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ALTERNATIVES TO SPORTAK

J. DIXON
T. A. ELMSLY
D. B. SMITH

Avocado Industry Council, P.O. Box 16004, Bethlehem, Tauranga
E-mail: jonathandixon@nzavocado.co.nz

ABSTRACT

It is an Export Marketing Strategy requirement that avocados exported to Australia are treated with prochloraz as a postharvest fungicide treatment. Relying on one chemical for postharvest fungal rot control is risky and it is desirable to find alternative postharvest rot control treatments. Chlorine dioxide (EnviroXyde) and bromo-chloro dimethyl Hydantoin (Nylate) dips were compared to a prochloraz postharvest dip treatment for control of ripe fruit rots on late season fruit harvested in February. Prochloraz treated fruit when ripe after 28 days coolstorage at 4°C had the lowest severity of brown patches compared to fruit dipped in water only, chlorine dioxide or Nylate. Dipping in solutions of chlorine dioxide or Nylate did not give as effective control of avocado ripe rots as dipping in prochloraz. Substituting chlorine dioxide or Nylate for prochloraz to control ripe rots in avocados cannot be recommended at this time.

Keywords: *chlorine dioxide, Nylate, stem-end rots, body rots*

INTRODUCTION

Currently, the New Zealand avocado industry Export marketing Strategy (EMS) requires post-harvest fungicide treatment with prochloraz (trade name: Sportak) for avocados exported to Australia. Relying on a single chemical for postharvest treatment is inherently risky should that chemical lose registration or resistance develops in the target organisms. The ideal alternative treatment should not only be as effective as the current industry standard but also provide all market access and have a more desirable health and safety profile. Chlorine dioxide (trade name: EnviroXyde) and bromo-chloro dimethyl Hydantoin (trade name: Nylate) have both been suggested as alternative treatments to prochloraz owing to their biocidal activity for sterilising water and removing odours. The advantage of these compounds is their better health and safety characteristics. The disadvantage of chlorine dioxide and bromo-chloro dimethyl Hydantoin is that they require activation or mixing in a specified way that will need to be conducted by trained personnel. The effectiveness of chlorine dioxide and bromo-chloro

dimethyl Hydantoin on reducing postharvest rots in late season avocado fruit was evaluated alongside similarfruittreated with prochloraz.

MATERIALS AND METHODS

'Hass' avocado fruit were harvested from three commercial orchards in the Bay of Plenty (37°S, 176°E). One orchard had not been sprayed with fungicide and two orchards had been sprayed with fungicide.

Five hundred fruit were harvested into crates from each orchard on 3 February 2004. Within 4 hours of harvest the fruit were placed into cool storage at 7°C overnight before treatment at ambient. One hundred fruit replicates per orchard were treated by dipping in a solution of each chemical compound for 2 minutes. There were 5 treatments including 2 controls: control with no treatment, control dipped in clean Te Puke tap water, prochloraz (Sportak) at 250 ppm, chlorine dioxide (EnviroXyde, Orica Chemnet) at 5-10 ppm, and bromo-chloro dimethyl Hydantoin (Nylate, Elliot Chemicals) at 15-20 ppm. The activation of chlorine dioxide and Nylate was conducted by the representatives of Orica Chemnet and Elliot Chemicals. The concentrations used in the treatments were those recommended by Orica Chemnetand Elliot Chemicals.

After dipping the fruit were allowed to drain before placing them in standard single layer trays. The fruit were then placed into a commercial cool store at 4°C ± 0.5°C, 85% RH for 28 days. The fruit were removed for ripening to 20°C ± 1°C, 60% RH. There were 5 trays of 20 fruit per treatment per orchard. An additional 20 fruit sample from each orchard at harvest was assessed for percentage dry matter by drying flesh peelings from the inside face of one quarter of each fruit after the seed, seed coat and skin were removed. After removal from storage unripe green fruit and eating ripe fruit were assessed for disorders according to the Avocado Industry Council Fruit Assessment Manual (Dixon, 2003). The incidence and severity of disorders in unripe green fruit and eating ripe fruit was analyzed by one way ANOVA using Minitab release 13.31. The severity of disorders was log square root transformed before analysis. The averages per treatment for the severity of brown patches and stem-end rot are reported as their untransformed values.

RESULTS AND DISCUSSION

The fruit used in the trial were all mature having on average 33.89% dry matter and took between 3 and 5 days to ripen after storage (Table 1), which is typical for 'Hass' avocado fruit harvested in February in the western Bay of Plenty (Dixon *et al.,* 2003).

Table 1. Average dry matter and days to ripen at 20°C ± 1°C, 60% RH for 'Hass' avocados harvested 3 February 2004.

Orchard	Dry matter	Days to ripen
1	35.07	3.3
2	34.63	3.7
3	31.96	5.5

Green fruit

Overall the severity of disorders on green fruit when removed from storage was very low (Table 2), with a moderate incidence. Both the severity and incidence of disorders on green fruit in this trial were unlikely to have been important commercially. On removal from storage control fruit that were not dipped had the least incidence and severity of fuzzy patches, peel damage and discrete patches compared to fruit that were dipped (Table 2), including fruit dipped in water.

Fuzzy patches on the skin of fruit are considered to be an early indication of body rots (Dixon, 2001). A reduction in the incidence or severity of fuzzy patches compared to control fruit would indicate that the fungicide is effective in reducing fungal infection. Dipping in Nylate reduced the incidence of fuzzy patches compared to dipping in water alone. The prochloraz and chlorine dioxide treatments did not differ in the incidence or severity of fuzzy patches, with both having a greater severity and incidence of fuzzy patches compared to the Nylate treatment. Fruit treated with prochloraz had the greatest incidence and severity of discrete patches while the other treatments were no different to the controls, including fruit dipped in water. The incidence and severity of peel damage was greater in the fruit that were dipped compared to the non-dipped control. The increase in peel damage for dipped fruit was presumably due to the extra handling these fruit received when the treatments were applied.

Table 2. Effect of post-harvest fungicide treatments on the incidence and severity of selected disorders on unripe green fruit at removal from storage at 4°C ± 0.5°C, 85% RH for 28 days.

Treatment	Fuzzy patches		Discrete patches		Peel damage	
	Inc[1]	Sev[2]	Inc	Sev	Inc	Sev
Control	8.7a[3]	0.09a	5.0a	0.06a	18.0a	0.18a
Water	17.0b	0.20bc	3.7a	0.04a	32.3b	0.35b
Prochloraz	21.3b	0.36b	14.3b	0.57b	49.7c	0.46c
Chlorine dioxide	22.3b	0.27b	6.0a	0.10a	34.0b	0.55b
Nylate[4]	13.0a	0.14ac	6.3a	0.07a	54.7c	0.63c

[1]Incidence; [2]Severity; [3]Values within the same column with the same letter are not significant at p=0.05 according to the Tukeys' HSD test; [4]active ingredient bromo-chloro dimethyl Hydantoin.

Ripe fruit

The fruit treated with prochloraz had the lowest average severity of brown patches and stem-end rot of all treatments (Table 3). The severity of brown patches in prochloraz treated fruit was about half that for chlorine dioxide or Nylate. The severity of stem-end rots for prochloraz treated fruit was less than for chlorine dioxide or Nylate treated fruit. Although not significant, the incidence and brown patches and stem-end rot, and the incidence of unsound fruit at a 5% threshold were the lowest in the fruit dipped in prochloraz. While the non-dipped control fruit at removal from storage had the lowest incidence and severity of disorders, once ripened, the control had similar levels of rots to the Nylate and chlorine dioxide treated fruit (Tables 2 and 3).

The concentrations of chlorine dioxide and Nylate used in this trial were recommended

by the product suppliers who also mixed or activated the chemicals for the treatments. It is possible that the concentrations of chlorine dioxide and Nylate were insufficient to effect good fungicidal activity. Further trial work using higher concentrations of chlorine dioxide or Nylate may result in effective fungicidal control treatments. Care will need to be taken when increasing the concentration of chlorine dioxide or Nylate that the fruit do not suffer phytotoxic damage or that the products do not become very hazardous to use.

Table 3. Effect of post-harvest fungicide treatments on the incidence and severity of selected disorders on avocado fruit ripened at 20°C ± 1°C, 60% RH after storage at 4°C ± 0.5°C, 85% RH for 28 days.

Treatment	Brown patches		Stem end rot		Unsound fruit (5%)
	Inc[1]	Sev[2]	Inc	Sev	Inc
Control	55.7	2.3ab[3]	26.7	0.7ab	15.7
Water	51.0	2.7a	20.0	0.6ab	12.3
Prochloraz	43.0	1.3b	17.0	0.5b	9.3
Chlorine dioxide	55.7	2.8a	27.7	0.7a	15.3
Nylate[4]	56.0	2.8a	26.0	0.7a	14.7

[1]Incidence, [2]Severity, [3]Values within the same column with the same letter are not significant at p=0.05 according to the Tukeys' HSD test. [4]active ingredient bromo-chloro dimethyl Hydantoin

CONCLUSIONS

Late season avocado fruit treated with a prochloraz dip when ripe had the lowest severity of brown patches compared to fruit dipped in water only, chlorine dioxide or Nylate, and an untreated control. At the concentrations used in this trial dips in solutions of chlorine dioxide or Nylate did not give as effective control of avocado ripe rots as a dip in a solution of prochloraz. Substituting chlorine dioxide or Nylate for prochloraz to control ripe rots in avocados cannot be recommended at this time.

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