Pollination of macadamia

B Howlett, S Read, B Cutting, D Pattemore, S. Cross, M. Goodwin

Photo: Brian Cutting

Plant and Food Research Australia, Level 14, 97 Creek St, Brisbane
Project and key aims:

Conducted within project MT13060 Optimising pollination of macadamia & avocado in Australia (funded by Horticulture Innovation Australia with co-investment from the New Zealand Institute for Plant & Food Research Limited and funds from the Australian Government)

Pollination can affect yields and nut quality

- Determine the key pollinating species and their efficiency.
- Floral biology
- Suggestions to improve macadamia pollination
Floral biology

Not typical pollen presentation

Pollen presenter

Pollen

style

stamen

petals

nectary

stigma
Floral biology

At least partial self incompatibility

Yields increase or improve with cross pollination

Most developing nuts drop off
Cross pollination

62 Cross pollination trials.

- All but 2, cross > open
- All but 7 <1 nut/raceme

Photo: Mark Goodwin
Self vs Cross pollination

Mean nut/raceme 741
Self vs Cross

Mean nut/raceme 741 (x816)

Mean nut/raceme 816 (x741)

Mean nut/raceme A203 (xA264)

Cross  Open  Selfings
How much cross pollination? 741

Nuts/Raceme Crossed

Nuts/Raceme not Crossed

Cross 0  Cross 1  Cross 3  Cross 15  Cross 100

Cross 0  Cross 1  Cross 3  Cross 15  Cross 100
Pollinators of Macadamia

Photos: Brian Cutting
### Pollen Deposition: stigmas styles

#### Ranking of pollinators based on frequency of pollen deposition

<table>
<thead>
<tr>
<th></th>
<th>Sampled</th>
<th>Stigma</th>
<th>Near stigma (&gt;5mm)</th>
<th>Style</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stingless Bees</td>
<td>33</td>
<td>1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Honey Bees</td>
<td>79</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Lycid Beetles</td>
<td>13</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Cantharid Beetles</td>
<td>11</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Nose Flies</td>
<td>10</td>
<td>4</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Control</td>
<td>68</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
</tbody>
</table>

- Bees beetles and flies capable of pollination
- Stingless bees deposited pollen to stigma more than other insects (just over 50% of visits)
### Pollinators

Number of orchards surveyed for each macadamia variety.

<table>
<thead>
<tr>
<th>Variety</th>
<th>Central Queensland</th>
<th>South East Queensland</th>
<th>Northern Rivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>741</td>
<td>7</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>344</td>
<td>0</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>842</td>
<td>0</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Daddow</td>
<td>0</td>
<td>3</td>
<td>1</td>
</tr>
</tbody>
</table>
Number of pollinators

Pollinator Counts/Day

Region 1  Region 2  Region 3  Region 4
Pollen Flow

Fluorescent powder
Different times of day
Six different orchard blocks

Photos: Brian Cutting
Evidence of pollen transfer
## Pollen Flow

**Orchard 1**: 422 pollinators  
**Orchard 2**: 53 pollinators

<table>
<thead>
<tr>
<th>Transferred powder</th>
<th>Orchard 1</th>
<th>Orchard 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pollen Presenter</td>
<td>163</td>
<td>8</td>
</tr>
<tr>
<td>Styles</td>
<td>119</td>
<td>13</td>
</tr>
<tr>
<td>Petals</td>
<td>141</td>
<td>14</td>
</tr>
<tr>
<td>Buds</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Stems</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>426</strong></td>
<td><strong>37</strong></td>
</tr>
</tbody>
</table>
Pollen flow vs flower visitors

Orchard 1: 344

Grain Count

Distance from marked raceme

12.00pm
9.00am
Summary

• Most varieties cross pollination better yields
• Various insects pollinators
• High variability pollinators between blocks
• Powder movements suggest insects key
Suggestions

• Mixing varieties (rows)
• Replace trees with alternative variety if possible
• Prune to add light to the canopy
Suggestions

• Include honey bees and stingless bees,

• Support wild species
  (eg Lycid beetles, flies)

• Minimise impact of pesticides
Support wild species
(eg Lycid beetles, flies)
Acknowledgments

Horticulture Innovation Australia, Australian Macadamia Society, Jenny Margetts, Robbie Commens, Jolyon Burnett, Kevin Quinlan, Andrew Pearce, Bob Howard, Chris Fuller, Chris Searle, Claire Hall, Sarah Cross, Simon Cornut, Murielle Cuenin, Thomas Besnier, Philomene Brunelliere, Bryony Wilcox, Romina Rader, Andrew Robson, and UNE supporting interns and staff, Clayton Mattiazi and the many growers assisting field work.