

Alternatives to copper fungicides. Preliminary Results of Spray Trial.

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Key words

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A spray trial was started in February 2007 to compare several new fungicides with copper for rot control. Sprays were applied at recommended rates (Table 1) at monthly intervals, a total of nine applications on February 13th, March 23rd, April 20th, June 18th, July 19th, August 21st, September 27th and October 23rd. Fruit were harvested on November 2nd 2007, 100 fruit per treatment as 20 fruit from each of 5 replicate trees in a completely random block. Two sites were used, in Whangarei and in Te Puke, but in November 2007 fruit was only harvested from the Whangarei site as there will be another harvest in February 2008, and there was not enough fruit on the trees in Te Puke for both harvests.

After harvest fruit was placed in a coolstore at the Mt Albert Research Centre of HortResearch at 5.5°C for 28 days. After that time it was placed at 20°C and evaluated daily until ripe. When fruit was ripe as adjudged by gentle hand squeezing, it was cut in quarters, peeled and rots were assessed according to the procedures in the Avocado Industry Council assessment manual.

Results were analysed using the General Linear Model (analysis of variance) of the Minitab statistical package, and means were separated using Tukey's test at a 95% confidence interval. Differences of $P < 0.05$ were considered statistically significant. The results that are presented are the [(incidence x severity) /100], or mean severity (Figure 1).



There were too few stem-end rots for the differences between treatments to be statistically significant, but four treatments significantly reduced body rots compared with the untreated control. These were fluazinam, boscalid/pyraclostrobin, Champ DP and Kocide 3000.

Both copper fungicides (Champ™ DP and Kocide® 3000) significantly reduced body rots in this trial. Kocide 3000 is a more finely milled formulation of copper hydroxide, and the manufacturer claims that less product needs to be used for the same effectiveness. This claim was supported from the results of this trial, Kocide 3000 was as effective as Champ DP when applied at a lower rate of active ingredient.

Two fungicides were as effective as copper in this trial. These were fluazinam (Shirlan®) and boscalid/pyraclostrobin (Pristine®).

Fluazinam was applied with the highest recommended rate of Nufilm-17® (120 mL/100 L). This was because fluazinam was not effective in a previous field trial despite performing well in laboratory tests. After discussion with the chemical company representative, it was suggested that this may have been because the formulation damaged the skin of the avocado. Since that time the formulation has been changed, and in combination with Nufilm-17 applied as a protectant covering on the skin of the avocados, it was an effective fungicide. Fluazinam is a broad spectrum fungicide with a multi-site mode of action. This means that resistance is unlikely to develop in the fungal population following repeated use. There are no maximum residue limits for avocados, and residue testing now needs to be carried out before this fungicide can be registered.

Shirlan is toxic to aquatic organisms, and is registered in New Zealand for use on grapes, tomatoes, potatoes and vegetable brassicas. The withholding periods range from 14 days for potatoes to 42 days for tomatoes. Toxicity to humans is calculated by feeding pure product to rats, and is expressed as lethal dose (LD) 50 values. This is the value, or lethal dose that kills 50% of the rats. Oral toxicity for Shirlan is a LD50 of >5000 mg/kg, dermal toxicity is >2000 mg/kg, and inhalation LD50 is 0.463 mg/L. For a person weighing 80 kg, 400 g of the active ingredient, or 800 g of actual product, needs to be eaten for 50% of rats to die. This amount is equivalent to almost two packs of butter. The environmental fate in soil is 26.5 days for half of the product to break down.

Nufilm-17 is considered to be practically non-toxic with an oral LD50 value of >5050 mg/kg, or 404 g for an 80 kg person. Nufilm-17 is derived from pine sap, is a food grade product, and is registered in Australia as an organic product (http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0016/120823/fruitgrowerswinter2001.pdf).

Pristine is a combination fungicide, of a carboxamide (boscalid) and a strobilurin (pyraclostrobin). Pyraclostrobin has a single-site mode of action and because of this there is a risk of resistance developing in fungal populations following repeated use. Boscalid has a single-site mode of action but is in a fungicide group that has less chance of resistance developing than the strobilurins. The combination of the two fungicides together is designed to reduce the risk of resistance developing. When applied by itself boscalid did not significantly reduce rots. There is a maximum residue limit for azoxystrobin, which is also a strobilurin fungicide, for avocados in Australia. Azoxystrobin (Amistar®) has been tested in a field trial in New Zealand, and was as effective as copper.

Pristine is very toxic to aquatic organisms. The oral LD50 is 1490 mg/kg, dermal LD50 is 2000 mg/kg, and inhalation LD50 is 5.4 mg/L/4h. For a person weighing 80 kg, 119 g of the active ingredient needs to be consumed for 50% of rats to die. For pure product, the amount consumed would be 313 g, or almost two-thirds of a pack of butter. However, neither active ingredient in Pristine is biodegradable by OECD criteria. The actual value is 150 days for 50% of the product to break down.

Results

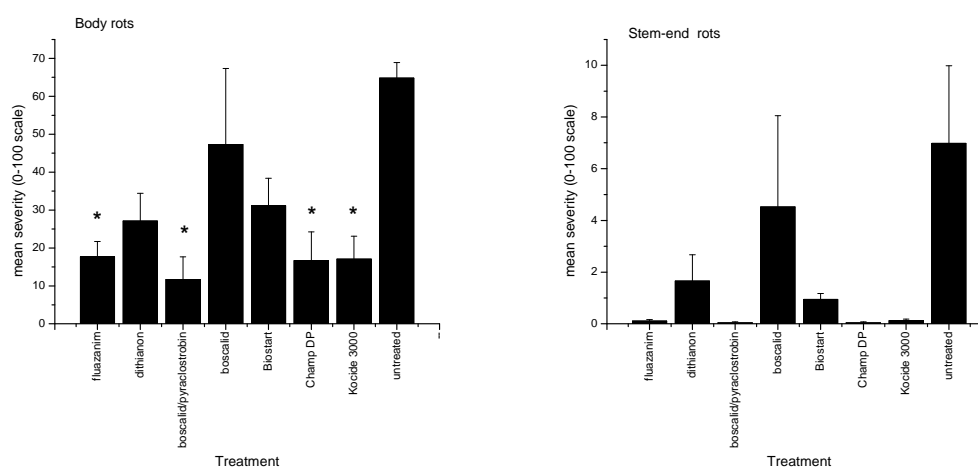


Figure 1: Mean severity of body rots and stem-end rots following nine monthly field sprays with test products. Fruit were harvested on November 2nd 2007, coolstored for 28 days at 5.5°C, and assessed after placing at 20°C when ripe as adjudged by gentle hand squeezing. Values are means \pm standard errors, and asterisks denote a significant difference to untreated controls as determined by analysis of variance and Tukey's test at a 95% confidence interval.

Table 1: Application rates of products tested as a spray application for control of avocado fruit rots.

Fungicide product	Active ingredient	% a.i.	Chemical group	Rate used/100 L
BAS 510F	boscalid	50	carboxamide	60 g
BAS 516F	boscalid/ pyraclostrobin	25.2/ 12.8	carboxamide/ strobilurin	60 g
Champ™ DP	copper hydroxide	37.5	copper	140 g
Kocide® 3000	copper hydroxide	46.1	copper	90 g
Delan® 700 WG	dithianon	70	quinones	18 g
Shirlan®	fluazinam	50	pyridinamine	100 mL
Biostart™ Foliacin	biological activators	?	?	1000 mL
Nufilm-17®	di-1-p-methene	96	terpene polymer	120 mL

¹WDG = water dispersed granules, WP = wettable powder.

²Champ is a trademark of Nufarm Americas Inc., Kocide is a trademark of Dupont, Delan is a trademark of BASF, Nufilm-17 is a trademark of Miller Chemical and Fertilizer Corporation, USA, and Biostart is a trademark of Biostart Limited.

The next phase of this 3 year study is to test the fungicide(s) that show the most promise as alternatives to copper in several different avocado growing regions in New Zealand as a field spray. The chemical companies have been informed of these results and decisions are yet to be made with regard to residue testing