EFFECT OF THE FRUIT COATING BIOCOAT™ ON RIPE ROTS OF 'HASS' AVOCADOS

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ABSTRACT

During storage, New Zealand 'Hass' avocado fruit can develop high incidences of ripe rots. A suitable treatment to control the development of ripe rots would be useful. Fruit coatings have been used to slow avocado ripening and are claimed to control the development of ripe rots by blocking water loss from the lenticels and increasing skin resistance to water movement. Slow to ripen avocado fruit have been shown to develop more ripe rots than fast to ripen avocado fruit. The development of ripe rots is thought to be related to the rate of water loss. Biocoat™ is a suspension mixture of beeswax and olive oil that is claimed to be effective in increasing avocado fruit shelf-life. To determine the effectiveness of Biocoat™ in increasing shelf-life the ripening time and development of ripe rots, Biocoat™ was applied by: inline spray, dipping or rubbing with a towel to late season 'Hass' avocado fruit. Inline application of Biocoat™ reduced the incidence of brown patches by 13 to 16% compared to the control and towel treatments. There was no difference in the days to ripen, incidence and severity of stem end rot and the severity of brown patches. Overall, the application of Biocoat™ on late season 'Hass' avocado fruit was ineffective in reducing ripe rots to commercially acceptable levels.

Keywords: *Natralife™, ripe rots, body rots, stem end rot*

INTRODUCTION

New Zealand 'Hass' avocado fruit can develop a high incidence of ripe rots during ripening following coolstorage when exported to distant markets. The amount of ripe rots avocado fruit develop during ripening is related to a number of factors but the expression of the rots can be controlled if the fruit are ripened under the right conditions. Slow to ripen avocado fruit typically have more ripe rots than fast to ripen avocado fruit where the rate of water loss from the fruit appears to be related to the rate of ripening and incidence of ripe rots (Dixon *et al.*, 2005). Low rates of water loss after harvest can increase ripening times and consequently the incidence of ripe rots (Dixon *et al.*, 2003a; Dixon *et al.*, 2004). Reducing water loss after harvest through the use of high humidity ripening conditions increases ripening times but also increases the incidence of ripe rots (Dixon *et al*., 2004). Water loss of fruit can also be reduced by fruit coatings that block lenticels and increase the skin resistance to water moving through the fruit (Dixon *et al*., 2005). Fruit coatings while effective in reducing water loss also block air from getting into the fruit (Johnston and Banks, 1998). A lack of oxygen in the fruit leads to fermentation or an altered internal atmosphere within the flesh of the fruit that can increase the amount of rots. Such fruit coatings can be made, for example, an 11% concentration of 'Avocado wax' provides a reduction in water loss without increased risk of fermentation (Johnston and Banks, 1998). A product based on beeswax, 'BeeCoat', was evaluated by Feygenberg *et al.* (2005) and found to slow ripening and reduce chilling injury in 'Ettinger' avocados. Biocoat™ (now marketed as Natralife™, Natratec, Katzrin, Israel) is a suspension mixture of beeswax and olive oil that is claimed to partially block pores in the fruit skin, reducing the rate of water loss but allows sufficient gas exchange to avoid fermentation (Sait, 2006). Biocoat™ is currently recommended by the manufacturer as suitable for use on avocados.

To be most effective a fruit coating needs to be applied in a manner that gives an even coating to

the fruit so that water is lost equally from all parts of the fruit to avoid partial ripening of the fruit. The application method of Biocoat™ may therefore be a significant factor in the efficacy of the coating in reducing ripe rots and slowing ripening. New Zealand avocado fruit typically have a pebbly surface with the potential for parts of the skin to be poorly covered by a fruit coating.

The application of fruit coatings is not currently a typical practice in the New Zealand avocado industry but may be a useful postharvest treatment to maintain fruit quality if a suitable coating formulation could be found that increased shelf life without also increasing the incidence of ripe rots. To determine the effectiveness of the fruit coating Biocoat™ in increasing shelf life and its potential to reduce the amount of ripe rots avocado fruit were treated using 3 different application methods at 1 concentration of Biocoat™ according to the manufacturer's instructions.

MATERIALS AND METHODS

Four hundred 'Hass' avocado fruit were sampled from a single field bin of commercially harvested fruit from 1 orchard in the Bay of Plenty region, North Island, New Zealand (37°S, 176°E) on 14/4/2003 and packed into single layer trays. Three methods of application were tested:

i. Inline spray application of Biocoat™. One hundred fruit were sprayed with a 33ml/L Biocoat™ solution at a rate of 0.75L/min, sufficient to ensure thorough coverage of fruit while passing across the grader line.

ii. Dipped in Biocoat™ solution. One hundred fruit were placed together in a single F40 crate and immersed in 100L of 33ml/L Biocoat™ solution for 1 minute.

iii. Biocoat™ solution rubbed on with a towel. One hundred fruit were rubbed individually over the entire skin surface and cut petiole for 3-4 sec with a soft cotton towel, soaked in 33 ml/L of Biocoat™ solution.

iv. Untreated control treatment.

All fruit were passed across a commercial grader prior to treatment to give fruit exposure to a typical handling treatment, but were not graded. The fruit were allowed to dry at ambient temperatures for 1 hour. All fruit were packed into single layer trays and stored at 5°C ± 0.5°C, 85% ± 5% relative humidity for 28 days. After storage the fruit were ripened at 20°C ± 1°C, 65% ± 5% relative humidity before assessment of external and internal disorders according to the Avocado Industry Council Fruit Assessment Manual (Dixon, 2001) when eating ripe. Once the fruit had reached at least a minimum eating softness equivalent to a firmometer measurement of 85 with a 300g weight, the fruit were cut and assessed for disorders. Disorders were rated by assessing the percentage of the skin surface or cut surface area affected by disorders.

Results were analysed by One-Way ANOVA to identify significant effects on fruit quality disorders at a $p<0.05$ level using MINITAB version 13.31.

RESULTS

The inline application of Biocoat™ reduced the incidence of brown patches by 13% and 16% compared to the control and towel application treatments, respectively (Table 1). The average severity of brown patches was lowest in the inline treatment and only different to the towel treatment (Table 1). There was no difference in the days to ripen, incidence and severity of stem end rot and the severity of brown patches of infected fruit (Table 1).

Table 1. The effect of Biocoat™ treatments on days to ripen, incidence and severity of brown patches and stem end rot.

Treatment	Days to ripen	Brown patches			Stem end rot		
		Incidence (%)	Severity (%)	Severity of infected fruit (%)	Incidence (%)	Severity (%)	Severity of infected fruit (%)
Control	3.1	81.0 ab[1]	5.0 ab	6.2	27.0	0.7	2.5
Inline	3.1	68.0 c	3.1 b	4.5	25.0	0.9	3.5
1 Min. Dip	3.0	71.0 bc	3.9 ab	5.5	25.0	0.5	2.1
Towel	3.2	84.0 a	5.8 a	6.8	22.0	0.6	2.7

[1]*Means within a column followed by the same letter are not significantly different according to a One-way analysis of variance using a Tukey's family error rate of 5%.*

DISCUSSION

Overall, application of Biocoat™ to freshly harvested avocados only reduced the incidence of brown patches by a small amount. No change in incidence or severity of stem end rot was found. This may be due to the short delay in treatment application of Biocoat™ in this experiment. Application immediately after harvest is recommended to gain any reduction in stem end rot. The reason for the absence of a treatment effect on stem end rot in the experiment is not known. There was no effect of Biocoat™ on the time to ripen with all the fruit reaching eating ripeness in 3 days after removal from storage. These results were similar to those described in presentation on the Natratec website by Báez-sañado *et al*. (2008) for Mexican avocados. The experiment utilized fruit harvested in April at the end of the New Zealand harvest season. Such fruit is known to have greater ripe rot levels than mid season fruit (Dixon *et al.*, 2003b). Application of Biocoat™ to avocado fruit harvested earlier in the export season may be more effective in reducing ripe rots than was found in this experiment. Treating less mature fruit may result in longer ripening times and more ripe rots as was found with the Alobua™ FC-12 fruit coating (Dixon *et al*., 2005).

The best application methods were inline sprays and dipping of the fruit. Rubbing Biocoat™ on the fruit with a towel was ineffective and differed little from the control. The small decrease in the incidence and severity of brown patches suggests that there may be merit in future research with Biocoat™ on fruit harvested before February and using inline or dipping application methods.

CONCLUSIONS

Inline application of Biocoat™ reduced the incidence of body rots of late season 'Hass' avocados by a small but significant amount, relative to the control treatment. Inline applied Biocoat™ also reduced the average severity of brown patches by 2.7% over that of rubbing Biocoat™ onto the surface of the fruit. There was no effect on stem end rot or ripening times. Overall, the application of Biocoat™ on late season 'Hass' avocado fruit would be ineffective in reducing ripe rots to commercially acceptable levels.

REFERENCES

Báez-sañado, M., Contreras, R. and Contreras, L. (2008). Presentation: Effect of the edible coating Natralife™ on postharvest quality of 'Hass' avocados stored previously for 21 days under refrigerated conditions. http://www.natratec.com/uploads/File/Results-AVOCADO.%20FINAL%20REPORT.%20ENG.pdf

Dixon, J. (2001). Avocado Assessment Manual 2001. Avocado Industry Council Ltd.

Dixon, J., Smith, D.B., Elmsly, T.A. and Pak, H.A. (2003a). Quality of avocado (*Persea americana* Mill.) fruit after high humidity storage and/or exogenous ethylene removal. *New Zealand Avocado Growers' Association Annual Research Report.* **3**: 99-107.

Dixon, J., Pak, H.A., Mandemaker, A.J., Smith D.B., Elmsly, T.A. and Cutting, J.G.M. (2003b). Fruit age management: the key to successful long distance export of New Zealand avocados. *New Zealand Avocado Growers' Association Annual Research Report.* **3**: 60-65.

Dixon, J, Smith, D.B. and Elmsly, T.A. (2004). Quality of Hass avocado (*Persea americana* Mill.) fruit after high humidity storage in polyethylene bags. *New Zealand Avocado Growers' Association Annual Research Report.* **4**: 54-60.

Dixon , J., Smith D.B., Elmsly, T.A. and Fields, F.P. (2005). The impact on shelf-life and ripe fruit quality of Alobua™ FC-12 fruit coating on late season New Zealand 'Hass' avocados. *New Zealand Avocado Growers' Association Annual Research Report.* **5**: 51-56.

Feygenberg, O., Hershkovitz, V., Ben-Arie, R., Jacob, S., Pesis, E. and Nikitenko, T. (2005). Postharvest use of organic coating for maintaining bio-organic avocado and mango quality. *V International Postharvest Symposium. Acta Hort.* (ISHS) **682**: 507-512.

Johnston, J.W. and Banks, N.H. (1998). Selection of a surface coating and optimisation of its concentration for use on 'Hass' avocado (*Persea Americana* Mill.) fruit. *New Zealand Journal of Crop and Horticultural Science* **26**:143-151.

Sait, B. (2006). The Effect of Natalife™ on Water Loss, Shelf Life and Marketability of Avocado Fruit. Natratec, Katzrin, Israel.

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