

# Drop-sheeting to understand pest and beneficial dynamics in macadamia

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Several insect pests can limit macadamia production and these pests can vary in severity from region to region and from one season to the next. Seasonal conditions can also affect certain pest populations. *Leptocoris*, while found in most growing areas and normally considered a minor or emerging pest, can explode in numbers in a dry season, causing significant damage.

Fruit spotting bugs (FSB) continue to be the industry's most serious and widespread pest. Traditional methods of measuring fallen stung nuts for FSB levels seem to be less accurate as we have more dry seasons and the trees appear to be holding stung nuts when normally they would drop, allowing for a more thorough assessment. As well as more accurate methods, we also need to develop techniques to determine FSB levels after November, when stung nuts do not drop.

Pest scouts have developed monitoring techniques to provide reasonably accurate estimations of the pests in orchards. This information, along with other data such as beneficial insect counts, orchard history and the grower's attitude towards acceptable pest damage levels, is used to determine when pest levels have reached a threshold where a recommendation for action is given. However, crop protection is a complex balancing act.

Some pest scouts are starting to use the drop-sheeting technique to determine which pests and beneficials are in the orchard. Drop-sheeting involves laying 'drop sheets' under the canopy (Figure 1). A broad-spectrum insecticide

is then used to take a 'point in time' sample of the insect population dynamics within the selected tree. The trees chosen for drop-sheeting will then represent the population dynamics of the whole orchard, similar to how a census represents the ideas and opinions of Australia.

It is important to eliminate bias when drop-sheeting by:

- sampling a reasonable number of trees to represent the orchard
- randomise the sample by starting in a different area each time
- avoid border rows when sampling for the general insect population but use border rows as hotspot zones for specific pests
- always return for efficacy counts for the same duration after spraying.

As drop-sheeting becomes more popular and consultants have a network for sharing their data, the industry can be better informed about pest and beneficial populations in the various regions. Understanding these population dynamics, how they change throughout the year at different life cycle stages and what they mean for crop production and damage, will help us with overall crop protection. Furthermore, industry can then start to develop acceptable spray thresholds based on drop-sheet sampling. This will allow a more strategic spray regime that is more likely to be accepted by quality certification programs.

Drop-sheeting also allows 'real world' evaluation

of chemical efficacy in the field. As new chemistry becomes available, drop-sheeting can be used to evaluate its effectiveness. For instance, if the drop sheet is in place when the new chemistry is applied, the target pest efficacy can be readily assessed. By repeating this process 7 days later with the known effective product, the presence or absence of the target pest insect population on the second spray will give you an objective assessment of the effectiveness of the new product in controlling the target pest.

Drop-sheeting seems to be more accurate than the current monitoring systems, but ideally would be used to complement other systems.

### Drop-sheeting tips

- Use relatively strong material that has some weight to it so it does not flap around; it should also be permeable so chemical run-off does not pool when insect assessments are made
- Always wear appropriate PPE; paint drop sheets are cheap but the chemicals can 'pool', potentially creating a hazard
- Geotech fabric may be an option to consider as it is relatively cheap and permeable
- Try to lift the corners while having weight at the middle of the sheet to funnel the insects and to stop them from blowing off the sheets (Figure 2)
- Try pinning the sheets down with a perimeter of star pickets or timber to give the sheets a raised edge that catches the dropped insects as they blow across the sheets.

### Note

Once sprayed for drop-sheeting, be wary of the chemical re-entry period. Try to use a product that will allow re-entry for assessments at 2, 6 and 24 hours after spraying. A pyrethrin spray allows entry once dry, approximately 15 minutes. If the chemical label does not have a re-entry period, then it must be assumed that re-entry is allowed when the chemical has dried or 24 hours after application, whichever is longer.

See Figure 3 on page 3 for more tips.



Figure 1. The author, Chris Fuller, using the drop-sheet method to determine which pests and beneficials are in the orchard.



Figure 2. A drop sheet in place, under the canopy, with the corners raised.

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# DROP SHEETS FOR MACADAMIA MONITORING

MATERIAL	TIMING	PLACEMENT	PRODUCT	APPLICATION EQUIPMENT	IDENTIFICATION
<ul style="list-style-type: none"> <li>Strong permeable material, avoid pooling of chemical e.g. avoid plastics</li> <li>Consider weight and size for ease of deployment</li> <li>Corners either tied down, weighed down or pinned.</li> <li>Size should be the same on all sites. Dependent on tree spacing and canopy size i.e. aim to capture everything falling from as much of the canopy as possible</li> <li>Examples: cloth painting drop sheets, geotech fabric, heavy fabric</li> </ul>	<ul style="list-style-type: none"> <li>Know the aim of the process e.g. scouting 'should I spray?' OR product efficacy 'how effective was my spray?'</li> <li>The process is time consuming, so how often you do it will depend on your aim e.g. pests that have high potential to cause crop loss</li> <li>Can utilise any time during the season, nut development to harvest</li> <li>Highly valuable exercise for finding pests that can't be effectively monitored by other methods e.g. visual monitoring, trap monitoring</li> <li>Good fit for late season pest monitoring e.g. spotting bug</li> </ul>	<ul style="list-style-type: none"> <li>Many options - dependent on tree spacing, canopy size and equipment being used to apply chemical</li> <li>Number of sites: dependent on orchard/block size and aim. Example 4-8 sites on 50-100 ha</li> <li>For targeting general insect population: Random distribution, avoid border rows and outside edges</li> <li>For hotspots and specific pests: Know your target and how it behaves e.g. does it come in from a vegetated area? If yes monitor border rows</li> <li>Example 1: Young trees you can walk around - 1 whole tree sprayed with backpack mist blower, air gun or high pressure hand lance with 2 sheets one either side or wrap around the trunk</li> <li>Example 2: Mature trees closed canopy along row, airblast sprayer to spray 3 trees on both sides, drop sheet/s placed centrally under the middle tree collecting from both sides</li> <li>Example 3: Mature trees with a closed canopy along tree row, airblast sprayer to spray 3-5 trees one side, drop sheet/s placed along tree line between trunks</li> </ul>	<ul style="list-style-type: none"> <li>Product properties: Generally broad-spectrum insecticides; rapid knockdown; short re-entry period</li> <li>Always follow label instructions for PPE, dosage rates and re-entry</li> <li>If re-entering before label specifies, PPE critical, e.g. gloves, long sleeves and pants</li> <li>Trained staff and safety protocols must be in place</li> <li>If close to harvest check withholding periods of products</li> <li>Examples: beta cyfluthrin, pyrethrin (natural or synthetic)</li> </ul>	<ul style="list-style-type: none"> <li>Good coverage is critical to success</li> <li>Backpack sprayer e.g. motorised with hand lance, mist blower</li> <li>Small tank with hand lance</li> <li>Airblast sprayer if you have large trees and unable to get coverage with a smaller unit</li> <li>Drone sprayer</li> </ul>	<ul style="list-style-type: none"> <li>Assess at specific times, consistently over the season/years so can compare e.g. 2, 6, 12 hrs after spraying</li> <li>Shorter than this greater personal risk i.e. chemical exposure.</li> <li>Longer than this higher chance of predation e.g. ants and birds carrying the dead critters away</li> <li>Don't assume everything that drops is a pest!</li> <li>Entomological knowledge critical i.e. do you know how to correctly identify pests and beneficials?</li> <li>Utilise expertise of your consultant/bug scout e.g. collect samples or take good quality photos</li> <li>Formulate pest thresholds with your consultant/bug scout e.g. how many pests/sheet</li> <li>Not all pests and beneficials will 'drop out' of trees e.g. scale, coccid, mealybugs</li> <li>Not all pests and beneficials that do 'drop out' will be found e.g. exposed thrips and mites will drop but finding them on a drop sheet is unlikely, 1st instar spotting bug nymphs can look like dead flower debris</li> </ul>
<p>These general principles are a guide only Individual advice with your local consultant is recommended</p>		<div style="background-color: #333; color: white; padding: 10px; border-radius: 5px;">  <p><b>SAFETY</b> Always follow label instructions Trained staff and safety protocols must be in place Chemical residue will persist on some materials. Wear appropriate PPE and wash drop sheets as required</p> </div>			



Hotspots are locations with a history of high pest levels or where pests normally enter the orchard first and spread from

Figure 3. Principles of drop-sheeting in macadamia. Source: Australian Macadamia Society.