FUNGICIDE EVALUATION FOR CONTROL OF LEAF CURL OF NECTARINE AND PEACH

K.G. TATE, L.H. CHEAH and R.S. GAWITH

MAF Research Centres, Hastings and Levin

SUMMARY

In a field evaluation of fungicides against leaf curl (*Taphrina deformans*) of Fantasia nectarines and Springcrest peaches, captafol at 150 g ai/100 litres reduced disease levels from 48% infected shoots to 1%, and from 24% terminal infection to 1%. Four ergosterol biosynthesis inhibitor fungicides (prochloraz, diniconazole, myclobutanil and hexaconazole) at 3-25 g ai/100 litres gave similar levels of control. Other fungicides tested, though reducing total shoot disease from 48% to 8-23%, were not as effective as captafol at the rates used.

INTRODUCTION

Nectarines and peaches are important horticultural crops in Hawkes Bay, where half of New Zealand's nectarines (ca 1000 ha) and an additional 550 ha of peaches are grown. Hawkes Bay contributes about 40% of the nation's fresh nectarine exports and is the major area for production of canned peaches.

Growing nectarines and peaches for fresh export is a high risk venture with fluctuating yields, low packouts, short storage life and high establishment, packaging, coolstore and transport-to-market costs.

Leaf curl caused by *Taphrina deformans* is one of several diseases that can severely affect profitable investment in these crops. It is potentially damaging both to crop yields and tree longevity, but has in the past been cheaply and effectively controlled. The cost of control is usually the cost of two copper sprays per variety each year. However, in the last four seasons, growers have been very concerned about the increasing difficulty of maintaining effective control of leaf curl. Some have applied several additional captafol or chlorothalonil sprays, with very unsatisfactory results. In laboratory tests Cheah and Tate (1986) showed that this lack of control was not due to development of resistance to copper fungicides or captafol.

The disease produces distorted, thickened and highly coloured leaves during spring. Diseased leaves die and fall prematurely. In a severe infection, total defoliation may occur by early summer, the trees then producing a new crop of leaves. This weakens the trees and reduces yield, and annual recurrences eventually kill the trees.

Copper sprays are normally applied just before bud movement and 7-10 days later to destroy the overwintering yeast stage (MAF Export spray programme for tree fruit). Tate and van der Mespel (1984) demonstrated improved control of primary infections from the combined effects of copper sprays at leaf fall and bud movement. Captafol is an effective alternative which can also be used after leaf emergence to prevent secondary infections (Tate unpublished). More recently chlorothalonil has also been registered for leaf curl control. The use of captafol is to be banned for health reasons, leaving only copper fungicides and chlorothalonil for leaf curl control.

Ergosterol biosynthesis inhibitor (EBI) fungicides have been screened in vitro and some were shown to inhibit the overwintering yeast stage of *T. deformans* at less than 1 ppm (Cheah and Tate 1986). This report details evaluation of EBI fungicides in the field against leaf curl on nectarines and peaches.

METHOD

The trial was conducted at Hawkes Bay Agricultural Research Centre during spring 1986. The experimental design was a randomised block with four replicates of 3-year-old Fantasia nectarine and two replicates of Springcrest peach, both planted at high

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density spacings (3×0.5 m and 2×1 m respectively). The plots consisted of single trees. When spraying, the trees were shrouded on three sides with polythene sheet screens to prevent interplot spray contamination. Drenching sprays were applied by hand-operated knapsack sprayers at low pressure with solid cone nozzles. Sprays were applied on 4 August, 15 August and 28 August to allow for the different timing of growth stages. Captafol was used as a standard and some trees were left untreated. Weather conditions were calm at each application.

Fungicides (Table 1) were applied at proprietor's recommended rates without additional surfactant. All trees were inoculated by spraying with a pure culture of the yeast stage of *T. deformans* (2×10^5 cells/ml) on 5 August to promote disease development. To identify the occurrence of infection periods a mechanical temperature/leaf wetness recorder was installed at 1 metre in a Stevenson weather screen between two plot trees. Daily rainfall data was also collected from the Whakatu weather station 230 m away to the SE. Disease assessment was done on 21 October by two methods; firstly, five 1-year-old laterals per tree were selected at random and all green shoots classed as either diseased or healthy; secondly, the terminal shoots on all laterals of each tree were classified (Dooley and MacSwan 1978). From these data, percentage diseased shoots (total or terminal-only) was calculated.

The discrete binomial data was modelled under the standard logit transformation of $\log_e(p/(1-p))$ where p is the proportion of either terminal shoots or the total proportion of shoots affected by disease. The analysis used the generalised linear models feature of GENSTAT (Crosbie and Hinch 1985). Individual results for the two varieties were also examined, since Springcrest growth stages were 10-15 days in advance of Fantasia.

TABLE 1: Effect of fungicide sprays¹ from bud movement to leaf emergence, on development of leaf curl disease in peaches and nectarines.

Fungicide treatment	Product	Formulation	Rate g ai/100 litres	% ³ Shoots diseased ²	% ³ Terminals diseased
captafol	Difolatan	80% WP	150	1	1
prochloraz	Octave	50% WP	12.5	3	2
diniconazole		12.5% WP	15	4	6
myclobutanil	Systhane	12.5% EC	25	6	7
hexaconazole	Anvil	5% SG	3	6	5
bitertanol	Baycor	50% WP	25	8	10
penconazole	Topas	10% EC	20	9	10
prochloraz	Octave	50% WP	25	11	10
flusilazol	Nustar	20% DF	10	11	10
flusilazol	Nustar	20% DF	5	12	10
penconazole	Topas	10% EC	10	14	12
diniconazole		12.5% WP	30	15	11
ICI886		50% SG	50	15	15
triflumazole	NF114	30% WP	10	20	18
triflumazole	NF114	30% WP	20	23	14
untreated	—	—	—	48	24

¹ Each treatment was applied three times (Aug. 4, 15, 28th).

² Refers to terminal plus lateral shoots.

³ Percentages derived from back transforming the fitted values of the logit model.

⁴ Vertical lines indicate treatments not significantly different to captafol.

RESULTS

Weather, growth stage and disease.

Springcrest flower-bud swell commenced in late July and leafbud swell in early August, with bloom and leaf emergence commencing in late August. Fantasia was 10-15 days behind this for each stage. Although a wet period occurred at green tip for Springcrest (19-25 August), leaf curl disease did not appear on the first emerged leaves

of either variety. It was first observed on 2 October on both varieties, 16 days after the onset of a wet, (83 mm rainfall), cool (7-10°C) period between 15-22 September. Other wet cool spells occurred during 7-12 October (11-14°C, 18 mm) and 18-22 October (9.5-12°C, 15 mm) and resulted in further infections. Infection conditions therefore occurred three times over the bloom to shuck fall period when many new leaves were unfolding.

Total diseased shoots

In untreated trees 48% of the shoots were diseased (Table 1) and all treatments significantly reduced this level. Captafol (150 g ai/100 litres) reduced disease to 1% (98% control), and four other treatments (prochloraz, 12.5 g; diniconazole, 15 g; myclobutanil, 25 g; hexaconazole, 3 g) gave similar levels of control (87-94%). Prochloraz and diniconazole gave better control at the lower of the two rates tested. Other treatments, although giving significant control, were not as effective as captafol.

Diseased terminal shoots

In untreated trees 24% of the terminal shoots were diseased and all treatments reduced this significantly. Captafol (150 g) reduced diseased terminals to 1% (96% control) and prochloraz at 12.5 g was not significantly different (2% disease and 92% control). Other treatments were not as effective as captafol. Prochloraz and diniconazole were again more effective at the lower rates. There were similar levels of disease in both varieties, and when the data for each was considered separately, the same four fungicides showed the same merit, with respect to captafol, in three out of four comparisons.

DISCUSSION

As in previous years in Hawkes Bay the disease was late appearing, and did not show on the first unfolded leaves. This was probably because suitable infection weather (wet and cold), did not occur until mid-September (full bloom and leaf emergence in Springcrest). According to Dooley and MacSwan (1978), serious leaf infection does not occur unless growth is significantly slowed down by cool conditions and foliage is wet from rain. The earlier two wet spells during August probably enabled further multiplication of the yeast stage over the trees but did not constitute infection periods. Since the first leaf infection could not have occurred until after rain commenced on 15 September, the results reflect protective rather than eradicant effects of the EBI fungicides.

In the initial laboratory tests (Cheah and Tate 1986), the materials effective at < 1 mg/litre were bitertanol, flusilazol, penconazole, prochloraz, propiconazole and diniconazole. In these field trials only diniconazole and prochloraz equalled the efficacy of captafol. Other EBI's were noticeably less effective than captafol even at quite high rates. The decreased control by prochloraz and diniconazole at higher rates cannot be explained.

The present results have demonstrated that some EBI fungicides are effective against leaf curl when used as protective sprays at bud movement. However, because of the systemic activity of many EBI fungicides, they may be better applied during blossom, when green leaf first appears. This may enable them to be used as eradicant sprays in conjunction with standard protectants at bud movement, thereby compensating for poor timing of the bud movement sprays and possible imperfect coverage. This would coincide well with their intended use for control of blossom blight, caused by *Monilinia fructicola*, over bloom.

Timing of EBI's should be critically examined. Fitzpatrick (1934) showed that almost 100% control of leaf curl could still be achieved when spraying as late as full bloom (12 mm leaf showing). In a further trial (Tate and Cheah, unpublished) this result was confirmed using a single captafol spray in mid-September (full bloom).

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