal end and lowest in the distal end. Severity of visible injury in stored fruit was significantly reduced when Ca was applied to harvested fruit by vacuum infiltration of CaCl₂.

Chilling injury (CI) may occur when most tropical and subtropical fruits are exposed to temperatures in the range 0-12°C. There are excellent reviews on this subject (3, 4). Visible injury is chiefly seen in chilled avocados as dark brown or gray discoloration in the mesocarp (1, 9). Treatments based on controlled atmosphere storage (5, 9) and modified atmosphere storage (6) have been developed which protect avocados from CI at least to some extent. However, the time required for injury symptoms to occur in stored avocados is often variable (5, 6, 9) which implies that intrinsic susceptibility to injury may be affected by some endogenous fruit factor(s). The reasons for this variability have not been defined although there is evidence that chilling sensitivity changes at different stages of the respiratory climacteric (2).

In other fruits, Ca has been implicated in the incidence of numerous physiological disorders (8) and our results presented here suggest that Ca has an important role in the susceptibility of stored avocados to CI.

It has been consistently noted at this laboratory that visible CI symptoms occur first in the distal end of fruit while the proximal end remains apparently normal (Fig. 1). Symptoms become more severe and eventually extend to the proximal end as exposure times to chilling temperature increase. This observation suggests that there is a differential susceptibility to chilling within individual fruit. Subsequent investigations showed that the concentration of Ca in avocado mesocarp is not uniform but is invariably highest in the proximal end of fruit and lowest in the distal end (Table 1). This apparent relationship between endogenous Ca and the incidence of chilling symptoms is the first evidence that

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Ca may be associated with the susceptibility of stored avocados to CI.

Freshly harvested fruit of 2 common cultivars, 'Fuerte' and 'Hass', were vacuum infiltrated by the method of Scott and Wills (7) with CaCl$_2$ solutions of various concentrations and stored for 3 weeks at 5°C to test the hypothesis that fruit with high levels of Ca may be more resistant to CI. Fruit were transferred after storage to a ripening room and held at 20°C. Ripe fruit were cut longitudinally and assessed visually. Injury symptoms were scored for each fruit using a scale of 0 to 5, 0 indicating no apparent injury and 5 indicating severe injury. Mean injury scores are presented in Table 2.

There were significant and distinct differences in the severity of CI among treatments. Severity decreased as the concentration of applied Ca was increased. This result, achieved by presumably raising the Ca concentration of avocado fruit, is consistent with the relationship observed previously between endogenous Ca and CI. It is therefore postulated that Ca status has an important role in the determination of susceptibility of stored avocados to CI.
Literature Cited


