PIPS 2 update

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The Productivity, Irrigation Pests and Soils (PIPS) program coordinates different organisations to undertake orchard research for the apple and pear industry.

We are now taking PIPS research and communicating about it with growers.
Six projects

1. Tree structure.
2. Biennial bearing.
3. Apple tree and fruit nutrition.
4. Profitable new pears.
5. Integrated pest and disease management.
6. Program coordination by the RM Consulting Group.
1. Tree structure

**Team leader:** Dr Sally Bound

**Organisation:** Tasmanian Institute of Agriculture

**Topic:**

Artificial Spur Extension (ASE) versus chemical thinning
Why are we doing this research?

• Chemical thinning is not 100% reliable and a more reliable alternative would be helpful.

• A potential way to reduce the industry’s dependence on chemicals.
What is ASE?

- A pruning technique that imitates natural bud extinction.
- A way to reduce overall flower numbers.
- A form of early thinning (bud-break).
- Used to define where and how much crop is set on the tree.
- ASE Aims: to achieve accurate, predictable setting of crop load, to promote vigour and floral spur performance.
What are we doing?

- Alvina Gala set at 5 buds/cm² Limb Cross Sectional Area (LCSA).
- Fiero Fuji set at 6 buds/cm² LCSA.

**Compared:**
- Conventional management
- ASE management
- Conventional + chemical thinning
- ASE + chemical thinning

**Chemical thinning included:**
- 170ppm Ethrel @ FB
- 10ppm NAA @ 7 DAFB
- 150ppm BA @ 20 DAFB
Key findings so far...

• ASE appears to be viable alternative to chemical thinning.
• ASE trees have larger fruit in the trial and improved fruit shape in Gala.
• ASE buds were less impacted by chemical thinning
• ASE trees set more fruit per fruit cluster when compared to the clusters on conventionally thinned trees.
2. Biennial bearing in apple

**Team leader:** Dr Jens Wünske

**Organisation:** University of Hohenheim (Germany)

**Topic:**

Extending the understanding of the genetic, physiological and cultural aspects of biennial bearing.
Why are we doing this research?

• Improve the understanding of physiological aspects which are involved in biennial bearing.
• Improved understanding should enable insights into more effective control of biennial bearding
• The project is extending the understanding of the genetic, physiological and cultural aspects of biennial bearing
What are we doing?

• Induction of biennial bearing the ‘off’ trial trees is done by 100 percent hand thinning.
• The ‘on’ crop loads set at high levels where crop maturity is effected. Defined using LCSA (limb cross sectional area)
• Crop loads are reversed the following year by the same method.
Key findings so far

• The DA meter was very successful in monitoring fruit maturity non-destructively in the field easily separating different crop loads. This should allow ongoing non-destructive fruit analysis of on and off fruit.

• A higher crop load leads to later fruit maturity and reduced fruit size and soluble solids content.

• These are tools which are hoped to be used to allow prediction and monitoring of biennial bearing
3. Tree and fruit nutrition for improved apple productivity

**Team leader:** Dr Nigel Swarts (Project lead)

**Organisation:** Tasmanian Institute of Agriculture and New Zealand’s Plant and Food Research.

**Topic:**

Apple tree and fruit nutrition for improved productivity.
What are we doing?

**Irrigation treatments:**
- High (3.9L/hr)
- Medium (2.3L/hr)
- Low (1.6L/hr)

**N treatments:**
- Zero Nitrogen
- 15kg N pre-harvest and 15kg N post-harvest
- 30kg N pre-harvest and 30kg N post-harvest
- 30kg N post-harvest
- 60kg N post-harvest
Year 1 results for Galaxy apple fruit colour

- Red colour area (%)
- Intensity of red colour
- Background colour

- Zero Nitrogen
- 15kg N ha pr+po
- 30kg N ha pr+po
- 30kg N ha po
- 60kg N ha po
Year 1 trial results: fruit firmness

<table>
<thead>
<tr>
<th>Nitrogen Treatment</th>
<th>Fruit Firmness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero Nitrogen</td>
<td>7.2</td>
</tr>
<tr>
<td>15kg N ha pr+po</td>
<td>7.4</td>
</tr>
<tr>
<td>30kg N ha pr+po</td>
<td>7.6</td>
</tr>
<tr>
<td>30kg N ha po</td>
<td>7.8</td>
</tr>
<tr>
<td>60kg N ha po</td>
<td>8.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Irrigation Rate</th>
<th>Fruit Firmness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low (1.6 L/hr)</td>
<td>8.2</td>
</tr>
<tr>
<td>Medium (2.3L/hr)</td>
<td>8.4</td>
</tr>
<tr>
<td>High (3.9 L/hr)</td>
<td>8.6</td>
</tr>
</tbody>
</table>
Key findings so far

- Higher colour results with less N fertigation.
- Lowest colour where higher rates of pre Harvest N applied.
- Fruit firmness decreased with highest rate of N applications pre and post.
- Low irrigation rate had the hardest fruit.
- Both increased irrigation and N applications pre harvest resulted in increased vigour and girth size.
4. Profitable pears

**Team leader:** Dr Ian Goodwin

**Organisation:** Department of Economic Development, Jobs, Transport and Resources (Victoria).

**Topic:**

Maximising productivity and quality of new pear varieties.
What are we doing?

- Investigating the effects of rootstocks on growth, yield, and quality.
- Rootstock, training system and planting density.
- Investigate the effects of drip irrigation and irrigation interval on irrigation requirement, water status, growth and yield.

Training system examples
4. Why are we doing this research?

Maximising productivity and quality of new pear varieties

ANP-0118 (Lanya®)  ANP-0131 (Deliza®)  ANP-0534
Trial site: Tatura research station

- Planted July 2013.
- 1m X 4.5 m Spacing on Open Tatura Trellis- 4 leaders.
- Drip irrigated, fertigated.
- Randomised complete block design with 4 reps pre plot with 4 guard trees.
- Corella and Packham pollinators in each plot.
Key findings so far: rootstocks

- Third leaf flower cluster number, fruit number and yield of cultivars ANP-0118 (Lanya®) and ANP-0131 (Deliza®) were highest when grafted to Quince A and to a lesser extent Quince C rootstock.
- Leader height at the end of the third leaf for ANP-0131 (Deliza®) and ANP-0534 tended to be less when grafted to BP1, Quince A and Quince C rootstocks.
- There was no effect of rootstocks on fruit colour, firmness, sweetness and maturity for each of the cultivars.
Wetting patterns
<table>
<thead>
<tr>
<th>Treatment</th>
<th>Yield (kg/tree)</th>
<th>Fruit weight (g)</th>
<th>Fruit number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drip-standard</td>
<td>8.63</td>
<td>119.1</td>
<td>73.4</td>
</tr>
<tr>
<td>Drip-frequent</td>
<td>8.82</td>
<td>125.0</td>
<td>71.2</td>
</tr>
<tr>
<td>Microjet-standard</td>
<td>4.79</td>
<td>108.7</td>
<td>45.1</td>
</tr>
<tr>
<td>Microjet-frequent</td>
<td>5.65</td>
<td>129.1</td>
<td>44.1</td>
</tr>
</tbody>
</table>
Key findings so far: irrigation

• 35% less irrigation was applied using drip treatments.
• Drip irrigated trees were less stressed in Year 1.
• Frequently irrigated trees were less stressed in Years 3 and 4
• Yield was greater 167% under drip irrigation –attributed to fruit number.
• Spur flower clusters were greatest under drip.
• Fruit size was greater in the frequently irrigated treatments.
Team leader: Dr David Williams

Organisation: Department of Economic Development, Jobs, Transport and Resources (Victoria).

Topic:

Release of biocontrol agent against codling moth.
Why are we doing this research?

• The successful use of parasitoid wasp Mastrus ridens to aid in the control of codling moth in orchards is in place in California, Chile and Argentina.

• The release of this wasp was approved here in Australia after the program met the specific requirements set by DAFF.

• Significant control of codling moth by predator species will allow common place reduction in chemical control methods.
What is *Mastrus ridens*?

- *Mastrus ridens* is a parasitoid wasp that seeks out hibernating codling moth caterpillars and lays eggs in the cocoon that hatch and the larvae then feed on the codling moth caterpillars, killing them.
Next phase of the trial.

- Assessment of establishment in Goulburn Valley and Stanthorpe release sites.
- Testing common orchard pesticides for impact on Mastrus
- Field releases in NSW, SA, and Tasmania.
Key points so far

• The wasps were introduced into Australia after five years of host specificity testing in quarantine as part PIPS.
• Although approved for release in Australia the monitoring of existing and new population development is needed.
• Also needed is screening tests of current orchard pesticides and fungicides to understand the impact of these on any ‘resident’ Mastrus ridens populations.
• More trial releases would be required before there is sufficient levels of wasps established to influence codling moth populations.
Get more info on all PIPS research

APAL website has contacts, links, articles and videos about PIPS:
apal.org.au/industry-info/pips/
Acknowledgements

• **Funded by** Horticulture Innovation Australia Ltd using the apple and pear industry levy funds from growers and matching funds from the Australian Government.

• **Coordinated by** RM Consulting Group.

• **Research by** Department of Economic Development, Jobs, Transport and Resources (Victoria); Tasmanian Institute of Agriculture; and University of Hohenheim (Germany).

• **Extension by** AgFirst.

• **Communication support and industry input** by APAL.

• None of the work would have been possible without the support, goodwill, and professionalism of the orchardists who often risked their crops to generate new knowledge for the benefit of us all.