**Short Communication**

**Postharvest Response of Oranges to Ethylene**\(^{1,2,3}\)

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According to previous works \((1, 6, 7)\), young unripe oranges show, after harvest, phenomena which are not found in ripe oranges, and which are characteristic of typical climacteric fruits, e.g. (a) a marked increase in respiratory rate shortly after harvest and then a well-defined maximum, followed by a decrease \((1, 6, 7)\); (b) ethylene production parallel to the respiratory curves \((1)\); and (c) decomposition of the chlorophyll and appearance of the pigments typical for a ripe fruit \((1)\).

Since ripe oranges are classified, according to their respiration pattern, as non-climacteric fruits \((3, 4)\), the above phenomena raise the question whether oranges undergo a climacteric at their early stages of development, as was suggested by Trout et al. \((7)\). To elucidate this problem it seemed necessary to draw a comparison between additional physiological properties of young unripe oranges and those of typical climacteric fruits.

According to Biale \((3, 4)\), one of the important criteria for differentiation between climacteric and non-climacteric fruits is their physiological response to ethylene. In typical climacteric fruits such as avocado and banana, ethylene, when applied during the preclimacteric stage of the fruit, hastens the onset of the respiration rise without altering the shape of the curve; when applied during the post-climacteric stage, ethylene brings about no change in the respiration rate. In non-climacteric fruits, however, ethylene causes an immediate rise in the respiration following its application.

Since the effect of ethylene on the respiration rate of young unripe oranges has not yet been described, experiments were carried out to study the respiratory response of such fruits to ethylene.

Oranges \([Citrus sinensis\) (L.) Osbeck\] of the Washington navel, Shamouti and Valencia varieties, growing on a sandy loam near Rehovot, Israel, were picked in June, July, September, December and January. Immediately after picking, they were weighed, placed in glass jars, and stored at 20°.

Each experiment comprised 12 jars, 4 for each variety. A constant stream \((200 \text{ ml/min})\) of air containing 20 ppm of ethylene was run through the jars: A) in 2 out of 4 jars from the very beginning of storage, and B) in the other 2, starting after a certain period of storage (see Fig. 1) during which only air had been run.

The respiration rate was measured by the amount of \(\text{CO}_2\) evolved by the fruits, and based on a fresh weight unit. The method was in accordance with that described by Biale and Shepherd \((5)\) and adapted by Biale \((2)\).

The results (Fig. 1) show that in all 3 varieties, ethylene caused an immediate rise in respiration rate, at all stages of development tested, regardless of whether it was applied from the beginning of the test or after a certain period of storage in air. The pattern of response to ethylene of young unripe oranges (picked in June, July and September) was therefore similar to that of ripe ones (picked in December and January).

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Ethylene, when applied to young unripe oranges, accelerated the onset of the rise in the respiration rate in comparison to that of untreated young oranges, a phenomenon characteristic of climacteric fruits. However, 2 additional phenomena, different from those found in typical climacteric fruits, were also observed, namely: A) when applied immediately after harvest, ethylene caused a respiratory peak higher than that observed in air; and B) when applied during the period of decreasing respiration, which follows the respiratory peak, ethylene caused a new peak in respiration (which was usually lower than the first one).

It may be concluded that, although young unripe oranges evince some physiological properties similar to those of climacteric fruits as summarized in an earlier paper, their response to ethylene is different and similar to that of non-climacteric fruits.

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Literature Cited