AP99033
Intensive apple orchard production systems – Demonstration Planting

Paul James
PIRSA Rural Solutions

HAL

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HRDC Report

Intensive Apple Orchard Production Systems – Demonstration Planting

Project AP 99033

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Summary

An “orchard systems” planting has been established on the Lenswood horticultural Centre (SA) by the South Australian Pome Fruit Improvement Committee Inc and PIRSA.

This “orchard systems” planting involves approximately 2650 trees in a demonstration trial of 2 varieties, Pink Lady and Sundowner in 3 different planting systems on 4 different rootstocks at 3 different planting densities per system. An additional row of the European super spindle planting system has also been planted for demonstration purposes. This provides growers with 76 different orchard systems combinations to observe.

The 3 systems are
- Central Leader/vertical axis
- Closed “V”
- Open “V”

The rootstocks are
- M.9
- Ottawa.3
- M.26
- MM.106

And the tree spacings are
- 0.75m
- 1.0m
- 1.25m

This planting has been established by SAPFIC and PIRSA to be used as a trial and demonstration planting to improve Australian orchardists knowledge and acceptance of high density planting systems. It is the 3rd in a series of planting’s established by SAPFIC and PIRSA to encourage the use of high density orchards.

The majority of the work associated with developing this planting has been undertaken by members of SAPFIC and Mr Paul James, tree crops consultant (PIRSA)

Information gained from the planting will be utilised to develop an economic comparison of the different systems. This information will also be utilised using a range of different technology transfer techniques (field days, fact sheets, press articles etc) to demonstrate the most appropriate management techniques required for each system.

IFP principles and orchard monitoring will be used as the basis of the pest and disease management practices used on the planting.
Background

The South Australian Pome Fruit Improvement Committee Inc (SAPFIC) and the Department of Primary Industries and Resources South Australia (PIRSA) have over the last 15 years conducted several cooperative projects in a working partnership. These projects have all been aimed at maintaining and enhancing the international competitiveness of Australian orchardists and increasing their ability to meet the rapidly changing market and consumer requirements.

These projects have focussed on orchard productivity through variety and rootstock evaluation and tree training. The first major project was a variety X rootstock trial planted in 1990. This trial demonstrated the commercial performance of 4 new varieties (Royal Gala, Red Fuji (Naga Fu 2), Braeburn and Pink Lady on 6 rootstock’s M.9, Mark, Ottawa.3, M.26, MM.106 and MM.111. using medium density plant spacings (1250 trees/ha) and the central leader/vertical axis tree training system. This trial was a major success in terms of demonstrating to commercial producers throughout Australia the benefits of using modern training systems and smaller trees. It also had additional benefits highlighting the problems of the poor quality propagation material available to the Australian apple industry and the commercial problems of virus incompatibility. A very critical outcome of this trial was that it also demonstrated that trees could be grown even smaller and closer together to improve commercial productivity and orchard management.

In 1995 a second trial was established at a higher density of 2000 trees per hectare. In this trial the varieties Galaxy, Pink Lady, Sundowner and Red Fuji (Naga Fu 6) are being (the trial is still in operation) evaluated on the rootstock’s M.9, Ottawa.3, M.26, MM.102, M.7 and MM.106.

Both of these trials have been funded through the SAPFIC and PIRSA, no financial support was sort from HRDC.

A major outcome of these trials has been to successfully demonstrate that high density orchards using dwarfing rootstocks can be grown successfully under Australian conditions and that they perform economically and are more cost efficient to manage than conventional orchards.

In an endeavour to continue the success of these trials and further demonstrate to commercial producers the economic benefits of higher density orchards it was proposed that a third demonstration trial be established. This project covers the establishment phase of that trial.
Introduction

Throughout the world many high-density production systems have been developed, refined, and adapted commercially. Australia has been slow to utilise these systems for a number of reasons. One of these has been a lack of information on the performance of these systems under Australian conditions. Experience has also shown that commercial orchardists are reluctant to change their production systems until they have a comprehensive practical understanding of how to manage a "new" system.

Having gained experience from its first two trials and an awareness that producers need a "practical" assessment of the various high density planting systems, SAPFIC and PIRSA sought funding support to conduct a third project. This project will be developed and established in 2 phases.

The first phase (covered by this report) covers the establishment of the actual orchard demonstration block on Lenswood Horticultural Centre. The second phase (HRDC project AP00022) covers the demonstration, training, and data collection components of the project.

Overall this project involves the evaluation of

3 different training systems
- single row axis, "closed" V trellis and open V trellis
using 4 different rootstocks
- M.9, Ottawa.3, M.26 and MM.106
planted at 3 different spacings
- 0.75 cm, 1m and 1.25m.

The varieties Pink Lady and Sundowner were chosen because of their commercial importance to both the local and export markets. The strong growth habit of Pink Lady and the heavy cropping and moderate growth habits of Sundowner provide additional benefits in enabling the project to demonstrate different strategies for managing different vigour trees.

The 4 rootstocks chosen were selected for several reasons

- M.9 because it is the most dwarfing rootstock currently available in Australia and the basic rootstock used for high density planting's worldwide.
- Ottawa.3 was selected because trials 1 & 2 clearly demonstrated the commercial performance of this rootstock under South Australian conditions, particularly when used in conjunction with Pink Lady.
- M26 has also proven to be a very useful rootstock and is very suitable for use in high density plantings
- MM.106 is used extensively throughout Australia but is generally considered too vigorous to be used in high density planting's on strong soils.
One of the objectives of the trial is to demonstrate that vigour management practices can be utilised to manage excessive vigour in high density planting's.

The different spacings have been used to assess tree density issues and demonstrate the different aspects of tree training required for the different space allocations per tree.

The orchard will be used to provide growers with practical demonstrations of the management practices needed to optimise the performance of the differing systems.
Pre Establishment Activities

The actual establishment of the trial demonstration planting was carried out during the 1999/2000 financial year. The planting itself was the culmination of several years planning and development. Many aspects of the planting including site preparation, trial layout, rootstocks, grafting and nursery tree management had to be undertaken well in advance of the actual planting itself.

There were 3 key pre planting components of the project. These included

- Planning
- Site preparation
- Tree acquisition and propagation

Planning

This planting is part of the evolution of high density orchard planting's developed by the South Australian Pome Fruit Improvement Committee Inc (SAPFIC) and PIRSA. As previously mentioned it is the 3rd in a series of trial planting's established by this partnership.

Planning for the project by SAPFIC and PIRSA commenced several years before it actually became a reality. The first 2 trial planting's focussed on varieties, rootstocks and training systems. It was clear to all involved in these planting's that more information and practical demonstrations of what could be achieved was needed if the concepts of high density orchards were to be better understood by commercial producers. This led to the conceptual development of the "orchard systems planting" that has resulted in this project.

Considerable debate centred around what should and could be included in the project and how it should be set out. The Committee incorporated as many aspects as it could of research being conducted in Australia at the time. This included Dr Jill Campbell's (NSW) work on orchard replanting, Dr Gordon Brown (Tas) work on soil bio-assay's, Dr Simon Middleton's (Qld) work on orchard design and light interception and aspects of Methyl Bromide replacement research. Significant information gained by the committee itself from its previous trial work and from the overseas travel of its members and Mr Paul James (PIRSA) was also incorporated.

Various options were put forward and discussed. Ideally we would have liked to do more with the planting but the constraints of the site, time and money led to the final plan that has been used.

A particular point of discussion was wether or not to include a European style "Super Spindle" component. Many factors needed to be considered including, orchard and tree costs, grower skills, time, and Australian soil and environmental conditions. Reports from overseas on the commercial performance of these types of planting's, plus Dr Middleton's results indicating
that under Australian light conditions the ideal tree size was approx 3 - 3.5 m not 2 - 2.5m (as in Europe) and the constraints of the committee resulted in this orchard system not being included. However to provide growers with as much practical information as possible a separate row of this orchard system has been established for demonstration purposes.

Originally it was also proposed to include a row of trees based on Dr Middleton’s “ideal orchard system” for Australian conditions. This research was still in progress but preliminary conclusions by Dr Middleton led us to conclude that what he was proposing would already be achieved in part of the proposed planting. Subsequently this proposed row was dropped from the final plan.

Site Preparation

The planting site at the time of planning this project was an established orchard that was earmarked for removal. The old orchard was removed and the land prepared in accordance with the guidelines on successfully replanting orchards as determined by Dr Jill Campbell (NSW Agriculture) and Mr Paul James (PIRSA). These guidelines were developed at a national workshop conducted as part of Dr Campbell’s research into orchard replanting.

After considerable funding difficulties these guidelines will be published and distributed to all Australian pome fruit orchardists in “Pome Fruit Australia” August 2001 in an insert titled “Successfully Replanting Orchards - 5 Easy steps”.

As a guide to the potential for a replant problem a soil sample was taken from the site prior to orchard removal. This sample was then sent to Dr Wayne Brown TIAR- Newtown Laboratories (Hobart) for a bio-assay assessment. As a result of this assay Dr Brown concluded that without any adjustment to the site there was likely to be a 40% reduction in anticipated tree growth. (Dr Brown’s bio-assay technique compared the growth of apple rootstocks grown in the soil sample with a fumigated sample of the same soil.)

An additional benefit of the sample was that Dr Brown was able to develop a protocol with the Tasmanian Quarantine authorities to allow soil samples to be imported into Tasmania from the Australian mainland. This protocol was an integral pre-requisite to allow any larger or commercial bio-assay services to be developed in Tasmania for the benefit of all Australian orchardists.

Armed with this information the Committee ensured that as many steps of Dr Campbell’s guidelines as practical be followed. Particular attention was given to adjusting soil fertility. Soil samples were taken, analysed and interpreted by Mr Rod Karger (PIRSA). This interpretation included adjustments to macro and trace element levels, soil cation exchange capacity and soil amendments. A fertiliser mix was determined and then prepared by Pivot. All fertilisers and soil amendments were then applied to the soil in accordance with Mr Karger’s directions.
Because of SAPFIC’s concerns that methyl bromide would not be a long term tool for growers to use in their replanting strategies it deliberately did not fumigate the trial site prior to replanting. Instead of fumigating the committee followed the guidelines mentioned above and used a Canola crop as an alternative bio-fumigant. This crop was grown to flowering stage and then incorporated into the soil and allowed to decompose prior to planting the orchard.

Once considered in a ready state for planting a second soil sample was collected and sent to Dr Brown. The objective of this sample was to determine how much of the site adjustments (in the absence of methyl bromide fumigation) had effected the potential for replant effects. Unfortunately Dr Brown had subsequently left TIAR and no results were determined from this bio-assay.

From a commercial orchardist’s perspective this particular problem highlights some of growers frustration’s with research and development projects in Australia ie the lack on continuity in projects and the problem of researchers leaving projects without providing the growers with relevant information or results from their funded projects.

As a general guide the steps taken to redevelop the trial site were

1. Take an initial soil test
2. Obtain interpretation of required soil amendments and fertilisers
3. Assess the site for potential replant problems
4. Remove old orchard – as many roots as possible were removed with the trees.
5. Trees and roots removed off site for later burning
6. Site was roughly cultivated and root picked (twice)
7. Site heavily disced -to cultivate soil and cut up remaining roots
9. Soil amendments and fertilisers added to soil and incorporated.
10. Site ripped
11. Final root picking
12. Site left in rough condition to minimise erosion problems.

Tree Acquisition and Propagation

Because of the size and complexity of the variety and rootstock combinations required for the project it was not commercially feasible to obtain the trees from a commercial nursery anywhere in Australia.

Bits and pieces of the “planting Jigsaw” could have been obtained from several different nurseries but not from 1 nursery. However this created potential problems with large variations in the quality of trees. Because this was a trial it was considered essential that all the trees planted were of a similar quality.
Discussions with nurseries indicated that there would be a considerable lead period for any of them to produce the required trees (if contracted to do so). SAPFIC decided that in the best interests of the project and its budget that it would produce the required trees themselves.

The strategy of self propagation that was undertaken by SAPFIC also highlights many of the problems that commercial orchardists have in obtaining the right combinations and quality of trees from Australian nurseries. Problems that continue to be a limiting factor in the fruit growing industries ability to remain internationally competitive.

To propagate the required trees the MM.106, M.26 and Ottawa.3 rootstocks were obtained from the National Apple Rootstock Source Area at Monash (previously established by SAPFIC). The M.9 rootstocks were unavailable from Monash at the time so these were acquired from a NSW nursery. Scion material was obtained from Lenswood Horticulture Centre.

The trees were all bench-grafted by members of SAPFIC and then planted out in a nursery where they were carefully managed and grown on by a committee member. Various activities such as sucker/shoot removal and removal of the grafting plastic were carried out as group activities by the committee members.
Establishing the block

Establishing the "block" as it is colloquially known was undertaken in several steps. These included

1. Final soil preparation and marking out the block
2. Digging nursery trees
3. Planting
4. Attachment of tree guards
5. Installation of irrigation system
6. Installation of trellis systems
7. Training of trees
8. Block maintenance
9. Tree replacements

Final soil preparation and marking out

During winter the soil had been left in a rough condition to minimise any potential erosion. Prior to planting the site was disced to remove any weeds and fine up the soil condition.

The proposed rows (13) were then marked out on the block by SAPFIC members. This took considerable time because of the topography of the block and complexity of the planting design.

Once marked out the actual row (to minimise erosion potential) was rotary hoed into a fine tilth ready to plant.

Digging the nursery

Members of SAPFIC dug the nursery trees and carefully labelled and graded each rootstock/variety combination. Because the trees were only 1 year old there was very little side feather development on the trees, where feathers had developed these were removed as all trees were planted as "whips". Ideally 2 year old well feathered trees would have been preferred but this was not possible. Once dug and labelled the trees were delivered to the block.

All trees were planted within 24 hours of being dug from the nursery.

Planting

All trees (except pollinator trees) were planted by machine in accordance with SAPFIC's intention that the block be established as closely as possible to commercial practice. To machine plant at such close spacings a plastic pipe was marked out at the appropriate spacings and a committee member called out when a tree was required to be planted.

The machine used for planting was quite successful for the single rows and the first row of the double row planting's, however it created significant
problems when used to plant the second row of the double rows as it was not ideal in maintaining the required inter row spacing.

*This highlights the necessity to use the appropriate machinery for the planting system that is planned. A specialist double row planter is essential for double row "V" planting's.*

Approximately 2450 trees plus an additional 190 pollinator trees are planted in the block.

All planting was done in the same day. As the soil was moist and rain fell shortly after planting was completed the individual trees were not watered in at planting. Each tree was individually pressed in and checked to ensure that it had not been planted too deep.

**Installation of tree guards**

Initially it was only planned to place tree guards around the pollinator trees as a way of identifying where each orchard system/spacing started and finished. After consideration of the potential risks and value of the planting it was decided to place tree guards around every tree. The differentiation between systems was maintained through the use of different coloured tree guards for the pollinator trees. Spiral tree guards were the preferred option.

**Irrigation system installation**

To ensure that the block could be irrigated evenly a irrigation system was specifically designed for the block. Installation was done by the committee as soon as possible after planting.

The ability to apply differing irrigation amounts of water to the different rootstocks was considered an important vigour management tool therefore individual valves for each row have been incorporated into the design.

**Trellis system installation**

A commercial post and trellis contractor was employed to install the trellis systems in the block. This was done quite efficiently for the single row and open "V" systems, however the contractor had never put in a "closed V" system where the posts are placed adjacent to but side by side with each other. The posts in this system need to actually "cross" each other at soil level to ensure that the correct angles for the trees are maintained. Once post positions were sorted out the construction was easily undertaken.
Tree training

Once all trees were planted they were de-feathered to ensure that they were all the same to ensure evenness in the quality of trees used for each system. No trees were headed at planting.

During the growing season, the trees on all systems were checked to ensure that a dominant leader was maintained. This was undertaken to ensure that tree growth was not dis-proportional due to poor management. Any badly placed or overly large limbs were also removed to ensure even tree growth.

During the winter the trees were pruned according to their growth, vigour, system and spacing. This pruning was related to limb diameter and closely linked to the space allocated for each tree, correspondingly the smaller the allocated space the smaller the limb diameter retained.

These limb ratio’s and pruning practices will be essential components of the training and technology transfer components of the second stage of this project (AP00022)

Block maintenance

Routine block maintenance ie pest and disease control, mowing, weed control, irrigation etc was carried out by PIRSA staff. Particular attention was paid to weed control and pests that could influence tree growth ie mites and Light brown apple moth.

Block maintenance during stage 2 of the project will involve IFP principles and orchard monitoring practices.

Replants

At the end of the first growing season approximately 80 trees and 30 pollinator trees needed replacing. Most of these trees were evenly distributed throughout the block, no particular system or spacing had a significant problem.

The main combinations replaced were both Pink Lady and Sundowner on the dwarfing rootstocks M.9, M.26 and Ottawa.3. M.9 had the highest level of actual tree deaths followed by M.26. Ottawa.3 did not have many actual tree deaths but it had the highest number of trees that did not thrive and develop satisfactorily. No major problems were encountered with either the Sundowner or Pink Lady on MM.106.

In hindsight several trees that were replaced may have performed satisfactorily in the second season if left alone. A problem of over irrigation was detected at the end of the first season that may have contributed to the trees growth problems. Tree growth in the second growing season (after amendments were undertaken) appeared to be better.
Block Layout

Figure 1 Demonstrates the trial block layout

Combinations

Overall the block is split into 2 halves - Sundowner in 1 and Pink Lady in the other. Each half has 12 rows (4 rows (1 of each rootstock) of each orchard system) and within each row there are 3 sections (1 for each tree spacing used). In total this provides a total of 36 orchard combinations in each half and 72 combinations in total between the 2 varieties (halves).

An addition barrier row (row 0) was also established using the European Super Spindle training system. This row has 2 rootstocks (M.9 & M.26) with each variety (4 combinations in total). Each tree in this row is planted 0.5m apart allowing for a density of 5000 trees/ha.

When used for comparative purposes the total block has 76 (72 + 4) different orchard planting systems and tree densities to observe.

Planting Densities

- **Central Leader/axis**

  Each of the 4 rows planted to this training system are spaced at 4 metres apart. Within the row the 3 tree spacings are 0.75m, 1 m and 1.25 which result in tree densities of
  
  \[
  \begin{align*}
  4 \times 0.75 & = 3333 \text{ trees/ha} \\
  4 \times 1.00 & = 2500 \text{ trees/ha} \\
  4 \times 1.25 & = 2000 \text{ trees/ha}
  \end{align*}
  \]

- **Closed “V”**

  Each of the 4 rows planted to this training system are spaced at 4.5 metres apart. This planting system has all the trees planted in the same row with each tree then trained alternately to each side of the trellis. This results in effectively doubling the tree density within each row. Within the row the 3 tree spacings are 0.375m, 0.5 m and 0.65 which result in tree densities of
  
  \[
  \begin{align*}
  4.5 \times 0.375 & = 5926 \text{ trees/ha} \\
  4.5 \times 0.50 & = 4444 \text{ trees/ha} \\
  4.5 \times 0.65 & = 3420 \text{ trees/ha}
  \end{align*}
  \]

- **Open “V”**

  Each of the 4 rows planted to this training system are spaced at 4.5 metres apart With a gap between the 2 sides of the V of 0.5m. Within the row the 3 tree spacings are 0.75m, 1 m and 1.25 resulting in tree densities of
In total tree densities vary from 2000 – 5926 trees/ha an overall variation of up to approx 300%.

Pollinators

Pollinator layout

Pollinators have been planted at the beginning of each row and then at the end of each section of different tree spacings. This provides a pollinator every 15m along the row.

In the Open "V" rows pollinators have been placed in each row of the double rows.

In placing the pollinators this way they can be used as very obvious in row markers for the different spacings.

Pollinator Varieties

Both Pink Lady and Sundowner have a common parentage (Golden Delicious x Lady William) and therefore it is not recommended to use either variety as a pollinator for the other. Both varieties are also very early flowering cultivars, which restricts the options of varieties that can be used as pollinators.

To gain as much benefit from the planting as possible two types of pollinators have been used. Within each row Grannysmith have been used and at the beginning of each row (both Sundowner and Pink lady) the Crab apple varieties Golden Hornet and Manchurian Crab have been used.

The Crab apples have been used to demonstrate possible ways orchardists can increase the productivity of their orchards without having to lose valuable orchard space to pollinator trees, which create management, labour supervision and harvest problems for orchardists.
Figure 1. Intensive Apple Orchard Production Systems – Block plan

<table>
<thead>
<tr>
<th>Sundowner</th>
<th>Row No</th>
<th>Pink Lady</th>
</tr>
</thead>
<tbody>
<tr>
<td>MM.106</td>
<td>Open “V”</td>
<td>MM.106</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>M.26</td>
<td>Open “V”</td>
<td>M.26</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ottawa.3</td>
<td>Open “V”</td>
<td>Ottawa.3</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>M.9</td>
<td>Open “V”</td>
<td>M.9</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>MM.106</td>
<td>Closed “V”</td>
<td>MM.106</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>M.26</td>
<td>Closed “V”</td>
<td>M.26</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ottawa.3</td>
<td>Closed “V”</td>
<td>Ottawa.3</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>M.9</td>
<td>Closed “V”</td>
<td>M.9</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>MM.106</td>
<td>Central Leader</td>
<td>MM.106</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>M.26</td>
<td>Central Leader</td>
<td>M.26</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ottawa.3</td>
<td>Central Leader</td>
<td>Ottawa.3</td>
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<tr>
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<td>2</td>
<td>2</td>
</tr>
<tr>
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<td>Central Leader</td>
<td>M.9</td>
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<td>1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>M.9 Super Spindle</td>
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<td>M.9 Super Spindle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>M.26 Super Spindle</td>
<td>2</td>
<td>M.26 Super Spindle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>
Other issues

• Technology transfer

During the establishment of this block no major field days were conducted. This was essentially due to concentrated efforts on ensuring that the block was properly established. A press article (attached) covering the establishment of trial was prepared and published by Rural Press.

However since the block has been established there have been a large number of visitors and technology transfer field days and activities undertaken using the block. These visitors and activities were detailed in the milestone report 2 for project AP00022.

• Data recording

Field work sheets have been prepared to record all activities undertaken in the block or sections of it.

SAPFIC have invested in a computer program "Grow Data" to enable all of the economic information required from the project can be collected and collated.
Appendix 1. Media article

High density planting trial

A TRIAL is under way at Aldinga in the Adelaide Hills to demonstrate new high density planting systems available to fruit growers, particularly apple growers.

The six year project is being run by Primary Industry and Resources South Australia (PIRSA) horticultural consultant Paul James, with sponsorship and active participation from the South Australian Pome Fruit Improvement Committee.

It was established last year and is still in the early stages of development. Once fully established the trial would be used as a valuable training tool for growers.

Pome fruit improvement committee chairman Greg Cramond said the trial would promote new styles of orchards and new uses of fully dwarfing rootstocks in a bid to arrive about new techniques of production.

"We're trying a couple of different systems and some different planting distances to basically give the growers a demonstration site," he said. "A lot of people have tried things like this but not really on this sort of scale."

Mr Cramond said given the current economic climate, it was extremely important growers could see the results of trials such as this first before attempting a new way or managing their property.

"You can't really afford to put in an expensive orchard system where you are basically guessing what you are doing," he said.

Two different apple varieties, Pink Lady and Sundowner, are involved with the trial, along with four different rootstocks.

These include M-9, the most dwarfing rootstock currently commercially available; Ottawa-8, an experimental rootstock performing well in other trials; M-26, a semi-dwarfing rootstock that is becoming the main rootstock used in the industry; and MM-106, a vigorous rootstock which has been used by the industry for a long time.

"There are three different training systems and three different spacings between these trees which gives us a total of 72 different combinations growers can look at and see how it relates to their own orchard management," Mr James said.

"The training systems are the three main systems being used by commercial growers today, which is the free standing tree and the V-trellis, both as an open centre and a closed centre.

"We're looking at 75 centimetres, 1 metre and 1.25m spacings between trees and the row spacing varies between 3.5 to 4m depending on the system."

Mr James said spacing was the big issue because the trial was employing greater planting densities than most commercial growers were currently using.

He said Horticultural Research and Development Corporation funding had been obtained to assist with the next stage of the project - an economic analysis of the performance of the different systems over the next five years, giving growers hard data about the performance of the various combinations.

The site will also be used as a training ground for growers with field days and various other information days to be organised.

SA Pome Fruit Improvement Committee member Graham Hansen, chairman Greg Cramond, and PIRSA's Paul James.