Grower Summary

SF-HNS 112

Evaluation of insecticides for control of adult vine weevil under controlled conditions.

Final 2011

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Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Project Number:	SF HNS 112
Project Title:	Evaluation of insecticides for control of adult vine weevil under controlled conditions
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Report:	Final report (revised) 2011
Publication Date:	20/08/2012
Previous report/(s):	None
Start Date:	April 2010
End Date:	December 2011
Project Cost:	£19,000

Headline

Growers should not rely solely on insecticide sprays against adults for control of vine weevil. Although Hallmark gave complete control of adult weevils under semi-field conditions in 2010 it was not effective in 2011, when Steward and Chess were the most effective products.

Background and expected deliverables

Vine weevil is a serious pest of soft fruit and hardy nursery stock and control of the larvae in soil-grown soft fruit crops is difficult. As an alternative strategy, growers may apply timely insecticide sprays to control adult weevils, ideally before they can lay eggs. The main product used until recently was bifenthrin (Talstar), but EU legislation led to the withdrawal of this pyrethroid insecticide. Therefore there was an urgent need to screen replacement products, so growers retain access to effective insecticides for use against adult vine weevils.

The objective of this project was to evaluate a range of mainly IPM compatible insecticides for efficacy against adult vine weevil in order to help ensure that growers continue to effectively control this difficult pest.

Summary of the project and main conclusions

Evaluation of insecticides under semi-field conditions

Six insecticide treatments were tested against adult vine weevils collected from strawberry crops under semi-field conditions at ADAS Rosemaund in June 2010 and a similar range of insecticide treatments was tested in the same way at ADAS Boxworth in June 2011. In total, eight insecticides, one applied at two rates, were tested in 2010 and 2011. The rates used were label or Specific Off Label Approval (SOLA, now renamed Extension of Approval for Minor Use or EAMU) rates. Three of the insecticide treatments were the same for the two experiments.

Both experiments used mesh cages placed within a ventilated polytunnel. The vine weevils used were collected from crops of strawberry and raspberry. To simulate the field environment as far as possible, each cage contained refuges for the weevils, including a layer of compost on the floor and food plants. The plants and all interior surfaces of the cages were sprayed during the early evening, when adult weevils would be expected to become active.

Assessments were made (at intervals of seven and 14 days in 2010 and eight and 15 days in 2011) after treatment application, classifying weevils as dead, dying (moribund) or alive. The

levels of weevil mortality in insecticide-treated cages were compared to levels of mortality in cages treated with water only.

In 2010, natural mortality of weevils in untreated cages was 55% after 14 days while in 2011 it was just 7% after 15 days. The high level of mortality recorded in 2010 was most likely due to the very high temperatures recorded throughout this experiment. The timing of the 2011 experiment coincided with a period of relatively cool weather.

Results, corrected for control mortality, are summarised in Table 1.

2010

- In 2010, the pyrethroid insecticide Hallmark at 100 ml/ha gave complete control of adults within 14 days of application.
- When Hallmark was tank-mixed with chlorpyrifos (Equity) at 1,500 ml/ha, complete control was achieved within seven days.
- Steward (170 g/ha) also gave good control of adult vine weevil.

2011

- In 2011, Steward at 250 g/ha was the most effective of the insecticide treatments tested (71% mortality after 15 days).
- Chess (400 g/ha) was the next most effective (60% mortality after 15 days).
- For both insecticide treatments, most of the adult vine weevils died within eight days of the spray being applied.
- A lower rate of Steward (170 g/ha) and the neonicotinoid product Calypso (250 ml/ha) were less effective and did not significantly increase weevil mortality compared with the untreated control.
- The pyrethroid insecticides Hallmark and Toppel were also ineffective.

Table 1. Summary of insecticide efficacy against adult vine weevil in experiments done in 2010 and 2011 (data adjusted for control mortality)

Treatment no.	Product	Active ingredient	Rate (ml or g/ha) used	Mean % mortality after treatment			
				2010		2011	
				7 days	14 days	8 days	15 days
1	Control	N/A	N/A	N/A	N/A	N/A	N/A
2	Calypso	thiacloprid	250	23	67	21	25
3	Chess	pymetrozine	400	-	-	**58**	**60**
4	Gazelle	acetamiprid	250	-51	-22	-	-
5	Hallmark	lambda cyhalothrin	100	49	**100**	0	-4
6	Hallmark + Equity	lambda cyhalothrin + chlorpyrifos	100 + 1500	100	**100**	-	-
7	Pyrethrum	pyrethrins	20 ml/5 l water	-42	3	-	-
8	Steward	indoxacarb	170	45	**91**	32	26
9	Steward	indoxacarb	250	-	-	**70**	**71**
10	Toppel	cypermethrin	250	-	-	5	15

NB:

1. Figures in bold are significantly different from the untreated (P<0.05)
2. Negative figures indicate that mortality for that treatment was lower than in the control
3. A dash (-) means not tested

Evaluation of insecticides under controlled laboratory conditions – 2011

In contrast to the results obtained in 2010, Hallmark at 100 ml/ha was not effective under similar but much cooler semi-field conditions in 2011. Hallmark and Steward were therefore compared under controlled temperature (21°C) conditions in the laboratory in order to provide more definitive information on the inherent activity of these insecticides against adult vine weevils.

Two experiments were completed, one testing three rates of Hallmark and Steward when the adult vine weevils were directly sprayed. In a second experiment Hallmark at 100 ml/ha and Steward at 250 g/ha were sprayed onto foliage and soil before exposing weevils to these spray residues after 0, 12 or 24 hours.

In these experiments direct contact with Hallmark had little effect on weevil mortality (13-27% mortality after 14 days) or on the proportion of moribund weevils recorded (7-20% after 14 days). In the residue experiment weevil mortality (7-33% after 14 days) was again low but the proportion of moribund weevils (27-47% after 14 days) was higher. Hallmark and Steward also had a noticeable adverse effect on the behaviour of surviving weevils. These effects included abnormal/slow walking and, in the case of Steward, a liquid produced from the mouth. These sub-lethal effects may affect weevil survival or fecundity and so further reduce weevil populations over time.

The approval status on outdoor and protected crops of raspberry, strawberry and ornamentals of the insecticides used in the trials is shown in Table 2.

Table 2. Approval status of insecticides tested in this project for use on fruiting crops of strawberry and raspberry, and ornamentals – November 2011

Product	Approved for use on					
	Raspberry		Strawberry		Ornamentals	
	Outdoor	Protected	Outdoor	Protected	Outdoor	Protected
Calypso	EAMU (0336/06)	EAMU (0534/07)	EAMU (0333/06)	EAMU (0334/06)	EAMU (2831/08)	-
Chess	-	EAMU (0498/07)	-	EAMU (0499/07)	Label	Label & EAMU (2834/08)
Equity	Label	Label	Label	Label	-	-
Gazelle	-	EAMU (2856/08)	-	EAMU (2856/08)	Label	Label
Hallmark	EAMU (0728/06)	-	EAMU (1705/11)	EAMU (1705/11)	EAMU (2944/08)	EAMU (2944/08)
Pyrethrum	Label	Label	Label	Label	Label	Label
Steward	EAMU (2905/08)	EAMU (2905/08)	EAMU (2905/08)	EAMU (2905/08)	EAMU (2905/08)	Label
Toppel	-	-	-	-	Label	Label

NB:

1. A dash (-) means not approved
2. Note that the maximum rate of use, harvest interval and other statutory conditions for a product can vary between crops and situation of use (outdoor or protected)
3. The approval status of pesticides is subject to change
4. Consult the relevant label or EAMU before using a product

- Full details of conditions of use in the work in this project are given in the science section of this report

Effect of environmental conditions on treatment efficacy

The observed differences in levels of mortality and speed of kill between 2010 and 2011 strongly suggest that the efficacy of insecticides may be determined in part by environmental conditions as all other conditions of the trials were similar. The semi-field experiment completed in 2010 was characterised by high temperatures (daytime temperatures, mean = 28.3°C, range = 18.6-37.8°C) while in 2011 conditions were relatively cool (daytime temperatures, mean = 22.7°C, range = 19.0-26.0°C). The high temperatures in 2010 led to high levels of mortality within seven days in all treatments including the untreated (55%).

For the insecticide treatments (except Hallmark + Equity) tested in 2010 weevils died throughout the 14 days of the experiment. In 2011 control mortality was low and nearly all of the mortality in the insecticide treatments occurred within eight days. It seems likely then that a combination of insecticide treatment and high temperatures in 2010 led to large numbers of weevils dying more than a week after the sprays were applied. In 2011 the weevils were not stressed by high temperatures and so may have been better able to survive any long-term effects of the insecticide treatments.

Financial benefits

Vine weevil is a serious pest of soft fruit, and estimates suggest that, in the absence of bifenthrin, losses in strawberries and raspberries alone could increase to over £10 million per annum (Defra project IF01100). In nursery stock the feeding of adults on the foliage, causing characteristic “notching” of the leaves, is important, as it can lead to rejection of plants by buyers. In addition, the feeding of larvae on roots of containerised shrubs, alpines and herbaceous plants causes losses and reduction in quality unless controlled.

The estimated cost (both material and application) of treating one hectare of protected strawberries with a single spray of Hallmark (100 ml/ha) is around £39 and for Steward (250 g/ha) £85. Using the assumptions that one hectare would yield 20 tonnes of strawberries and that the value of the fruit is £3,000/tonne it is possible to estimate the financial benefit of these applications. As there are often hot-spots of adult vine weevil within a crop the affected area may be relatively small (e.g. approximately 5% of the total area). Therefore, if the affected area is left untreated and these plants either die or do not produce fruit then a loss of £3,000/ha can be estimated.

To be cost effective Hallmark would need to be at least 1% effective in reducing losses caused by vine weevil. Steward would need to be 3% effective to be cost effective. However, the relationship between adult vine weevil numbers and numbers of larvae in the soil or growing media is poorly understood. As such it is not possible to directly relate adult weevil numbers to damage caused by larvae. Insecticide applications against adult vine weevils also need to be considered within an IPM programme in order to avoid negative impacts on biological control agents being used against other pests within the crop.

Application later than September is expected to show a reduced financial benefit because, by that time of year, adult weevils would have already laid some eggs within the crop, allowing another generation of the pest to develop. The financial benefits from treatment of hardy nursery stock crops are difficult to quantify, but the area treated for control of adult weevils is likely to be significantly less than that on soft fruit.

Action points for growers

- Do not solely rely on insecticide sprays against adults for control of vine weevil. Consider how to optimize control of larvae with insecticides or biological control agents.

- If treatment is considered necessary against adult vine weevil, this project has indicated that several insecticides may give some control:

- Hallmark (and Hallmark + Equity) were effective in the 2010 semi-field trial but Hallmark was not effective in the 2011 semi-field trial. These inconsistent results may have been due to temperature effects but they indicate that Hallmark may give unreliable control. See Table 2 for crops that Hallmark and Equity may be used on.

- The 2011 semi-field trial indicated that Steward applied at 250 g/ha could give good control. However, this rate may only be used on outdoor ornamentals and outdoor, un-cropped raspberry and strawberry where a one year harvest interval is possible (EAMU 2905/08). For protected crops spray concentrations for this product should not exceed 12.5 g/100 l (the efficacy of this label rate was not tested in this project).

- The 2011 semi-field trial also indicated that Chess applied at 400 g/ha (EAMU 2834/2008) may also provide useful control on protected soft fruit crops. Chess may be applied to protected ornamentals at 60 g per 100 l water (EAMU 2834/2008) thus if applied at 600g in 1000 l water/ha, this rate should give useful control. The label

rate for Chess is 20g per 100 l water so if this rate is used on outdoor ornamentals the effect on adult vine weevil is currently unknown.

- Steward and Chess are more compatible than Hallmark and Equity with naturally occurring vine weevil predators, such as native carabid and staphylinid beetles, as well as biological control agents introduced for control of other pests.