

Future Orchards Trial Final Report: Maximising growth in young pedestrian orchard plantings

Project title:	Maximising growth in young pedestrian orchard plantings
Region:	Tasmania
Contact:	Sophie Folder (Pear Consulting) and Justin Miller (Millers Orchards)
Projective Objective:	A case study of growth and establishment techniques in young pedestrian orchard apple plantings.

Outline/method/ (what you did/ have done so far):	<p>Background</p> <p>A new pedestrian orchard block of Alvina Gala trees on M9 rootstock was planted at Millers Orchards in October 2015. They were planted as unfeathered whips, headed and grown as dual leader trees. A trial of direct heading vs delayed heading was undertaken on this block in 2015-16 season aiming to increase evenness between leaders. There was no effect of the heading treatment on leader evenness.</p> <p>On entering the 2nd year the question was raised by the Tasmanian COG, ‘how can we maximise growth in year 2 plantings’. The grower (Justin Miller) planned to use the same fertigation program as used in the 2015-16 season and had intended to compare differing rates of gibberelic acid (GA) to drive tree growth and canopy fill in 2016-17.</p> <p>Unfortunately an extremely wet winter and spring led to some tree losses, a delayed late bud break in late November and poor spring tree growth. A decision was made to use the same rate of GA across the whole block to in order maximise summer growth. The planned GA trial was abandoned and the focus changed to a ‘case study’ of young pedestrian orchard management instead.</p> <p>Five new pedestrian orchard blocks were established at Milers Orchard as year 1 plantings in 2016 and monitored to provide information for a case study of establishing pedestrian orchards.</p> <p>Method</p> <p><u>Aim:</u> to collate information on establishment techniques used and growth achieved in young pedestrian orchard apple plantings at Millers Orchards during 2016-17 growing season.</p> <p><u>Measurements</u></p> <ul style="list-style-type: none"> • Extension growth (Dec 16, Feb 17, March 17, April 17 & May 17) • Leader length (May 17) • Trunk Cross sectional area (TCA) (Dec 16, Feb 17 & May 17) • Tree height (May 17) • Photos (Sept 16, Dec 16, Feb 17, March 17 & May 17)
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Results Summary

Overview of pedestrian orchard blocks at Millers Orchard

Six young pedestrian orchard apple blocks were monitored for tree growth at Millers Orchard over the 2016-17 growing season. Of these one was a year 2 planting (Block 1A Alvina Gala 2015) and five were first year blocks planted in December 2016. Table 1 provides details of these blocks.

Photos and list of activities and observations can be found in the appendices of this report.

Table 1: Details of pedestrian orchard blocks planted at Millers Orchard

Block Name	1A (2015)	1A (2016)	1D	1F	1E	1F
Variety & Rootstock	Alvina Gala on M9	Alvina Gala on M9	Kanzi on M26	Agura Fuji on M26	Envy on MM102	Envy on MM102
Block size	0.5 ha	0.5 ha	0.65 ha	0.3 ha	1.6 ha	0.6 ha
Planting date	08 October 2015	14 -21 December 2016				
Tree type at planting	Unfeathered whips delay headed on 16/11/15 and grown as dual leader trees.	Unfeathered whips headed at planting	Unfeathered whips headed at planting. 4 rows dual leader nursery trees.	Unfeathered whip grown as a 2D single leader tree.	Unfeathered whip headed at planting. Grown as a three leader tree. Planted as unearthed whip and headed at planting. Grown as a triple leader tree.	
Trellis & mature tree type	Single – dual leader tree			Single – 2-D single leader tree	Single – triple leader tree	
Spacing	2.5 x 0.6m	2.65 x 0.65	2.65 x 0.65m	2.65 x 1.1m	2.65 x 1.1m	2.65 x 1.1
Trees per ha	6666 trees /ha	5814	5814	3430	3430	3430
Canopy intention	100% canopy fill by year 3 (2017-18)	Reach top wire by year 3(2018-19). 100% canopy fill by year 4				
Fruiting intention	Fruit in year 4 (2018—19).	Fruit in year 3 (2018—19).				
Rainfall (mm)	September to November: 277mm December to April: 468.mm					
Irrigation applied	1 L per tree per day (Dec – end March)	1.5L per tree per day (Dec – end March)				
Pre planting amendments	N/A	5t Gypsum & 0.5t Lime /ha	Nil			
Fertiliser at planting	N/A	250KG MAP, 250KG SOP & 8Kg Manganese Sulphate /ha	300KG MAP, 300KG SOP & 10Kg Manganese Sulphate /ha	1200Kgs 0-6-8-10 + Trace Elements / ha		
Fertigation during season	MAP 75L/ha fertigated between 5-20/01/17 Nitroquad 450L /ha fertigated between 20/01/17 to 10/04/17					
Fertiliser units applied - nutrient / ha	161 units N & 11 units P / ha	186 units N, 65 units P, 104 units K, 48 units S & 3 units Mn /ha	191 units N, 76 units P, 125 units K, 57 units S & 3 units Mn /ha	161 units N, 83 units P,96 units K & 12 units S /ha		

Year 2 pedestrian orchard planting

Block 1A: Alvina Gala (2015)

Block 1A Alvina Gala (2015) experienced a very wet winter and spring period. This resulted in some tree deaths due to water logging and a delayed bud break in late November 2016. The block had very uneven tree growth over the 2016-17 due to these early challenges.

Justin Miller explained, *“The wet spring affected the previous year’s planting. We had some trees that died and a huge staggering in breaking dormancy.”*

Extension Growth was measured between December 2016 and May 2017, shown in Figure 1. On average the block recorded 675 mm of new leader growth over the season. This was less than a target of 1000mm but not bad considering the challenges this block faced through the spring.

Three applications of 50mls per 10L water GA were applied to the block in late January to March to encourage leader growth which had slowed in late January. Growth in this block had terminated by April 2016.

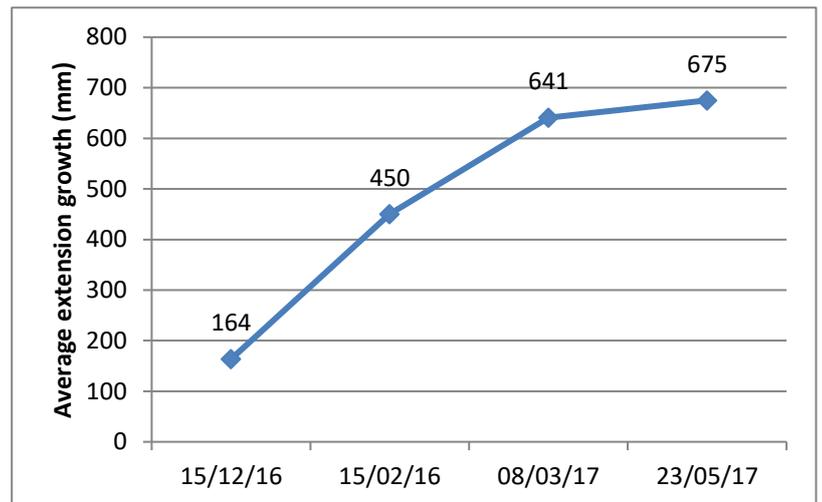


Figure 1: Block 1A Alvina Gala (2015), year 2 extension growth Dec 16 to May 17

Tree height was used as a measure of canopy fill and assessed in May 2017, with trees ranging on average from 1341 to 1495mm in height.

The effect of the different heading treatments at planting are still obvious and have impacted on the tree height at the end of year 2, shown in Figure 2. The trees which were headed at planting are on average 154mm taller (1495mm height) than the trees which were delay headed after planting (1341mm height). This difference is reflective of the extra growth they achieved in year 1.

The results from the heading trial in year 1 were a big learning for Justin, he explained;

“I wouldn’t delay head again that’s for sure.”

It was hoped that the trees would be close to reaching their target height of

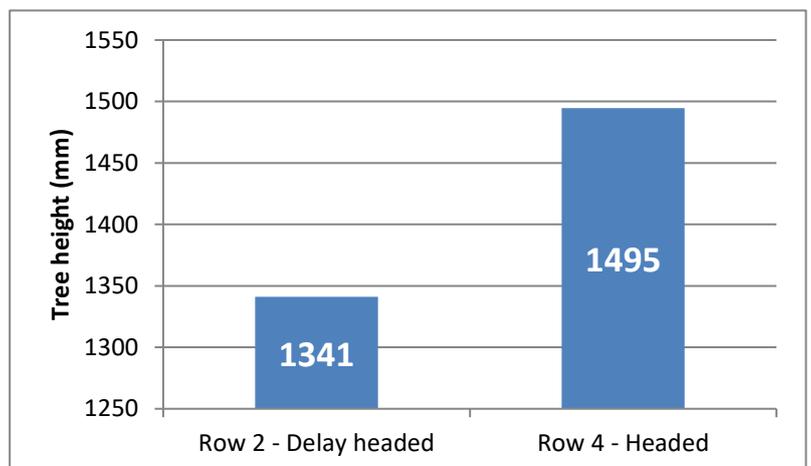


Figure2: Block 1A Alvina Gala tree height at end of Year 2 of trees delay headed after planting vs trees headed at planting

2600mm by the end of the year 2 growing season. Unfortunately disappointing year 1 growth and poor 2016 spring conditions meant this target was not reached. Careful management of crop load and inputs will be needed in year 3 to ensure that the trees grow well to achieve canopy fill.

TCA Measurements were taken from December 2016 to May 2017, shown in Figure 3. On average the TCA of the block increased by 1.69 Cm^2 over the season. Similar to tree height the impact of the heading treatments in year 1 can be seen in TCA measurements at the end of year 2. The trees headed directly at planting had a greater TCA (4.15 Cm^2) at the end of season compared to the delay headed trees (3.14 Cm^2), shown in Figure 4.

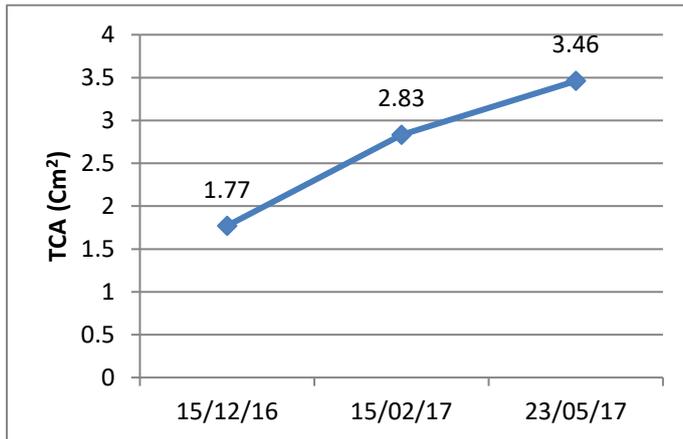


Figure 3: Average TCA of Block 1A Alvina Gala (2015), Dec 16 to May 17

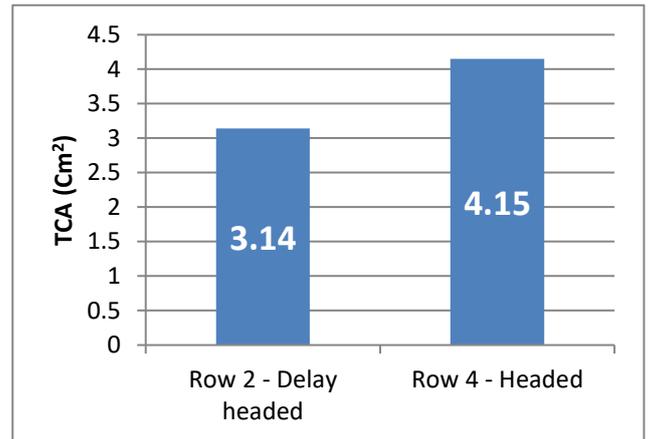


Figure 4: TCA of trees headed at planting vs delay headed after planting, 23 May 2017

Year 1 pedestrian orchard plantings (2016-17)

Five new pedestrian orchard blocks were planted in December 2016. Based on the lessons learnt from the heading trial the previous season, the multi leader blocks were headed as soon as they were planted to maximise growth potential for the season.

Justin Miller explained; *“In the first year we made two mistakes, firstly delay heading and secondly growing the trees as a bare poled rod in the nursery. We should have planted them as a dual leader tree from the nursery. I had always heard about issues with unevenness in dual leader tree, therefore we headed back once planted to try to achieve evenness.”*

A trial of trees grown as dual leaders in the nursery was undertaken in the new Kanzi planting.

Block 1D: Kanzi

Extension growth over the season for 1D Kanzi block averaged 550mm, shown in Figure 7. This block achieved less leader growth than the Envy and Agura year 1 blocks planted at the same time.

Some of the Kanzi trees had been grown as dual leader trees in the nursery and 4 rows were planted as dual leader trees in the new orchard block. The dual leader nursery trees had double the leader length of the trees planted as unfeathered as whips in the orchard in May 2017, shown in Figure 5.

Leader evenness was greater in the trees headed in the orchard compared to those planted as dual leader trees from the nursery, shown in Figure 5. Justin feels that this is outweighed by shorter time to canopy fill achieved by planting a dual leader tree. He explained;

“We were previously under the impression that it is hard to get evenness in leaders when you grew a dual leader tree in the nursery. We saw in our trials that they were not as even but they were even enough to not worry about it. The extra year’s production gained outweighs the small difference in leader uniformity.”

Justin explained that careful crop load management on the leaders will be used going forward to manage this difference in leader evenness.

“A few people have said to me, when you do multi leader systems that way, within a few years you don’t even notice the difference in evenness. So once you start cropping, you can crop one leader heavier and hang less crop on the other one, it catches up.”

Tree height measured in May 2017 showed an extra 504 mm in height in the trees planted as dual leaders. These trees should be on track to get close to the target height of 2600 mm by the end of Year 2, a year earlier than the rest of the block.

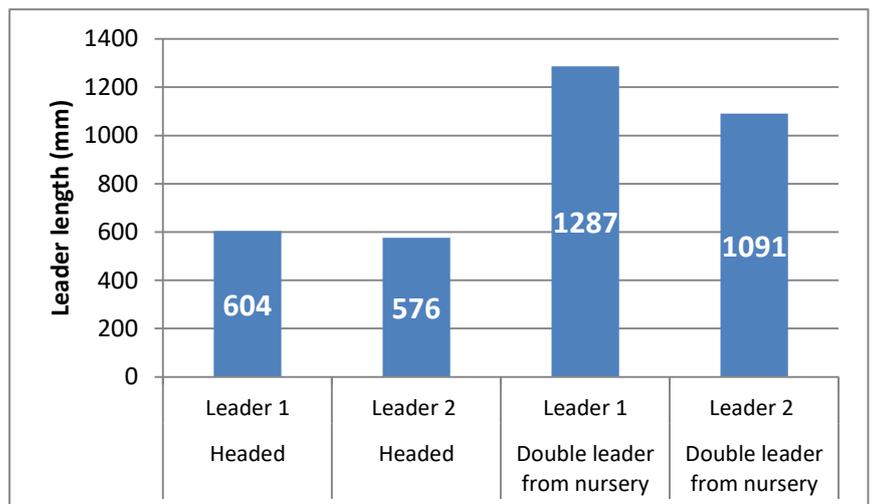


Figure 5: Total leader length in Block 1D Kanzi of trees headed at planting vs trees grown as dual leader in nursery.

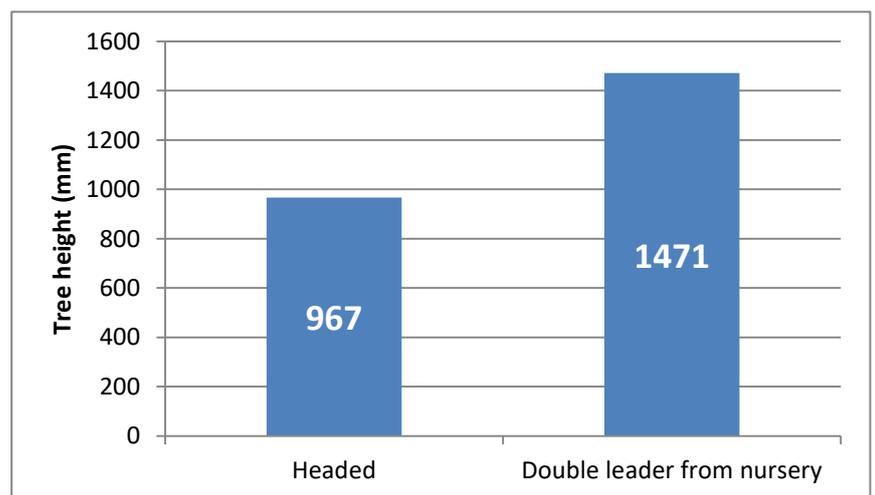


Figure 6: tree height in Block 1D Kanzi of trees headed at planting vs trees grown as dual leader in nursery

Blocks 1A: Alvina Gala, 1F: Agura and 1E: Envy and 1F: Envy

Extension growth for the five new pedestrian orchard blocks planted in 2016 was measured from March to the end of April 2017, shown in Figure 7.

Block 1F Agura achieved the highest leader growth for the season with 960mm, an excellent result given the late planting in mid December 2016. The higher growth may be attributed to the single leader system of these trees compared to the multi leader systems grown in the other new plantings.

The three leader Envy blocks achieved good leader growth with 814 mm (Block 1E) and 823mm (Block 1F) by the end of the season. Both dual leader blocks had the least leader growth and terminated early at 491 mm (Block 1A Alvina Gala) and 550mm (Block 1D Kanzi).

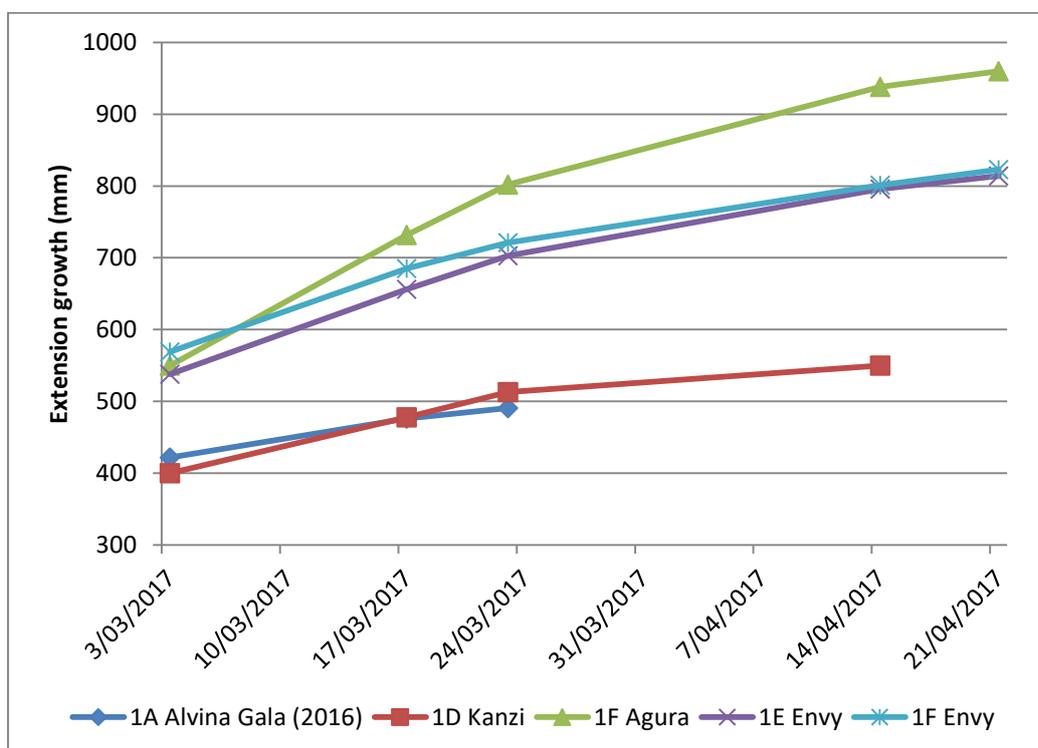


Figure 7: Average extension growth (mm) for new pedestrian orchard blocks planted in 2016

Other lessons learnt from the grower

Spacing of leaders was a big focus in the initial dual leader pedestrian orchard plantings (2015). Justin has since learnt to allow the leaders to get going before worrying about leader spacing. He explained;

“The year before, we were probably a bit too perfect in terms of getting the space right in the leaders before they reached the first wire. Now we let them grow at a bit of an angle and they have reached their spacing by the second wire. I don’t know if it impacted on any growth or not the previous year but it just allows us to not worry too much about getting them as perfect.”

Angle of leaders is important to ensure one leader does not dominate in growth and evenness. Justin explained;

“Ensuring that the angle of the leaders on the trellis is correct is more important than getting the spacing right, so you do not have one leader that is more dominant. This is harder when you are planting dual leader tees to get it exactly right because the leaders have already grown the way they are. You might have one that is straighter than the other one, from the way it had grown in the nursery. So you need to clip it to the wire to compensate for that.”

Trellising processes were refined this season to maximise tension in the wires. Justin explained;

“We did a few different things as we were tensioning the wire up to make sure it is fully tensioned and there was no more room for the wire to give, this will have positive impacts on the orchard later on.”

Implications

The results of two years managing young pedestrian orchard plantings at Millers Orchards have led to the following changes for future plantings.

- Trees are headed at planting rather than delay heading, when grown as a multi leader tree. This change maximises leader growth for the season.
or
- Dual leader trees will be grown in the nursery and then planted in the orchard. This change will reduce the time taken to establish the block and enable a faster return on investment.

Plans for pedestrian orchard block management next season

Plans for next season’s young pedestrian orchard block management will include;

- Managing shoot growth on leaders to develop spurs along the pole. Justin plans to use a combination of pruning techniques in spring and Regalis to terminate shoots and allow for future fruiting spurs. He explained;

“The advice we got from the Future Orchards walk was instead of removing the stronger shoots off the pole we need to just cut them back shorter or use Regalis. So they don’t get blind sites and so we don’t lose those fruiting sites later.”

- A review the fertiliser program will be undertaken and will be tweaked to include trace elements and provide balanced nutrition for the tree. He explains;

“A bit more of a broad spectrum fertiliser rather than so much nitrogen and give them a few trace elements as well. A slightly more balance fertiliser program.”

- A crop load trial to evaluate the effect of leaving some fruit on the tree to uptakes the starch in the growing wood and assists in leader growth will be undertaken next season in Year 2 and Year 3 blocks.

Conclusions

- The effect of delayed heading after planting is still evident by differences in reduced tree height and TCA at the end of year 2.
- Trees grown as dual leaders in the nursery are on track to reach tree height targets one year earlier than trees grown as unfeathered whips and headed at planting.
- Single leader trees recorded higher leader growth than multi leader year 1 pedestrian orchard plantings.

Appendix I - Photos

Block 1A – Alvina Gala (2015)



Image 1: Block view, 19 September 2016



Image 2: Tree view, 19 September 2016



Image 3: Block view, 15 February 2017



Image 4: Tree view, 15 February 2017



Image 5: Trees delay headed after planting,
8 March 2017



Image 6: Trees headed at planting, 8 March 2017



Image 7: Trees delay headed after planting, 23 May 2017



Image 8: Trees headed at planting, 23 May 2017

Block 1D – Kanzi



Image 9: 1D Kanzi headed at planting, 23 May 2017



Image 10: 1D Kanzi planted as dual leader from nursery, 23 May 2017

Appendix II – Case study activities undertaken and observations

Milestones	Date	Comments and observations
Trial site visit	19/09/2016	Soil sample taken. Photos taken. Nigel Bartels reviewing and completing a recommendation based on soil test results with this being passed onto Justin for review and implementation with current Fertigation programs. Many growers chasing elements fertiliser inputs due to the effects of the rain fall.
Trial notes	August – Dec 2016	A very wet winter had a large effect across the pedestrian orchard block. Orchard staff had a lot of trouble trying to access the winter rain sodden ground for a number of weeks after the heavy rains. This also had a large effect on the gala trees within the block, with a number in the bottom half of the block not coping with the prolonged wet feet. With this came intense weed pressure through the block during this time with no ability to access the block to spray the competing weeds out. The block had an extremely late bud break. Has the wet feet and prolonged rain had this impact on the trees? or was it previous GA applications from last season? or any lasting effects of pushing the tree growth during last season? Very poor early extension growth observed across the block.
Record measurement	15/12/2016	Measure TCA & leader growth of trees in trial area. Take photos Late bud break (late Nov / early Dec 2016) and poor growth noted.
Planting of 2016 blocks	14 -21/12/2016	Planting of new pedestrian orchard blocks including; 1A Alvina Gala (2016), 1D Kanzi, 1F Agura, 1E Envy and 1F Envy.
Re-define trial	January 2016	With limited team at their disposal, Justin Miller decided that the whole Pedestrian Orchard block will need to be treated with GA to really kick the block into action. It is vital have the trees up and going especially given the early issues encountered. Justin observed he needed to act now or possibly have a lot longer return to profit on the block than expected. After this decision the following applications of GA were applied across the entire block: <ul style="list-style-type: none"> • 29/01/2017 application of GA @ 50 mls per 10ltrs • 09/02/2017 application of GA @ 50 mls per 10ltrs • 19/02/2017 application of GA @ 50 mls per 10ltrs Given the above factors, the trial will now be continued as a 'case study' to look at block management in year 2 of a pedestrian orchard.
Records measurement	15/02/2017	Leader length measured & photos taken. The block was viewed on the 15/02/2017 the trees seemed to be parking up and pushing growth back down the tree and limiting the extension growth. Justin hoping the final application of GA will even out the extension growth across the block, as currently the growth across the block is very uneven in patches.
Records measurement	3/03/2017	Measure leader growth of 5 new year 1 pedestrian orchard plantings.
Records Measurement 3	08/03/2017	Site visit with Ag First consultant Craig Hornblow to measure leader growth for trial trees and take photos.

		It was noted that the soil mound need reworking to reduce the shank length.
Records measurement	17/03/2017	Measure leader growth of 5 new year 1 pedestrian orchard plantings.
Records measurement	23/03/2017	Measure leader growth of 5 new year 1 pedestrian orchard plantings.
Records measurement	14/04/2017	Measure leader growth of 5 new year 1 pedestrian orchard plantings.
Records measurement	21/04/2017	Measure leader growth of 5 new year 1 pedestrian orchard plantings.
Records Measurement 4	23/5/2017	Site visit to measure leader growth, TCA and height of trial trees and take photos. Measured Block 1D Kanzi trial of trees planted as dual leaders from nursery vs headed at planting. Headed at planting trees observed to be more even in leader length than dual leader trees from nursery.
Field day	19/6/2017	Visited the Y1 Kanzi and Envy pedestrian orchard blocks as part of the Future orchards walk at Millers Orchard. AgFirst consultant Steve Spark suggested hanging 1 or 2 fruit on the stronger trees in year 2 to provide a sink for starch in the tree and thus improve leader growth. He further suggested removing stronger shoots along the branch in late spring and using Regalis to terminate shoots and to encourage small spurs to develop along the two leaders of the tree. These points will be considered for trial ideas in 2017-18 growing season.