INFLUENCE OF WATER BLASTING ON DEVELOPMENT OF RIPE ROTS

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ABSTRACT

Water blasting has been shown to be an effective method for removal of surface contaminants on fruit. It has also been suggested that this may include the removal of fungal propagules (spores, appressorium) from the surface of the fruit resulting in a reduced incidence of postharvest rots. The influence of water blasting on both the incidence and severity of rots was determined experimentally. The results indicate that there was no significant effect of water blasting on either the incidence or severity of both stem-end rots and body rots. A comparison of USA out-turn data for those packsheds which had water blasters installed and those which did not were also made. These results indicate that the variability between packsheds with water blasters installed was as great as the variability between packsheds without water blasters. Based on these two sets of data it is reasonable to conclude that water blasting should not be considered as a reliable technique for the reduction of post-harvest rots.
Keywords: surface contaminants, post-harvest rots

INTRODUCTION

Water blasting technology was developed for use on avocados in New Zealand with the assistance of a grant from Technology New Zealand (TAP 1975034; OPC 801) over a period of 2 years. (Woolf et al, 1999; 2000). The technology is protected by licence and five packsheds currently are licensed to use water blasting technology in New Zealand.

Several studies have shown that water blasting effectively removes several types of surface contaminants. This particularly applies to removal of pollen and copper residues, but can also be effective against insects and their eggs, provided spray nozzles are orientated appropriately (Woolf et al, 1999; 2000).

It has been suggested that fungal propagules on the surface of the fruit may also be removed, potentially providing a method for the reduction of post-harvest rots. However, the results obtained on the effects of water blasting over a two year period were ambiguous (Woolf et al, 1999; 2000).

Given the ambiguity in results, an investigation was made into the effect of water blasting on control of rots using commercial installations. These involved a

controlled experiment and comparison of library tray and out-turn data from those sheds equipped with water blasters and those without.

MATERIALS AND METHODS

AIC trial

Fruit for use in the experiment were harvested commercially from a single orchard block on 31 October 2001. A single field bin was set aside for the experiment and a sample of 100 fruit for the non-water blasted control was taken from the grader after the bin dump and prior to the water blaster. The water blaster was then activated and a second sample of 100 fruit was collected off the grader after the fruit had passed through the operational water blaster. The fruit were then packed into single layer trays and placed into cool storage at 5 to 7° C for a period of 4 weeks. Fruit were removed from cool storage and ripened at 20° C. Individual fruit were assessed at a hand firmness of 85-100, based on a firmometer with a 300g weight. Green and ripe fruit quality was assessed using the AIC fruit assessment manual (AIC, 2001). Visible residues of pollen and copper fungicides were assessed by percent coverage of individual fruit.

Rot levels in fruit from packsheds with and without water blasters

The level of rots in those packsheds using water blasting technology was compared with those packsheds where water blasters were not used. Comparisons were carried out using the mean incidence and severity of stem-end rots and body rots, based on out-turn data from fruit exported to the USA collected in 2001. Total numbers of water blasted fruit assessed were (n=682) out of a total of 4092 fruit.

Results were analysed using ANOVA or a 2 sample T-test using Minitab release 13.

RESULTS AND DISCUSSION

AIC Trial

Water blasting was very effective at cleaning the fruit, both in terms of the incidence of fruit with detectable residues, and the extent of coverage of the residues (Table 1). The main contaminants were copper residues and pollen deposits. Water blasting did not visibly damage the fruit, with no difference in either the incidence or severity of peel damage between treatments (Table 1). The days to ripen after fruit were removed from cool store decreased slightly for water blasted fruit. However, both the severity and incidence of rots was unaffected by water blasting. This finding was regardless of the actual nature of the rots and applies equally to fuzzy patches on green fruit, body rots (brown patches) and stem-end rots (Table 1).

Table 1. Influence of water blasting on days for fruit to ripen, incidence of peel damage (%), Incidence (%) and severity (%) of fuzzy patches on green fruit, visible surface contaminants (residues), stem-end rots and brown patches under peel. Values are means ± standard errors (n = 100).

	Treatment		
	Control	Water blasted	Significance
days to ripen	3.8 ± 0.04	3.7 ± 0.05	p = 0.04
Residues			
incidence	63.5 ± 4.9	24.0 ± 4.4	p < 0.001
Severity	2.9 ± 0.3	0.9 ± 0.2	p < 0.001
peel damage	39.6 ± 2.3	40.6 ± 2.4	Ns
fuzzy patches			
incidence	69.8 ± 4.7	74.0 ± 4.5	Ns
Severity	3.1 ± 0.3	3.0 ± 0.3	Ns
stem-end rots			
incidence	31.3 ± 4.8	40.6 ± 5.0	Ns
Severity	0.2 ± 0.09	0.2 ± 0.05	Ns
brown patches			
incidence	58.3 ± 5.0	58.3 ± 5.0	Ns
Severity	2.3 ± 0.4	2.4 ± 0.5	Ns

Rot levels in fruit from packsheds with and without water blasters

The mean rot levels for each of the packsheds assessed in the 2001 out-turn programme are represented in Figs. 1 and 2. Those sheds with a water blaster installed on the grader are highlighted in red. The range of rot levels amongst sheds with water blasters installed reflected that in those sheds without water blasters. This applies both to body rots as measured by brown patches under the peel (Fig. 1) and stem-end rots (Fig. 2).

The days to ripen for out-turn fruit was decreased slightly for water blasted fruit compared to non-water blasted fruit (Table 2). Both the incidence and severity of rots, apart from the severity of stem-end rots, was increased by water blasting. As with the AIC trial this finding was regardless of the actual nature of the rots and applies equally to fuzzy patches on green fruit, body rots (brown patches) and stem-end rots (Table 2).

Table 2. Influence of water blasting on days for fruit to ripen, incidence (%) and severity (%) of fuzzy patches or peel damage on green fruit, visible, stem-end rots and brown patches under peel for fruit from packsheds using water blasting compared to packsheds not using water blasting. Values are means ± standard errors (n = 682 for water blasting, n = 3410 for no water blasting).

	Packshed		
	Water blasted	Not Water blasted	Significance
days to ripen	3.5 ± 0.06	3.7 ± 0.02	p = 0.001
peel damage			
Incidence	88.3 ± 1.2	82.1 ± 0.7	p < 0.001
Severity	10.8 ± 0.5	9.0 ± 0.2	NS
fuzzy patches			
Incidence	7.2 ± 1.0	3.2 ± 0.3	p < 0.001
Severity	0.1 ± 0.03	0.06 ± 0.01	p = 0.002
stem-end rots			
Incidence	22.3 ± 1.6	13.4 ± 0.6	p < 0.001
Severity	0.8 ± 0.1	0.5 ± 0.06	NS
brown patches			
Incidence	71.3 ± 1.7	52.9 ± 0.9	p < 0.001
Severity	6.8 ± 0.5	2.4 ± 0.1	p < 0.001

DISCUSSION

These results have confirmed previous studies that have demonstrated that water blasting will remove visible surface contaminants, including pollen, copper residues and bird lime. Water blasting may confer benefits in terms of a food safety programme, provided attention is paid to water quality, and in particular the issue of whether recycling water is appropriate. If the nozzles are appropriately arranged, there will also be benefits in terms of insect removal, especially of leaf roller larvae, egg rafts and crawling insects and mites (Woolf et al, 1999; 2000).

It has been suggested that fungal propagules on the surface of the fruit may also be removed, potentially providing a method for the reduction of post-harvest rots. However, the results obtained on the effects of water blasting over a two year period were ambiguous. A series of experiments carried out in 1998 (Woolf et al , 1998) indicated that there was no significant effect of water blasting on body rots and that there was a trend towards increased incidence of stem-end rots.

A series of trials carried out in 1999 on late season fruit showed that for non-cool stored fruit there was no effect on rots, although a reduction in body rots was achieved in fruit cool stored for a period of 21 days at 5.5° C (Woolf et al, 1999) Cool storage did not have an effect on stem-end rots in stored fruit. Repeated water blasting treatments had no effect on the level of rots in ripe fruit. Water

blasting plus Sportak reduced stem-end rots, although there was no effect on body rots. Therefore, there was a lack of repeatability of results between different experimental runs.

In a further series of trials performed in 2000 on early season fruit, non-cool stored water blasted fruit had more rots than the control (Woolf et al, 2000). Fruit that had been cool stored had a higher severity of body rots and no effect on stem-end rots.

The results of the controlled experiment in this study did not show any effect of water blasting on either incidence or severity of body rots or stem-end rots. This finding is reflected in the out-turn data where the range of rot levels amongst sheds with water blasters installed was similar to those without a water blaster.

SUMMARY

Water blasting technology is effective at removing surface contaminants from fruit, without damaging the fruit surface. This may also convey considerable benefits in terms of food safety. Water blasting may also be effective at pest removal, if correctly installed.

However, water blasting does not provide a reliable method for reduction of postharvest rots, and should not be relied upon for this purpose.

REFERENCES

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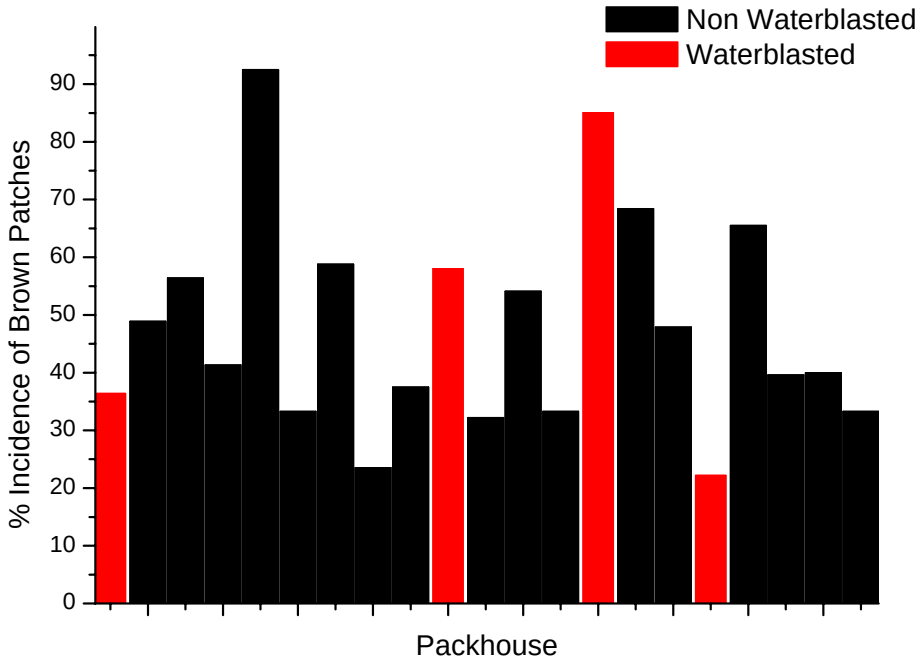
Woolf A.B., Jamieson L.E., Whiting D.C., McDonald R.M., Connolly P.G., Davy M., Cox K., Stevensen B., White A. and White J. 2000. 1999-2000: Water blasting avocados postharvest fro the enhancement of export and domestic market value by the removal of surface contaminants including insect pests. HortResearch client report No 2001/111 contract no 7652.

A)



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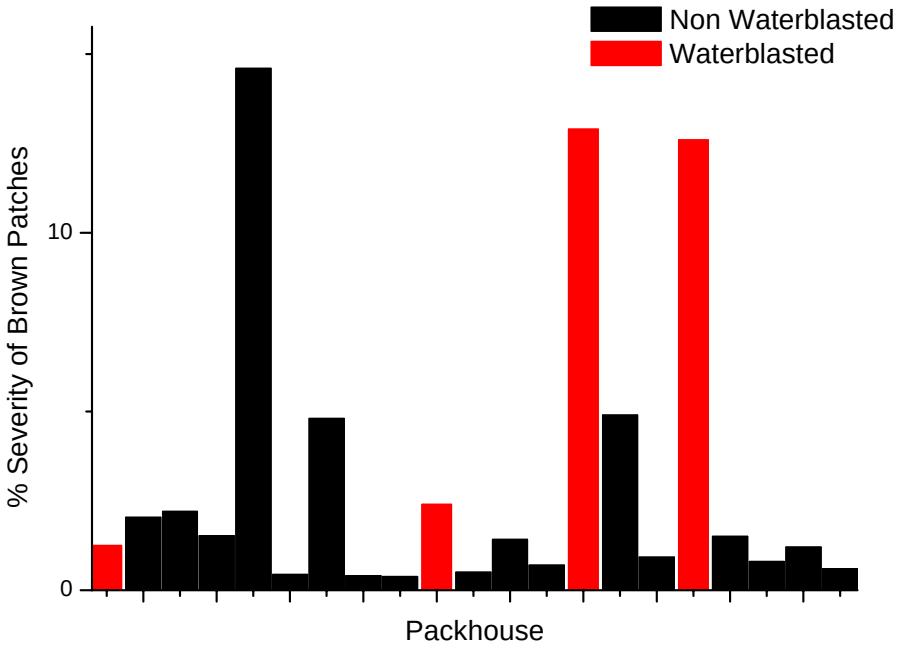
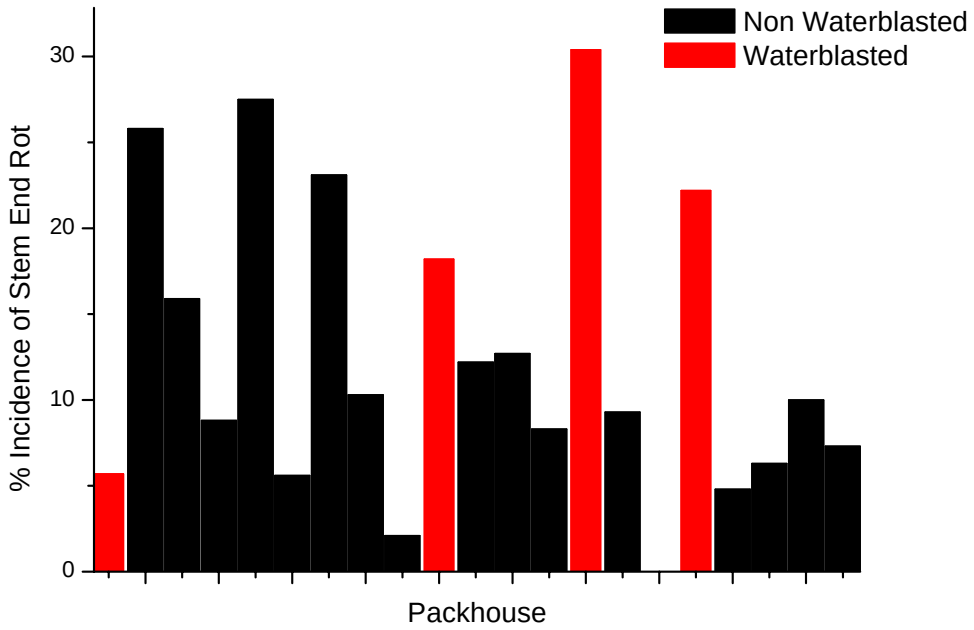


Figure 1. Out-turn data for a) incidence of brown patches and b) severity of brown patches, for those packsheds with and without water blaster installations.

A)



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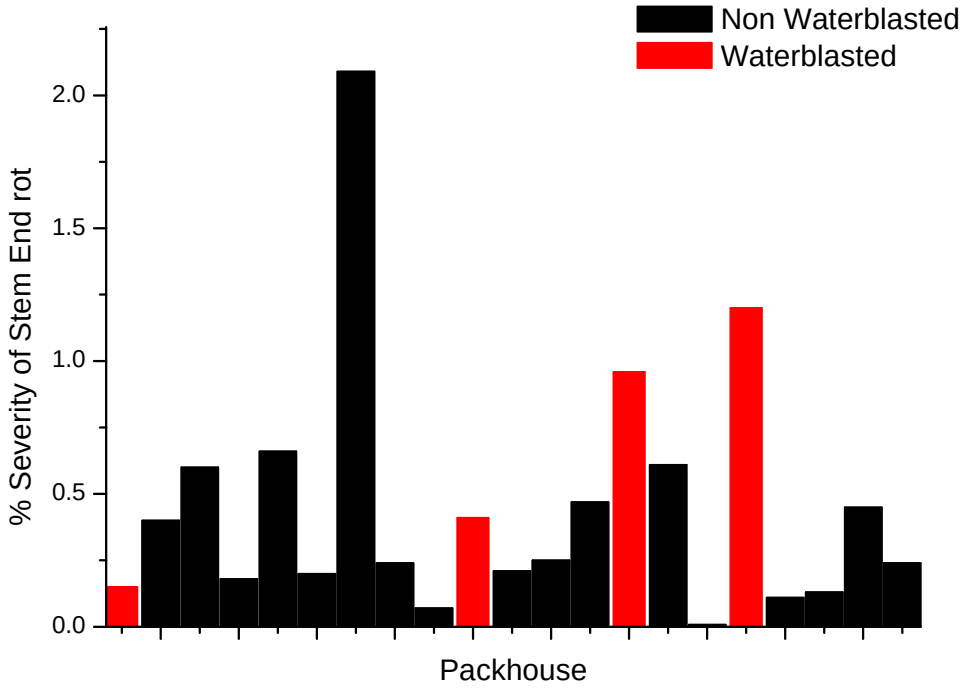

Figure 2. Out-turn data for a) stem-end rot incidence and b) stem-end rot severity, for those packsheds with and without water blaster installations.