

Horticulture Innovation Australia

Final Report

Future Orchards 3

Angus Crawford
Apple & Pear Australia Limited (APAL)

Project Number: AP11017

AP11017

This project has been funded by Horticulture Innovation Australia Limited using the apple and pear industry levy and funds from the Australian Government.

Horticulture Innovation Australia Limited (Hort Innovation) makes no representations and expressly disclaims all warranties (to the extent permitted by law) about the accuracy, completeness, or currency of information in *Future Orchards 3*.

Reliance on any information provided by Hort Innovation is entirely at your own risk. Hort Innovation is not responsible for, and will not be liable for, any loss, damage, claim, expense, cost (including legal costs) or other liability arising in any way (including from Hort Innovation or any other person's negligence or otherwise) from your use or non-use of *Future Orchards 3*, or from reliance on information contained in the material or that Hort Innovation provides to you by any other means.

ISBN 0 7341 3796 6

Published and distributed by:
Horticulture Innovation Australia Limited
Level 8, 1 Chifley Square
Sydney NSW 2000
Tel: (02) 8295 2300
Fax: (02) 8295 2399

© Copyright 2016

Contents

A.	Content of This Report	4
B.	General Commentary on Future Orchards®	4
C.	Milestone Achievement Criteria	4
1.	AP11017 Future Orchards 3 Project Summary	5
2.	Keywords.....	6
3.	Introduction	6
4.	Methodology.....	8
5.	Outputs	11
6.	Outcomes.....	17
7.	Evaluation/Discussion	19
8.	Recommendations	22

A. Content of This Report

This document will not report specifically on all activities occurring within the project. For comprehensive reports and documentation of all project activities see the project Milestone Reports.

B. General Commentary on Future Orchards®

The previous Milestone reports have shown that the Future Orchards® project AP11017, and its extensions, have delivered all activities as required by the original project contract and the contract for the project extensions. In many instances the project has delivered more than the contracts required.

This report will show that the methodology was multi-faceted; the outputs extensive; there were both quantitative and qualitative outcomes; and all project assessments indicated that the project was highly successful.

C. Milestone Achievement Criteria

This report will provide the final report requirements for a technology transfer project and include;

1. Summary
2. Key words
3. Introduction
4. Methodology
5. Outputs
6. Outcomes
7. Evaluation and Discussion
8. Recommendations
9. Acknowledgments

1. AP11017 Future Orchards 3 Project Summary

AP11017 Future Orchards 3 is essentially a technology transfer project consisting of a number of activities and modalities each of which contributes to the overall project aims.

As the name suggests, Future Orchards 3 is the third project in a series which began in 2006. The first two iterations of the project were both successful and well-received by the apple and pear industry. This third iteration refined and built the original concept in order to provide better, more measurable and better documented outcomes.

The overall goal of the project was stated to be;

“Growing high quality fruit at internationally competitive prices” as outlined in the industry strategy document “New Horizons”. (From the original tender document)

The successful tenderer for the delivery of the project horticultural expertise was New Zealand agricultural consultancy, AgFirst. In their tender document, AgFirst interpreted the goal as assisting Australian apple and pear growers to produce high yields of the fruit the market desires. Specific, measurable goals were set; namely that a successful Australian apple and pear growing business requires to -

- Harvest \geq 40 tonnes per ha average across the entire business
- Pack \geq 73% Class 1 recovery
- Grow a commercially sound variety mix
- Harvest at maturities appropriate for the ultimate market window
- Control pests and diseases effectively within MRL allowances
- Be investigating export opportunities

The project commenced at the beginning of April 2012 and was due to end at the end of March 2014. It was extended four times; once for five months until the end of August 2014, again for nine months from October 2014 until the end of May 2015, then from May 2015 to August 2015 and then from August 2015 to September 2015.

The project was developed to include activities in all 8 major apple and pear growing regions in Australia and national activities embracing the entire industry.

National activities and outputs proposed and delivered by the project were;

- Data gathering, recording and analysis (using AgFirst’s OrchardNet on-line system) for the provision of orchard management and benchmarking opportunities
- 2 Orchard Business Analysis reports
- The provision of monthly articles for publication in Australian Fruit Grower
- Provision of technical notes for all orchard walk events which also add to the project library
- Provision of webinars published on line

Regional activities and outputs proposed and delivered by the project were;

- Establishment of two focus orchards in each region
- Two field trials in each region per year for the initial two years
- 4 orchard walks (2 per year) proposed and a total of 7 delivered over the extended project

Regional activities and those national activities requiring input from the regions were locally coordinated by a team of Front Line Advisors (FLAs). FLAs were drawn from several different sources including local consultants, state departments of agriculture, local fruit growing associations and commercial operations.

The project also included significant and diverse management tasks provided by APAL, AgFirst and SPW Solutions Pty Ltd.

The project outcomes have been;

- Measurable improvement in orchard performance; and
- Self-reported change in orchard practices by growers

The cumulative success of this project and its predecessors has been such that it is recommended that Future Orchards continue into a fourth iteration which has a time frame of up to 5 years.

2. Keywords

Future Orchards; apples and pears; technology transfer; focus orchards; orchard walks; benchmarking; improved performance; change; webinars; horticulture.

3. Introduction

The Future Orchards project was established by APAL in 2006 with a grant from the Federal Government. The two-year project was seen as the first step to a longer-term set of objectives which were articulated at the time as being;

- *To establish a road map to an internationally competitive Australian apple and pear industry*
- *To provide Australian apple and pear growers with the technology roadmap they need to make their orchards globally competitive now and into the future.*

The project goals were:

- *2 years: improve Australian apple and pear grower's attitude to intensification, production quality, world competitiveness and the need to understand profitability.*
- *5 years: there will be a major uptake of intensive orcharding for new plantings, while older plantings have been managed to provide maximum profitability to the orchard business.*
- *10 years: The Australian apple and pear industry will be world competitive.*

The original project, titled Future Orchards 2012 (2006 – 2008) was followed by Future Orchards Australia (2008 – 2011).

The project just completed commenced in March 2012 for two years and was extended four times to September 2015.

Future Orchards was instigated as a means to assist the Australian apple and pear industry meet the challenges of a domestic market open to import competition and the challenges of expanding its export markets.

The first project was conceived from an item in the industry's Strategic Plan and implemented when funding became available through the Department of Agriculture, Fisheries and Forestry (DAFF).

The first project was so well received, and deemed to be of such significance, that the industry has continued it since.

This iteration of the Future Orchards concept focussed on the strategic goal of “growing high quality fruit at internationally competitive prices.” To meet this goal the project emphasised orchards producing high yields of the fruit the market desires, focussing on yield, and fruit quality (size, maturity and MRLs).

Growing high quality fruit at internationally competitive prices is a subjective goal and difficult to measure; however, the project submission articulated the following goals;

- Harvest ≥ 40 tonnes per ha average across the entire business
- Pack $\geq 73\%$ Class 1 recovery
- Grow a commercially sound variety mix
- Harvest at maturities appropriate for the ultimate market window
- Control pests and diseases effectively within MRLs
- Be investigating export opportunities

To assist the industry towards these outcomes, this project undertook activities to provide information, examples and opportunities for growers to step up their productivity, quality, business management, market awareness and orchard management practices.

Future Orchards™ 3 follows guidance from the industry strategic plan which at the time was the *New Horizons 2015 – Apple and Pear Strategic Plan*. The document provides a pathway to ultimately lead the industry to a situation where “The Australian apple and pear industry will be world competitive; satisfying consumer demand for its products and with sustained profitability.” Future Orchards™ 3 meets this goal through assisting growers in improving yields, improved pack-outs resulting in growing better products and achieving better farm gate returns. Future Orchards™ 3 drove this change in the industry delivering technical guidance to enhance on farm profitability.

4 Methodology

This Future Orchards project was multi-faceted, involving a range of technology transfer techniques and a number of personnel delivering the project activities. The aspects of the project delivery can be considered either “national activities” or “regional activities”. The project actions (methodology) were;

National Activities

- National benchmarking
- Business development panel
- Webinars
- Orchard Business Analysis
- Magazine articles

Regional Activities

- Focus orchards
- Front Line Advisors
- Orchard walks
- Regional trials

4.1 National Orchard Benchmarking

Part of the tender for this project required the consultants to provide orchard benchmarking.

The selected project consultancy, AgFirst, has the established “OrchardNet” system which has the capacity to deliver this requirement.

OrchardNet breaks the orchard business into productive units or orchard blocks. Entering data into OrchardNet and using the program outputs provides growers with specific information upon which to base management decisions. It can produce reports on tree age, productivity, variety mix, profitability, fruit sizing and benchmark aspects of orchard performance against a range of local, state or national orchards.

4.2 Business Grower Development Panel (BGDP)

As part of the project submission, AgFirst included access for up to 1200 orchard blocks (approximately 1800 hectares) in the OrchardNet system including all orchard blocks for every Focus Orchard (see below) and access for other growers who agreed to some basic and minimum parameters.

Training for the use of OrchardNet was provided through webinars, by Front Line Advisors (see below) and AgFirst consultants.

4.3 Webinars

This Future Orchards project proposed using a webinar/video format to provide more information which growers could access when and as often as they wished.

The project proposal included the production of 5 webinars/videos on topics related to tree management issues and two further webinars to provide training in the use of OrchardNet.

The seven webinars added to the 12 previously produced and a final addition made in May 2015 to make a library of 20 available through the APAL website.

4.4 Orchard Business Analysis

The objective of the Orchard Business Analysis (OBA) was stated in the project proposal as “to determine the productivity and economic performance of the Australian pome fruit industry in each year for which an OBA is carried out”.

To create an OBA, physical and financial data was collected. The proposal was to recruit 24 orchard businesses, located throughout Australia to contribute data for analysis.

Previously OBAs had been completed for both 2008 and 2010. The initial project proposal was to develop OBAs for 2011 and 2012. The project extension proposed to deliver an OBA for 2013 based on actual data and, to improve timeliness, for 2014 based on forecast data.

The purposes and uses of an OBA include; the creation of an Australian model orchard; tracking productivity, pack out and profitability at the business level; tracking cost of production; division of performance into quartiles; provision of quality industry data; and the provision of a written commentary on industry outcomes.

All OBAs have been delivered as proposed with the resulting reports adding valuable data to not only growers but key industry decision makers.

4.5 Magazine Articles

The project proposal included one magazine article in every issue of Australian Fruit Grower magazine. The articles were to provide technical, time specific content including; case studies of Focus Orchards; outcomes of trials; and other relevant information. Articles were described in the proposal as; relevant to the time of the year; relating directly to focus orchards and benchmarking outcomes; including several authors; and of a high standard.

4.6 Regional Focus Orchards

The project proposal included the introduction of focus orchards - a concept that was discussed between APAL and AgFirst for about 12 months prior to the submission being made.

The focus orchard concept was seen as a way to refresh and intensify the Future Orchards program.

The objective of the Focus Orchard network was stated as to “provide a platform to demonstrate the adoption of ‘best practice’ and new technology”.

The goals of the network were; to provide the ability to demonstrate “best practice”; generate commitment by local growers; improve integration with local FLAs through their involvement; and improve the skills of local support personnel.

2 Focus Orchards in each region were instigated.

Focus Orchard participants were required to commit to specific involvement in the project and were offered a range of advantages such as business assessment and planning, FLA assistance with OrchardNet data entry and orchard data gathering, and the opportunity to host local field trials.

4.7 Regional Front Line Advisors

Administration of a multi-faceted project being delivered in 8 different regions in 6 states across Australia presents a complex logistical challenge. To overcome the inherent issues a Front Line Advisor (FLA) was contracted in each region.

FLA tasks included all local management activities such as organising orchard walks, communicating with local growers, promoting OrchardNet and working with Focus Orchards.

4.8 Orchard Walks

Orchard walks are the central activity of the Future Orchards technology transfer project. Having called on previous experience regarding the timing of the events, AgFirst proposed to APAL that two orchard walks per year be carried out. As the original two year project was extended by 5 months, then later by a further 8 months, then another 4 months the total number of Orchard Walks for the project was 8. The last extension from August 2015 to September did not include Orchard Walks.

Orchard walks are timed to coincide with vital orchard activities. The project included events during winter and spring each year with an extra event to coincide with the harvest time in March 2015.

It was expected that the Focus Orchards in each region would host the orchard walks, however, orchard walk could be conducted on any property that provided a good venue for the topic under discussion.

Presentation notes prepared prior to the event were distributed at the orchard walks and added to the on-line project library.

4.9 Management and Oversight

Management of the project was provided by a team including representatives of APAL, AgFirst and a person contracted to provide other management functions.

It was decided to commence the project with a meeting of the entire management / consulting team to ensure coordinated decision making. A second, similar meeting was held about the time the second extension commenced.

5 Outputs

All the different aspects of the project methodology produced outputs for the project.

5.1 National Orchard Benchmarking

The data now available in the OrchardNet system is very extensive. Growers using the system are now able to benchmark their own orchard performance against others. This benchmarking can be carried out against other growers in the same region, other growers in the same state and other growers nationally.

Examples of the parameters that can be benchmarked are;

- Tonnes per hectare overall
- Tonnes per hectare by variety
- Class 1 pack out overall
- Class 1 pack out by major varieties
- Revenue per hectare
- Fruit growth rate monitoring and benchmarking

5.2 Business grower development panel

The Business Grower Development Panel comprises all the growers who have decided to add orchard data to OrchardNet. Complete and detailed information has been provided in Milestone Reports and the key data have been summarised here. The output from the BGDG comprises the entire dataset held in OrchardNet. It is this data set that allows for national orchard benchmarking (see above), and any data query APAL wants or needs for research or reporting purposes.

The data included in the last Milestone report indicated that:

- The number of companies using OrchardNet has increased
- The total number of blocks recorded in OrchardNet is increasing
- Growers using OrchardNet are entering more historic data
- Users appear to becoming more efficient in their use of OrchardNet
- The advent of AP13013 Apple & Pear Industry Data Collection has increased the use of OrchardNet significantly
- The number of growers using the fruit sizing tool in OrchardNet is increasing, they are adding more blocks and an increasing area of orchard to this section every year.
- Entries for block year production actual data and estimated data are both increasing
- The overall use of OrchardNet is growing

5.3 Webinars

The APAL YouTube channel now includes 20 webinars, all of which were made by AgFirst and 16 of which have been added during this current project.

Topics covered by the webinars and the dates of posting are;

#	Title	Posted
1	Fruit Size Monitoring In the Field	13/11/12
2	OrchardNet® Training Webinar	6/6/12
3	Fruit Size Monitoring Using OrchardNet®	14/2/12
4	Optimising Harvest	13/2/12

5	Pruning Demonstration	22/11/11
6	Variation in Flowering	20/11/11
7	Orchard Systems: A few to compare	28/8/12
8	Orchard Systems Pt 2: Show me the money	28/8/12
9	Bud Counting and TCA Measurement	12/8/12
10	Improving ATS Effectiveness	30/9/12
11	Picking Techniques: Picking & Fruit Handling	10/1/13
12	Picking Techniques: Ladder Work	9/1/13
13	Picking Techniques: Fruit Line-up	9/1/13
14	Picking Techniques: Bag Setup & Bin Filling	9/1/13
15	Crop Review	20/5/13
16	Rules for Modern Pruning Systems	9/6/13
17	Improving Chemical Thinning Result	26/9/13
18	Field Trials - Simple Steps	16/10/13
19	Assessing Fruit Maturity	23/1/14
20	New Orchard Planting Systems	5/5/15

5.4 Orchard Business Analysis

During this project Orchard Business Analysis reports were produced for each of 2011, 2012, 2013 and 2014. APAL considers these documents to be sensitive and confidential and so they have never been published in their entirety.

For growers, the most visible output from the OBA activity was a series of four magazine articles providing information on three specific findings from the OBA; production volumes; class 1 recovery; and orchard costs. The articles appeared in March, April and May of 2013 and October 2014.

The OBA is also proving useful to the Australian research community. For example DEPI has sought a copy to assist in an economic study of netting.

There have also been other requests from researchers who find the information is valuable to their work. The benefit to the apple and pear industry is that researchers become more efficient as they do not need to start by gathering the orchard data they require and, because research projects can now be based on a single, reliable data set, the outcomes of various projects will be more comparable.

5.5 Magazine articles

In total 50 magazine articles were submitted and published during the project. The contract required one article per issue or a total of 40 for the project (note: one issue is published for December and January each year and no funding was provide for September 2014) – a total that was well exceeded. The titles and publication date for each article is listed below.

Publication Month	Title
May 2012	Pruning – a critical factor in orchard performance
June 2012	Walk This Way – Future Orchards
June 2012	Pruning – getting the job done well
July 2012	Orchard Profitability – Strategies & Management
August 2012	Future Orchards wraps up orchard walks

August 2012	Achieving Better Black Spot Control
September 2012	Chemical Thinning – a tool for managing biennial bearing
October 2012	Focus Orchards Update No 1
November 2012	Crop Loading: The key to an Easy harvest
Dec/Jan 2013	Pear industry Developments
February 2013	Focus Orchard Update
February 2013	OrchardNet reels in key data
March 2013	Postharvest Management
March 2013	Australian Orchard Business Analysis Part 1
April 2013	Australian Orchard Business Analysis Part 2
April 2013	Strategic Planning: Critical for Business Success
May 2013	Orchard Walks Announced
May 2013	Australian Orchard Business Analysis Part 3
May 2013	Focus Orchards Get a Handle on Issues
June 2013	Mechanisation: A Strategy to Stay Competitive
July 2013	Future Orchards team creates hive of activity in the north
July 2013	Risk Management: control what you can, manage what you can't
August 2013	The Art of Post-Harvest Management: Part 2
September 2013	Focus Orchard: How to improve orchard returns by \$18,000 per hectare
October 2013	Growing Season Vigour Management
November 2013	Focus Orchard: More water for increased tree growth
Dec '13 / Jan'14	Focus Orchard Update No. 4: Reviewing Successes and Failures
March 2014	Focus Orchard Update 5: Harvest Management
April 2014	Strategic Planning on Orchards Raises Profitability
May 2014	Managing Orchards for Fruit Size
June 2014	Pruning: Setting up the Tree Canopy for Future Crops
July 2014	Overcoming the Effects of Spring Frosts
August 2014	Future Orchards Winter Walks
August 2014	Orchard trials Shape Future Management Strategies
Oct 2014	Orchard Business Analysis: 2013 and 2014 forecast
Dec/Jan	A Critical Time for Orchard Management
Feb 2015	Post-harvest Orchard Management
Feb 2015	Spraying Lessons and Orchard Business Analysis
March 2015	Future Orchards Focuses on Mechanisation
March 2015	Multi Leader Trees and Mechanical Pruning in Europe
April 2015	Improving Harvest Efficiencies with Picking Platforms
May 2015	Pressing on when nature is against you: Grafting Success
June 2015	Understanding Irrigation Requirements
June 2015	Improving labour productivity in orchards
July 2015	Q&A at Battunga Orchards: Harvesting data and pruning by numbers
August 2015	Spring crop management
September 2015	Lightbulbs moments mark for orchard innovations
September 2015	The Australian orchard of the future
October 2015	Perfecting your orchard's nutrient balance
November 2015	High orchard performance depends on good thinning

The magazine articles are an example of world class outputs from the Future Orchards project. The articles were seasonally appropriate (pruning article published in May, harvest management article published in March, Growing Season Vigour Management in October, etc.), covered management

topics (Orchard Profitability, OrchardNet Reels in Key Data, Strategic Planning Critical for Orchard Success, etc.), included case studies from focus orchards (5 Focus Orchard Update articles), and covered a wide range of orchard topics.

5.6 Regional focus orchards

The regional focus orchards activity of the project provided a range of outputs some of which were exclusively for the Focus Orchard but many of which were available for all growers.

Focus orchards provided significant data to OrchardNet, thus contributing to the benchmarking aspects of the project.

Focus orchards were predominately the hosts for orchard walks, contributing significantly to the outputs of that part of the project.

Focus orchards also helped to devise and hosted regional trials of issues identified as being of local significance. The trials were conducted by the Front Line Advisors (see below).

Focus orchards also provided subject matter for many of the magazine articles and case studies.

Examples of the great outputs from the Focus Orchards program can be found in magazine articles;

October 2012	Focus Orchards Update No 1
February 2013	Focus Orchard Update
May 2013	Focus Orchards Get a Handle on Issues
September 2013	Focus Orchard: How to improve orchard returns by \$18,000 per hectare
November 2013	Focus Orchard: More water for increased tree growth
Dec '13 / Jan'14	Focus Orchard Update No. 4: Reviewing Successes and Failures
March 2014	Focus Orchard Update 5: Harvest Management

Orchard walk presentations also included Focus Orchard case studies. These case studies can be found in the Future orchards library and include the June 2014 presentations; Focus Orchard learnings 2012-14 by Ross Wilson and Craig Hornblow of AgFirst; Focus Orchards – the power of numbers by Jason Shields of Plunkett Orchards and Listen to the Experts by Peter Sanders of Three Bridges Orchard.

5.7 Appointment of Front Line Advisors

Much of the work of the Front Line Advisors was administrative in nature or contributory to other outcomes. Examples of these activities are; organising orchard walk events, gathering fruit sizing and other tree data from focus orchards, liaising with AgFirst consultants and focus orchardists; encouraging other growers to use OrchardNet; and provide assistance with the program interface.

The local orchard trials took place in both of the first two years with all regions requested to establish 2 trials per year. Theoretically, this should have been 32 trials with reports and outcomes. Owing to some issues with FLAs (see below), the total number of trials conducted, completed and reported over the two years was 30 with Batlow and Orange regions completing extra trials, Southern Victoria and Western Australia completing 3 trials in two years, and Tasmania not completing any trials.

A comprehensive list of the trials appears below.

Place	Trial Topic	Year
Southern Victoria	A comparison of 2 fumigants and 2 bio inoculants	Year 1

Batlow #1	Do pruning rules work?	Year 1
Batlow #2	Effectiveness of root pruning	Year 1
Batlow #3	Step grafting versus crown bark grafting	Year 1
Stanthorpe #1	Compare various tree treatments to encourage growth in 4 year old Gala trees.	Year 1
Stanthorpe #2	Regalis spray timing effect on shoot growth of Royal Gala trees	Year 1
South Australia #1	Using Summer NAA spray and root ripping to reduce biennial bearing in Fuji trees.	Year 1
South Australia #2	Trialling various methods to encourage growth in young trees planted in non-fumigated replant block	Year 1
Northern Victoria #1	Determining the impact of variations in pruning time for Corella pear trees.	Year 1
Northern Victoria #2	As above for Cripps Pink trees.	Year 1
Western Australia	Best fertigation practices for optimum young apple tree growth	Year 1
Orange #1	Effect on tree growth from fumigating soil	Year 1
Orange #2	Efficacy of black spot sprays for prevention or cure	Year 1
Stanthorpe #1	Are Our Spray Thinning Decisions Robust?	Year 2
Stanthorpe #2	Enhancing Young tree Growth	Year 2
Western Australia #1	Best Fertigation Practice for Optimum Young tree Growth	Year 2
Western Australia #2	Focus Orchard Trial results 2014	Year 2
Orange #1	Root Pruning Pink Lady Orchard	Year 2
Orange #2	Are Our Spray Thinning Decisions Robust?	Year 2
Orange #3	Fertiliser Budgeting in Pink Lady Apple Orchard	Year 2
South Australia #1	Root Pruning (Report & Presentation)	Year 2
South Australia #2	Growth effects of GA applications on Kanzi Trees	Year 2
Batlow #1	Summary of Future Orchards® Trials	Year 2
Batlow #2	Root Pruning Field Demonstration	Year 2
Batlow #3	Simple Pruning Rules and Post Frost Pruning Demo	Year 2
Southern Victoria #1	Ruby Pink Fruit Quality When Grown in Singles vs Clusters	Year 2
Southern Victoria #2	Optimal Pink Lady Crop Load for Optimal Canopy Development	Year 2
Goulburn Valley #1	Establishing Tree Height in young Cripps Pink trees	Year 2
Goulburn Valley #2	Comparing the use of Regalis and Ethrel for Vigour	Year 2

Each of the trials was reported in written form and reported to growers at an Orchard Walk event. Trial outputs also featured in many of the magazine articles including most of the Focus Orchard Update articles and many of the technical articles.

All the trial descriptions and outcomes can be found in the Future Orchards library on the APAL website.

5.8 Orchard walks

The orchard walks are the centrepiece of the Future Orchards project. The outputs of this activity are;

- The events themselves. Each orchard walk represents a long half day of activity including presentations of material by a range of people including AgFirst personnel, APAL personnel, guest presenters (local and international) and FLAs. The events also include significant time spent in orchards with the presenters. Here the presenters provide practical demonstrations of the topics discussed and answer participants' questions. In the orchard the discussion can become quite wide-ranging depending on the nature of the orchard being

visited. The orchard walks are an opportunity for the host orchardists to show off their best blocks and to seek advice about those not performing as well. In this process, all the attending orchardists are able to gain further insights into orchard management and productivity.

- Additions to the project library. Over the years of the previous Future Orchards projects and the 37 months of this project, every orchard walk has added quality material to the Future Orchards Library. This collection now represents the most comprehensive set of practical orchard advice available in Australia. All the articles and presentations developed for the orchard walks are available through the APAL website. The library contains nearly 300 different items including presentation notes, presentation data files, webinars, magazine articles and statistical data.

6 Outcomes

The outcomes of any technology transfer project can be difficult to measure, but APAL believes that the documented outcomes of the Future Orchards projects over time are impressive. The data below shows improvements in orchard performance and change in grower behaviour arising from the Future Orchards project.

6.1 Measurable Change

The Orchard Business Analysis reports have now gathered significant industry data from 2008 to 2014. At first glance, the data appear to show only that seasons are highly variable. However, graphing the data and including a trend line shows average yield, class one recovery and revenue per hectare are all improving over time and trending to further improvement.

The graphs illustrating these trends have been redacted and is considered to be sensitive industry information.

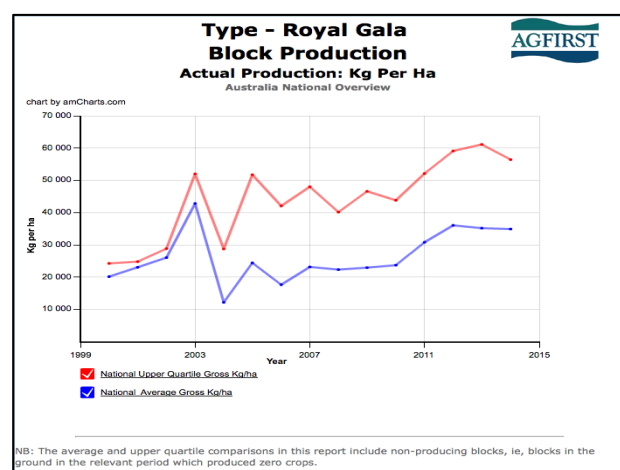
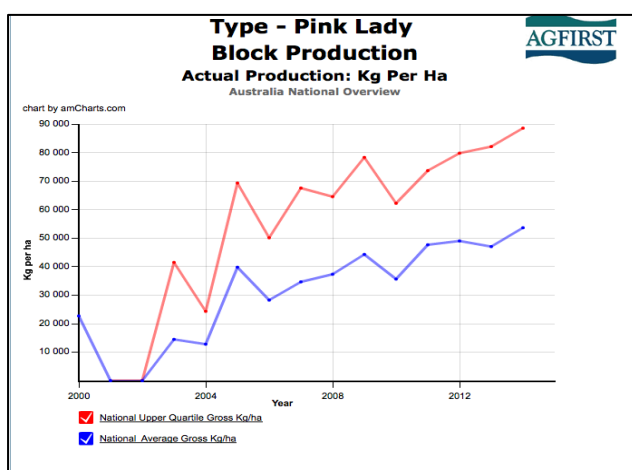
OrchardNet also enables tracking and graphing of national yield per hectare by variety data for major varieties.

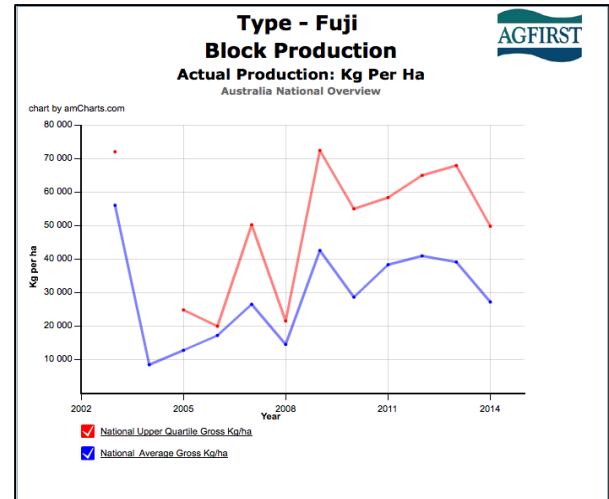
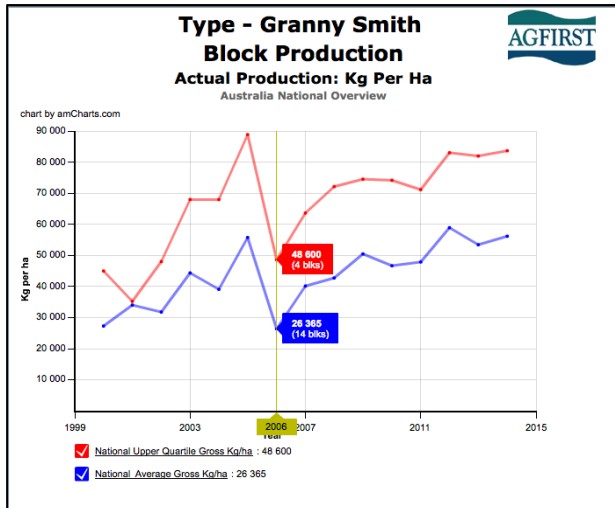
Increased Production by Variety

The following four graphs show the change in gross yield of Australia's four major varieties over the Future Orchards project period 2006 to 2014. The blue graph lines show the national average and the red the upper quartile average.

Considering the national average data, during the period 2006 to 2014:

1. Pink Lady increasing from 38t/ha to 55t/ha (83% increase)
2. Royal Gala increasing from 20t/ha to 35t/ha (75% increase)
3. Granny Smith from 30t/ha to 55t/ha (83% increase)
4. Fuji from 20t/ha to 40t/ha (100% increase)





6.2 Behavioural Change

All growers attending orchard walk events were asked to complete assessment forms.

One of the most important of the questionnaires (November 2013) asked growers whether or not attending Future Orchards events had led them to change any practices in their orchards.

Of the growers who returned questionnaires, 80% stated they had already made changes to their orchard as a result of being involved in the Future Orchards project, 13% had not made changes but were planning to and 7% had not made changes and did not intend to do so. 93% of the growers surveyed had either made changes or were planning to do so.

These survey results indicated that behavioural change in orcharding has been an outcome of the Future Orchards project. The specific areas where growers reported making changes were;

- Tree training
- Chemical thinning
- Pruning
- Vigour control
- Managing crop load
- Replanted block(s)
- Fertiligation
- Assessing crop load
- Tree spacing in new planting
- Fruit size monitoring
- Pest & disease control
- Orchard record keeping
- Tree density in new planting
- Labour management
- Business planning
- Harvest management
- Replant soil preparation
- Picker training
- Pollination practices

Most growers who answered in the affirmative indicated changes in more than one area.

6.3 Examples of Success

Through the course of the project, each AgFirst consultant has been asked to provide highlights from the regions to which he has been appointed. Some of these individual examples of success are;

- The performance of the young Jazz blocks Omodei orchard in WA. (AgFirst comment September 2014)
- The Newton Brothers orchard in WA planned to increase average orchard productivity across all blocks by 15% to reach or exceed a target of 50 t/ha by 2015. In 2013 the average across all blocks was 58 t/ha. (AgFirst comment September 2014)

- Sanders focus orchard in Southern Victoria achieved a significant improvement in crop yields and quality during the course of the project. The Sanders' experience was presented at the June 2014 orchard walk series.
- Success on multiple levels at Battunga Orchard in Southern Victoria was featured in the AFG magazine article "Focus Orchards Get a Handle on Issues" in May 2013.
- The Calthorpe orchard in Tasmania embarked upon a redevelopment and improvement strategy. For more details refer to: 'Strategic Planning on Orchards raises Profitability,' AFG magazine, April 2014, P 28-31.
- Oakleigh orchard in South Australia produced some great crop outcomes and worked well with FLA and AgFirst. This orchard was included in the Australian Fruit Grower article "Focus Orchard Update no. 4: Reviewing Successes and Failures" in December 2013 and "Managing Orchards for Fruit Size" in May 2014. Oakleigh Orchard set itself a goal of achieving 100 tonnes per ha on a block of Rosy Glow and achieved 108 t/ha (90% Class 1 and an average fruit size of 170 grams) in 2014. This outcome was documented and presented at the June 2014 orchard walk series and in the paper "Future Orchard Learning 2012 to 2014".
- Flavell family has made many changes to orchard management during the project increasing harvests from 31 t/ha in 2012 to 41t/ha in 2014.
- Late in 2014, South Australian orchardist, Robert Green, was named the ABC Rural and Kondinin Group Farmer of the Year. In his interview with Australian Fruit Grower magazine, Robert mentioned the influence and importance of the Future Orchards project. "I've been a vocal supporter of the Future Orchards program" said Robert. "I think it's been one of the better programs in terms of growers' levy money spent and its value and return on investment." (Australian Fruit Grower April 2015)

7 Evaluation/Discussion

7.1 Project Evaluation

Future Orchards has been evaluating throughout, by issuing questionnaires to all those attending events, in a mid-term independent evaluation and in a telephone survey of Focus Orchards and FLAs.

All evaluations indicate this is an excellent project which is making a difference. The independent evaluation indicates it is of significant benefit to the industry.

All evaluations have produced suggestions for improvement and commentary on the current project. APAL takes all such input seriously and has discussed changes to the project during its lifespan and for the next project iteration.

7.2 Evaluation at Orchard Walks by Attendee Questionnaire

Value of Orchard Walks

The 8 orchard walk events have all included assessment questionnaires, all of which have been reported in the project Milestones.

In summary, the assessment forms noted that;

- 100% found the consultants' presentations valuable or of some value
- 100% found the guests' presentations to be valuable or of some value

- 100% found that any other presentations made (e.g. local trial outcomes) were valuable or of some value
- 99% found the in orchard presentations valuable or of some value
- 99% found that visiting the Orchard Walk venues was valuable or of some value
- 98% found the opportunity to meet with other growers valuable or of some value.

With regard to relevance of content;

- 99% learnt something that would work in their orchard or business
- 95% learnt something they would definitely implement in their orchard or business
- 99% thought they would attend other Future Orchards events.

Other Items Surveyed at Orchard Walks by Attendee Questionnaire

Webinars and the Future Orchards Library

- About half of responders knew of the existence of the webinars
- About a third of responders had actually watched a webinar
- Of those who had watched webinars 99% rated them valuable or of some value.

Articles in Australian Fruit Grower magazine

- About 85% of responders were aware of the articles
- About the same number actually read the articles
- 98% of those who read the articles found them to valuable or of some value.

Changes in Orchard Practice

As a result of attending orchard walk events

- 80% of growers had actually made changes and
- many growers had made changes in more than one aspect of their orchard practice
- A further 13% were planning to make changes (see section 6.2 above).

Attendance and Non-Attendance at Orchard Walks

- Many have been attending since the project commenced
- About a third indicated they had started attending during the current project.
- 84% gave external reasons non-attendance (I was sick, I was too busy, etc.).
- 11% gave organisational reasons for non-attendance (I didn't know it was on; I didn't know where it was; etc.).
- 5 responders cited reasons related to content. 1 response was "I couldn't see any value" and 4 said the event was on at the wrong time of the year.

Importance of Project Activities

- Orchard walks ranked as very important or important by 100% of responders
- Presentation notes, Australian guest speakers, Australian guest presenters and local trials were next four ranked activities
- All but 3 of the activities were ranked very important or important by $\geq 93\%$ of responders.

- The lowest ranked 3 items were access to OrchardNet; webinars; and specific pear activities.

Focus Orchards

- awareness of the focus orchards 84%
- knowledge of which local orchards were focus orchards 75%
- 94% stated that Focus Orchards helped them to gain from the project
- 98% stated that focus orchards should continue in the future

7.3 Debrief Reports and Milestone Inputs by AgFirst Personnel

After each round of orchard walk events the lead AgFirst consultant is to provide a “debrief report”. These reports describe the round of events, the conditions encountered, the efficiency of the operation and impressions of the reception by growers. These subjective evaluations provide insights into the project and changes that are observed. All debriefs have been attachments to Milestone reports.

AgFirst consultants are also asked to provide inputs for each Milestone Reports through specific questionnaires. Comments from these reports have been used to complete Milestones over the life of the project.

7.4 Independent Project Review

In September 2013 an independent review, commissioned by HAL and carried out by Scott Williams Consulting and Miracle Dog, was published.

The abstract of the review is below:

“This independent review of the Future Orchards (FO) project concludes that it is an excellent extension project, highly regarded by the vast majority of the industry. It is very likely that FO is delivering significant economic returns to the industry, although the evidence for this conclusion is somewhat fragmented and indirect. In addition, there is very strong support for the continuation of the program. It is quite possible that FO is delivering far greater benefit than existing evaluation processes indicate.

Notwithstanding, the review has identified some areas where FO may be enhanced.

The project review’s recommendations have been considered by project management. Some recommendations were implemented immediately, some have been incorporated into the next project proposal and some have been rejected impractical or unaffordable.

7.5 APAL Questionnaires for Front Line Advisors and Focus Orchardists

As part of its consideration of a new Future Orchards project, APAL commissioned a consultant to conduct a telephone survey of all Focus Orchardists and Front Line Advisors. The opinion of the consultant was;

“The views of these growers who have Focus Orchards on their property are overwhelmingly positive. They have learned and grown. Their businesses are better. They love the one on one interaction with (the consultants). They have benefitted extensively.”

“A number felt “guilty” that they had got so much from the program when other growers nearby hadn’t got much.”

This summary was followed by a discussion of the outcomes which included the following:

“The nub of the issue (to me) is that while the grower who has a FocOrch site on his/her property benefits hugely, how well do other growers of the region benefit? My guess is (due to the comments about feeling guilty) not very much.”

This view does not align with the views expressed by growers attending the March 2015 orchard walks. A discussion of their views appears in the last Milestone report and a summary at 7.2 (above)

FLAs were asked 10 questions relating the Focus Orchards. The conclusions drawn were;

“The FLAs generally support FO and the FocOrch work. The biggest concern is that while the growers who host the FocOrch sites definitely benefit from the FocOrch program, not enough “other” growers benefit. Accordingly, two FLAs feel that there are better ways forward.”

It can be noted that no “better ways” were included in the discussion.

8 Recommendations

- 1 That Future Orchards should continue into another iteration and the new Future Orchards project should be contracted for the longest time period possible – up to 5 years.

Assuming recommendation 1 is accepted the following recommendations will also apply.

Deliverables

- 2 That the project be strongly focussed on change that is measurable through the Orchard Business Analysis process and through OrchardNet especially yield per hectare and class 1 pack outs (see 6.1.2)

Orchard Walks

- 3 That orchard walks continue as the centre piece of the project. (see 7.2.2 Importance of Project Activities)
- 4 That the general format of orchard walks remains, including a presentation segment and an in-orchard segment. Presenters be an appropriate mix of AgFirst, FLA and APAL personnel as well as guests from Australia and overseas
- 5 That orchard walks in years 1, 3 and 5 be held 3 times per year including a harvest time walk.
- 6 That orchard walks in years 2 and 4 be held twice per year in Winter and Spring
- 7 That spring orchard walks alternate between September and November to capture the two critical pre-Summer orchard activity phases.
- 8 That the PIPS project activity be integrated into Future Orchards by including a PIPS presentation at each orchard walk. The costs of this activity to be borne by the PIPS project.

Front Line Advisors

- 9 That regional management of project activities be carried out by a network of Front Line Advisors (FLAs) as has previously been the case.

- 10 That the budget for FLAs be reviewed and sufficient funds provided to allow for notes to be printed in colour and appropriate disbursements for refreshments.
- 11 That the management budget be increased to allow for more management input around the FLA activity.

Focus Orchards

- 12 That the Focus Orchard approach be continued but be restricted to 1 per region. The first group of Focus Orchards to be in place for 2½ years and then replaced with a second group.

Local Orchard Trials

- 13 That 2 local orchard trials, overseen by the FLAs, be carried out each year of the project.

Business Development Group

- 14 That growers continue to be encouraged to use the OrchardNet program and that FLAs continue to assist growers new to the system to understand it and gain facility in its use.

Orchard Business Analysis Reports

- 15 That annual Orchard Business Analysis reports be compiled and made more timely by including the year for which sales have been completed and a forecast for the current year.

Pear Specific Activities

- 16 That the Future Orchards team provide one specific pear industry “masterclass” per year to be held in the Goulburn Valley in Victoria. These events will be coordinated by AgFirst Australia and would be an additional cost outside the Future Orchards budget.

Communications

- 17 That communications continue as a main feature of the project including monthly articles in Australian Fruit Grower magazine, additions to the Future Orchards library, e-mailed newsletters to the Business Development Group, regular contact between AgFirst personnel and Focus Orchardists, and other communications activities as required.
- 18 That AgFirst explores communications technologies which may enhance data gathering and/or communications, for example a smart phone application.

Project Advisory Committee

- 19 That a project advisory committee be appointed and meet annually with project management personnel to review project progress and provide advice on implementation activities.

Management

- 20 That the project budget allow for two meetings of the project implementation team; one at the beginning of the project and one about half way through.
- 21 That the management function be allocated in a similar fashion to previously with major project oversight and financial management provided by APAL, technical management and communications activities provided by AgFirst, local management and organisational activities provided by FLAs, and management of FLAs, project internal assessment and all reporting functions be outsourced or managed by APAL, as required.