WINE INDUSTRY ASSOCIATION WESTERN AUSTRALIA

Australian Government
Grape and Wine Research and Development Corporation

Improved management of garden weevil in WA – a warning service and assessing exclusion bands



Garden weevil adults dislodged from a trunk monitoring band onto a ground sheet

FINAL REPORT

to

GRAPE AND WINE RESEARCH & DEVELOPMENT CORPORATION

Project Number: RT04/07-2

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Department of Agriculture and Food
Western Australia

Research Organisation: Wine Industry Association of Western Australia

Date: 22 February 2011

1. Executive summary:

Garden weevil is an important pest of winegrape vineyards in the southern growing regions of Australia. A strategic method of protecting vines is to apply a trunk drench of insecticide before weevil entry into the canopy. Also, some vignerons have been using artificial fibre trunk bands in an attempt to prevent weevils entering the vine canopy.

This project aimed to determine whether area-wide sentinel monitoring of garden weevil is useful in advising vignerons of the timing of trunk drenching and to assess the efficiency of artificial fibre trunk bands in excluding weevils from the vine canopy.

Vignerons involved in monitoring of garden weevil emergence were selected to be representative of the infested area in Western Australia. Results of the monitoring were reported to the industry via the internet. They showed the timing of spraying varied both within and between regions and that individual vineyard monitoring is the best approach on which to base decisions for the need and timing of insecticide to control garden weevil. There was a range in attitudes among vignerons on the pest status of garden weevil and the need for insecticide. This supported the view that individual vineyard monitoring is essential for garden weevil management according to each vigneron's management philosophy.

The study on the role of exclusion trunk bands was inconclusive in field trials because of low weevil abundance in study sites. Laboratory studies confirmed earlier observations that artificial fibre trunk bands have limited effect on preventing weevils from entering the vine canopy. This is at variance to the experience of some vignerons who have had success with weevil management where the bands have been used. Further studies are required to clarify this anomaly.

2. Background:

The key insect pest of winegrapes in WA and to a lesser extent in parts of South Australia, Tasmania and Victoria is garden weevil (GW). During the 2003/04 season its pest status in reducing grape yield was demonstrated with a yield boost from 6.5 t/ha in untreated areas to 10.6 t/ha in sprayed areas. As well as reducing yield, damage by GW to the growing tips in heavily infested vines makes it difficult to manage vine growth when pruning. GW feeding on individual berries can result in a greater incidence of bunch disease such as botrytis under suitable weather conditions.

A package of measures can help reduce weevil numbers (Fisher and Learmonth 2003), but where weevil abundance is very high, insecticides are relied upon to protect crops. Vignerons who experience GW problems and rely on synthetic pyrethroid insecticides for control, have the choice of trunk drenching (see Fig. 1 for one type of rig used for this) or foliar spraying. In terms of reducing the chance of outbreak of secondary pests such as longtailed mealybug, mites and scale, butt drenching is preferred. For this to be effective, insecticide must be applied before weevils enter the vine canopy because once there, few return to the ground. Therefore the trunk drench application must be applied in the early stages of weevil emergence during spring.



Fig. 1. Recycling spray rig to apply trunk drench insecticide to grapevines to prevent garden weevil adults from entering the canopy of grapevines.

The first assessment of artificial fibre bands as a means of protecting vines by excluding GW adults from the canopy was made during the 2003/04 season. On this occasion the bands proved to be ineffective as a barrier. Since that assessment other types of artificial fibre bands have become known and different methods of deployment have been considered. Although labour intensive to attach to vine trunks and posts, if such bands were effective in preventing weevils gaining access to the vine canopy, an insecticide free-means of management would be available. Already, there has been sufficient interest in such an approach by some vignerons, and bands have been used in reasonably large blocks of vines (see Fig. 2).



Fig. 2. Artificial fibre bands on grapevine trunks to prevent garden weevil adults from accessing the vine canopy. The higher band on each vine was more recently deployed to replace the earlier band that had deteriorated under field exposure.

This study reports on further research conducted on these aspects of garden weevil management.

3. Objectives:

- To encourage those vignerons who plan to use synthetic pyrethroid insecticide to control GW, to adopt the trunk drench approach. To implement an area-wide monitoring program to determine its value in advising the correct timing of insecticide application.
- To assess the use of artificial fibre bands to exclude GW from the canopy of grapevines.

4. Method:

Reporting garden weevil abundance in vineyards

Eighteen vignerons from the Swan Valley to Pemberton were contacted during September 2004 who agreed to check and report on a weekly basis the abundance of garden weevil in monitoring bands placed in their vineyards. The details for this monitoring are given in Appendix 1. The photograph on the cover indicates the method for measuring weevil abundance on trunk monitoring bands (see also Fig. 3).



Fig. 3. The type of cardboard trunk monitoring band used to assess the abundance of garden weevil adults is just below the crown of this vine.

The reporting service was called *GARDEN WEEVIL watch* and the weekly reports from all vignerons were collated and placed on the Department of Agriculture and Food website – http//www.agric.wa.gov.au. As the abundance of garden weevil adults increased, a recommendation was made to individual vignerons as to whether insecticide should be applied. Whether vignerons had applied insecticide was also indicated on the information posted on the website. The reporting service was run until weevil numbers declined to levels not considered a risk to the vines.

The role of artificial fibre exclusion trunk bands

Two field experiments and a laboratory study were undertaken to clarify the role of exclusion trunk bands of artificial fibre in preventing garden weevils from accessing the canopy of grapevines.

The details of the treatments in the field studies are shown in Table 1 (see also Figs. 4 and 5).

Table 1. Treatment details in trials on two commercial vineyards to assess the effectiveness of a range of trunk treatments on grapevines to exclude garden weevil from entering vine canopies in the 2004/05 season.

Trunk treatment	Product	Rate
Untreated	-	-
* Artificial bonded fibre bands attached with surveyor's tape half way up the trunk of vines	-	-
* Artificial bonded fibre bands placed half way up the trunk of the vine and attached with surveyor's tape near the top of the band with the bottom part of the band splayed as much as practicable	-	-
* Artificial loose fibre bands attached with surveyor's tape half way up the trunk of vines	-	-
# Alphacypermethrin applied as a butt drench @ 500 mL per vine.	Dominex 100EC	100 mL/100 L

* artificial fibre bands attached to vine trunks before weevil emergence commenced in spring.

the timing of the trunk drenching was based on weevil abundance in trunk monitoring bands.



Fig. 4. Artificial bonded fibre band on a grapevine trunk attached near the top of the band with the lower portion splayed in an attempt to enhance its ability to prevent garden weevil adults from accessing the canopy of grapevines.



Fig. 5. Artificial loose fibre band on a grapevine trunk to assess its ability to prevent garden weevil adults from accessing the canopy of grapevines.

5. Results and Discussion:

Reporting garden weevil abundance in vineyards

The average numbers of garden weevil adults in the 18 vineyards involved with the *GARDEN WEEVIL watch* service are shown in Table 2. Whether and when insecticide was applied as a trunk drench or foliar application is also indicated in the table. An example of a report from one week's monitoring results is given in Appendix 2.

Table 2. The abundance of garden weevil adults in trunk monitoring bands in vineyards across south west WA to indicate timing for insecticide application. A trunk drench application is indicated by light shading and foliar application by darker shading. After insecticide application, insect abundance data are in bold type.

	Numbers of weevils										
Vineyard location	28-Sep	05-Oct	12-Oct	19-Oct	26-Oct	02-Nov	11-Nov	17-Nov	26-Nov	03-Dec	09-Dec
Millenden	0.1	0.2	1.1	**2.5**	**0.7**	**1.0**	**0.6**	**0.2**	**-**	**0.3**	**-**
West Swan	0	0	0	0.1	0.3	0.6	1.0	0.4	1.0	2.0	1.2
Boalia	0	0	0	0	**0.2**	**0.1**	**0.3**	**0.3**	**0.7**	**1.4**	**1.3**
Yallingup	-	0	**0.1**	**0.0**	**0.0**	**0**	**-**	**-**	**-**	**-**	**-**
Willyabrup	0.1	0.2	0.1	0.1	0.1	0.4	0	0	0.1	0	0
Carbanup	0	0.9	0.6	5.6	7.5	5.8	6.2	10.2	2.4	2.6	2.4
South Carbanup	0.2	0.2	0.1	**0.6**	**0.1**	**1.2**	**1.1**	**1.7**	**4.0**	**-**	**-**
Metricup	-	0	0.1	0.3	0.3	1.1	**-**	**-**	**2.7**	**0.1**	**-**
Rosa Brook	0.1	0	0	0.1	0.1	0.5	1.0	2.9	1.7	**7.7**	**1.4**
Margaret River	0	0	0.1	0.6	1.9	**1.0**	**0.8**	**0.5**	**1.8**	**1.3**	**0.2**
South Margaret River	0.1	0	0	0.1	0.2	0.2	0.5	0.6	0.5	-	1.6
Karridale	0.5	0.1	0	**0.8**	**-**	**0.0**	**0.2**	**0.3**	**0.5**	**-**	**0**
West Manjimup	0.1	0.3	0.1	0.1	0.3	0.6	3.0	2.8	**0**	**0**	**0.2**
North Pemberton	0.1	0	0	0	0.4	3.6	**-**	**0.1**	**0**	**0**	**0**
Pemberton	-	0	0	0.1	0.1	1.0	4.6	5.3	10.9	20.0	14.6
West Pemberton	0.4	0.1	0.4	0.3	2.9	5.9	**0.3**	**0.3**	**0.3**	**0.3**	**0.2**
SW Pemberton	0	0	0	0	0	0.2	0.1	0.3	0.3	1.1	0.5
South Pemberton	-	-	-	0.2	0.5	1.0	-	4.3	-	-	-

Not all participating vignerons applied insecticides – the reasons for this varied from insufficient numbers of weevils to vignerons who decided to live with damage rather than use insecticide. Some vignerons preferred a foliar application of insecticide rather than trunk drenching. The service generated positive feedback from vignerons who encouraged its continuation.

For the 2005/06 season 22 participants contributed to ***GARDEN WEEVIL watch***. These sites cover the principal wine growing regions of the south west of Western Australia including the Swan Valley, Margaret River, Manjimup/Pemberton, and the Great Southern wine regions.

Until more sustainable methods of managing garden weevil are developed, it is felt that this reporting initiative encouraged vignerons to adopt the approach of using a trunk drench of insecticide to protect vines while minimising any adverse effects of insecticide use.

The role of artificial fibre exclusion trunk bands

For comparison of artificial fibre exclusion bands at the two trial sites, the average number of adults in bands at the height of the emergence period in late spring was two and eight weevils for untreated plots. With such low numbers, any comparison between exclusion band treatments was not considered reliable and these trials were abandoned.

In order to obtain some measure of the effectiveness of the different artificial fibre bands for ability to prevent garden weevil adults moving over them, we resorted to a demonstration in a laboratory. This included a comparison with two other weevil pests – apple weevil and Fuller's rose weevil. A range of band types as described above for the field trials was attached to circular pine posts held vertically with crushed gravel in plant pots. To prevent weevils escaping when placed on the gravel, the inside surface of the pots was coated with a teflon-like liquid which dries to a fine powder over which insects cannot walk. In order to measure whether weevils had successfully tracked across the different bands, a food source was attached to the top of the post with a pin – a rolled-up fresh apricot leaf for Fuller's rose weevil, a fresh apple leaf for apple weevil and chopped carrot for garden weevil (see Fig. 6). The laboratory had the light/dark times of day reversed so that these nocturnally active weevils could be viewed during the day.



Fig. 6. The method used to assess a range of artificial fibre barriers for their ability to prevent weevils moving across them. The test band was attached to a pine post held vertically by crushed gravel in a plastic pot with the inner top surface of the pot coated with a liquid teflon-like material that dries to a fine white powder which prevents the escape of the weevils when placed on the crushed gravel. A food source (in this case chopped carrot for garden weevil adults) was placed on the top of the post to retain weevils as a measure of successful negotiation of the band.

We found that none of the artificial fibre bands prevented garden weevil and Fuller's rose weevil adults from tracking over them. It was particularly spectacular to see Fuller's rose weevil adults racing over the loose artificial fibre bands (see Fig. 7). In contrast, all types of artificial bands stopped almost all apple weevil adults. Weevils trapped in the fibres desiccated (see Fig. 8).

The most likely reason for this difference among the three weevil species was apparent under a dissecting microscope. Apple weevil adults are covered in short spines that help trap the weevils in the fibres. Such spines are not present in such density on the other species, which are "smooth" in comparison (see Fig. 9).

We are aware that some vignerons report success with the artificial fibre bands against garden weevil, for example see Fig. 2. Unfortunately such comments are often based on whole blocks being similarly treated, with no vines left unbanded for comparison. In any case, from our tests we have some doubts as to how effective they would be across a range of situations in the field. More research is required before we can recommend using the bands with confidence.



Fig. 7. Fuller's rose weevil adults on a loose artificial fibre band in a laboratory demonstration of whether the band would prevent their ability to walk over it. A rolled up apricot leaf was attached to the top of the pine post to retain weevils as a measure of successful negotiation of the band.

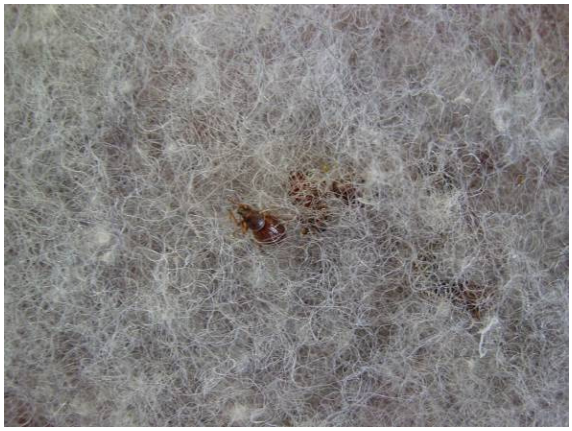


Fig. 8. Apple weevil adults trapped in bonded artificial fibre in a laboratory demonstration to determine the effect of such bands on weevil movement.



Fig. 9. The wing covers of (from left to right) Fuller's rose weevil, garden weevil and apple weevil showing the prevalence of spines, with apple weevil having the most.

6. Outcomes/Conclusions:

Describe the outcomes of your project:

The area-wide monitoring exercise ***GARDEN WEEVIL watch*** was considered successful in providing data on weevil abundance in individual vineyards to make a recommendation on the need for treatment of this pest. The monitoring indicated differences between vineyards in the same region as to the timing of intervention with insecticides, so the applicability of the information would be restricted in its usefulness as a reminder of the presence of the weevil and for individual vignerons on the need to check their vines to decide if and when insecticide is required to protect vines from garden weevil.

A laboratory demonstration of different artificial fibre bands as a means of excluding garden weevils from entering a vine canopy showed they would not be effective. This contrasts with reports from vignerons on the successful deployment of such bands.

Did it achieve what you set out to do in your original application? If not, why?

Running an area-wide monitoring program on weevil abundance showed that it is relevant for individual vineyards but has real limitations as an advice tool across any region. It would not replace monitoring within individual vineyards on the need for action against garden weevil.

Assessing the role of artificial fibre trunk bands was somewhat inconclusive because the abundance of insects in field trials in this one-year project was too low to draw reliable conclusions. A laboratory demonstration supported earlier work showing the bands to be unsuitable for excluding weevils from grapevine canopies. More heavily infested field sites would be required to assess the role of these fibre bands in crop protection.

Could changing anything you did have improved the outcome?
More field sites should have been included in the study of fibre trunk bands. Soil sampling for larvae improves the reliability of knowing whether sites will be subsequently infested with enough adult weevils so reliable assessments can be made.

Identify any benefits from your project either in terms of economic returns to the participants, improvements in the quality of your product, environmental benefits or benefits to your community.
Running the ***GARDEN WEEVIL watch*** program across regions reinforced the principle that individual site monitoring of pests is required to make the correct decision on pest management for a non-flying pest like garden weevil. Area-wide approaches to pest management are generally suited to more mobile pests capable of rapid and en masse infestation by wing, for example plague locusts and moth pests such as grapevine moth and apple looper.

More research is required on use of artificial fibre trunk bands as a means of crop protection against garden weevil in vineyards.

Describe what you did to let other growers know about your results.

A summary of the main findings of the project was reported in the WA Department of Agriculture Wine Industry Newsletter:

> Learmonth, S.E. (2005). Insect pest round-up – the 2004/05 season. Dept Agriculture Wine Industry Newsletter April 2005: 3-4.

A report on the ***Garden Weevil watch*** area-wide monitoring program was published in Australian Viticulture, an industry magazine:

> Stanaway, M.K. and Learmonth, S.E. (2006). Watching out for garden weevil in WA. *Australian Viticulture* **10** (1, **Jan-Feb)**: 52-3.

If appropriate, describe what you think the GWRDC could do to maximise the benefits for others in your circumstances or the whole industry. If appropriate, include any suggestions about future research which build on the work undertaken by your organisation.

We are confident the area-wide monitoring and reporting of garden weevil numbers has limited application for recommendation for action against garden weevil and that individual vineyard monitoring is the preferred method for making decisions on the need for and timing of any intervention.

Further study on the role of artificial fibre trunk exclusion bands is warranted on the basis that many vignerons use them, but our research indicated they have limited effect.

Since the conclusion of this project, GWRDC has provided funds for further research on garden weevil in grapevines. This more recent research has been completed and is being collated for the final report. The results of this project are relevant to the research undertaken here.

References:

Fisher, D.L. and Learmonth, S.E. (2003). *Garden weevil in vineyards.* Farmnote 60/03. Department of Agriculture, WA.

Acknowledgments

This research was undertaken by Stewart Learmonth and Mark Stanaway of the Department of Agriculture and Food, Western Australia.

We are grateful to the Australian Grape and Wine Research and Development Corporation for providing financial support through their Regional Innovation and Technology Adoption program.

The Wine Industry Association of Western Australia provided logistical support in being able to run the project and we thank them for that.

We thank the many vignerons who gave their time to gather and report information on weevil numbers for ***GARDEN WEEVIL watch*** and as well the two vignerons on whose vineyards the fibre bands experiments were set up.

Appendix 1. Information supplied to vignerons collaborating in a program to report on garden weevil emergence

***Garden Weevil watch* –** abundance and actions against garden weevil in WA vineyards in 2004/05

INFORMATION SHEET FOR COLLABORATORS

Together with this Information Sheet, you will have received:

- 25 single-faced cardboard monitoring bands – 20 for the job, plus 5 spares.
- A ground sheet to use when monitoring.
- Score sheets for monitoring.
- A computer disk with a file to record the results of monitoring.

What to do:

'Y' Select a vineyard block, preferable a single variety, where you have had trouble with garden weevil.

'Y' Select two lots of adjacent rows equally spaced over the infested area – 4 rows total.

'Y' Place 10 monitoring bands in a zigzag fashion down each set of adjacent vineyard rows that is, 20 in total. Space the bands equally along the row or that proportion of the row you intend monitoring.

'Y' Place the band high up on the butt, just below the cordons.

'Y' Draw a map of the block and number the bands 1 to 20 in the order you will check them.

'Y' Check the bands early in the week – preferably Monday or Tuesday, and try to keep to the same day if possible.

'Y' Check the bands weekly to the end of November. We'll review the monitoring interval at this time.

'Y' When checking bands, place the sheet around the vine butt before removing the band.

'Y' Count the number of garden weevils – some will fall out of the band onto the sheet. Knock out of the band onto the sheet those weevils remaining on the band.

'Y' Replace the band on the vine butt.

'Y' Shake weevils off the ground sheet at the vine where they have fallen & move on to the next band.

'Y' Fax or email the score sheet to the Ag Dept: 97770001 stewart.learmonth@agric.wa.gov.au

'Y' Please remove the bands if insecticide is applied to the vines. Replace them after the spray has dried.

'Y' If you have any queries, contact Stewart Learmonth
Tel: 97770000. Mob: 0417959319.

Appendix 2. Example of a *GARDEN WEEVIL watch* report posted on the WA Department of Agriculture and Food web-site

GARDEN WEEVIL watch

Department of Agriculture

Issue No. 4, 20 October 2004

GARDEN WEEVIL watch is a weekly report on the abundance of garden weevil adults in vineyards in Western Australia. The aim of the report is to assist vignerons who have garden weevil problems and have decided to apply a butt drench for weevil control. For best effect, the timing of the butt drench should be in the early stages of the spring emergence of the weevil.

This report is to encourage monitoring of garden weevil and applying butt drenches at the most appropriate time. Effective butt drenching should mean that foliar spraying won't be required, thereby reducing the chance of secondary pest outbreaks.

Vignerons other than those supplying data on weevil abundance are welcome to contribute to ***GARDEN WEEVIL watch*** with their observations and experiences with weevil management.

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Email slearmonth@agric.wa.gov.au

General Comments

Weevil numbers have jumped at two vineyards – one in the Swan Valley & one at Carbanup. I have included the counts per band in these two vineyards to indicate the numbers present when we recommend it's time to apply the butt drench. With the odd band with high numbers, it's a definite signal that the weevils are emerging & also a confirmation that there are sufficient numbers to actually warrant the use of insecticide. I realise it's a fine line in terms of time to get the butt drench over what might be large areas in some vineyards. That's where having a reliable butt drenching machine is a valuable piece of equipment.

For quite a few of the **other vineyards,** garden weevil adult numbers are slightly higher than last week. However, I do not think that any of these require a butt drench at this stage. With soil temperatures increasing, it won't be long before insecticide will be required on some of them.

We **plan to post notes** regarding the latest information and suggestions for **managing garden weevil** in WA vineyards, on our web site next week. If you have any urgent queries on this, please contact the Department of Agriculture.

GARDEN WEEVIL COUNTS

The table is the average number of GW adults per 20 bands in the vineyards in the locations listed. **After insecticide** has been applied, the average is followed by the letter **"b" where a butt drench** has been applied, and by **"f" where a foliar spray** has been applied.

The numbers of weevils on **individual bands** at the Millendon & Carbanup vineyards is included this week to indicate the range of numbers we have seen in the early stages when adult weevils commence emergence. Insecticide application has been recommended for these vineyards

DATE	SEPT	OCT		
VINEYARD LOCATION	**28**	**5**	**12**	**19**
SWAN VALLEY				
Millendon	0.1	0.2	1.1	2.5 **f**
West Swan	0	0	0	0.1
MARGARET RIVER				
Boalia	0	0	0	0.0
Yallingup	-	0	0.1 **b**	0.0
Willyabrup	0.1	0.2	0.1	0.1
Carbanup	0	0.9	0.6	5.6
South Carbanup	0.2	0.2	0.1	0.6
Metricup	-	0	0.1	0.3
Rosa Brook	0.1	0	0	0.1
Margaret River	0	0	0.1	0.6
South Margaret River	0.1	0	0	0.1
Karridale	0.5	0.1	0	0.8
MANJIMUP/PEMBERTON				
West Manjimup	0.1	0.3	0.1	0.1
North Pemberton	0.1	0	0	0.0
Pemberton	-	0	0	0.1
West Pemberton	0.4	0.1	0.4	0.3
South West Pemberton	0	0	0	0.0
South Pemberton	-	-	-	0.2

Individual bands	
Millendon	Carbanup
5	4
3	0
4	13
3	10
1	4
0	6
4	14
13	4
2	0
0	1
0	0
1	27
3	0
0	9
6	5
0	3
3	2
1	2
0	4
0	3

GARDEN WEEVIL watch

GARDEN WEEVIL watch is sent direct to readers via e-mail, by a request to stewart.learmonth@agric.wa.gov.au. Current and back issues can be found at: www.agric.wa.gov.au and search on the word ***GARDEN WEEVIL watch***.

This service benefits from reports from its readership. If you have recently observed or heard news of **garden weevil** contact the editor: Stewart Learmonth on (08) 97770000 or at stewart.learmonth@agric.wa.gov.au

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NEXT ISSUE OF *GARDEN WEEVIL watch*, THURSDAY 28 OCTOBER, 2004.