K.R. Everett[1]
I.C. Hallett[1]
C. Yearsley[1]
N. Lallu[1]
J. Rees-George[1] &
H. Pak[2]

[1]HortResearch
Private Bag 92169
Auckland
New Zealand

[2]New Zealand Avocado Industry Council
P.O. Box 16004
Bethlehem
Tauranga
New Zealand

HortResearch
www.hortresearch.co.nz

Avocado Lenticel Damage

Introduction

Upon arrival in the market, New Zealand avocado fruit has been prone to the development of black spots and patches on the skin of green fruit. These symptoms appeared to be associated with lenticels and were worse in fruit harvested following a period of rain. This prompted the initiation of a number of research projects aimed at determining;

1. how long after fruit is wet, lenticels change morphologically and consequently become susceptible to damage and to rots,
2. how long after removal of water, lenticels revert to the 'dry' morphological state and become less susceptible to damage and to rots.

Method

Four sets of experiments were carried out to answer these questions:

- Water uptake (imbibition),
- Dehydration,
- Morphological examination,
- Fungal isolations.

Water uptake (imbibition)

- Detached avocado fruit were artificially imbibed with water by inserting the cut stem of the fruit covered with a plastic bag into a flask filled with reverse osmosis water.
- Fruit in flasks were placed in a high air flow in a chamber fitted with a row of fans (Fig. 1).

Figure.1: Transpiration chamber. At the rear of the chamber a row of three fans was placed to provide a constant flow of air. The opening was closed with one bulldog clip to prevent air from the coolstore fan entering into the chamber. Fruit were placed on wire trays and flasks on the tray below.

- Water gain and loss was measured by measuring change in fruit and water weight.
- Damage to lenticels was simulated by rolling, or jostling, fruit ten times from one side to another of a plastic container (Fig. 2).
- Fruit were damaged by jostling after 0 mins, 5 mins, 10 mins, 15 mins, 30 mins, 1 hour, 2 hours, 4 hours, 8 hours and 24 hours of water imbibition.
- Spots with diffusible blackening (Fig. 3) were counted after leaving fruit for two days in a coolstore (5.5°C).

Figure.2: Jostling in a plastic container.

Figure.3: Diffuse browning on fruit surface.

Dehydration

- Fruit were removed from flasks and plastic bags after 24 hours of water imbibition, and placed directly in the airstream to dehydrate. Fruit were damaged and spots counted as for water imbibed fruit.

Morphological examination

- Spots and normal lenticels were sampled and examined under the light microscope and the electron microscope.

Fungal isolations

- Fungal isolations were made from areas of diffuse browning and from larger 'measles' symptoms that developed in the coolstore after 4 - 5 weeks (Fig. 4).

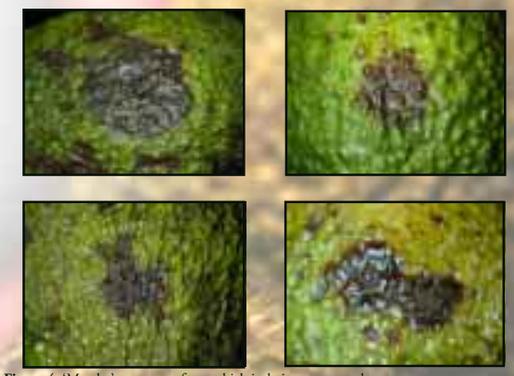

Figure.4: 'Measles' symptoms from which isolations were made.

Results

Water uptake (imbibition)

- After two hours of water uptake, the number of lesions caused by jostling increased markedly from an average of 15 per fruit to an average of 20 - 25 lesions per fruit (Fig. 5).

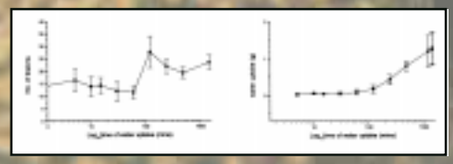

Figure.5: Change in susceptibility to lenticel damage after increasing time of water uptake. Values are means ± standard error.

Dehydration

- When fruit was taken out of the water and placed in the air stream, the fruit became markedly less susceptible to damage after two hours (Fig. 6).

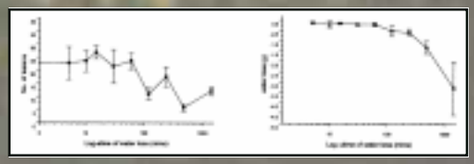

Figure.6: Change in susceptibility to lenticel damage after increasing time of water loss. Values are means ± standard error.

Morphological examination

- There was an identifiable morphological change in lenticels associated with water uptake. In normal fruit, there was a lot of space between cells under the lenticels (Fig. 7), but when the fruit had taken up water, the cells became swollen (or turgid) and took up the space (Fig. 8).

  It seemed that swollen cells in the lenticels were also more susceptible to damage, and responded by turning brown (Fig. 9). These cells turned brown faster than other fruit cells. In other words, lenticels were more susceptible to damage than other fruit cells. The cells under the lenticels could be thought of as over-inflated balloons which 'popped' when exposed to pressure ('rubbed').

Figure. 7: Loosely packed cells around lenticel cavity. Bar = 0.1 mm

Figure. 8: Swollen round loosely packed cells filling lenticel cavity. Bar = 0.1 mm

Figure. 9: Lenticel region after damage showing browning to the cells around lenticel cavity. Bar = 0.1 mm

Fungal isolations

- *Colletotrichum acutatum* and *Phomopsis* were the fungi isolated most frequently from 'measles' symptoms (Table 1).

Table 1:

Isolations from 100 fruit that had been jostled and placed in the coolstore for 4 - 5 weeks until 'measles' symptoms developed. Four samples of skin swabbed with 70% ethanol were taken from each fruit, two from 'measles' symptoms and two from symptomless regions (control).

	Fungi isolated							
symptoms	C.a.	C.g.	B.p.	B.d.	P.	No isolation	sap.	total
control	6	24	2	0	0	163	5	200
'measles'	50	20	4	0	29	85	12	200

C.a.= *Colletotrichum acutatum*, C.g.= *Colletotrichum gloeosporioides*,
B.p.= *Botryosphaeria parva*, B.d.= *Botryosphaeria dothidea*,
P.= *Phomopsis* sp., sap = saprophytic fungi.

Conclusions

- Lenticels changed morphologically and became more susceptible to damage after two hours of water uptake.
- Lenticels changed morphologically and became less susceptible to damage after two hours of dehydration.
- On the basis of isolations the pathogens most likely to cause 'measles' symptoms are probably *Colletotrichum acutatum* and *Phomopsis* sp.

Recommendations

- Fruit should not be harvested immediately after or during a heavy period of rain.
- Results of this study suggest that 2 hours of water uptake is required for fruit to become susceptible to lenticel damage, and 2 hours of dehydration to become less susceptible to lenticel damage.
- However, before these results can be applied directly to the field situation, the effect of delayed packing after picking fruit in the rain on water loss and on susceptibility to lenticel damage should be ascertained.

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