Frost Injury Predisposes Grapefruit to Storage Rots

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ABSTRACT

Grapefruit from orchards subjected to freezing temperatures or below developed a higher incidence of rots, particularly stem-end rots, following prolonged storage when compared with fruit not subjected to frost. Valencia oranges exposed to similar low temperatures did not show an increase in the incidence of rots, following storage.

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Additional key words: stem-end rots, Valencia oranges.

Typical symptoms of frost damage to citrus fruit concern the development of pulp deterioration accompanied by drying-out of the tissue. This phenomenon gradually increases after frosting, either when the fruit is left on the tree or when it is picked and placed in storage. The purpose of this work was to examine if, in addition to texture deterioration, exposure to frost affected susceptibility of the fruit to rot development during storage.

Grapefruit and Valencia orange fruits were picked from orchards in low-lying areas after the temperatures had ranged from 0 to −6 C for several hours during 15 consecutive nights. The keeping quality of this fruit was compared with that from a higher elevation in the same orchards, not subjected to temperatures below 0 C. The fruit was picked 4 weeks following exposure to low temperatures when initial symptoms of internal drying-out were already noticeable in 30% of the fruit. After picking, the fruit was treated by the usual way in a commercial packing-house: disinfected with a 0.5% solution of sodium orthophenylphenate, waxed with a wax containing 0.4% thiabendazole, and packed in cartons. Grapefruits were stored and examined for rots at 8, 12, or 17 C and Valencia oranges at 2, 8, or 17 C for periods of 8 or 14 weeks, followed by an additional 2-week shelf-life period at 17 C. A lot of fruit at each temperature and storage period consisted of approximately 500 fruits.

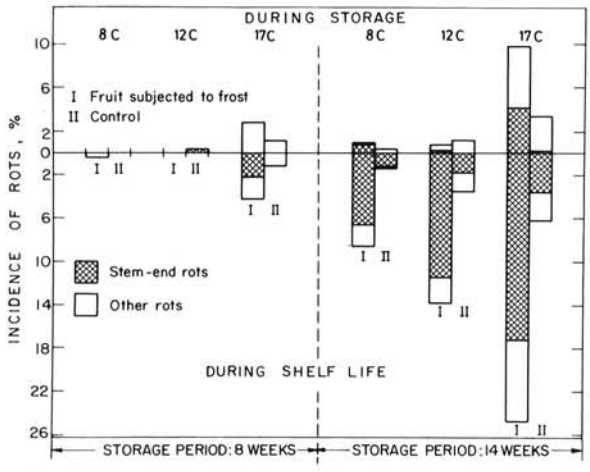

Fig. 1. The effect of frost conditions in the orchard on the incidence of rots in grapefruit during storage.

In fruit subjected to frost, the incidence of texture deterioration during storage increased from about 30% to more than 50%. In the control fruit, almost no texture deterioration was evident either at the beginning or after storage.

The incidence of rots in grapefruit during prolonged storage following exposure to frost in the orchards was significantly higher (t-test, $P = 0.01$) than that of fruit not subjected to the frost. This was found for all three storage temperatures tested. The rots developed principally after prolonged storage of 14 weeks and mostly after the 2-week shelf-life period (Fig. 1). The difference in the incidence of rots between fruit subjected to the frost and that which was not, resulted from a significant difference ($P = 0.01$) in the incidence of stem-end rots between these two groups. In Valencia oranges, symptoms of internal drying-out due to frost conditions were similar to those in grapefruit, but were not accompanied by an increase in the incidence of rots during prolonged storage at either 2, 8, or 17 C.

The main fungus causing stem-end rots was *Alternaria citri* Pierce. Other rots, which developed to a lesser extent, were caused by *Penicillium italicum* Wehm., *P. digitatum* (Pers.) Sacc., and *Geotrichum candidum* Lk. ex. Pers., [*Oospora citri-aurantii* (Ferr.) Sacc.].

The susceptibility of frost-exposed grapefruit to stem-end rots resembles the susceptibility to chilling injury of grapefruit subjected to low storage temperatures (2-6 C), which also results in an increase of stem-end rots (2). A similar phenomenon of increased susceptibility of tomato fruits to Alternaria rot following exposure to chilling temp has been previously reported (1). The increase in rots, as the result of frost or chilling conditions, may be related to a decrease in the resistance of fruits to rots, brought about by low temperature. Supporting this hypothesis is the fact that in Valencia orange, which is not sensitive to low storage temperatures of 0 or 2 C as is grapefruit, frost conditions did not cause an increase in the incidence of rots during storage, even when it had resulted in frost injury similar to that in grapefruit.

LITERATURE CITED

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