CONTROL OF GRASS GRUB BEETLES IN BLUEBERRIES

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SUMMARY

Fruit damage by grass grub (*Costelytra zealandica*) beetles on blueberries (*Vaccinium corymbosum*) was controlled effectively by three sprays of cypermethrin (7.5 g ai/100 litres) and permethrin (20 g ai/100 litres) applied at 7 to 8 day intervals during the beetle flight season in late spring. Eight sprays of dichlorvos (150 g ai/100 litres) applied at 2 to 4 day intervals were ineffective. Detectable residues of cypermethrin (average 0.15 - 0.69 mg/kg) and permethrin (average 0.87 - 2.56 mg/kg) were present on the fruit at harvest, 6-12 weeks after spraying.

INTRODUCTION

Production of export blueberries is expanding rapidly in areas such as the Waikato, with 300-400 ha currently producing and a projected 25-fold increase in production by the early 1990's. Defoliation by grass grub beetles during spring has become an increasingly serious problem as horticulture expands into grass grub-infested pastoral farming areas (Blank *et al* 1983; East *et al* 1983). This problem is aggravated in blueberries by the occurrence of flowering and fruit-set during the period of beetle attack. As well as attacking blueberry foliage, grass grub beetles frequently chew the calyxes off the developing berries, resulting in a scar at ripening and rejection of the fruit for export.

The current recommended MAF spray programme for export blueberries includes three insecticides, azinphos-methyl (50 g ai/100 litres), carbaryl (120 g ai/100 litres), and dichlorvos (60 g ai/100 litres). Synthetic pyrethroid insecticides provide much better protection against grass grub beetles than azinphos-methyl or carbaryl (East *et al* 1983). This paper reports the results of a field trial comparing the control obtained by dichlorvos and the synthetic pyrethroids cypermethrin and permethrin. The residue levels of the pyrethroids on the fruit at harvest were also assessed.

METHODS

Three insecticide treatments (Table 1) were applied to a row of mature blueberry bushes containing a mixture of four cultivars, Stanley, A9, C11 and Dixi, at the Rukuhia Horticultural Research Area. Each plot comprised a single bush with an adjacent unsprayed bush as a buffer on each side. Prior to the first insecticide application percentage flowering was assessed by counting the numbers of fruit (petals dropped) and flowers in three randomly selected bunches on each bush.

Treatments were applied shortly before dusk (after bee activity had ceased for the day) by spraying to runoff. The first sprays were applied at the onset of grass grub beetle feeding activity, on 27 October 1983, and the final sprays on 11 November 1983. During this period dichlorvos was applied at 2 to 4-day intervals and the synthetic pyrethroids at 7 to 8-day intervals. Each treatment was replicated four times in a randomised block design, taking cultivars as blocks.

On ripening, the fruit was harvested at 3 to 6-day intervals, weighed, and a random subsample of 100 berries from each plot inspected for damage at each harvest. Samples of fruit from each harvest of the synthetic pyrethroid treatments were analysed for residues. These samples (20 g) were washed with hexane: acetone (50 ml 3:2 v/v) for 60 minutes. Following partition with water, the extract was analysed by gas liquid chromatography with electron capture detection. Recoveries of cypermethrin and permethrin were 87% and 94% respectively at 0.7 mg/kg.

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TABLE 1: Effects of insecticide treatments to blueberries (applied 27 October to 11 November 1983) on fruit damage at harvest.

Insecticide	Rate		No. sprays	% fruit damage	
	(gai/100	litres)		Mean	Range
dichlorvos (Vapona Concentrate EC)	150	.	8	30	15-59
cypermethrin (Cymbush 10 EC)	7.5		3	7	3-14
permethrin (Ambush 50 EC)	20		3	6	5-11
unsprayed	-		-	34	21-51

TABLE 2: Synthetic pyrethroid residues on blueberries at different stages of harvest.

Insecticide	Cultivar	Mean berry wt. (mg)	Mean residue (mg/kg)		
			Cumulative % harvest:	0-25	26-75 76-100
cypermethrin	Stanley	0.5		0.69	0.65 0.44
	C11	0.7		0.35	0.29 0.22
	A9	0.7		0.51	0.32 0.26
	Dixi	1.2		0.25	0.15 0.16
permethrin	Stanley	0.4		2.56	2.29 1.99
	C11	1.0		1.89	1.73 1.20
	A9	0.6		1.75	1.34 1.11
	Dixi	1.3		1.04	1.26 0.87

RESULTS

Cypermethrin and permethrin provided effective protection against fruit damage but dichlorvos was ineffective, despite the frequency of spraying and the relatively high application rate (Table 1). The range in the percentage of fruit damaged within the dichlorvos and unsprayed treatments (Table 1) is typical of the pattern of grass grub beetle attack.

Both of the synthetic pyrethroids were very persistent, with easily detectable residues on the fruit at harvest (Table 2). These residues were influenced by the percentage fruit-set at the time of spraying. At the commencement of spraying the cultivars Stanley and C11 had almost completed fruit-set, A9 was past the peak of flowering and Dixi was in full flower (Table 3). Within cultivars the earliest fruit had the highest residues (Table 2). The time between fruit set and harvest also influenced residues. The bulk of the fruit (26 -75% of the cumulative yield) from Stanley, C11 and A9 was harvested about 6½ - 8½ weeks after the last insecticide application, compared to about 9 - 11 weeks for Dixi (Table 3). These factors plus the relatively small berry size of Stanley and large berry size of Dixi probably account for the trends for Stanley to have the highest residues and Dixi the lowest (Table 2).

DISCUSSION

The presence of detectable residues of cypermethrin and permethrin on the fruit at harvest shows that effective chemical control of grass grub beetles on export blueberries will not be available to growers until residue tolerance levels have been set for synthetic pyrethroids in overseas markets.

TABLE 3: Flowering of blueberry cultivars at commencement of spray programme (27 October 1983) and times of harvest in relation to completion of spray programme (11 November 1983).

Cultivar	Mean % flowering	Mean times of harvest (days after final insecticide application)			
		Cumulative % harvest:	0-25	26-75	76-100
Stanley	2		39-43	46-60	64-78
C11	8		39-43	44-54	57-76
A9	25		39-47	48-64	68-89
Dixi	59		46-61	62-79	81-89

Assuming acceptable residue tolerances are eventually set, there are two other possible drawbacks to the use of synthetic pyrethroids to control grass grub beetles on blueberries, viz., the effects of pyrethroids on mites and bees. Tydeid mites (*Tydeus californicus*) can seriously contaminate export blueberries. Synthetic pyrethroid-induced outbreaks of phytophagous mites are well known (Chapman and Penman 1979) but it is not known whether pyrethroids influence tydeid mite populations in this way. Sampling for mites on 22 February 1984 (A.R. Tomkins, pers comm) revealed average numbers of tydeids (nymphs and adults) of 5.7 (dichlorvos), 0.0 (cypermethrin), 0.3 (permethrin), and 5.4 (unsprayed) per 100 leaves on the blueberry bushes used in this trial, indicating that pyrethroids reduced tydeid populations 4 months after spraying.

While synthetic pyrethroids have high contact insecticide activity against bees, under field conditions they have a highly repellent effect. This lasts for 1 - 2 days, during which the bees cease working sprayed flowers but suffer little mortality, and after which normal pollinating activity resumes (Shires and Debray 1982; Stark 1982). These observations require confirmation under New Zealand conditions. They suggest that it may be possible to use synthetic pyrethroids against grass grub beetles on flowering plants without seriously affecting bees, especially if the insecticides are applied late in the afternoon. Bees were observed to visit pyrethroid-sprayed and unsprayed flowering blueberry bushes (cultivar Dixi) in similar numbers 2 - 5 days after spraying at Rukuhia. An alternative approach to overcoming this problem would be to use early blueberry cultivars which finish flowering by mid to late October and hence do not attract bees during the grass grub beetle season. Such cultivars are also preferred because the fruit can be harvested for the valuable pre-Christmas export market.

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