Future Orchards 2012

Orchard walk notes

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Economic Performance of High Density Orchards under Australian conditions – A Snapshot.

Introduction

One of the principal objectives of the Future Orchards 2012 project is to increase the uptake of higher density orchards to around 2500 trees per hectare and improve orchard productivity (yields and packouts) as a result.

Just what does this mean for growers?

Since the early 1990's the increased use of high-density orchards has been a key focus of the South Australian apple and pear industry. A number of activities have been undertaken including a series of trials. The South Australian Pome Fruit Improvement Committee Inc in conjunction with Primary Industries & Resources SA (PIRSA) has conducted these trials. In 1999 a special trial block was established on Lenswood Horticultural Centre to specifically evaluate the production performance, labour requirements and overall economic performance of high-density orchard systems. This planting was established with assistance from HAL (AP99033) and is ongoing AP 00022 and AP 06069. Project AP 00022 enable the evaluation of the plantings first 5 years performance and AP 06069 will enable the evaluations to continue up until the end of the plantings 1st 10 years (the most critical economic period).

The planting has used Cripps Pink (high vigour) and Cripps Red (precocious) planted on 4 rootstocks, M.9, Ottawa.3, M.26 and MM.106. Each variety x rootstock combination is planted using a traditional single row central leader/tall spindle system and V trellis both open centred (space between rows, often called Open Tatura in the eastern states) and closed centres (tree planted in same row but alternately attached to different sides of the trellis). For each system 3 row spacings were then used – 0.75m, 1.0m and 1.25m. These combinations resulted in planting densities of 2000 – 6666 trees /ha. Additionally a row of European Super Spindle (5000 trees/ha) has also been planted. In total there are 38 planting system combinations for each variety.

For each combination a large amount of information including yields, all labour and management requirements, prices received etc have been measured and used to develop an economic evaluation of each systems performance to date. The SA Pome Fruit Committee members have provided the majority of labour used for the trial to ensure the labour costs are as commercially realistic and relevant as possible.

Performance to date

Establishment costs

The cost of establishment using the actual costs from the project are summarised in the following table

Orchard System	Tree density Trees/ha	Establishment costs ($)	Tree cost ($)	Tree cost as % of total cost
Vertical trellis	2000	32,105	14,600	45.5
Vertical trellis	2500	36,505	18,250	50.0
Vertical trellis	3333	43,835	24,331	55.5
Open V	3555	48,974	25,952	53.0
Closed V	4000	53,800	29,200	54.3
Open V	4444	56,797	32,441	57.1
Closed V	5000	62,600	36,500	58.3
Super Spindle	5000	58,500	36,500	62.4
Open V	5926	68,839	43,260	61.9
Closed V	6666	77,261	48,662	63.0

Key points

- Establishment costs increased with increasing plant densities
- Costs of the lowest density (2000 trees/ha) were approx 42% those of the highest density (6666 trees/ha) – tree costs the major difference
- As individual tree costs increase the establishment cost differences between different densities increase significantly.

Yields

Throughout the life of the project the actual yields and marketable yields of each combination have been measured accurately. The trees had their first yields in 2001 with major yields commencing in 2005 and have continued each year since.

In 2006 there was a decrease in overall yields from 2005 but the average yield performance for Cripps Pink was still in excess of 40 tonnes /ha – one of the yield objectives of the Future Orchards 2012 project.

In 2007 the yield of Cripps Pink averaged **68.25** tonnes/ha (range 40.7 to **97.2** tonnes/ha) and Cripps Red so far has averaged approx 55 tonnes/ha (final harvest data not available)

Cripps Pink has consistently out yielded Cripps Red. This is due in part to Cripps Red not developing enough tree structure to fill the allocated space resulting in lower yields, particularly at the lower planting densities.

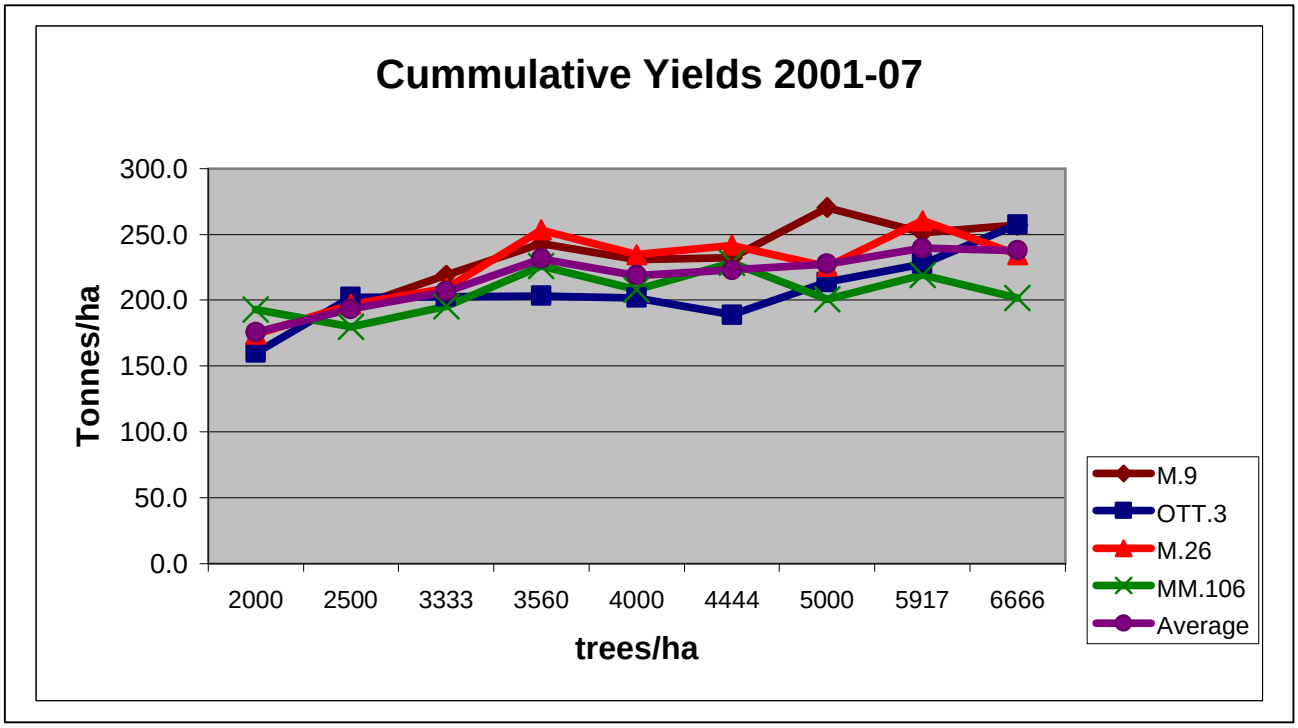
The cumulative yields for Cripps Pink in the period 2001-2007 are shown in table 2

Overall the yields of each combination have increased with increasing density.

Table 2 - Cripps Pink Cumulative yields (tonnes/ha) 2001-2007

Orchard System	Tree density Trees/ha	M.9	OTT.3	M.26	MM.106	Overall average (All R/s)
Vertical trellis	2000	175.4	159.9	174.2	193.1	175.6
Vertical trellis	2500	194.0	202.2	197.0	179.7	193.2
Vertical trellis	3333	219.1	202.7	209.2	196.5	206.6
Open V	3555	243.0	203.3	253.4	226.3	231.4
Closed V	4000	230.9	201.8	234.7	207.8	218.8
Open V	4444	232.5	189.0	241.8	228.3	222.9
Closed V	5000	270.3	213.7	225.5	200.7	227.6
Super Spindle	5000	230.5		260.9		245.6
Open V	5926	251.4	227.5	260.3	219.0	239.6
Closed V	6666	257.1	257.4	234.7	201.7	237.7

Graph1 - Cripps Pink Cumulative yields (tonnes/ha) 2001-2007



Rootstock effects

Both M.9 and M.26 have been the best commercial performers with Cripps Pink. While M.26 has performed particularly well with Cripps Red

MM.106 while performing well in the first two crops has quickly dropped to be the worst performing rootstock through a combination of excessive vigour, labour requirements and lower yields as the trees have become larger. This effect is compounded at the higher densities.

Ottawa.3 has not performed as consistently as M.9 and M.26 particularly at the lower planting densities. However it has performed better with increasing densities and is the equal best performing rootstock at 6666 trees/hectare. This is due to the branch structure and cropping habits produced by this rootstock.

Planting System Effects

The major evaluation to date has only been carried out on trees up to 5 years old; during this period you would not expect many differences in overall performance of the different systems. It is the second 5 years where we expect the major issues to develop.

Subsequently not a lot of conclusions can be made, however there are several observations that can be commented on

Cripps Pink

- The vertical trellis generally has had the highest percentages of cull fruit on the tree i.e. highest percentage of fruit grown but not ending up in a bin.
- There have been no major fruit colouring problems to date but the Closed V system requires more “focus” to ensure that there is adequate light distribution throughout the trees.
- In the early years of tree development the Open V system requires more effort and labour than the other 3 systems.
- There appears to be a slight yield difference in performance between the 2 “V” systems (Open V performing better with most rootstocks)

Cripps Red

- More evaluation of the data is required

Until this season there has not been a significant second pick required for either variety on any system.

Labour Requirements

A detailed monitoring of all of the labour requirements for each combination has been undertaken since the initial planting.

Not all of the final figures were available at the time of preparing these notes but will be presented in the field day presentation

General observations

- There are major differences between rootstocks and orchard systems in the labour requirements for the different components of tree training, development and crop management i.e.
    - Tree training
    - Tree ties and management

- Tree leader management
- Tying down
- Winter pruning
- Summer pruning
- Fruit thinning
- Fruit harvest and bin handling

- **Total** labour requirements do not vary greatly between the different systems
- Overall M.9 & M.26 have required less labour per tonne of fruit produced than Ottawa 3 and MM.106
- Ottawa.3 combinations have required significantly more hand thinning than the other combinations
- MM.106 has required more labour to manage tree vigour issues.
- With Cripps Pink there has not been a significant difference in the amount of labour to produce a tonne of fruit at the different densities
- However with Cripps Red there is a decreased amount of labour required as the tree densities increase.

Economic analysis

All of the yields, packouts, operating costs, overheads and labour costs have been collated and put into an economic analysis. This analysis has produced some interesting results.

Based on performance up to 2005 *(intentions are to make data up to 2007 available for the orchard walks)* these results included:

- The orchard labour figures produced very little net effect (differences) on the Internal Rate of Return (IRR) or Net Present Value (NPV) of any system.
- Small changes in fruit pack-outs or increases in prices received had a very significant and obvious beneficial effect on overall economic performance
- Trying to "save" money in the orchard is not necessary the most effective income generating strategy.
- Because such a large proportion of the costs of producing a carton of apples occurs once the apples have been picked it is critical to ensure that as many apples as possible in a bin obtain the best return possible.
- Profitability is linked to a combination of pack-out (size and quality) and price, <u>not just yield alone</u>.

In looking at the impact of orchard labour and operating costs on overall economic performance the following observations are made.

1) Orchard management strategies that focus on minimising "in" orchard costs are "false savings" if they negatively affect the pack-outs, fruit size or quality of the fruit.

2) If doing something results in a net improvement in fruit size, quality or pack-out then that activity is worth doing.

In undertaking the economic analysis 2 different "scenarios" were evaluated for the establishment of a 20ha block.

1) Establishing the block within an existing business
2) A "Greenfield's" investment (starting from scratch – all capital costs included).

This analysis included data for a 10 year or 15 year period.

The full details can be viewed in report AP 00022. Please note that these results are based on actual performance figures for this experimental site for the first five years and subsequent extrapolations based on those figures.

Overall the preliminary economic comparison showed that under Australian costs, returns and growing conditions that

Cripps Pink

- Was commercially viable under all scenarios
- Had an average IRR (all combinations) of 11.23% (10 years) and 13.74% (15 years) for a "Green-fields" site.
- For a new block within an existing orchard the IRR was 23.08% for 10 years and 25.90% for 15 years (approximately double the "Green-fields" figures)
- Generally the IRR was slightly higher for single row systems than the V systems (both scenarios)
- The NPV for the "Green-fields" scenario went from $0.7m at 10 years to $1.7m at year 15 (Only 1 combination MM.106x 6666 trees /ha showed a negative result)
- The NPV for the "existing" business went from $1.71m at 10 years to $2.95m at 15 years (no combinations showed a negative result)

Cripps Red

- Was not commercial under all scenarios, especially for the 'green field' site.
- Had an average IRR (all combinations) of 6.56% (10 years) and 8.83% (15 years) for a "Green-fields" site. (Less than half the Cripps Pink performance)
- For a new block within an existing orchard the IRR was 15.22% for 10 years and 18.74% for 15 years (approximately double the "green-fields" figures)
- Again the IRR was slightly higher for single row systems than the V systems (both scenarios)
- The NPV for the "Green-fields" scenario went from **$-0.23m** at 10 years to $0.26m at year 15 (Only 10 out of the 38 combinations showed a positive result)
- M.26 was clearly the best performing rootstock whilst M.9 and MM.106 were the worst.
- M.9 only showed positive results for the "closed V" systems
- The NPV for the "existing" business went from $0.68m at 10 years to $1.45m at 15 years (no combinations showed a negative result)

The results to date show a clear picture; growing Cripps Pink is certainly profitable for those with commercial expertise in growing apples. The range of Internal Rates of Return (IRR) achieved in the project of between 10.22% and 17.19% (at 15 years) are better than many investment options, clearly covering the cost of borrowing money for at least some of the orchard investment.

There appears to be no economic reason for increasing tree densities beyond the range of 2000-3500 trees per hectare

The choice of system and density basically becomes a personal choice based on the skills, orchard conditions and resources of the individual orchardist.

There are some appreciable differences in the performance of the different rootstocks when grown at Lenswood with M.9 and M.26 better suited to the higher density orchard systems in preference to Ottawa.3 and particularly MM.106. This may be different in other growing regions.

Overall Conclusions (based on the initial economic analysis up to 2005)

- There is no economic advantage (or significant disadvantage) in using the V systems in preference to the traditional single row upright vertical trellis unless appropriate quality nursery trees are used
- The most economic orchard densities are between 2,000 and 3,500 trees per hectare.
- Experience with tree management in the trial suggests that this could be further refined to 2,500 – 3,500 trees per hectare as the tree spacing of 4 x 1.25m used for the 2000 trees per hectare system created acute problems with tree training and pruning.
- A between tree spacing of up to 1m was more practical to manage than a spacing over 1m - for all systems
- Careful rootstock selection for any particular site and orchard system is crucial
- MM.106 was too vigorous which affected its cropping potential and subsequent economic performance.
- Ottawa.3 has potential depending on the market opportunities of the variety grown on it. However it has certain growth and cropping characteristics that need to be understood to get the best performance out of it.
- While there is considerable difference in where the labour is required in each of the systems there was very little difference in total labour requirements per tonne of fruit produced, between most systems.
- Total **orchard** production costs per hectare are not as crucial to profitability as fruit pack-outs and quality.
- In the orchard focussing on fruit pack-outs and quality is more important than trying to save a dollar.
- Any action or lack of action that affects pack-out affects economic returns.