AGRICULTURAL DEVELOPMENT AND ADVISORY SERVICE

REPORT TO: Horticultural Development Council

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Control of root weevils in soft fruit

CHEMICAL TREATMENTS APPLIED TO MODULE/POT - RAISED STRAWBERRY RUNNERS

SUMMARY

In 1988-9 insecticide drench treatments applied to module or pot-raised strawberry runners before planting in spring gave inconclusive results, so the trial was repeated in 1989-90. In the second trial both microencapsulated fonofos (Cudgel) or chlorpyrifos e.c (Dursban 4) applied either in February/March or in April (before the runners had rooted or shortly before planting), protected strawberries against vine weevil attacks in August. Drenches of Dursban 4 applied at twice the normal rate before runners rooted checked growth temporarily, but did not affect yields.

In a two-year trial designed to assess the persistence of insecticides applied to pot-raised strawberry runners planted in August, Dursban 4 gave better control (60 per cent) of vine weevil larvae is the first season than either chlorfenvinphos e.c. (Birlane 24) (42 per cent) or Cudgel (20 per cent). However, in the second season Dursban was ineffective, although both Birlane and Cudgel gave some control (20-25 per cent respectively). Despite the poor control in the second year, plants treated with Dursban that had protected the crop while it established in the first season, grew and cropped well.

Module treatment appears to be an effective, economical and environmentally desirable method of controlling vine weevil on strawberries raised this way.

Introduction

Dursban 4 (chlorpyrifos) applied to pot-raised runners in summer 1988 controlled vine weevil larvae well in that year. In the second year of the investigation, the potential of this method was assessed in greater detail, complemented by phytotoxicity trials funded by the Ministry of Agriculture, Fisheries and Food (MAFF). In an earlier, spring-planted, crop there was no difference between the numbers of larvae found the following autumn in runners drenched with Dursban 4 before planting, and the untreated ones so this trial was abandoned. However, a more extensive trial was done at Efford EHS in the spring of 1989 to assess the relative phytotoxicity and effectiveness of treatments applied either immediately after potting up runners, or immediately before planting.

Material and Methods

(i) Spring-planted trial

Site: Efford Experimental Horticulture Station

Design: Factorial design.
10 plants per plot, in double rows under polythene mulch

Variety: Ostara, rooted in 9 cm (9K Optipot) pots, each of approximately 350 ml capacity.

Date of treatment:	Before rooting	Before planting
Chlorpyrifos (Dursban 4)	17 March 1989 (week 11)	26 April 1989 (week 17)
Fonofos (Cudgel)	22 February 1989 (week 8)	26 April 1989 (week 17)

Treatments

Insecticide

	Rate	
	ml product per litre "Normal" (N) rate	(ml product per plant) "Twice normal" (2N) rate
Chlorpyrifos 48% e.c. (Dursban 4)	0.77 (0.27)	1.54 (0.54)
Fonofos 39.2% microencapsulated formulation (Cudgel)	0.1 (0.04)	0.2 (0.07)
Untreated (water only control)	-	-

NB. "normal" rate = label rate for similar crops.

Method of Application

The treatments were applied in sufficient water to soak the pots, using a watering can fitted with a dribble bar. Foliage was lightly rinsed with water just before and just after treatment.

Date of planting: 28 April 1989 (week 17)

Vine weevil eggs applied : 9 August 1989 (week 32).

In order to try to ensure a uniform infestation, 30 vine weevil eggs were added to each plant, placed in a small trench made around the base of each plant, which was covered after eggs had been applied.

Assessments

The weight of marketable fruit per treatment (not per plot) was assessed on 28 June, 5 July and 17 July. Samples of fruit from each treatment were collected and frozen on each occasion for residue analysis.

On 26 July, the foliage was mown off the plants and stored on open trays in an unheated store. On 30 October it was oven-dried and weighed.

On 15 November, six plants per plot were sampled at random using a 15 cm (6") diameter corer. Each core was washed through a series of sieves and the number of vine weevil larvae per plant was recorded.

Statistical analysis

Data, except that for yields, was subject to analysis of variance.

(ii) Summer-planted (1988) trial

Materials and Methods

Site: Ashton, Bishops Waltham, Hants

Design: Randomised block design with three replicates. Eight plants per plot.

Variety: Elsanta, supplied in polystyrene trays containing cells of approximately 235 ml. There were 15 cells per tray.

Date of treatment: 18 August 1988

Treatment

Insecticide	Rate: ml product per litre Half "normal" rate (0.5N)	Rate: (ml product/plant) "Normal" rate (N)
Chlorpyrifos 48% e.c (Dursban 4)	1.25 (0.295)	2.5 (0.59)
Chlorfenvinphos 24% e.c (Birlane 24)	0.15 (0.035)	0.3 (0.07)
Fonofos 39.2 % microencapsulated formulation (Cudgel)	0.05 (0.011)	0.1 (0.023)
Untreated	-	-

Date of planting : 30 August 1988

Vine weevil eggs applied : 4 August 1989.

This site was naturally infested with vine weevil, but to try to ensure attacks were uniform, approximately 30 vine weevil eggs were added to each plant.

Assessments

In February 1990, eight plants per plot were removed using a 15 cm (6") diameter corer. Each core was washed through a series of sieves and the number of vine weevil larvae per plant was recorded.

Statistical analysis

Data was subject to analysis of variance.

Results

(a) Spring-planted trial

In the spring-planted crop, only treatments applied before rooting were noticeably phytotoxic. However, affected plants recovered after planting out, so that by the autumn, no consistent differences could be detected between plants treated before rooting, or plants treated immediately before planting out. The foliage from plants treated with the normal dose of insecticide was invariably heavier than either the untreated plants, or plants treated with twice the normal rate of insecticide. However, the results were not statistically significant because of the variation between plots.

The total weight of fruit taken from each treatment on the specified dates for residue analysis was also variable, and so no statistical analyses were done.

Although the attack of vine weevil was not high at this site (approximately two larvae per plant in untreated plants), all the treatments significantly controlled the pest, with Dursban proving the most effective. (Table 1). Numbers ranged from none per plant (100 per cent control) in plants treated with twice normal rate of Dursban 4 before rooting, to just over one per plant (50 per cent control) in plants treated with the normal rate of Cudgel, also before rooting. Differences in the levels of control between the rates or timings of treatments were not significant.

Table 1. Mean number of weevil larvae per plant in the spring-planted crop

	Treatment					
	Cudgel		Dursban		Untreated	
Rate of insecticide	Early	Late	Early	Late	Early	Late
N	1.12	0.67	0.54	0.29		
2N	0.25	0.25	0	0.13		
Untreated					2.15	2.00
Mean	0.69	0.45	0.27	0.21	2.15	2.00
Mean of treatments	0.57		0.24		2.07	

SED: 0.645

(b) Summer-planted trial, planted 1988

Pre-planting drenches of Dursban at both "normal" (N) and "half-normal" (0.5N) rates controlled vine weevil well in the first season, but were ineffective in the second season (Table 2). Although slightly less effective than Dursban in the first year, Birlane continued to have a slight but significant effect (25 per cent control) in the second season. Cudgel, which had been ineffective in the first year, also reduced the number of larvae slightly in the second season (20 per cent control). There was no difference between the rates of each treatment applied.

Table 2. Mean numbers of vine weevil larvae per plant, recovered one month or 18 months after pre-planting treatment of the summer planted runners

	Mean numbers of larvae per plant					
	1988-1989			1989-1990		
	Rates of Insecticide					
Treatment	0.5N	1N	Mean	0.5N	1N	Mean
Chlorpyrifos (Dursban)	0.58	0.37	0.48	24.2	28.2	26.2
Chlorfenvinphos (Birlane 24)	1.33	0.79	1.06	22.1	17.8	19.98
Fonofos (Cudgel)	4.7	1.33	3.02	20.8	21.9	21.35
Untreated	4.5	5.88	5.19	26.5		26.5
Mean	2.78	2.09	2.44	23.4	23.6	23.5

SED treatment means = 1.5598 SED treatment means = 5.955

(Fungus treatments not shown here)

Discussions

Treatments, particularly Dursban at twice the normal rate, applied to strawberry runners immediately after potting and before they had rooted, were phytotoxic, but the plants recovered fully. Drenches applied shortly before planting did not appear to affect growth. These results are in line with results obtained when module-raised brassicas were treated with insecticides or fungicides, where affects were less the later the treatments were applied. Because module treatments appear so promising, further tests at a range of concentrations should be done with Dursban, Birlane 24, and Cudgel on plants shortly before planting to determine accurately the maximum safe dose (the rates of Dursban in these trials, it should be noted, were different).

Dursban drenches controlled vine weevil larvae in the season of treatment in both trials, although in the two-year trial it was ineffective (at the N rate) in the second year.

Cudgel, when applied in either February or April (Spring-planted trial) was also effective in controlling vine weevil larvae introduced in August. However, when applied in late August, one month before vine weevil eggs were applied, it was not effective. The same treatment, however, was more effective than Dursban the following summer although the numbers of weevil larvae present were still unacceptable. These results are probably due to the formulation, which releases the active ingredient slowly. There is evidence from elsewhere that to be fully effective, Cudgel should be applied well before the insect attack is expected. As this treatment was relatively safe to the crop, it too should be tested further. Higher rates applied at least six to eight weeks before vine weevil eggs are expected to hatch, are suggested.

Birlane 24 is a similar insecticide to Dursban, but it tends to be more persistent, and this was borne out by the two-year trial. Like the other treatments, however, the numbers of vine weevil larvae present in the second year were unacceptable.

These results suggest that drench treatments, applied to module-raised strawberries, give useful control of vine weevil in the first year, but not in subsequent years, at the rates used here. Further work is needed to determine the maximum safe dose of each product and when this should

be applied. As with comparable treatments used on brassicas, the amount of insecticide used with this technique is much less than with conventional methods, and so environmentally is highly desirable.

Before the technique can be adopted commercially, however, residue data is needed to show that insecticide levels in fruit, especially in spring-planted crops, are acceptable.

Conclusions

1. Pre-planting drenches of certain insecticides control attacks of vine weevil effectively for one season. Although some continue to be effective the following season, the rates used here were not sufficient to prevent a high infestation.

2. The persistence of the treatment could well be increased by altering the rate of application.

3. An Off-Label Approval should be sought now for the use of Dursban on module-raised strawberry runners that will not be cropped for one year.

4. Residue data is urgently needed if these treatments are to be Approved. The HDC and the relevant agrochemical companies should discuss possible ways of funding this work.

APPENDIX 1

Table 3. Spring-planted crop: Mean numbers of vine weevil larvae per plot spring-planted crop. ($\log_{10} n$)

Treatment	Timing	Rate of insecticide N	2N	Untreated
Cudgel	Early	3 (0.6021)	0 (0.0000)	
		1 (0.3010)	4 (0.06990)	
		19 (1.3010)	0 (0.0000)	
		4 (0.6990)	2 (0.4771)	
Cudgel	Late	1 (0.3010)	2 (0.4771)	
		0 (0.0000)	1 (0.3010)	
		15 (1.2041)	0 (0.0000)	
		0 (0.0000)	3 (0.6021)	
Dursban	Early	5 (0.7782)	0 (0.0000)	
		7 (0.9031)	0 (0.0000)	
		1 (0.3010)	0 (0.0000)	
		0 (0.0000)	0 (0.0000)	
Dursban	Late	0 (0.0000)	3 (0.6021)	
		1 (0.3010)	0 (0.0000)	
		5 (0.7782)	0 (0.0000)	
		1 (0.3010)	0 (0.0000)	
Untreated	Early	-	-	4 (0.6990)
				11 (1.0792)
				3 (0.6021)
				14 (1.1761)
				5 (0.7782)
				31 (1.5051)
				16 (1.2304)
				19 (1.3010)
Untreated	Late	-	-	17 (1.2553)
				9 (1.0000)
				9 (1.0000)
				8 (0.9542)
				10 (1.0414)
				22 (1.3617)
				12 (1.1139)
				9 (1.0000)

APPENDIX 1

Table 4. Summer-planted crop: mean number of vine weevil larvae per plant one month and 18 months after planting

Treatment	1988-1989 Rates of insecticide 0.5N	1.0N	1989-1990 Rates of insecticide 0.5N	1.0N	Untreated
Chlorpyrifos (Dursban)	1	1	26	32	
	1	0	23	29	
	0	0	24	23	
Chlorfenvinphos (Birlane)	2	2	27	20	
	1	0	13	17	
	2	1	27	16	
Fonofos (Cudgel)	3	4	23	26	
	7	0	22	20	
	4	0	18	20	
Untreated	0	17			32
	7	1			27
	6	0			32
					28
					18
					24

NB. Neither numbers of larvae in plants infested immediately after planting, nor fungus treatment data from 1988-1989 are included here.