

## Future Orchards Demonstration Trial: Final Report

<b>Project title:</b>	Control of woolly aphid ( <i>Eriosoma lanigerum</i> ) by using insecticide soil-root drenches and foliar application
<b>Region:</b>	Southern Victoria
<b>Contact:</b>	Angus Crawford and Petar Bursac
<b>Projective Objective:</b>	<p><b>Objective:</b></p> <ol style="list-style-type: none"> <li>1. To achieve eradication of woolly aphid without disruption of predatory organisms by foliar application of selective insecticides and root drenching with imidacloprid</li> <li>2. To compare efficacy of foliar application and root drenching</li> <li>3. To see in which part of tree systemic activity of root drenching insecticides does have effect (penetration, retention)</li> </ol>

<b>Outline/method:</b>	<p><b>Location:</b> Fankhauser Apples, 515 Old Drouin Road, Drouin VIC 3818</p> <p><b>Demonstration trial design:</b> The trial was set up as a large block un-replicated design.</p> <p>Plot size was one row per treatment.</p> <p><b>Variety:</b> Alvina Gala, Galaxy Gala, Fuji, Jazz grafted on M9</p> <p><b>Treatments:</b></p> <p><b>Foliar:</b></p> <ol style="list-style-type: none"> <li>1. spirotetramat (240 g/l formulation) @ 800ml/Ha + non-ionic surfactant @ 50ml/ 100L</li> <li>2. clothianidin (500 g/l formulation) 800 ml/Ha</li> <li>3. spirotetramat (240 g/l formulation) @ 800ml/Ha + Hasten @ 50mls/ 100L</li> </ol> <p><b>Soil Drenching:</b></p> <ol style="list-style-type: none"> <li>1. clothianidin (500 g/l formulation) @ 4 Kg/Ha (fertigated)</li> <li>2. imidacloprid (350 g/l formulation) @ 3.5 ml /tree (fertigated)</li> <li>3.</li> </ol> <p><b>Soil Drenching + Foliar:</b></p> <ol style="list-style-type: none"> <li>1. imidacloprid (350 g/l formulation) @ 3.5ml /tree (fertigated) + spirotetramat (240 g/l formulation) @ 800 ml/Ha + non-ionic surfactant @ 50 ml/ 100L</li> </ol>
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	<p><b>Application details:</b>  <b>Spray date:</b> 20/11/2015  <b>Weather conditions:</b> temperature 20°C; fine  <b>Assessment:</b> A visual assessment was completed in January 2016 followed by a final assessment which was completed in March 2016.</p> <p>Assessment was made by inspecting the roots and foliage of 50 individual trees and rating for the presence or absence of woolly apple aphid colonies.</p> <p>Results are presented as percent efficacy.</p>
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### Results:

Treatment		Percent (%) efficacy
<b>1. Foliar Application Only</b>	1. spirotetramat (240 g/l formulation) @ 800ml/Ha + non-ionic surfactant @ 50ml/ 100L 2. clothianidin (500 g/l formulation) 800 ml/Ha 3. spirotetramat (240 g/l formulation) @ 800ml/Ha + Hasten @ 50mls/ 100L	100% efficacy on canopy 90% efficacy in the base of the tree Comment: residual effect of insecticide
<b>2. Soil Drenching Only</b>	1. clothianidin (500 g/l formulation) @ 4 Kg/Ha (fertigated) 2. imidacloprid (350 g/l formulation) @ 3.5 ml /tree (fertigated)	100% efficacy on canopy 70% efficacy in the base of the tree Comment: insecticide does not penetrate into trunk, high mobility, low retention in lower parts
<b>3. Foliar Application + Soil Drenching</b>	1. imidacloprid (350 g/l formulation) @ 3.5ml /tree (fertigated) + spirotetramat (240 g/l formulation) @ 800 ml/Ha + non-ionic surfactant @ 50 ml/ 100L	100% efficacy on canopy 100% efficacy in base of the tree

### Discussion

Woolly aphid have a characteristic white sticky wool appearance which causes damage to trees by forming galls both above and below ground. These galls restrict sap flow causing ruptures which create further sites for the aphid to feed. Galls will also potentially allow other pathogens into the tree. Woolly aphid can become severe in apples where it leads to damage to fruit quality, restrict tree growth and production.

The overall objective of the trial is to achieve control of woolly aphid using products and application methodologies which are least likely to disrupt of predatory organisms. Several natural enemies of

woolly aphid exist including lacewings, ladybirds, hoverflies, earwigs and the parasitoid wasp *Aphelinus mali* (Nicholas et al, 2004).

### **Foliar application only**

Movento and samurai are molecules that move well both up and down within the plant providing good control of woolly aphid both in the foliage and roots. Due to good systemic properties of both insecticides and good coverage this treatment has achieved 100% control in the canopy. On the base of trunk, the situation was little bit different. Considering that systemic insecticides could not penetrate bark, only contact efficacy has been achieved with 90% of efficacy.

Foliar application of insecticides for the control of woolly aphid is commonly used. There are number of active ingredients registered for this purpose. Application generally occurs during the growing season, while the colonies are present on the tree while some other products which are less selective with high toxicity and residual properties are used during dormancy. In order to satisfy IPM (Integrated Pest Management) principles of woolly aphid control, some criteria must be satisfied.

Insecticides must have good efficacy on woolly aphid and be safe to predators, second, in order to control woolly aphid, a direct contact with the insecticide must be achieved. Waxy covering and honeydew, provide protection from some insecticides. Therefore, in order to break surface tension of dew and waxy material and allow insecticides to get in contact with pests, an insecticide with low surface tension should be used or insecticides tank mixed with surfactants. For this purpose we have used two insecticides with different modes of action with addition of surfactant.

### **Soil drenching only**

Failure to control aerial infestations can result in underground infestations on susceptible rootstocks. In order to control root colonies, an insecticide, registered for use as soil drenches should be applied.

On blocks where we applied root drenching with systemic insecticides, imidacloprid and spirotetramat, the efficacy on control of WA on canopy was 100%. In order to achieve control, woolly aphid needs to be managed from all parts of tree. After inspection of trunk base, we have discovered that some of the colonies survived. The efficacy on trunk was 70%. Therefore this method of controlling woolly aphid did not provide complete stand-alone control compared with the other treatments.

A soil drench can be used on trees up to 7 years old. In order to obtain efficient woolly apple aphid control it is important that the active roots can take up sufficient quantity of product. This is achieved by ensuring the soil is moist prior to application, preventing the product from running away from the treated area and ensuring the application zone is weed free. The most commonly used insecticide for this purpose is imidacloprid.

Imidicloprid has favourable physical-chemical properties with sufficient soil half-life and dissipation which allow it to last and work longer in soils (DT50 170-190 days). This means the winter cycle of woolly aphid will be broken along with high leaching potential/soil adsorption coefficient (Koc 132-310), which allows penetration to root galls.

### **Soil Drenching and Foliar application combined**

In late spring an application of selective insecticide spirotetramat was foliar applied as well as a soil-root drenching which was fertigated with imidacloprid.

As woolly aphid have a life cycle on the tree and in the ground, we combined these two methods in order to cover all stages and colonies. The result of this combined application was 100% efficacy. Therefore, foliar application of systemic insecticides with root drenching provides excellent control of this pest.

This would give complete control of woolly aphid by breaking the entire life cycle of the aphid which is less likely to interfere with predatory organisms.

### Conclusion

Foliar alone gave 90 % control, soil drenching gave 70% control and both methods combined gave 100%.

These results have demonstrated an effect but still a key question remains, do we need 100% efficacy? What are the economic thresholds? In order to answer those questions, this trial could be scaled up to run over a number of years with other parameters to be observed such as predators and costs.

100% control would be the most expensive method and would probably not leave any food for natural predators (earwigs, *Aphelinus mali* etc.). Therefore, in second year of trial, the emphasis should be on predator monitoring, costs and other methods to help boost predator numbers.

Effects of 100% efficacy, with no potential food for predators could be compared with foliar application and soil drenching where insecticide does not get in contact with predators and colonies (at the bottom of trunk) do not cause direct damages.



Photo: Woolly aphid white stick wool appearance on parts of the tree which can also be found underground on roots.

### Reference:

Nicolas, A.H., Spooner-Hart, R.N., Vickers, R.A., Abundance and natural control of woolly aphid *Eriosoma lanigerum* in an Australian apple orchard IPM program. *BioControl* (2005) 50:271-291.