

The role of ethylene in the phenomenon of uneven ripening and fruit drop in avocado

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Summary

The relationship between the rate of ethylene production in the various parts of the fruit of Ettinger, Hass and Fuerte and the uneven softening that exists in these fruits was examined. In all three varieties there was a significant correlation between the initiation of ethylene production in a particular part of the avocado (neck, base) and the advance softening of this part.

In young Ettinger fruit (with viable seed coat), three clear and distinct ethylene production peaks were discovered. The first caused by the seed coat, the second by the neck of the fruit and the third by the base of the fruit. The long interval (5-6 days) between the ethylene production peaks of the neck and the base of young Ettinger fruit is responsible for the phenomenon of early softening of the neck and subsequent rotting of fruit that were harvested prematurely. In mature fruit the process of distinct ethylene production peaks between the neck and the base of the fruit also occur but the shorter interval between the peaks gives the impression of continuous ethylene production in the whole fruit.

The hypotheses that there is a link between high levels of inhibitors in a particular portion of the fruit and the delay of softening of that side was checked in the three avocado varieties mentioned above. Such correlation was found in young Hass avocados, in mature Hass fruit, and in Fuerte fruit throughout the study period. In Ettinger fruit, such correlation was not found and in very mature Hass fruit ethylene production started in the neck area even though the level of the inhibitors in the neck was higher than the base. Similar phenomenon was observed in Hass fruit during September and October. It appears to us that the reason for the slowdown in ethylene production and softening is not in the absolute level of the inhibitors but rather in their flow rate. We assume that rapid flow rate can increase the level of ethylene production inhibitors in the areas where the fruit softening is delayed.

The relationship between fruit separation and the production of ethylene was tested in picked Hass fruit and their stems during fruit growth. Young avocado fruit dropped after they produced pre-climacteric ethylene from the seed coat during several days, and at the beginning of the production of the climacteric ethylene that was concentrated during this stage in the neck area. The rate of ethylene production in the whole fruit was the lowest (at the level of pre-climacteric ethylene production), and the rate of ethylene production of the stem was 25 times higher than that of the whole fruit when it dropped. The peak of ethylene production in the stem was one day after fruit drop. Mature Hass

fruit dropped during peak ethylene production of the fruit and stem, and with very high levels of ethylene at the base and the neck. In these fruit there was an initial drop in the separation strength even without an increase of ethylene production while in the young fruit the drop in the separation strength was associated with the pre-climacteric ethylene production from the onset. We assume that the difference between the fruit drop of young and mature avocados stems from the preparation of the young fruit to drop by the production of the continuous pre-climacteric ethylene production by the seed coat.

A strong correlation exists between the changes in the rate of ethylene production, the levels of abscisic acid and fruit drop of young Hass fruit. An increase in pre-climacteric ethylene production brought about an increase in the level of the abscisic acid in the neck, and a drop in the ethylene production brought about a decline in the level of the abscisic acid. This phenomenon points to the existence of a recovery mechanism in young fruit which works with the removal of the cause of stress and the stopping of the production of the pre-climacteric ethylene.

In the fruit stems we found a mild increase in the level of the abscisic acid related to fruit drop, albeit the steep increase in ethylene production, a phenomenon that maybe is associated with the stoppage of the drop between the stem and the branch, which happens only in fruitlets.