A COMPARISON OF BUPROFEZIN AND DELTAMETHRIN/OIL FOR CONTROL OF GREENHOUSE WHITEFLY ON TAMARILLO

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SUMMARY

Buprofezin 6.25 g/100 litres was compared with deltamethrin/oil 0.6 g/0.3%/100 litres for control of greenhouse whitefly (*Trialeurodes vaporariorum*) on tamarillo (*Cyphomandra betacea*). Treatments were applied by airblast sprayer (2,000 litres/ha) when whitefly exceeded 20 adults/leaf. Ten applications were made from December 1989 to April 1990. Buprofezin gave similar control to deltamethrin/oil with a seasonal average of 39 and 33 adults/leaf respectively. The number of live larvae, fruit yield, defoliation and sooty mould contamination did not differ significantly between chemical treatments. Untreated whitefly populations peaked at 300 adults/leaf and 7,700 larvae/leaf in February. This caused a 75% reduction in yield, 63% defoliation and heavy sooty mould contamination compared to both buprofezin and deltamethrin/oil treated tamarillo.

Keywords: greenhouse whitefly, *Trialeurodes vaporariorum*, tamarillo, buprofezin, deltamethrin

INTRODUCTION

The greenhouse whitefly is a serious pest of tamarillo. Heavy infestations reduce crop yield while lower infestations contaminate fruit with a honey dew exudation on which grows a sooty mould (Blank *et al* 1986a; Blank 1987). Whitefly infestations on tamarillo are currently controlled using pyrethroid insecticides either alone or mixed with mineral oil. To avoid sooty mould contamination and yield loss, sprays are applied when whitefly adults reach a threshold of 20/leaf (Blank *et al* 1986b; Blank 1987).

Pyrethroids cannot be applied to export crops within 60 days of harvest because of the requirement to maintain residues below detectable limits. Whitefly are difficult to control with current alternative insecticides such as diazinon and methomyl (Blank *et al* 1986b). Tamarillo growers, wishing to export fruit, are faced with the dilemma of how to control whitefly without using pyrethroids in February or March, when populations increase exponentially. This is especially difficult on crops to be harvested in April and May.

Whitefly have developed resistance to pyrethroids in many countries with a subsequent threat to the maintenance of control (Wardlaw 1985). It may be only a question of time before New Zealand populations also become resistant to pyrethroids. There is an urgent need to develop alternative control strategies against whitefly not only on tamarillo, but also on many other important crops including tomatoes, cucurbits and egg plants.

Buprofezin is a mould inhibiting insect growth regulator which inhibits chitin synthesis in insects (Uchida *et al* 1985). It has shown good activity against greenhouse whitefly at very low rates (Yasui *et al* 1985; Ikeda *et al* 1986). Buprofezin is not toxic to immature *Encarsia formosa* parasites and is considered suitable for use in integrated pest management programmes (Garrido *et al* 1985; Martin and Workman 1986). Adults treated with buprofezin lay fewer eggs which fail to hatch (Yasui *et al* 1987). It has been registered for use in Japan and Europe where the withholding period is 3 days for tomatoes (R.S. Buchanan pers. comm.).

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The objective of this study was to investigate the effectiveness of buprofezin for control of whitefly on tamarillo over a growing season under conditions similar to those encountered by commercial growers. Buprofezin was compared with a deltamethrin/oil mixture as an example of an effective treatment which is currently available.

METHODS

A field experiment was carried out at the Kerikeri Horticultural Research Station on a 0.4 ha block of 4 year old red tamarillos. Plant spacing was 1 m within a row and 5.5 m between rows. Buprofezin (Applaud, 25 WP, 6.25 g ai/100 litres) was compared with deltamethrin (Decis 2.5, EC 0.6 g ai/100 litres)/ oil (Sunspray mineral oil 96 EC, 0.3%/100 litres) and an untreated control. The two insecticide treatments were randomised amongst six plots (27 x 20 m) to give three replicates per treatment with a single unsprayed control plot (27 x 40 m) at the end of the block.

To decide when to apply insecticides, adult counts on leaves were taken at regular intervals from 10 or 20 random locations in each treatment or control plot respectively. At each location a heavily infested young leaf (70-125 mm) was selectively chosen in less than 30 seconds and numbers of adult whitefly on the underside of the leaf estimated. Insecticides were applied when the mean leaf count exceeded 20 adults/leaf for both treatments.

Insecticides were applied using a Cropliner airblast sprayer at 2000 litres/ha at the lowest fan setting, to minimise drift. All sprayed plots were four rows wide with one row adjacent to a different spray treatment. This row plus the next row were sprayed only in the direction of the centre of the plot and thus effectively acted as sprayed buffer rows. The remaining tamarillo rows were sprayed from both sides. Plants in the central area of each plot were used for assessments.

The effectiveness of treatments was assessed from larval counts on randomly selected leaves on 12 February 1990 and at harvest. Ten leaves were assessed from each sprayed plot (30/treatment) and 20 leaves from the unsprayed plot. Mortality and growth stage were visually assessed for 10 larvae adjacent to each other from each of two randomly chosen positions on the underside of each leaf. Estimates of the total number of larval stages and the presence of eggs and pupae were also noted. An estimate of sooty mould contamination and yield (total fruit counts and weight) was made from five trees per plot at harvest (2 May). A scoring system, with a score of 1 for a trace of contamination to 5 for a very heavy contamination, was used for sooty mould assessment. Leaf defoliation was assessed by counting the number of leaves on one shoot chosen at random from five trees per plot. Analysis of variance, excluding the untreated plot, was used to detect differences between spray treatments.

RESULTS

Adult whitefly populations in the untreated plot increased rapidly in late December and early January peaking on 19 February at 298 adults/leaf before dropping to levels of 120-200 adults/leaf in March and April giving an average seasonal count of 184 (SEM 18.8) (Fig.1). Adult whitefly counts for the 18 assessments throughout the season were 33 (SEM 5.6) and 39 (SEM 6.1) adults/leaf for the deltamethrin/oil and buprofezin treatments respectively.

Untreated tamarillo leaves had considerably higher larval numbers, with a higher proportion of older instars and much lower mortalities than treated leaves (Table 1). There was no significant difference between buprofezin and deltamethrin/oil larval assessments. In the February sampling, buprofezin treated leaves had more larvae than the deltamethrin/oil treatment but after adjusting for mortality levels, both treatments had similar numbers of live larvae.

At harvest, the untreated plot had a 75% lower yield, smaller fruit and 63% fewer leaves than treated plots with both leaves and fruit heavily contaminated with sooty mould (Table 2). There was no significant difference between buprofezin and deltamethrin/oil treatments in fruit yield, defoliation and sooty mould. Both treatments had light to moderate sooty mould contamination.

Fig. 1: Adult whitefly counts on tamarillo leaves for untreated, buprofezin and deltamethrin/oil treatments from December 1989 to April 1990. The 20 adults/leaf spray threshold and spraying dates are also shown.

TABLE 1: Numbers and mortality of whitefly larvae and proportion of larval stages on tamarillo leaves in summer and autumn after treatment with buprofezin and deltamethrin/oil.

Treatment	Larval Stage (%)			Mortality (%)	Number (mean/leaf)
	I instar	II instar	III & IV instar		
12 February 1990					
untreated	34	25	41	12	7700
buprofezin	60	29	13	56	3800
deltamethrin/oil	55	27	18	31	1900
SED (excluding untreated)	-	-	-	14	940
2 May 1990					
untreated	62	19	19	5	5300
buprofezin	63	36	1	29	900
deltamethrin/oil	66	24	10	35	700
SED (excluding untreated)	-	-	-	13	170

TABLE 2: The effect of applying buprofezin and deltamethrin/oil sprays according to adult whitefly thresholds on tamarillo fruit yield, weight, defoliation and sooty mould ranking compared to unsprayed tamarillos

Treatment	Yield (kg/tree)	Fruit size (g)	Leaves/ shoot	Sooty mould ranking	
				Leaves	Fruit
buprofezin	6.5	74	8.5	2.3	2.2
deltamethrin/oil	7.5	77	8.6	2.7	3.4
untreated	1.7	52	3.5	4.5	5.0
SED (excluding untreated)	0.4	3.2	1.1	1.2	0.9

DISCUSSION

In order to minimise cost, this trial attempted to optimise plot size, so as to avoid the influence of adult invasion, but with some replication. Therefore, with the trial design used, only large differences would be expected to be statistically significant. Given these limitations, this trial shows that buprofezin can control whitefly as effectively as deltamethrin/oil.

Adult invasion probably occurred between plots. This would have prevented the potential sterilising effect of the buprofezin from contributing to control (Yasui *et al* 1987). It is likely that where large areas are sprayed with buprofezin, whitefly build-up may be reduced to give longer periods of control than was obtained in this study. The deltamethrin/oil treatment may be slightly more effective than buprofezin at suppressing adult numbers through a possible repellency effect. This did not give any advantage to the deltamethrin/oil treatment in control of larvae.

This trial further substantiates the effectiveness of management strategies which use adult whitefly threshold counts to determine timing of spray applications (Blank *et al* 1986a; Blank 1987). Over the main growing season, 10 spray applications were used in this trial compared with 11 and 12 applications in earlier studies. Some sooty mould contamination occurred and this can be attributed to actual adult counts greatly exceeding threshold levels. Assessments in February should ideally have been carried out at shorter intervals.

The damaging effect of whitefly on unsprayed tamarillo plots compared to the regularly sprayed plots was similar in magnitude to the 60% yield reduction and 78% defoliation measured in an earlier trial (Blank 1987). This further emphasises the importance of maintaining whitefly at low levels to prevent crop loss and sooty mould contamination.

Buprofezin is now registered for use in New Zealand on tamarillo with a 7 day withholding period.

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