HDC Project Report - October 1989

Title of Project:	Vine weevil and other root weevils: control measures (Cross-Panel)
Project Number:	SF/15/87; HO/15/87; PC/15/87
Location:	AFRC Institute of Horticultural Research (IHR) and ADAS
Project Leader:	Dr.C.C.Payne (IHR)

INTRODUCTION

The need for alternative methods of vine weevil control has intensified since the ban on the use of aldrin. This report provides the results of the use of alternative chemical control methods to protect module-grown and bare-rooted strawberry runners from infestation by vine weevil larvae. The experiments were conducted by Mrs.Sue Hockland, ADAS Reading.

OBJECTIVES

1. To establish soil-incorporated pre-planting treatments for bare-rooted strawberry runners.

   The larvae of vine weevil and other root weevils cause damage to roots of strawberry and other soft fruit, which results in loss of crop and sometimes death of plants. Many growers still buy fresh dug or cold-stored runners but at present there are no Approved, pre-planting treatments for this pest. The efficacy of Gamma-Col (gamma-HCH) mixed into the soil before planting was therefore investigated. This product is already Approved for use in this way to control wireworms, leatherjackets and cockchafers but little is known about its effects on vine weevil.

2. To investigate the potential of Dursban 4 and other products for the control of weevil infestation on module- and pot-raised strawberry runners.

   Preliminary work done in 1987-1988 indicated that Dursban 4 applied to pot-raised runners in the summer provided good control of weevil larvae in that year. In the second year of the investigation the potential of this method was assessed in greater detail, complemented by phytotoxicity work supported by the Ministry of Agriculture, Fisheries and Food (MAFF).

RESULTS AND DISCUSSION

1. Soil-incorporated treatments

Two treatment sites were selected to investigate the efficacy of gamma-HCH.

Sites	Mortimer Hill, Berks.	Iver, Bucks.
Design	11 plots of 4 rows approx. 100 plants each	2 x 0.2 hectare plots
	Alternate plots treated	One plot was treated, the other left untreated
Pre-planting treatment (applied by the growers)	Gamma-Col applied to base of each planting hole prior to planting equivalent to 1.4 litres per hectare (1 pint per acre)	Gamma-Col admixed into the soil mechanically prior to planting, at 1.4 litres per hectare (1 pint per acre)
Cultivar	Cambridge Favourite	Cambridge Favourite
Date of treatment	17th June 1988	8th September 1988
Date of planting	17th June 1988	15th September 1988
Eggs applied	23rd August 1988	29th September 1988

Both sites were naturally infested with vine weevil, but to ensure attacks were more uniform, 20 vine weevil eggs were added to five randomly-chosen plants in each plot on the Berkshire site, and to 50 randomly-chosen plants in each plot at the Buckinghamshire site, on 23rd August and 29th September respectively. Artificially infested plants were marked with a blue cane.

In February 1989, the artificially-infested plants in each plot were removed using a 15 cm (6") diameter corer. Each core was washed through a series of sieves and the number of larvae per plant was recorded.

The numbers of larvae found are shown in Table 1.

Table 1 Mean numbers of larvae per plant in treated and untreated areas

Site	Pre-planting treatment of Gamma-Col	No treatment
Berkshire	11.75	13.67
Buckinghamshire	0.58	1.2

The pre-planting treatment significantly reduced the numbers of weevil larvae per plant at the Buckingshamshire site, but not in the Berkshire site.

There were approximately ten times as many larvae in plants removed from the Berkshire site as there were in those removed from the Buckingshamshire site. The reasons for this are not clear. The eggs produced in August might have been more viable than those produced in September. Alternatively, conditions for survival might have been better in August than in September.

Although there was no direct experimental comparison, because the treatments were made at different times, it appears that incorporating Gamma-Col into the soil before planting in September may be more effective than placing it 15 cm below the soil surface at the base of each planting hole in June. Soil incorporation should ensure that more larvae come into contact with the insecticides. The time of the treatment in relation to when the eggs were applied, may also have had a significant effect. At the Berkshire site, the insecticide was applied two months before the eggs were applied, compared with two weeks at the site in Buckinghamshire.

Although not affording total protection, the use of gamma-HCH at or shortly before planting may be of some assistance to growers in the immediate future. However, this chemical is an organochlorine compound and is being reviewed by the Advisory Committee on Pesticides. Its future is therefore uncertain and other pre-planting treatments should be evaluated.

2. Chemical treatments applied to module/pot-raised runners

Treatments were applied on one site in Hampshire to module-grown strawberry plants. Two planting dates were evaluated; spring and summer planting. The treatments examined were Dursban 4, Birlane 24, Cudgel and Strain 275 of the insect-pathogenic fungus, Metarhizium anisopliae. The treatments were applied in sufficient water to soak the module cells, using a watering can fitted with a dribble bar. The site was naturally infested with vine weevil but to ensure attacks were more uniform, 20 vine weevil eggs were added to each plant in selected plots at the appropriate time. Further reinfestation of the site with vine weevil was carried out during 1989 to provide a future evaluation of the long-term efficacy of the products. In March 1989, the plants artificially infested in 1988 were sampled using a 15 cm (6") diameter corer. Each core was washed through a series of sieves and the number of larvae per plant was recorded. Full details of the treatments are given below.

Site	Ashton, Bishops Waltham, Hants.	
	Spring-planted trial	Summer-planted trial
Design	Randomised block design with five replicates. Six plants per plot	Randomised block design with three replicates. Eight plants per plot
Variety	Elsanta, supplied in polystyrene trays containing cells of approximately 235 ml 15 cells per tray	Elsanta, supplied in polystyrene trays containing cells of approximately 235 ml 15 cells per tray
Date of treatment	10th May 1988	18th August 1988
Date of planting	11th May 1988	30th August 1988

Treatments

	Rates of product (ml) per litre of compost	
	0.5 N	1.0 N
Chlorpyrifos (Dursban 4)	spring plants -	2.5
	summer plants 1.25	2.5
Chlorfenvinphos (Birlane 24)	0.15	0.3
Fonofos (Cudgel)	0.05	0.1
Metarhizium anisopliae	250 x 10^7 spores	500 x 10^7 spores
Untreated (water only)	-	-
Time of treatment	10th May 1988	18th August 1988
Vine weevil egg application dates	1st July 1988	30th August 1988
	27th July 1988	27th September 1988
	7th September 1988	
Proposed egg application dates in 1989	May 1989	August 1989
	July 1989	
	September 1989	

In the spring-planted crop, there was no difference between the numbers of larvae found around the Dursban 4 drenched plants and the untreated ones (Table 2).

Table 2 Numbers of vine weevil larvae per plant in the spring-planted strawberry crop

	Egg application date		
Treatment	1st July	27th July	7th Sept
Dursban 4	2.6	2.1	2.4
No treatment	1.9	2.1	2.1

In the summer-planted crop, differences were recorded between the numbers of larvae found in treated and untreated plants (Table 3.).

Table 3 Numbers of vine weevil larvae recovered from summer-planted strawberries drenched with insecticide, or fungal spores, or water only

Treatment	Eggs applied immediately after planting		Eggs applied one month after planting		Mean		Overall Mean
	0.5N	N	0.5N	N	0.5N	1.0N	
Chlorpyrifos (Dursban 4)	0.16	0.59	0.67	0.59	0.41	0.59	0.5***
Chlorfenvinphos (Birlane 24)	0.83	0.42	1.02	0.63	0.92	0.53	0.73**
Fonofos (Cudgel)	0.91	0.83	1.56	0.70	1.23	0.76	1.0
Metarhizium anisopliae 275	1.60	1.05	1.88	1.38	1.74	1.21	1.48
No treatment (water only)	1.56	0.93	1.35	1.19	1.46	1.06	1.26
Mean	1.01	0.76	1.29	0.90	1.15	0.83	

** and *** represent results that are significantly different from the 'water only' treatment.

Chlorpyrifos (Dursban 4) was the most effective treatment overall. There was little difference between its effectiveness at either rates or at either time of egg application.

Chlorfenvinphos (Birlane 24) was moderately effective overall, and was slightly more effective at the higher rate than chlorpyrifos when eggs were applied immediately after planting, but slightly less effective when eggs were laid one month after planting. Overall, the higher rate of chlorfenvinphos was more effective than the lower rates. In these experiments Fonofos (Cudgel) and M. anisopliae did not appear to reduce the level of vine weevil infestation. Overall, the survival of larvae in this trial was poor; the reasons for this are unclear.

In summary, Dursban 4 applied in May shortly before planting failed to protect strawberries against vine weevil attack 7, 11 and 17 weeks after planting. Effective control was, however, again obtained with the same chemical applied in the same way to a summer-planted crop. Here the eggs were applied immediately and one month after planting. Birlane 24 was moderately effective but Cudgel, and the entomophilic fungus, Metarhizium anisopliae, were ineffective in these experiments.

FUTURE WORK

1. Application for off-label approval of Gamma-Col for vine weevil control should be sought. In addition, further trials work is needed to examine the persistence of gamma-HCH and the efficacy of other products incorporated into the soil prior to planting.

2. The summer-planted trial of module-grown and treated runners is to continue so that the persistence of the treatments can be assessed a year later. The effect of treatments applied to a spring-planted crop will be reinvestigated and a new experiment has been established at Efford EHS.

3. Investigations will continue on the role of Metarhizium anisopliae as a biological control agent for vine weevil, particularly on HONS and protected ornamentals. Spore persistence studies are continuing to determine the maximum period of pest control that may be obtained with a single spore application.