Effects of Each of the Stages in the Pack-line on the Incidence of Lenticel Damage in Keitt and Tommy Atkins Mango

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ABSTRACT

Keitt and Tommy Atkins fruits were exposed to the commercially adopted packline treatments to determine their effect on lenticel damage. The effect of brushing *per se* was assessed in Keitt. In Keitt, soap washing and hydro-heating caused lenticel damage, whereas waxing acted to prevent lenticel damage from occurring due to these treatments. The net effect of all of the packline treatments was a increase in lenticel damage incidence (LDI). Brushing, when looked at specifically, was found to cause lenticel damage. In Tommy Atkins, soap washing, hydro-heating, prochloraz dipping and waxing all acted to prevent lenticel damage. The results suggest that the effects of the stages in the packline on LDI require independent assessment in each of the mango cultivars grown in South Africa for export. Adjustments to reduce lenticel damage can, in this way, be tailored for each cultivar.

INTRODUCTION

Lenticel damage is evidenced by the darkening of tissue immediately surrounding lenticels on the skin of mango fruits. Although internal quality is not affected, a detraction in appearance results. Damaged lenticels on fruits generally become noticeable shortly after the initiation of cool-storage (pers. obs.). Lenticel damage may also be noticed prior to the commencement of cool-storage (pers. obs.). Often it is most conspicuous on skin regions having been exposed to sap flow. Lenticels having become exposed to sap may become sunken, this occurrence giving rise to the disorder referred to as pitted spot (Oosthuyse, 1993). Varieties apparently differ in their susceptibility (Donkin and Oosthuyse, 1996). The lenticels on Tommy Atkins and Keitt fruits are particularly be prone to damage, although all of the varieties grown for export can show a severe incidence.

In Heidi, lenticel damage has been found to be prevented by hydro-heating at 50C for 5 or 7 minutes (Oosthuyse, 1996). Enhanced damage incidence has also been associated with hydro-heating (Jacobi *et al.* 1996a, 1996b). A reduction was found when fruits were pre-conditioned by hydro-heating them at a reduced temperature beforehand (Jacobi *et al.*, 1996a). Pre-storage of Zill fruits at 20C for 72 hours prior to cool-storage was found to reduce the sensitivity of the lenticels to damage (Oosthuyse, 1994).

Postharvest calcium infiltration of mango fruits, done by placing the fruits under low pressure in a calcium containing water solution, caused lenticel damage (Joyce and Shorter, 1996). Moreover, gamma-irradiation exposure of harvested fruits was found to induce damage (McLauchlan *et al.*, 1990; Johnson *et al.*, 1990; Lonsdale *et al.*, 1990; Lonsdale, 1992).

The effect of environmental conditions on the day of harvest on the incidence of lenticel damage after extended cool-storage, was previously assessed in a number of mango cultivars (Oosthuyse, 1998). Strong negative correlations were generally found with maximum temperature, minimum temperature, and Class A Pan evaporation. Strong positive correlations were generally found with maximum humidity and amount of rainfall. These results were stated to indicate that cool, humid or wet conditions on the date of harvest strongly favour the postharvest occurrence of lenticel damage. Conversely, dry, hot conditions were indicated to disfavour the postharvest occurrence of lenticel damage.

In the present study, the effect of each of the consequential stages of the commercial pack-line on the incidence of lenticel damage was assessed in Keitt and Tommy Atkins mango. In Keitt, the effect on lenticel damage incidence of packline brushing specifically was also assessed.

MATERIALS AND METHODS

Experiment I - Packline treatment of Keitt and and Tommy Atkins

The fruits of each cultivar were handled identically unless it is stated otherwise.

Fifty cartons (4 kg) of fruits were harvested from a number of adjacent trees in the Letsitele Valley. The conditions on the date of harvest were dry.

The following treatments were carried out within 12 hours of harvesting:

1. Rinse in water.

2. Rinse in water; wash in 1% BiProx (soap) solution.

3. Rinse in water; wash in 1% BiProx solution; dip in water at 50C for 5 minutes.

4. Rinse in water; wash in 1% BiProx solution; dip in water at 50C for 5 minutes; dip in Omega (180 ml / 100 l water)

for 20 seconds.

5. Rinse in water followed by wash in 1% BiProx solution, dip in water at 50C for 5 minutes, dip in Omega (180 ml / 100 l water) for 20 seconds, wax treatment ("Avocado" polyethylene wax).

In each instance, the treatments were carried out in the order in which they are stated. Ten cartons of fruits were given each treatment-set (random carton allocation). After treatment, the cartons of fruits were placed in cool-storage at 9.5C (±0.5C) for 28 days. The fruits were then placed in a well ventilated laboratory maintained at 20C (±1C) to ripen.

In Keitt, lenticel damage incidence was assessed directly on removal of the fruits from cool-storage and on their ripening. In Tommy Atkins, lenticel damage incidence was assessed on ripening. Following cool-storage, the degree of softening of each fruit was monitored daily with a densimeter (Heinrich Bareiss, Obischingen, Germany). When a reading of less than 60 was obtained, the assessment was made.

Lenticel damage in each fruit was rated by visually approximating the percentage of the skin surface over which symptoms could be seen. The carton averages were subjected to analysis of variance.

There were 10 carton replicates on five treatments (incl. control). The treatments were allocated to the cartons in accordance with the Randomised Complete Blocks Design. The ordering (stacking order) of the cartons was maintained during and after cool-storage.

Experiment II - Brushing of Keitt

Eighty newly harvested Keitt fruits were selected at the Letaba Packers pack-shed in Politsi. All were respectively subjected to hydro-heating at 50C for 5 minutes and were dipped in prochloraz (180 ml Omega/ 100 l water) for 20 seconds. Forty of the fruits (randomly selected) were then placed on the brush roller line. The duration of brushing was 123 seconds. All of the fruits were subsequently hand waxed ("Avocado" polyethylene wax) and were placed in cool-storage (in cartons) at 9.5C (±0.5C) for 28 days. These procedures were carried out within 12 hours of harvesting. After cool-storage, the fruits were placed in a well ventilated laboratory, held at 20C (±1C), to ripen. LDI was assessed both directly on removal from cool-storage and on ripening. LDI assessment was made as in Experiment I. There were 40 single fruit replicates of two treatments (brushed and non-brushed) in a completely randomised design.

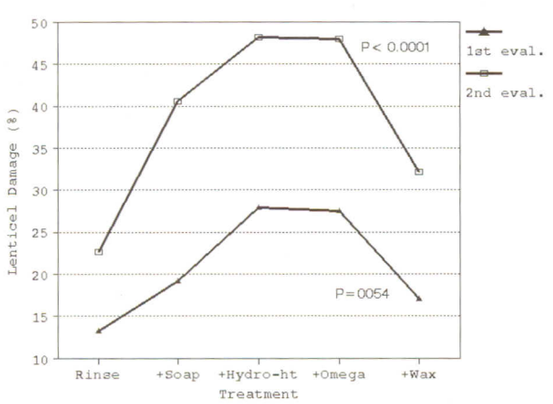

Fig. 1 *Lenticel damage incidence (LDI) in relation to treatment in Keitt. Soap washing and hydro-heating caused lenticel damage, whereas waxing acted to prevent lenticel damage from occurring due to these treatments.*

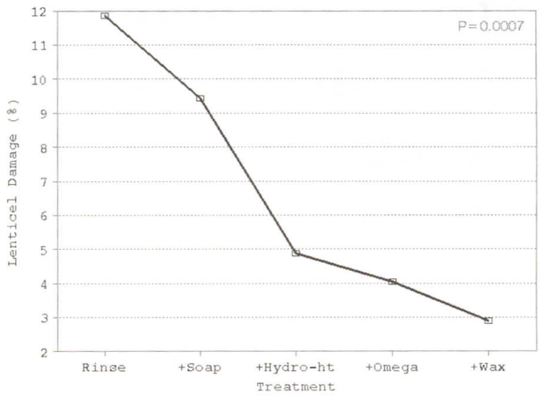

Fig. 2 *Lenticel damage incidence (LDI) in relation to treatment in Tommy Atkins. Soap washing, hydro-heating, prochloraz dipping and waxing all apparently acted to prevent lenticel damage from occurring.*

RESULTS AND DISCUSSION

Experiment I - Packline treatment of Keitt and Tommy Atkins

Fig. 1 shows lenticel damage incidence (LDI) in relation to treatment in Keitt. LDI increased markedly during the period of ripening after cool storage. The packline stages of soap washing and hydro-heating caused lenticel damage, whereas the stage of waxing acted to prevent lenticel damage from occurring due to washing and hydro-heating. In considering the situation at ripening, the net effect of the packline treatments was an increase in LDI from 23 to 32%. These results suggest that to reduce lenticel damage in Keitt,

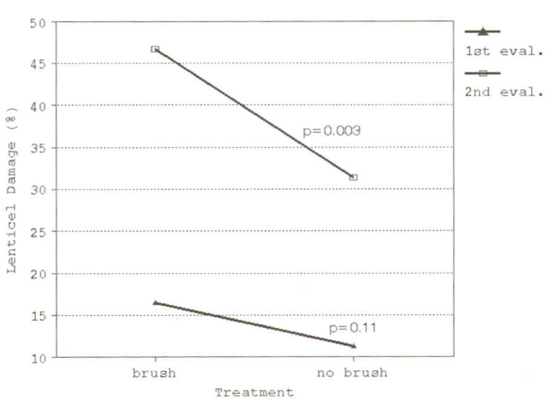

Fig. 3 *Lenticel damage incidence (LDI) directly after cool-storage and on ripening in relating to brushing. Brushing caused lenticel damage, increasing its incidence by 15%.*

adjustment in as far as soap washing and hot water treatment is required. Waxing was beneficial. The extent of the effect of other waxes should be considered in future studies.

Fig. 2 shows LDI in relation to treatment in Tommy Atkins. LDI was generally low. Lenticel damage was not caused by any of the treatments. Soap washing, hydro-heating, prochloraz dipping and waxing apparently acted to prevent lenticel damage from occurring in this cultivar. It would appear, therefore, that conditions on the day of harvest, and possibly during cool-storage, specifically impact on the incidence of lenticel damage in Tommy Atkins.

Experiment II - Brushing of Keitt

Fig. 3 shows LDI in relation to treatment on removal of the fruits from cool-storage and on their ripening. Irrespective of treatment, LDI increased markedly during the period of ripening after cool storage. LDI was greater in the brushed fruits both directly after cool-storage and on ripening. The difference in LDI in relation to treatment was 15% when the ripe-stage was attained.

CONCLUSION

The results indicate that the effects of the stages in the packline, and of brushing specifically on LDI, require independent assessment in each of the important mango cultivars grown in South Africa for export. Adjustments to reduce LDI can, in this way, be tailored for each of the cultivars grown. Variation in cultivar susceptibility relating to season, conditions on the day of harvest, pre-packing storage conditions, pack-line treatment, and temperature and humidity during cool-storage, can be expected.

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