A production and economic comparison of different intensive apple orchard systems under Australian conditions

Paul James

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South Australian Pome Fruit Improvement Committee Inc
"The beauty of this project is there is as much value in doing the project as there is in the results"

Kym Green – 2007

Team approach
This project is being undertaken in 2 stages

Stage 1 – The first 5 years
Stage 2 – The next 5 years

This presentation focuses on the Cripps Pink outcomes of stage 1 and yield performance to 2007
Project Objectives

This project endeavours to

- demonstrate various high density production systems
- capital investment requirements,
- various management & labour requirements
- provide an economic comparison of each systems performance

Valuable collaborative & interactive learning activity
Project Focus

Need to manage the “whole system” not individual components

Growers involvement maintains commercial relevancy
Fruit Quality

All management actions & labour activities focussed on

maximising commercial pack-outs

not total yields
Planting Layout

2 Cultivars - Cripps Pink (Pink Lady™)
  - Cripps Red (Sundowner™)

4 Rootstocks - M.9, Ottawa.3, M.26, MM.106

3 Spacings (in row) - 0.75 m, 1.00 m, 1.25 m

3 Different Orchard Systems –
  Central leader/vertical axis (Tall Spindle)
  Closed V
  Open V

Row of 4th System - Super Spindle
76 different orchard combinations
Vertical trellis (Tall Spindle)
# Planting Densities

<table>
<thead>
<tr>
<th>System</th>
<th>Spacing</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>Standard</td>
<td>4 x 1.25</td>
<td>2000</td>
</tr>
<tr>
<td>Standard</td>
<td>4 x 1.00</td>
<td>2500</td>
</tr>
<tr>
<td>Standard</td>
<td>4 x 0.75</td>
<td>3333</td>
</tr>
<tr>
<td>Open V</td>
<td>4.5 x (1.25 x 2)</td>
<td>3555</td>
</tr>
<tr>
<td>Closed V</td>
<td>4 x (1.25 x 2)</td>
<td>4000</td>
</tr>
<tr>
<td>Open V</td>
<td>4.5 x (1.00 x 2)</td>
<td>4444</td>
</tr>
<tr>
<td>Closed V</td>
<td>4 x (1.00 x 2)</td>
<td>5000</td>
</tr>
<tr>
<td>Open V</td>
<td>4.5 x (0.75 x 2)</td>
<td>5926</td>
</tr>
<tr>
<td>Closed V</td>
<td>4 x (0.75 x 2)</td>
<td>6666</td>
</tr>
<tr>
<td>Super Spindle</td>
<td>4 x 0.50</td>
<td>5000</td>
</tr>
</tbody>
</table>
Nursery Tree Quality

• Trees for trial were propagated by SAPFIC & pruned to whips when planted.
• Nursery tree quality has had a significant impact on tree performance
• Better quality trees could have
  – Increased significant early yields
  – Significantly improved profitability
  – Reduced training and vigour management costs
  – reduced tying down required
• **Virus Freedom !!!!!**
Results so far
Records & Measurements

Establishment costs

Tree growth

Pest & Disease
  - Routine monitoring
  - Specific problems
  - Records

Labour
  - Fixed
  - “Variable” Labour

Yields

Pack-outs & Returns
Establishment Costs /ha @ $7.60/tree
Yield Performance
M.26 x Open V
3555 trees /ha
2007 = 74.6 tonnes/ha
 Marketable yield = 66.6 tonnes
Ave fruit size 175 gm
Wastage problems 11%
  (Birds 37.7 %)
  (Sunburn 19.4%)
Cripps Pink - Average Yields

Since planting (average all combinations)

- 2005: 63.4 t/ha
- 2006: 36.6 t/ha
- 2007: 68.25 t/ha
2007 Performance

Cripps Pink

- Average all combinations – 68.25 tonnes/ha
- Average fruit size 172 gms (count 105)
- Highest 97.24 t/ha (Ott.3 @ 3333 trees/ha)
- Lowest 40.70 t/ha (MM.106 @ 2500 trees/ha)
- Single row – ave yield – 58.5 t/ha
- Open V – ave yield – 72.5 t/ha
- Closed V – ave yield – 75.3 t/ha
Cumulative Yields 2001-07

- M.9
- OTT.3
- M.26
- MM.106
- Average

Trees per hectare:
- 2000
- 2500
- 3333
- 3560
- 4000
- 4444
- 5000
- 5917
- 6666

Tonnage per hectare:
- 0.0
- 50.0
- 100.0
- 150.0
- 200.0
- 250.0
- 300.0
Rootstock Effects

- Cripps Pink – M9 & M.26 best performers
- Cripps Red – M.26 best performer
- MM.106 performed early but now worst performer
  - Excessive vigour
  - Labour
  - Fruit size
  - Lower yields
    (Problems are compounded at higher densities)
- Ottawa.3 – not as well performed at lower densities but improves with increasing density
  - Hand thinning costs
Fruit Quality

2004 - 90% 1st Grade - Domestic market

2005 – 81.1% 1st Grade – Export pack
16.7% 2nd Grade – *60% bruising
2.2% Juice

2006 – 85.6% 1st Grade – Domestic pack
12.7% 2nd Grade
1.7% Juice

2007 – yet to be marketed
Labour

Comprehensive analysis of all labour inputs

2 categories of labour costs

- “Fixed” costs/ha irrespective of density
  mowing, spraying, weed control etc

- “Variable”
  Tree training, tree support, leader management,
  winter pruning, tying down, thinning, summer
  pruning
% of total labour hours
Cripps Pink x M.26 (2001-2005)
Overall
Similar labour requirements /tonne of fruit between all systems

but large variations in where the labour is used within the different systems
Economic Comparison

What does this all mean for the hip pocket?
Economic Evaluation

4 different “scenarios” for a 20 ha orchard were evaluated using Net Present Values (NPV) & Internal Rates of return (IRR).

1. Within an existing business
2. “Greenfields” investment
   – starting from scratch – all capital costs included.
3. @ 10 years
   – early removal (worst case scenario)
4. @ 15 year
   – assumed commercial life for the block.
IRR @ 10 years – Pink Lady™

“Greenfield”
Project Observations

• Got to have an orchard “Vision” & resources to achieve it
• Currently no major economic advantage or disadvantage using V systems over single row systems – personal preference
• Most economic & lowest risk densities are 2000 – 3500 trees per hectare
• Further refined to 2500 – 3500 trees/ha because of tree management/training issues with in row spacings > 1.0m
Project Observations

- Tree spacings < or 1m easier to manage
  - Compromise decisions
  - Light

- Careful rootstock selection per site and variety is essential
  - M.9 & M26 best performing rootstocks overall
  - MM.106 – very variety and site specific, fruit size issues
  - OTT.3 – market options & variety influence use of this rootstock
Project Observations

- Similar total labour requirements between systems (early years)
- Large variations in where labour is specifically utilised
- Economically total orchard production costs /ha not as crucial to profitability as fruit pack-outs and price
- Storage/packing and marketing costs have more significant impacts on profitability than orchard production costs
- Need to aim for best quality fruit possible
- Saving a $ in the actual orchard is not necessarily good economics
Project Observations

Need to consider the impact of doing (or not doing) an orchard activity or management practice on pack-outs
Project Partners

South Australian Pome Fruit Improvement Committee Inc
PIRSA
SARDI
Rural Solutions SA
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Horticulture Australia Ltd
Australian Federal Government
APAL
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Lenswood Rural
Lenswood Irrigation Services
Stafford Farm Monitoring
Agrilink Pty ltd
Thank you Questions?
### Establishment Costs/ Ha

@ $7.60 / tree (1999)

<table>
<thead>
<tr>
<th>Density</th>
<th>System</th>
<th>Replant</th>
<th>New soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Vertical</td>
<td>32,105</td>
<td>29,975</td>
</tr>
<tr>
<td>2500</td>
<td>Vertical</td>
<td>36,505</td>
<td>34,375</td>
</tr>
<tr>
<td>3333</td>
<td>Vertical</td>
<td>43,835</td>
<td>41,705</td>
</tr>
<tr>
<td>3559</td>
<td>Open V</td>
<td>49,009</td>
<td>46,879</td>
</tr>
<tr>
<td>4000</td>
<td>Closed V</td>
<td>53,800</td>
<td>51,670</td>
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<tr>
<td>4444</td>
<td>Open V</td>
<td>56,797</td>
<td>54,667</td>
</tr>
<tr>
<td>5000</td>
<td>Closed V</td>
<td>62,600</td>
<td>60,470</td>
</tr>
<tr>
<td>5000</td>
<td>S/Spindle</td>
<td>58,505</td>
<td>56,375</td>
</tr>
<tr>
<td>5917</td>
<td>Open V</td>
<td>69,760</td>
<td>67,630</td>
</tr>
<tr>
<td>6666</td>
<td>Closed V</td>
<td>77,261</td>
<td>75,131</td>
</tr>
</tbody>
</table>
Cripps Pink - Pink Lady™

**IRR – Existing business scenario @ 10 years**

- **Range** -14.40% – 28.75%
- **Average all combinations** – 23.08%

**IRR – Existing business Scenario @ 15 years**

- **Range** - 18.01% - 31.57%
- **Average all combinations** 25.90%
Cripps Pink - Pink Lady™

IRR – **Green Field scenario @ 10 years**

- **Range** - 8.42% – 14.75%
- **Average all combinations** 11.23%

*(Super spindle – best performing “system”)*

IRR – **Green Field scenario @ 15 years**

- **Range** - 10.22% - 17.19%
- **Average all combinations** 13.74%