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Ripening and Reduced Ethylene Production by Nectarine Fruits following Exposure to Ethylene[1]

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Abstract. **Treatment of 'Fairlane' nectarines [*Prunus persica* (L). Batsch] with as high as 500 ppm C_2H_4 during 1 week of storage at 0 or 10°C, or treatment of 'Flamekist' nectarines with up to 100 ppm C_2H_4 for as long as 4 weeks at 0 or 10°, had no effect on the rate of color change or softening during storage or subsequent ripening periods at 20° in air relative to air storage. Treatment of 'Flamekist' nectarines with 100 ppm C_2H_4 for 1 week at 0 or 10°, however, resulted in maximal C_2H_4 production rates upon transfer to 20° in air that were approximately 60 and 40% less, respectively, than fruits stored in air or treated with 1 or 10 ppm C_2H_4 during storage.**

Ethylene is an important factor in the storage of many fruits. Its role in the initiation of fruit ripening and various associated phenomena is well known (11). The importance of C_2H_4 in refrigerated and controlled-atmosphere storage of fruits has recently become more recognized (6). Its presence during storage of apples (3, 7, 9), avocados (5,15), bananas (8, 12,14), and kiwifruit (1) decreases storage and shelf life by increasing the rate of respiration and fruit softening. The present study was initiated to determine the effects of C_2H_4 treatment on stored nectarines.

Fruits of #70 size (average weight 130 g), picked at shipping maturity, were obtained from a commercial packinghouse. In 1 experiment, 'Flamekist' nectarines were held at 0 or 10°C for 1, 2, 3, or 4 weeks under continuous flow of air or air containing 1, 10, or 100 ppm C_2H_4 and then ripened at 20° in air for 5 days. Air flow was adjusted so that CO_2 accumulation remained below 0.25% and respiration measurements were made daily on each of 3 replicates per treatment using the colormetric method (2). Similarly, C_2H_4 production was determined by measuring its concentration in the outlet flow from the chambers by gas chromatography. Measurements of flesh color using a Gardner Color Difference Meter and flesh firmness using a UC Firmness Tester with 0.79-cm tip were made initially, at each transfer, and after 3 and 5 days at 20°. In another experiment, 'Fairlane' nectarines were used and a 500-ppm C_2H_4 treatment added. Maximum storage was only 1 week and samples were taken after 2, 4, 6, and 7 days storage and each of 5 subsequent days at 20° for measurement of flesh color and firmness.

There was no effect of treatment with exogenous C_2H_4 on color change or softening (Table 1). Endogenous levels of C_2H_4 in the control may have been sufficient to saturate these ripening phenomena. However, while C_2H_4 concentration in air storage reached as high as 6 ppm at 10°C, at 0° C_2H_4 levels never exceeded 0.03 ppm in air storage. Yet, the rates of color change and softening were not enhanced by treatment with high levels of exogenous C_2H_4 compared to air control. Therefore, the presence of C_2H_4 in commercial nectarine storage facilities may not be as critical as with other fruits at 0°.

Treatment with exogenous C_2H_4 during storage of these nectarines had no significant effect on either respiration or C_2H_4 production rates during storage. However, C_2H_4 production during the subsequent 5 days in air at 20°C was reduced in the fruits which had been exposed to 100 ppm C_2H_4 for 1 week at either 0 or 10° compared to air control (Fig. 1). Fruits stored 2 weeks or longer at 10° were at or past the climacteric upon transfer to 20°. Fruits from 0° storage of 2 weeks or longer showed no significant differences between treatments with regard to C_2H_4 production, but the 100 ppm treatment was consistently lower than other treatments.

Similar autoinhibition of C_2H_4 production has been reported by Zauberman and Fuchs (15) after storage of avocados at 6°C under 100 ppm C_2H_4 for 13 days. Vendrell and

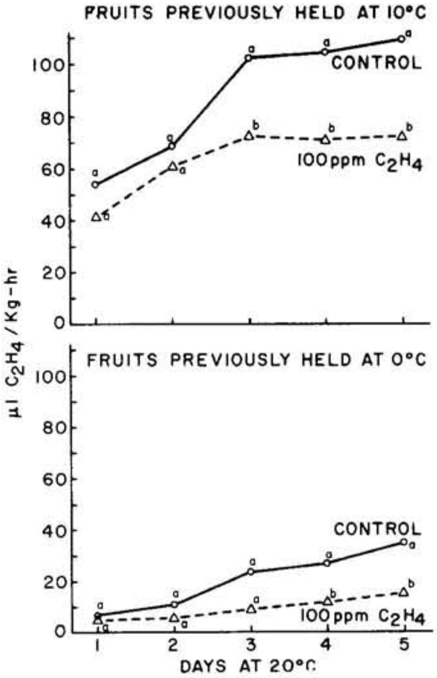

Fig. 1. Ethylene production by 'Flamekist' nectarines during holding at 20°C in air following holding at 0 or 10° for 1 week under air or air + 100 ppm C_2H_4. Pairs of data points labeled by different letters are significantly different at the 5% level.

McGlasson (13) also have reported an irreversible inhibition of endogenous C_2H_4 production following exposure of bananas to 5 or 10 ppm C_2H_4 and propylene has been shown to have the same effect at 500 ppm (10). Zeroni et al. (16) have reported autoinhibition of C_2H_4 production in certain non-ripening stages of the Sycomore fig. They suggested that inhibition of endogenous C_2H_4 production by exogenous C_2H_4 may be a mechanism whereby the autocatalytic production of C_2H_4, necessary to trigger ripening, is prevented in immature and non-ripening fruit. This seems to be supported by the fact that in this study and the previously cited work all the fruits used were apparently preclimacteric. Hall et al. (4) found that application of ethephon during the early growth phases of grape berries tended to delay ripening but later applications hastened ripening. Current work in this laboratory is attempting to discover any changes in response to C_2H_4 by nectarine fruits picked at various stages during their development and

Table 1. Influence of C_2H_4 treatments during storage at 0°C for 7 days followed by holding in air at 20° for 2 days on flesh color and firmness of 'Fairlane' nectarines. Data shown are means of 20 measurements ± SD.

	Color "a" value[z]		Firmness (kg)[y]	
Treatment at 0°C	After 7 days at 0°C	+ 2 days at 20°C	After 7 days at 0°C	+ 2 days at 20°C
Air control	7.4 ± 2.1	8.4 ± 1.4	3.3 ± 1.3	1.3 ± 0.2
Air + 1 ppm C_2H_4	7.1 ± 2.6	7.9 ± 2.0	4.0 ± 1.1	1.3 ± 0.2
Air + 10 ppm C_2H_4	7.2 ± 1.6	7.6 ± 1.5	4.5 ± 0.8	1.4 ± 0.3
Air + 100 ppm C_2H_4	8.1 ± 3.4	8.3 ± 2.0	3.3 ± 1.5	1.3 ± 0.3
Air + 500 ppm C_2H_4	7.3 ± 2.1	8.3 ± 2.4	3.7 ± 1.1	1.4 ± 0.3

[z]Initial color "a" value = 7.5 ± 1.7.
[y]Initial firmness (kg) = 4.9 ± 1.1.

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their endogenous C_2H_4 production that might support the hypothesis of Zeroni et al. (16).

Literature Cited

1. Arpaia, M. L., F. G. Mitchell, and G. Mayer. 1980. The effect of ethylene and high carbon dioxide on the storage of kiwifruit. HortScience 15:423. (Abstr.)
2. Claypool, L. L. and R. M. Keefer. 1942. A colorimetric method for CO_2 determination in respiration studies. Proc. Amer. Soc. Hort. Sci. 40:177–186.
3. Forsyth, F. R., C. A. Eaves, and H. J. Lightfoot. 1969. Storage quality of McIntosh apples as affected by removal of ethylene from the storage atmosphere. Can. J. Plant Sci. 49:567–572.
4. Hall, C. R., B. C. Coombe, and J. S. Hawker. 1970. Effects of ethylene and 2-chloroethylphosphonic acid on the ripening of grapes. Plant Physiol. 45:620–623.
5. Hatton, Jr., T. T., and W. F. Reeder. 1972. Quality of 'Lula' avocados stored in controlled atmospheres with and without ethylene. J. Amer. Soc. Hort. Sci.97:339–341.
6. Kader, A. A. 1980. Prevention of ripening in fruits by use of controlled atmospheres. Food Technol. 34(3):51–54.
7. Knee, M. 1976. Influence of ethylene on the ripening of stored apples. J. Sci. Food Agr. 27:383–392.
8. Liu, F. W. 1970. Storage of bananas in polyethylene bags with an ethylene absorbent. HortScience 5:25–27.
9. Liu, F. W. 1978. Effects of harvest date and ethylene concentration in controlled atmosphere storage on the quality of 'McIntosh' apples. J. Amer. Soc. Hort. Sci. 103:388–392.
10. McMurchie, E. J., W. B. McGlasson, and I. L. Eaks. 1972. Treatment of fruit with propylene gives information about the biogenesis of ethylene. Nature 237:235–236.
11. Pratt, H. K. 1975. The role of ethylene in fruit ripening. p. 153–160. In: Facteurs et Regulation de la Maturation des Fruits, CNRS, 238, Paris.
12. Smock, R. M. 1967. Methods of storing bananas. Phillippine Agr. 51:501–517.
13. Vendrell, M. and W. B. McGlasson. 1971. Inhibition of ethylene production in banana fruit tissue by ethylene treatment. Austral. J. Biol. Sci. 24:885–895.
14. Woodruff, R. E. 1969. Modified atmosphere storage of bananas. Mich. State Univ. Hort. Rpt. 9:80–85.
15. Zauberman, G. and Y. Fuchs. 1973. Ripening processes in avocados stored in ethylene atmosphere in cold storage. J. Amer. Soc. Hort. Sci. 98:477–480.
16. Zeroni, M., J. Galil, and S. Ben-Yehoshua. 1976. Autoinhibition of ethylene formation in non-ripening stages of the fruit of Sycomore fig (*Ficus sycomorus* L.). Plant Physiol. 57:647–650.