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BROWN SPOTS DISORDERS ON 'FUERTE' AVOCADO PEEL SKIN

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Abstract

Dark-brown spots show up on 'Fuerte' fruit peel makes severe economical problem in fruit marketability. The symptoms as small bright-brown spots develop at picking time, become dark-brown during storage in cold temperature of 4-50C and could reach more than 25% cover of peel area. The spots are visualized more profoundly on background of hypertrophic lenticels. Damage is correlated with lenticel intensity on peel and with fruit size. The damage severity showed up differently in different season, location and picking time. The damage was affected by the clonal rootstock/scion combination. Bruising during fruit packing and handling accelerates the peel damage. Foliar application with NPK nutrition and fruit dipping in GA_3 and in the antitranspirant Antistress had partially preventive effects.

Additional index words: fruit damage, fruit quality, lenticel, *Persea, americana,* storage

1. Introduction

Dark-brown spots show up on 'Fuerte' fruit peel makes severe economical problem in fruit marketability. In Israel this kind of disorders has been shown more widely at recent years. It seems that this type of disorder is visible only on fruit skin without penetration and therefore could be classified as external physiological damage (Swarts, 1984). The symptoms as small bright-brown spots develop at picking time, become dark-brown during storage in cold temperature of 4-5°C and could reach more than 25% cover of peel area. The spots are visualized more profoundly on background of hypertrophic lenticels. The actual cause and the stimulating conditions for this disorders is not clear. However, 'Fuerte' fruits showed a significant increase in lenticel damage when were picked wet (Duvenhage, 1993).

The objective of the present paper is to elucidate effects of some potential influencing factors. This will hopefully result some preventive approaches to this problem.

2. Materials and methods

Mature fruits were picked from 'Fuerte' orchards grown in the Coastal Plan of Israel during 1992-1994 years. Fruits were stored in cold room (4-5°C) in the dark. Fruit weight, lenticel intensity and damaged area were determined in the picking day and in intervals during the storage period. More detailed methodology will be described for each experiment.

3. Results and discussion

The brown spots are visualized more profoundly on background of the bright lenticels. Peel area, covered with bright-brown spots (referred as 'damage' in the following figures), correlated with lenticel intensity of peel (Figure 1). Lenticel intensity was characterized by brightness of fruit peel, which determined by peel area covered by hypertrophic lenticels. The fruits were classified to groups with different degree of brightness (lower number denotes lower lenticel intensity).

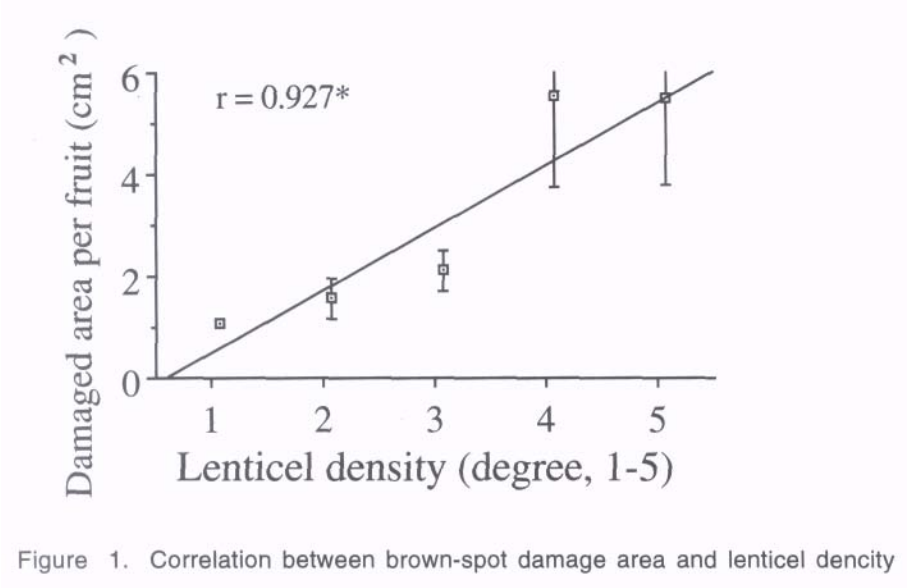

Figure 1. Correlation between brown-spot damage area and lenticel dencity

The correlation between damage and lenticel intensity could be explained according to the conclusion that presence of lenticels, as other rigid bodies embedded in the surface tissue, may indicate a sensitive site where cuticular membrane is ruptured (Brown and Considine, 1982). However, anatomy study showed that brown spots were not related exclusively to lenticel. The browning expanded out of the lenticel area but were much less visible (Tomer et al., 1996).

There was a highly significant correlation between browning damage and fruit weight (Figure 2). Large fruits (usually >350 g) have been damaged more severely and frequently than small fruits. It was found that high lenticel intensity is characteristic to larger fruits. Therefore fruit weight could influence the damage indirectly.

During the processes of picking, transporting, packing and shipping fruits are usually exposed to mechanical damage such as scratching, chafing, or bruising. The relationship between mechanical impact and the brown disorders has been examined.

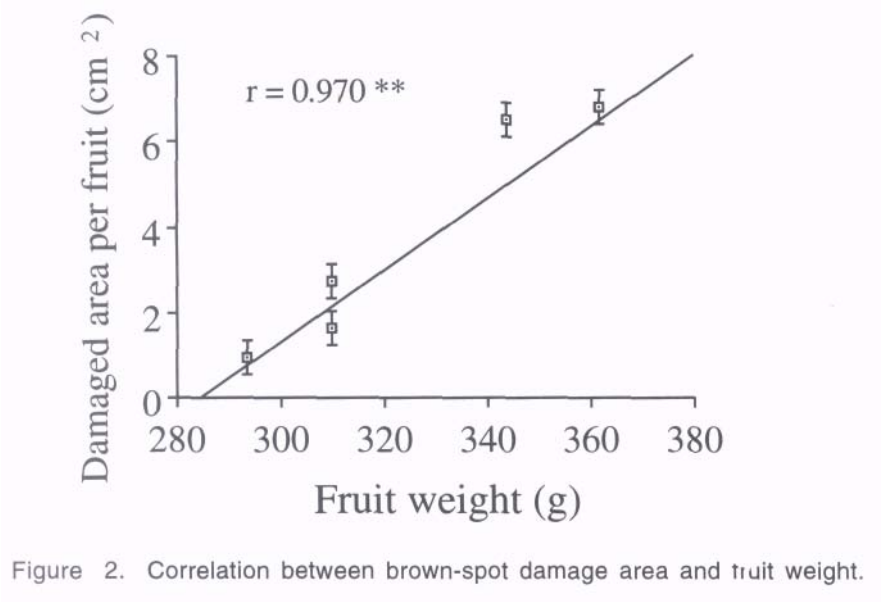

Figure 2. Correlation between brown-spot damage area and fruit weight.

Fruit were locally impacted by penetrometer (bar diameter of 7.8 mm) to a pressure of 15-25 lb. The rate of brown spot's development for bruised fruits was significantly higher than for designed control areas at the same fruits (Figure 3).

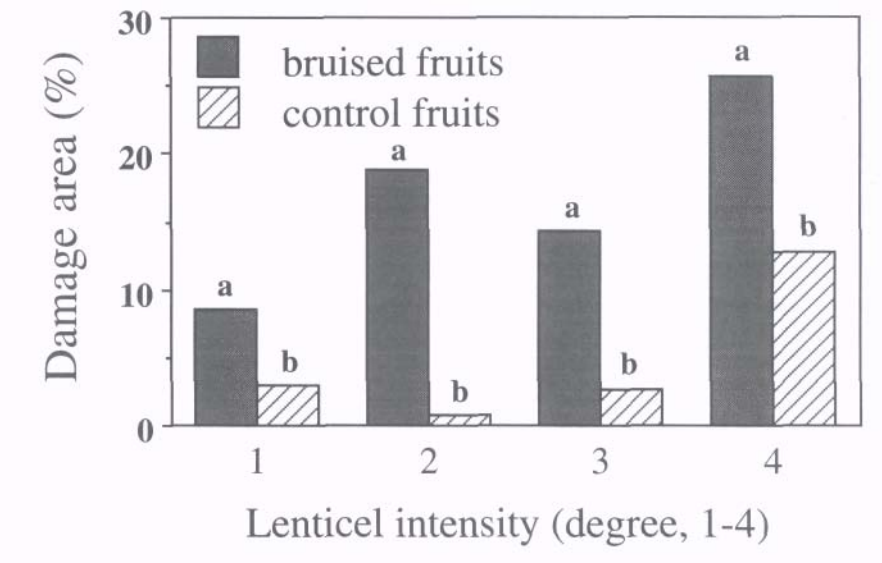

Figure 3. Effect of bruising on brown-spot damage appearane in groups of fruits with different lenticel intensity. Lower number denotes lower intensity.

Physiological disorders might be affected by some pre-harvest orchard factors and postharvest storage conditions such as storage duration, temperature and atmosphere in addition to effects of pre- or post-harvest factors, the interaction between these two groups of factors has also to take in account (Bower and Van Lelyveld, 1985).

Some potential influencing factors have been studied. Commercial solution of nutritional elements (Alvaton, was cordially donated by Deshanim Co., Israel), 5% (v/v) was sprayed 4 times during the fruit growth season (9.6, 13.7, 8.9 and 9.11.93). The solution contained N, P and K (7% each) and micro elements (Fe, Cu, Zn, Mn and Mo). The

treatment didn't influence the appearance of brown spots on the picking time, but decreased significantly the spot damage development during cold storage (Figure 4).

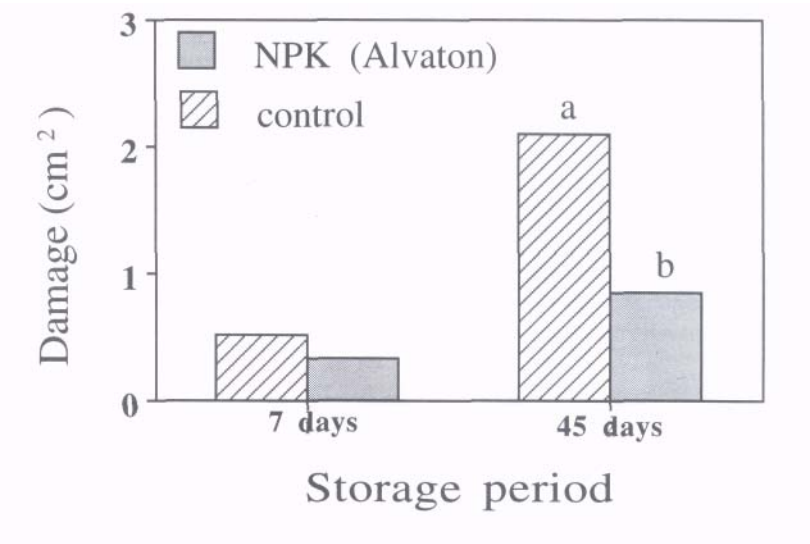

Figure 4. The effect of foliar nutritional spray on brown spots damage.

Browning of tissues has been attributed to activity of polyphenol oxidase (PPO, Kahn, 1975). Phenols become oxidized to form dark colored pigments, such as appearance of physiological disorders. PPO activity was elevated under stress conditions (Bower and Lelyveld, 1985). Antistress (Hagarin, Israel) is a commercial anti-transpirant. Fruits were dipped in 3% Antistress solution and 100 ppm GA_3 for 30 seconds. Both treatments reduced significantly the brown spots damage appearance after storage (figure 5).

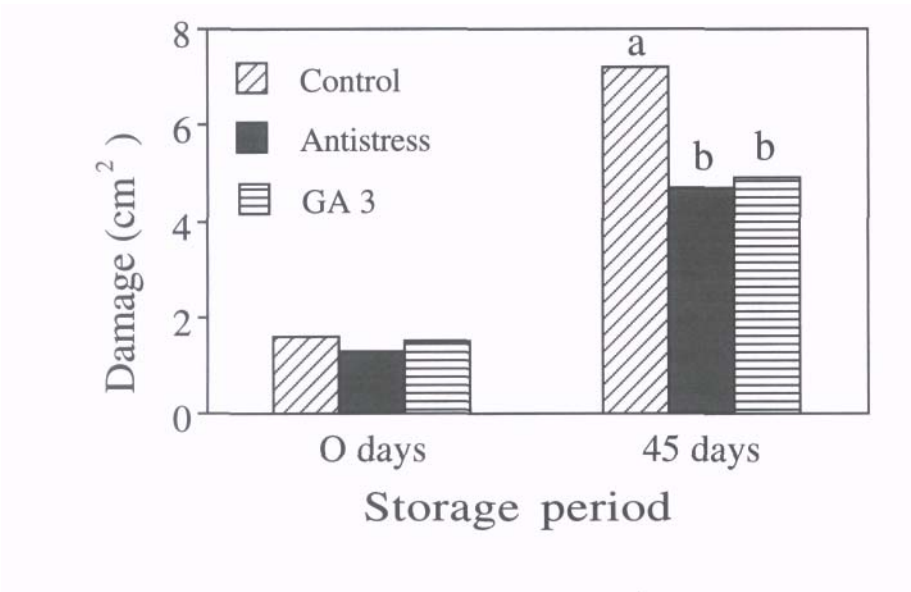

Figure 5. Effect of pre-storage dipping of fruits in Antistress and GA3 solutions.

Scion-rootstock combinations have been found to affect the post harvest physiology (D'hallewin et al, 1994). The influence of three scion - rootstock combinations has been studied (Figure 6). It can be shown that the genetic factor within the same cultivar play a significant role in sensitivity to appearance of brown spots after cold storage.

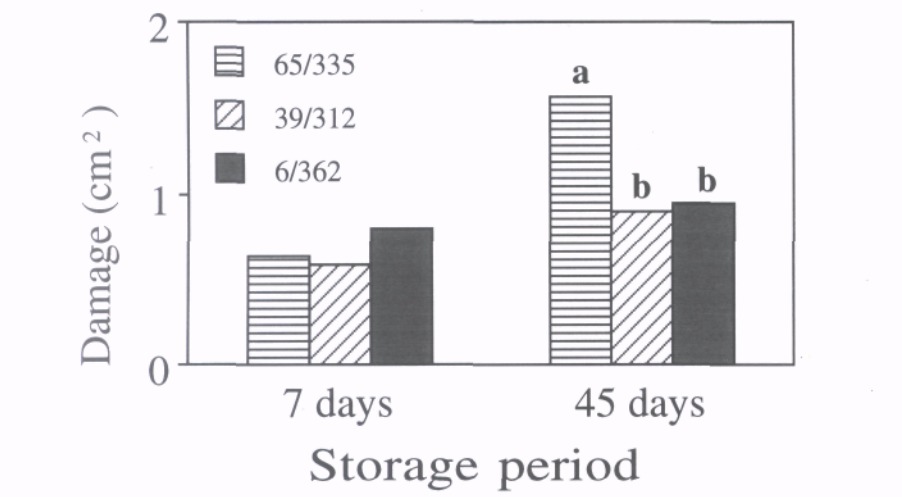

Figure 6. Effect of rootstock/scion combination on appearance of brown-spot damage.

4. Conclusions

Pre-harvest and pre-storage fruit treatments found to affect the spot damage appearance during cold storage. Larger fruit size and higher intensity of lenticel on fruit peel correlated with severity of brown spot appearance. Modification the nutritional and hormonal status of fruits during their development combined with post-harvest treatments might reduce this physiological disorders of avocado peel.

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