Final Report

Dried Grape Production Innovation and Adoption Program 2018-2021

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Dried Fruits Australia

Project code:

DG17001

Project:

Dried Grape Production Innovation and Adoption Program 2018-2021 (DG17001)

Disclaimer:

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Content

Summary

The primary aim of the project was to work with dried grape producers in promoting and exchanging leading and emerging research and knowledge on production techniques to assist with productivity improvements. This will enhance industry capacity, production, participants breadth of skills, along with maintaining quality dried grapes that match customers' expectations.

Three key delivery elements of this project were:

1. Workshop – "Reducing pruning labour"

This workshop looked for ideas to reduce the cost of winter pruning dried grapes. Pruning is the biggest cost activity in dried grape production.

The workshop included leading dried grape growers, processors, national and international robotics experts and local machinery and electrical experts. The workshop identified 3 key areas for detailed investigation.

1. How well can the physiology of the swing arm production system adapt to mechanised pruning.
2. Designing an efficient and affective cutting system that can prune up to 5 acres a day leaving only a small amount of hand pruning.
3. Making incremental improvements to current pruning systems

The detail behind these concepts was developed into a report for the Hort Innovation dried grape SIAP recommending consideration of 9 areas of investment associated with the issue.

3. Delivery of technology transfer events

The project delivered 34 discreet on-site or on-line technology transfer events incorporating 42 separate information presentation sessions. In addition to this four non site specific Technology Transfer activities were provided including the development of a certificate IV in horticulture for the dried grape industry; a two year trial program on the use of Chlormequat sprays to meet European MRL requirement in Currant production; a revision of the content and layout of the industry Best Practice Guides; and coordination of a development program to fund, build and trial a mechanized vine pruning system

4. Benchmarking production systems

The Project has delivered annual benchmarking on 12 sites over three seasons across the Sunraysia region. Key elements of the program have involved capturing viticulture activities during the year with a particular focus on time "spent on" and "timing of" activities and inputs on all key activities during the year. Each of the sites has been mapped and data collected across three seasons looking at all cultural activities including, pruning, nutrition, disease control, weed control, canopy management, irrigation, wetting, cutting and harvesting. The benchmarking program has delivered two annual reports in the dried grape industry "The Vine" magazine

Keywords

Pruning
Yield
Benchmarking
Technology Transfer
Innovation
GrapeInvest
Mechanisation
Management
Evaluation

Introduction

With market demand for Australian quality dried grapes increasing it was, and still is, important to pursue knowledge on innovative and efficient systems that will increase productivity of the dried grape production system. Through direct contact with dried grape producers, located primarily in the geographic region from Swan Hill to the Riverland of NSW, Victoria and South Australia, Dried Fruits Australia with Hort Innovation funding has provided an industry development service that has helped extend the capacity, scale, and skills of those involved in this important food industry sector.

Maintaining strong linkages and information exchange with current Australian and global research and development professionals has been pivotal for productivity; biosecurity; risk minimisation; and enabling producer capacity. Dried Fruits Australia continues to work diligently in maintaining a global and Australian network of research and development professionals, along with biosecurity and market information to assist producers in these areas.

Engaging with existing and new industry participants through the provision of information on key research and development issues and exploring innovative opportunities, is key to continuing to propel the industry forward and in reaching a goal of 30,000 tonnes of dried grape production per annum.

This project provided these crucial benefits and was aligned particularly with Outcomes 2 and 3 of the Dried Grape Strategic Investment Plan 2017-2021, with direct benefits flowing through to Outcome 1.

Outcome 2 Increase the volume of high quality dried fruit produced: Research, development, extension and delivery of key information to producers on critical issues for the industry, such as yield, quality, climate, biosecurity and cost of production are vital areas that contribute to quality and quantity of fruit produced. Understanding the industry sector and being able to engage in an appropriate and relevant manner with industry participants, along with the provision of experienced personnel on these issues, is an important service which Dried Fruits Australia has been able to deliver through this project. Through ongoing consultation with producers and processors, Dried Fruits Australia has determined important issues that industry stakeholders were keen to learn more about which has contributed to growing overall efficiency, yield and profitability. These issues included adoption of new varieties; vineyard management practices such as the costs associated with winter pruning; disease management; irrigation; and adoption and familiarisation with information technology.

Outcome 3 The capacity of industry participants is increased: Increasing the capacity of industry participants is an area that Dried Fruits Australia takes very seriously. Through various field walks; study tours; panel sessions with researchers; encouraging innovation amongst industry participants; engagement with world leading researchers – Dried Fruits Australia has increasingly encouraged and delivered engagement with researchers bringing new ideas and resources to the dried grape industry sector.

Outcome 1 Increased demand for Australian product in high-value markets: Through delivery of the project outputs already discussed, Australian producers of dried grapes have been provided with information, resources and feedback to assist them in maintaining and increasing the quality dried grape product that is in demand in both the domestic and export markets.

Methodology

The key to success for this program was to focus on improved profitability of dried grape enterprises. The three overarching elements impacting profitability are Product Price, Cost of Production and Production levels. There was very limited opportunity to influence price within this program hence the obvious aspirational targets were increasing Production Levels and reducing Cost of Production. With regards to Cost of Production the program focused on maintaining cost control rather than significantly trying to reduce input costs which carries a significant risk of reducing yield.

The primary aim of the project was to work with dried grape producers in promoting and exchanging leading and emerging research and knowledge on production techniques that will assist with productivity improvements. The aim was to enhance industry capacity, production, participants breadth of skills, along with maintaining quality dried grapes that match customers' expectations.

The four key elements that combined to form the framework of this project were.

1. Workshop – "Reducing pruning labour"
2. Preparation of annual innovation and adoption plan
3. Delivery of technology transfer events
4. Benchmarking production systems

Workshop – "Reducing pruning labour": A critically important and specific activity of the project was the coordination of a workshop to identify reducing the cost of the winter pruning process. Pruning currently accounts for nearly 30 % of the cost of producing dried fruit. Insight from the 2017 DFA lead, Hort Innovation funded, dried grape study tour to California revealed pre-production technology capable of robotically pruning grape vines. While the cost and stage of development of this particular system is not currently suitable for the Australian Dried Grape industry it revealed that there were realistic technologies available to reduce the cost of labour involved in pruning.

The workshop investigated relevant technologies from a wide range of Horticultural industries. It brought together appropriately skilled and experienced people from key organisations to discuss and assess options for development of lower cost pruning systems.

Annual Planning: The annual planning process involved consultation with all dried fruit growers across the industry facilitated initially through the regional branches of Dried Fruits Australia and then the Drying for Profit Committee. This process identified the most important issues to be addressed at technology transfer sessions throughout the year.

This information was combined with recommendations from other projects such as DG 17000 (Californian study tour), DG 12006 (New rootstocks to improve production and water use efficiency, sustainability and reduce risks of dried grape production) and MT15026(Evaluation of dried and table grape varieties) along with input from key researchers at CSIRO and Agriculture Victoria.

These ideas were then developed into the annual "Adoption and Innovation" program. Obviously, adaptions to the program were made during the year in response to any extraordinary seasonal conditions that occurred.

Technology Transfer Events: The technology transfer events were the backbone of the program. They primarily comprised combined workshops and field walk formats. DFA's analysis of previous evaluation from technology transfer events (DG 13001) clearly indicated that growers got more value out of sessions where they can listen to information and then follow up immediately with a hands-on session to see it in practice. Other event types included tours and forums.

The design of all events focused on the supporting the Knowledge acquisition, Attitudes, Aspirations and Skill acquisition of participants. All events were designed to promote social networking allowing for the informal exchange of ideas between growers which will often support and sometimes go beyond the scope of the program in terms of assisting growers to adopt best practice methods that suit their business.

Content for each of the events was sourced through DFA's significant network including:

- Leading growers currently operating in the industry

- Key Australian research organisations (Agriculture Victoria, CSIRO and Universities)
- International research organisations (USDA, Californian Department of Agriculture and University of California, Kearney Agricultural Research and Extension Centre)
- Key international industry contacts in; California, China, Turkey
- Australian dried grape processors and marketers (Sunbeam, Australian Premium Dried Fruits and Murray River organics)

Where possible all events were recorded. Edited versions of these recordings from these events were uploaded to the DFA YouTube channel for those growers who couldn't attend in person to be able to view all of the information presented. These videos now form a technical library for dried grape producers

Benchmarking: Key production systems of the industry were benchmarked across the three full production years of the project. It mainly focused on Swing arm trellis for the two new varieties, Sunglo and Sunmuscat.

Structure of the benchmarking program in terms of data collection across the chosen sites was built around the framework used to run the BizMod program. While BizMod was primarily focused on redevelopment costs and returns within the dried grape industry it also provided a well-considered framework for analysing the industry production system. Using this framework allowed the benchmarking data to be used in the redevelopment of the Bizmod program into the online model GrapeInvest.

Specifically, data from the benchmarking activity provided more accurate benchmarks of production per hectare, production practices, prices received and input cost.

Benchmarking also provided information and site visits for the technology transfer events program.

Outputs

The project delivered 34 discreet on-site or on-line technology transfer events incorporating 42 separate information presentation sessions. The events covered a wide range of production issues. Their selection was guided by input from industry participants at annual review sessions and DFA's "Drying for Profit Committee". Evaluation results on all 42 presentations demonstrates that the information was always well presented with the lowest average rating of the quality of presentations being a 4 in a 5-point scale.

The project additionally delivered four non site specific Technology Transfer activities including the development of a certificate IV in horticulture for the dried grape industry; a two year trial program on the use of Chlormequat sprays to meet European MRL requirement in Currant production; a revision of the content and layout of the industry Best Practice Guides; and coordination of a development program to fund, build and trial a mechanized vine pruning system. Managed on an annual basis through an Innovation and Adoption plan developed through close collaboration between Hort Innovation and DFA, these Technology transfer activities clearly amount to meeting the target 38 activities contracted to be delivered over the life of the project. Details on each of the activities delivered in each year with supporting documentation and web links is contained in Appendices 1- 4.

The Project has delivered annual benchmarking on 12 sites across the Sunraysia region. Key elements of the program have involved capturing viticulture activities during the year with a particular focus on time spent on and timing of activities and inputs on all key activities during the year. Each of the sites have been mapped and data collected across three seasons looking at all cultural activities including, pruning, nutrition, disease control, weed control, canopy management, irrigation, wetting, cutting and harvesting. The benchmarking program has delivered two annual reports in "The Vine" magazine. A summary of three years data collection is available in Appendix 5.

The project delivered a major workshop on winter pruning labour. The workshop looked for ideas to reduce the cost of winter pruning dried grapes. Pruning is probably the biggest cost activity in dried grape production. If the industry can reduce pruning costs in a similar way that mechanised harvest reduced the cost of harvest, then there are significant benefits for improving the profitability of dried grape production.

The workshop included leading dried grape growers, processors, robotics experts and local machinery and electrical experts. Through two half days of examining current pruning practice, learning about the technical capabilities of robotics and agricultural machinery engineering along with some time to think and consider the options a group of 20 participants identified 3 key areas for detailed investigation.

1. How well can the physiology of the swing arm production system adapt to mechanised pruning.

2. Designing an efficient and affective cutting system that can prune up to 5 acres a day leaving only a small amount of hand pruning.
3. Making incremental improvements to current pruning systems

The detail behind these concepts was developed into a report for the Hort Innovation dried grape SIAP recommending consideration of 9 areas of investment associated with the issue. A lack of funding in the Hort Innovation Dried Grape investment program meant that resources form DG17001 were redirected from the Technology Transfer Events outputs (see above) into securing other sources of funding for the identified priorities and managing the delivery of that research, specifically the development of a mechanized pruning system.

As part of the last round of technology transfer events in January 2021 the project delivered a Research, Development and Extension planning forum with 22 industry participants.

The day resulted in three major themes for Hort Innovation and DFA to investigate.

1. Education and training
2. New production systems
3. Automation and mechanisation

Education and training

The industry has a range of knowledge development, knowledge sharing, and skill development needs in a range of different target audiences.

For the purposes of this program we can consider them to be

- Industry leadership
- Farm management
- Farm operation
- Understanding of industry investment potential

New production systems

The focus of this theme was around keeping the benefits we already have with current production system based around swing arm trellis, and consider if there are any improvements or changes that could be investigated that would result in either lower cost of production or improved production levels for the same cost. A rigorous approach is required to ensure the industry does not lose the gains, made in production systems improvements in the past 30 years.

Automation and Mechanisation

The automation and mechanisation theme have two obvious components. Firstly, can we mechanise any systems that are currently unmechanized? Automation would be the next step taking out one or more of the human inputs to that process such as driving the tractor.

Information from these three themes has helped inform the development of the next Hort Innovation Dried Grape Strategic Investment Plan (SIP).

Through the delivery of all of these outputs the project worked to accumulate an online learning platform. This is now hosted on the DFA You Tube channel but also represents the use of Facebook live streaming; events hosted on Microsoft teams; and specific video presentations hosted on the You tube channel. The project has developed 18 new videos on the DFA channel https://www.youtube.com/channel/UCX0YH4NFH8Jxh1pJoMu493A/videos. Cumulatively these videos were viewed 4568 times. The videos that generated the most views were on Vine Pruning, Vine Physiology and Fruit Dehydration.

Outcomes

Evaluation data from the technology transfer events show that the participants intended to use much of the information shared during the events. Analysis of the 42 presentations evaluated over the life of the project show that the average intent to use the information in participants' farm business is scored 4.4 on a 5-point scale, where 5 is the strongest intent to use.

Obviously, there was a lot of variation across the individual topics. The topics with the highest intent to use (4.7-5.0) tended to be those readily applicable to existing operations e.g. irrigation monitoring, weed management, vine nutrition and pruning.

Others that are less applicable to immediate implementation such as use of satellite and aerial imagery for vineyard management (2.9-3.9).

A presentation on using Aerial Imagery for managing vineyards had the lowest score on this of 2.9. This is likely driven by two things. First the audience at the event were mostly small-scale growers (up to 25 Ha) and didn't feel they needed this overview information because they can visually inspect their operation more frequently than the imaging system. The second is that the score may reflect that this technology, for Dried Grapes, is still in the development /demonstration phase rather than adoption. Use of the technology will build experience and help set some of the trigger benchmarks that will make its use more practical.

There was also a group of events in a medium range of intent to use (4.0-4.6) based on the farming business models where it was obvious participants were picking up pieces of information that suited their needs and perhaps not all of what was being presented.

Another key outcome was the learning that participants felt they achieved as a result of participating in each of these presentations. All of the presentations showed participants rated their knowledge on the topic after the event as higher than before the event. There were of course individuals who rated their knowledge before and after as the same where they already understood that topic. In the review meetings each year this issue was discussed, and the response was always that participants were happy with this as they saw it as an investment in reinforcing their management decisions.

Interestingly the biggest improvements in participants' knowledge was not necessarily positively associated with their intent to use the information in their business. Both the Satellite imaging and Aerial imaging events were rated highest for improvement in participants' knowledge. Hopefully this represents a strong investment in the future adaptability and adoption of this information.

The benchmarking program has been able to help the industry demonstrate for the first in several decades that it has a strong investment potential. The key outcomes of the reports highlighted the potential of these sites to consistently produce at or above 10 tonnes per hectare, which is a key turning point in production levels resulting in significant profitability for the industry. Consistent evidence of 10 tonne per hectare production did not exist overtly within the industry prior to this program. This evidence has been used in another project to help build and promote the GrapeInvest model for investment into the Dried Grape industry. This model has currently been used by six investment organisations to assess relative investment opportunities in the Dried Grape industry.

The program also demonstrated the financial and labour saving benefits of the minimal pruning system which reduced pruning costs by 28%. This new system is now in early adoption phase across 30 ha in two growers' properties.

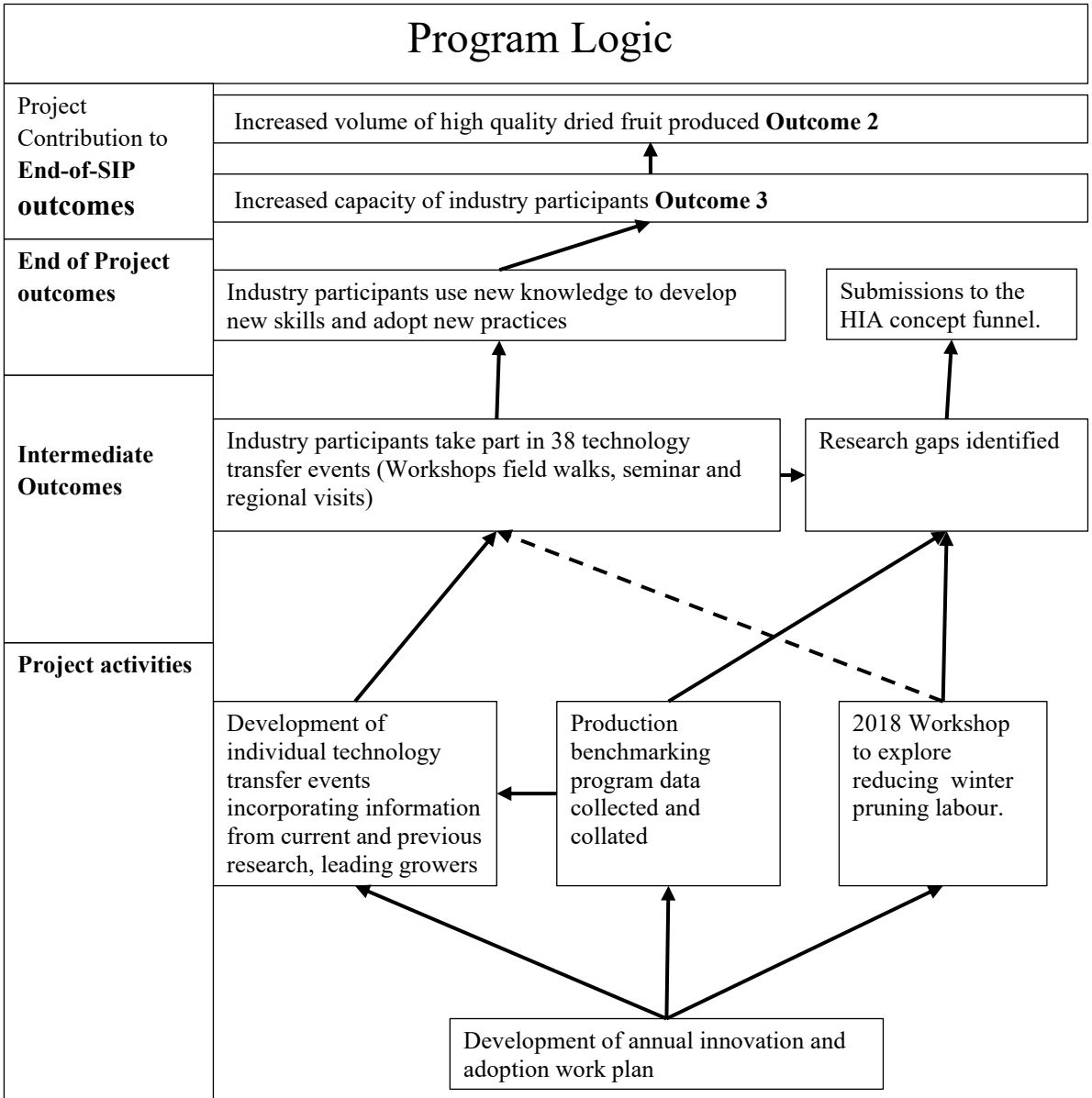
Another key outcome of the benchmarking program was the ability of growers to match nutrition requirements of vines. Historically the dried grape industry has had significant problems with excessive cane growth and subsequent shading reducing vine fruitfulness. This historic issue has been a significant barrier to adoption of proper nutrition programs for vines growing on modern trellis systems at wider spacing which avoid the shading issue. All of the sites in the benchmarking program that were producing 10 tonnes per hectare and above were using a nutrition program that replace nutrients at a rate equal to or above the rate of nutrient removal associated with taking of the crop. This focus on improved nutrition will now be an important part of DFA's future extension programs to help build industry production levels.

Finally, the focus of the project on future research and development opportunities has led to the development of a prototype mechanical pruning system. If fully realized this development will cut out 20-30% of the cost of production for dried grapes.

Monitoring and evaluation

The following program logic was developed as the project was initiated and this was used to help guide the development of the key evaluation question and the gathering of evaluation data.

Figure 1 Logic model for project


Program Logic
Project Contribution to End-of-SIP outcomes
Increased volume of high quality dried fruit produced Outcome 2
Increased capacity of industry participants Outcome 3
End of Project outcomes
Industry participants use new knowledge to develop new skills and adopt new practices
Submissions to the HIA concept funnel.
Intermediate Outcomes
Industry participants take part in 38 technology transfer events (Workshops field walks, seminar and regional visits)
Research gaps identified
Project activities
Development of individual technology transfer events incorporating information from current and previous research, leading growers
Production benchmarking program data collected and collated
2018 Workshop to explore reducing winter pruning labour.
Development of annual innovation and adoption work plan
Resources
Dried grape growers, Extensive DFA industry communication network, Hort Innov investment, Industry Investment, DFA and Hort Innov Staff and Dried Grape SIAP members, DFA board members, DFA regional branches.
Foundational Activities
Annual consultation with growers, researchers and marketers to identify the most important knowledge and skill gaps in preparation for development of annual innovation and adoption work plan outlining technology transfer events.
Identification of 10 benchmarking sites
Development of Benchmarking protocol
Project and financial management processes implemented

Evaluation of the industry technology transfer events used Dried Fruits Australia's evaluation framework. It gathered information on the changes in knowledge, attitude, skills and aspirations of participants at the events with a combined pre and post survey.

For each presenter (or topic) at each technology transfer event participants were asked to fill out a one-page survey to answer the following questions using a 5-point scale (1- low through to 5 – high)

1. How do you rate the quality of the information presented?
2. How do you rate the usefulness of the information presented?
3. How do you rate your understanding of the topic before this presentation?
4. How do you rate your understanding of the topic after the presentation?
5. What is the likelihood of you using some of this information in your business in the future?

In the one-page survey participants will also be asked for written feedback on:

1. Any improvement on how this event was run
2. Any other information they would like to hear about at future events

Basic data on the number of participants, participant's role within industry and how they heard about the event will also be gathered as part of the one-page survey at each event.

DFA's experience with this evaluation process demonstrates that it is effective in understanding the three most important areas.

1. Likely on-farm uptake of issues discussed and investigated at technology transfer events,
2. Improvement in knowledge and skills of participants
3. The perceived quality of the event and the presenters

Data from these surveys and the annual review meeting with project participants. Has been used to answer the key evaluation questions

KEQ	Source and method
To what extent did participants adopt new practices and processes? To what extent has the project improved participants' knowledge and awareness of best practice?	*Results of the evaluation data indicate that participants had a strong intention to adopt information into there business. On average across the 42 different presentations evaluated participants rated their intent to adopt at 4.4 on a 5-point scale* *Across all but one of the 42 presentations surveyed participants indicated that they had learned new information about the topic*
To what extent have participants (Industry levy payers) valued the activities delivered in the project?	*Over the project there were 449 attendances at events from 120 individual participants. This indicates significant return business by participants and by implication satisfaction with the value the project*

	activities delivered.
What proportion of the industry were engaged in the face to face activities? What were the engagement levels with the information delivered through the DFA on line learning platforms?	*Attendance records show that 120 industry people attended the face to face events, this represents nearly half of the 250 estimated growers in the industry* *The project's 18 on-line videos associated with the technology transfer events have had 4568 views and will remain as an information source on DFA's You Tube channel*
How did participants find out about the activities delivered in the project	*The biggest information source for notification of events was "Currant News" followed by DFA's Text message Service< DFA's face book page and "other Growers"*
What process or content improvements were made as a result of reviewing from evaluation feedback.	*There were a number of minor suggestions for improvement in the delivery of events*

Recommendations

Three main recommendations form the project are ;

1. Dried grape producers and stakeholders have shown that they value extension work and platforms that assist in promotion of innovation, current and relevant research, and information that assists with long term sustainability of the industry.
2. Benchmarking over three years has proven valuable to the industry and should continue in a lesser form to allow the industry to track yields from known patches over a longer period of time.
3. Support for industry development projects that bring resources in from alternate sources should continue.
4. Industry participants greatly value the opportunity to participate in well planned face to face events so these should continue.

Refereed scientific publications

N/A

References

N/A

Intellectual property, commercialisation and confidentiality

No project IP, project outputs, commercialisation or confidentiality issues to report

Acknowledgements

Dried Fruits Australia (DFA) would like to acknowledge the range of guest speakers present at field walks and grower forums held over the last three years. These guest speakers have been diverse and have come from relevant scientific and viticultural areas along with those from the farming and business sector. DFA would also like to acknowledge Hort Innovation, the Drying for Profit Committee and the Board of DFA for their ongoing support and input to this very important program for the dried grape industry.

Appendices

Appendix One DG 17001 Dec 2018 report

Appendix Two DG 17001 Dec 2019 report

Appendix Three DG 17001 Dec 2020 report

Appendix Four DG 17001 Dec 2021 report

Appendix Five Benchmarking 3 year summary

Appendix Six – refer to DFA YouTube Channel as listed below (223 subscribers)

https://www.youtube.com/channel/UCX0YH4NFH8Jxh1pJoMu493A

APPENDIX ONE: DG17001 **Reporting against 2018 Innovation and adoption plan:**

Topic	**Event**	**Timing / Location**	**Progress**	**Comments**
Project introduction	Media release	April "The Vine"	Completed	The "Vine" article "New Industry Development Program Launched" Also included in "The Vine" was the "Best Practice In Action" article, highlighting forthcoming pruning activities and promoting the "Dried Grape Best Practice Guide" http://www.driedfruitsaustralia.org.au/library/files/o_1ca71hd0p3231gsqg641vg6eub7.pdf
Dehydration systems	Tech Transfer event 1 Farm Visits & Seminar	18th of April, at Tony Martin's and Terry Hunyadi's properties	Completed	21 people attended the event at Tony Martin's property and Terry Hunyadi's commercial dehydration facility in Merbein. Growers discussed the technicalities of finish drying fruit and looked at the cost of getting fruit dried commercially. They also discussed a new Swiss solar drying system. Evaluation showed growers took on new information that would change some aspect of how they run the finish drying component of their business Information available on E learning platform: https://www.facebook.com/DriedFruitsAustralia/videos/692061907584479/ https://www.youtube.com/channel/UCX0YH4NFH8Jxh1pJoMu493A
Fruit Quality • Physical contamination	Tech Transfer event 2	20th of June at Sunbeam's processing	Completed	There were several difficulties in coordinating suitable times and locations for these events. Eventually the decision was taken to combine the events into one.

Topic	Event	Timing / Location	Progress	Comments
• Chemical Contamination	Processing line visit & seminar	plant in Irymple.		12 people attended a breakfast meeting at the Sunbeam processing factory. Sunbeam staff provide a factory tour and lead a discussion of latest trends in marketing of dried grapes; fruit quality and MRL issues associated with dried grape production. MADEC staff lead a discussion on compliance issues and OH&S responsibilities with regard to seasonal labour. Evaluation showed that participants took away new information from both sessions that would influence how they run their businesses in the future.
Labour management • Finding skilled labour • How to manage people • Legal requirements	Tech Transfer event 3 Seminar			
Reducing Winter pruning costs	Workshop and vineyard visit	27th 28th June at Agriculture Victoria, Irymple Mildura	Completed	The workshop was run over two days (27th &28th of June) Evaluation results were positive. Findings of the workshop were collated into a document "Hort Innovation / DFA Workshop results "Reducing cost of winter pruning in dried grape production" 27th -28th June 2018". The report was presented to the Dried Grape SIAP meeting on the 30th of August where recommendations from the workshop were prioritised for investment and action. Video of some of the infield presentations has been loaded onto the DFA YouTube channel https://www.youtube.com/watch?v=gYQiOGmhM3w To date this video has had 81 views.

Topic	Event	Timing / Location	Progress	Comments
				"Current News" Post event article: https://mailchi.mp/7312517fc219/currant-news-12-july-488329 See APPENDIX 4 Report, "Reducing cost of winter pruning in dried grape production"
Winter Pruning	Vineyard discussion	10th of June at Brian Boulton's vineyard at Vinifera near Swan Hill	Completed	12 growers around Vinifera and Nyah region attended a field walk to look at pruning practices. Ivan Shaw lead a discussion with the group that focussed on the key issues with pruning swing arm trellis. All the participants indicated that they got real value out of the discussion. Video of the presentation has been loaded onto the DFA you tube channel https://www.youtube.com/watch?v=BqiTDuHD9pg To date this video has had 76 views "Current News" Post event article: https://mailchi.mp/49a67dff778b/currant-news-9-august-500589
Water Trading	Discussion	17th of June Mildura	Completed	Event held at the DFA office with a presentation form Peter Morrish from Rural co. 15 growers attended. The evaluation of the event was very positive with a strong indication that participants took home a lot of new information. "Current News" Post event article: https://mailchi.mp/49a67dff778b/currant-news-9-august-500589
Benchmarking	Identification of benchmarking sites	June Mildura	Completed	Seven growers with a total of ten sites have been identified and initial data gathered on the properties. Sites are located at Pomona, Irymple, Cardross and Red Cliffs. Sites focus on new varieties (Sunmuscat and SunGlo) with some Sultanas and

Topic	Event	Timing / Location	Progress	Comments
				Currants included for comparison. All are grown on the industry best practice Swing Arm trellis system.
Introduction to benchmarking program	Media release	July "The Vine"	Completed	"The Vine" article; Dried Grape Production Benchmarking Also included in "The Vine" was the "Best Practice In Action" article, highlighting forthcoming Vineyard Health and Quality Control issues and promoting the "Dried Grape Best Practice Guide" http://www.driedfruitsaustralia.org.au/library/files/o_1cgsn0cabl04lv6djbomj1hsp7.pdf
Farm Security • Biological • Criminal	Tech Transfer event 4 Seminar	2nd of August at David Lyon's property Red Cliffs	Completed	16 growers attended this event at David Lyons property on August 2nd. Mark Baumann from Mildura police presented a session on making your property secure and Dr Amanda Kobelt from Agriculture Victoria discussed some of the most significant biosecurity threats to the industry and what growers can do if they identify a new pest they are concerned about. "Currant News" promotion:https://mailchi.mp/8b6dcb425dbe/currant-news-26-july-494345
Benchmarking	Round 1 data collection	July, Mildura	Completed	Initial collection of site data and establishment of information collection sheets completed
Benchmarking Vineyard Walk	Farm Visit as part of event 4	2nd of August at David Lyon's property Red Cliffs	Completed	As part of the Farm Security event the benchmarking program was introduced, and discussion focussed around the differences in pruning practices. David Lyons demonstrated his pruning system and all other benchmarking participants in attendance made comment on differences in their system.
Industry statistics	Report collated on	August	Completed	Available production, import and export figures were collated and presented at the annual Growers Forum and published in the 2018 DFA Annual Report. The project

Topic	Event	Timing / Location	Progress	Comments
	2017/18 season production, import and export figures from ABS and Processors figures			also assisted in the development of new GIS project with SunRISE21 to accurately map all dried grape production areas in Vic, NSW and SA. This ongoing piece of work will improve rigour in collating annual production figures. http://www.driedfruitsaustralia.org.au/userfiles/presentations/DFAannualreport2018.pdf
Business growth • Redevelopment planning. • Business succession • Farm financing options	Tech Transfer event 5 Seminar with discussion panel.	5th of September at Mark King's property at Pomona	Completed	10 people attended. Steve Wait presented information on business development, financing options and succession planning. Stuart Putland also presented some basic information on avoiding herbicide resistance in weed populations in response to some discussions recently held on the Dried fruit growers messenger app. Also presented was data from the benchmarking program highlighting the relative inputs for pruning at each site. "Currant News" promotion:https://mailchi.mp/53aaa3201699/currant-news-23-aug-507601
Benchmarking Vineyard Walk	Farm Visit as part of event 5	5th of September at Mark King's property at Pomona		As part of the Business Growth event Mark and Jason King showed participants the patch of sunglo that is included in the benchmarking program. Discussion was around pruning and weed control programs.
Spray equipment efficacy	Tech Transfer event 6 Farm visit and	1st of November at Lloyds property in Irymple	Completed	Twelve people attended. Alison MacGregor presented information on the key issues on spray application and sprayer set up. After this, participants investigated the set of three different spray rigs. "Currant News" promotion:https://mailchi.mp/b4d8d56a2c6f/currant-news-18-oct-2018

Topic	Event	Timing / Location	Progress	Comments
	demonstrations			In a collaboration between DFA and Murray Valley Wine growers, dried grape growers that attended the DFA pruning workshop in Swan Hill were sent an invitation to the spray application workshop in Swan Hill presented by Alison Macgregor and organised by Murray Valley Wine Growers but none attended.
Benchmarking Vineyard walk	Farm Visit as part of event 6	September, Mildura	Cancelled	Block walk cancelled because the associated spray application workshop required more time
Industry tour	Tech Transfer event 7 NSW (Uni Sydney robotics, Griffith prune industry and dried grape producers visits,	October	Postponed	Tour planned for the last week of November but cancelled because of lack of numbers. Planned tour included visits to the prune and walnut industries, National Wine and Grape Industry Centre at Wagga, Goulburn Murray Water presentation on river operations and a tour of irrigation industries with Agriculture Victoria from Echuca to Swan Hill. Agreement was reached with HIA to cancel the tour and look at including it in next year's program, possibly after harvest.
DFA Members forum	Tech Transfer event 8 Seminar	8th of November Mildura		Forty-six people attended the DFA growers' forum in Mildura. The program included industry presentations from DFA, each of the major processors, National Farmers Federation and Plant Health Australia. Technical presentations from University of Adelaide on Vineyard cooling and CSIRO on Rootstock and new varieties research. Video of Dr Vinay Pagay's presentation was streamed live to the DFA facebook page https://www.facebook.com/DriedFruitsAustralia/videos/269929636989248/ To date this video has had 94 views.

Topic	Event	Timing / Location	Progress	Comments
				"Currant News" promotion : https://mailchi.mp/e0af36119dee/currant-news-1-nov-543569 "Current News" Post event article: https://mailchi.mp/7505f6a8eb57/dfa-currant-news-550989 All forum PowerPoint presentations have been made available on the DFA website: http://www.driedfruitsaustralia.org.au/2018-annual-conference
Benchmarking	Round 2 data collection	October Mildura		Data collected, process is now ongoing. See APPENDIX 3
Review of winter pruning workshop	Media Release	October "The Vine"	Completed	"The Vine" article; "Winter pruning; the results are in" Also included in "The Vine" was the "Best Practice In Action" article, highlighting forthcoming pest and disease control issues and promoting the "Dried Grape Best Practice Guide" http://www.driedfruitsaustralia.org.au/library/files/o_1cop42em9aai1at1qosrhdqak7.pdf
Irrigation • Variety specific irrigation strategies • Vineyard Cooling • "Irrisat" program	Tech Transfer event 9 Seminar	7th of November at Lory's property in the South Australian Riverland at Loxton	Completed	Thirteen people attended the workshop . Jeremy Giddings from Agriculture Victoria presented information on using capacitance probe technology to schedule irrigation and some of the idiosyncrasies of key dried grape varieties. Dr. Vinay Pagay from the University of Adelaide presented information on the impact of adding extra irrigation water to cool vineyards in heat wave conditions. "Currant News" promotion: https://mailchi.mp/e0af36119dee/currant-news-1-nov-543569

Topic	Event	Timing / Location	Progress	Comments
Benchmarking Vineyard walk	Farm Visit as part of event 9	7th of November Loxton South Australia	Completed	The irrigation event included a tour of the Lory's vineyard even though this wasn't a benchmarking site.
Annual Focus group review	Tech Transfer event 10 Focus Group	13th of December Mildura	Completed	Only 4 growers attended the review session and 4 apologies from people who had intended to participate. Review of 2017 program was positive indicating experience growers benefited from reinforcement of their knowledge and skills and picking up small bit of new information. Apart from the presentations networking with other experienced growers was seen as very valuable. The most valuable session was identified as the water trading event as it presented information that most participants did not have. This response aligned with the evaluation data collected at the event which also indicated it was the most valued event. Feed back via one of the large corporate produces from new staff that attended one of the workshops was that it was highly informative and motivating for them. The session also focussed on developing a 2019 program.
Review of the project for the year	Media Release	December "The Vine	Completed	https://www.driedfruitsaustralia.org.au/the-vine-january-2019/
Benchmarking tour	Stick Beak tour	20th of December. Agriculture Victoria, Gardner's,	Completed	Currant News promotion: https://mailchi.mp/9d544c1b313c/wk6kjscr1z I8 growers attended this event. Evaluation feedback from the event was positive indicating participants found information that they can use in their businesses. See evaluation results below.

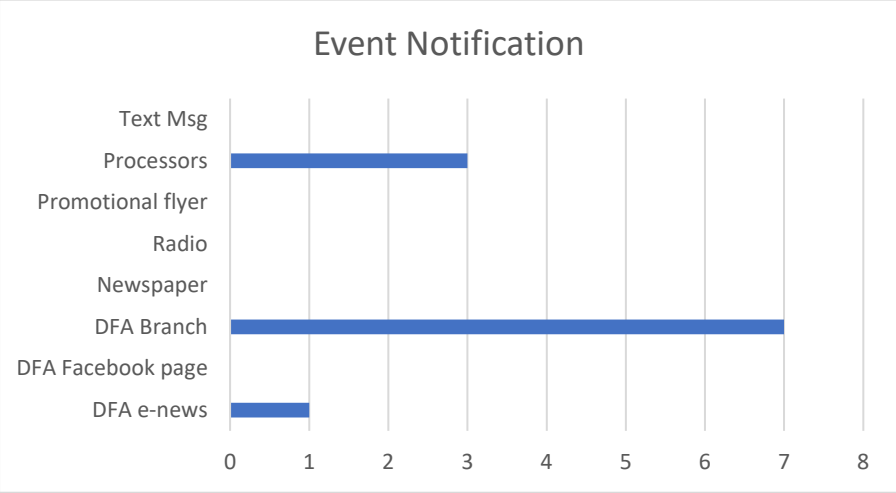
Topic	Event	Timing / Location	Progress	Comments
		Hunt's and Treeby's properties		

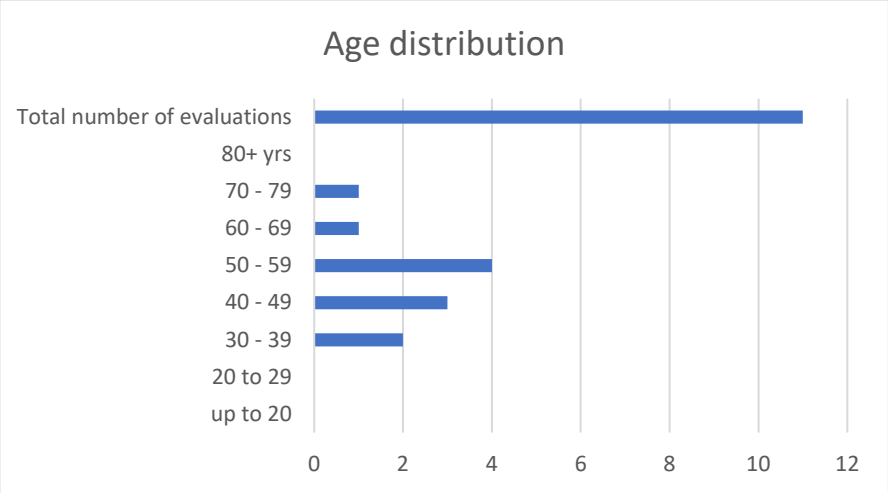
Workshop Evaluation results

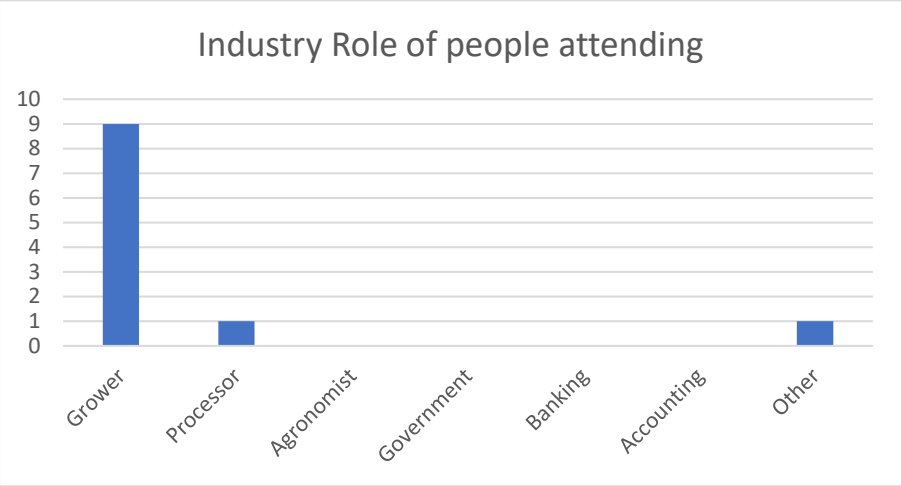
The seven workshop events during the second half of the year were evaluated. All of the evaluations confirmed that the quality and relevance of the presentations were sound. In all instances participants were able to identify that it was very likely that they were likely to use some of the information presented in their business. The best evaluation results in terms of amount of new information learned by participants was the “Water Trading “discussion held at the dried Fruits Australia office with Peter Morrish from Ruralco.

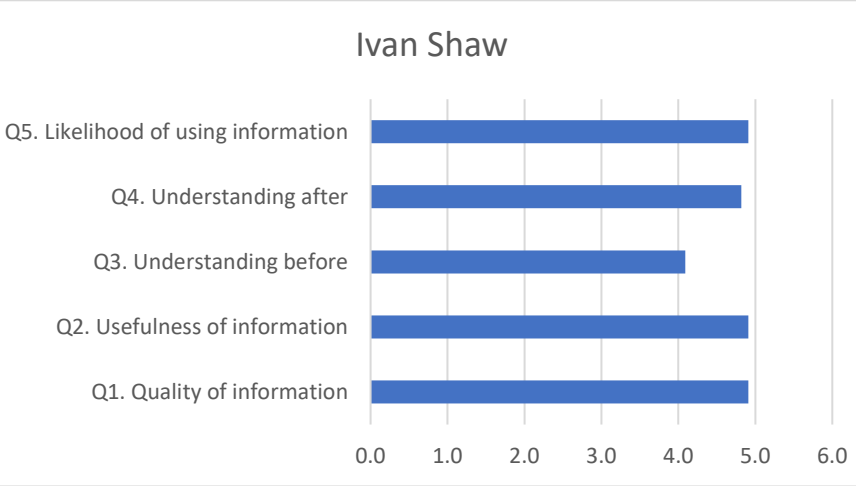
Winter pruning. July 17, 2018 Evaluation Data.

- 15 Attended
- 12 Evaluations





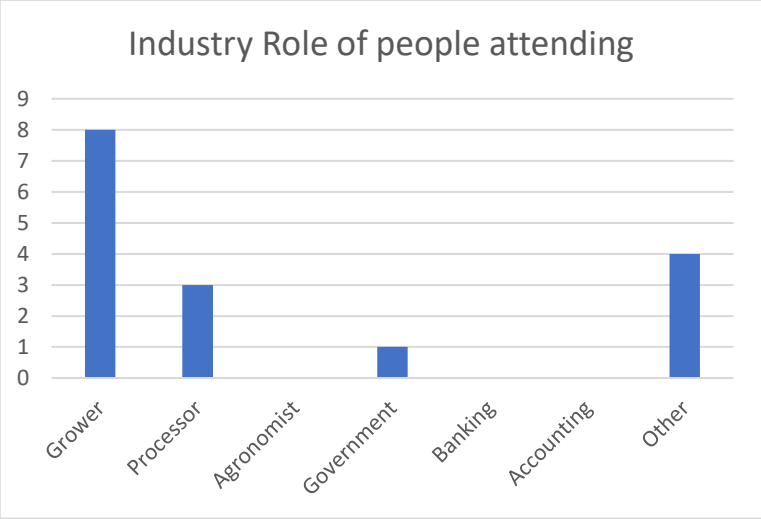


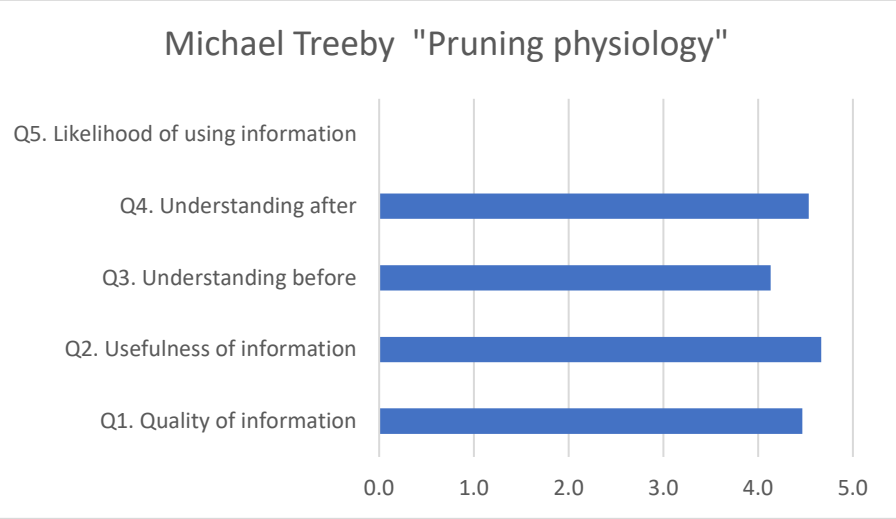


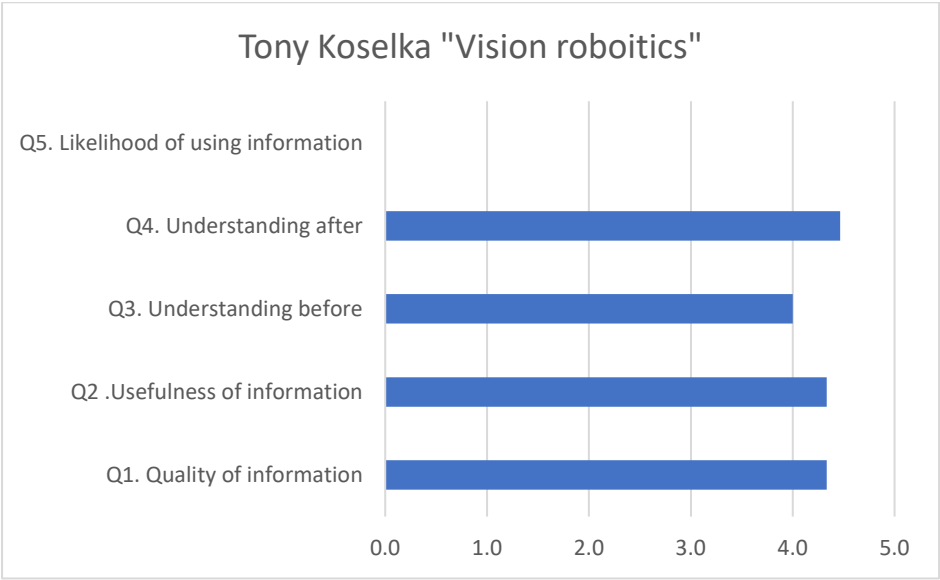
	Ivan Shaw
Q1. Quality of information	4.9
Q2. Usefulness of information	4.9
Q3. Understanding before	4.1
Q4. Understanding after	4.8
Q5. Likelihood of using information	4.9

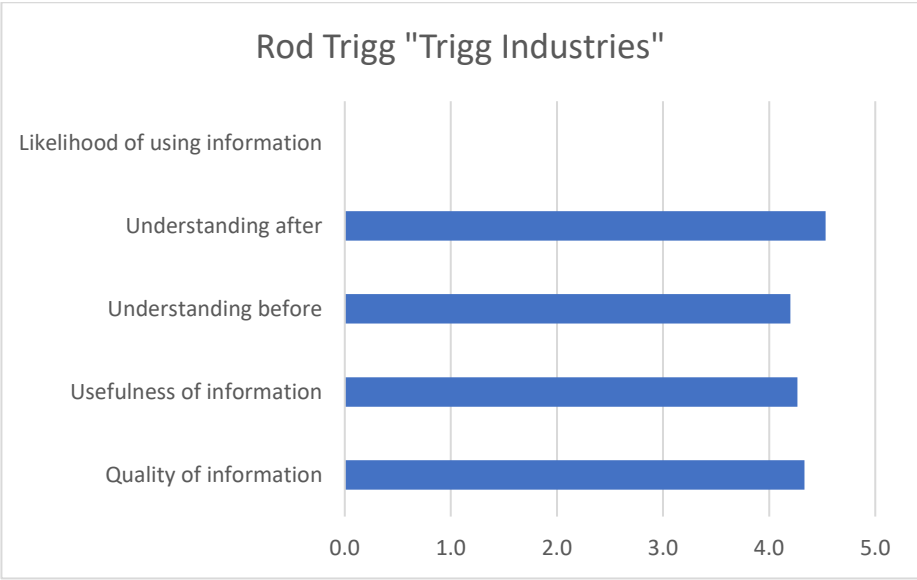
DFA /Hort Innovation “Reducing cost of winter pruning” workshop. June 27+28th, 2018 Evaluation Data.

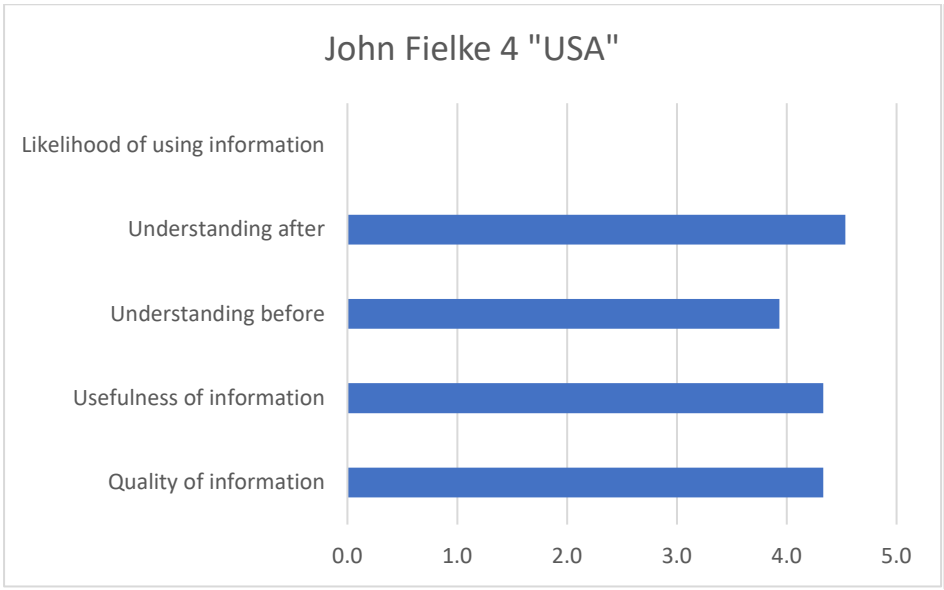
- 21 Attended
- 16 Evaluations

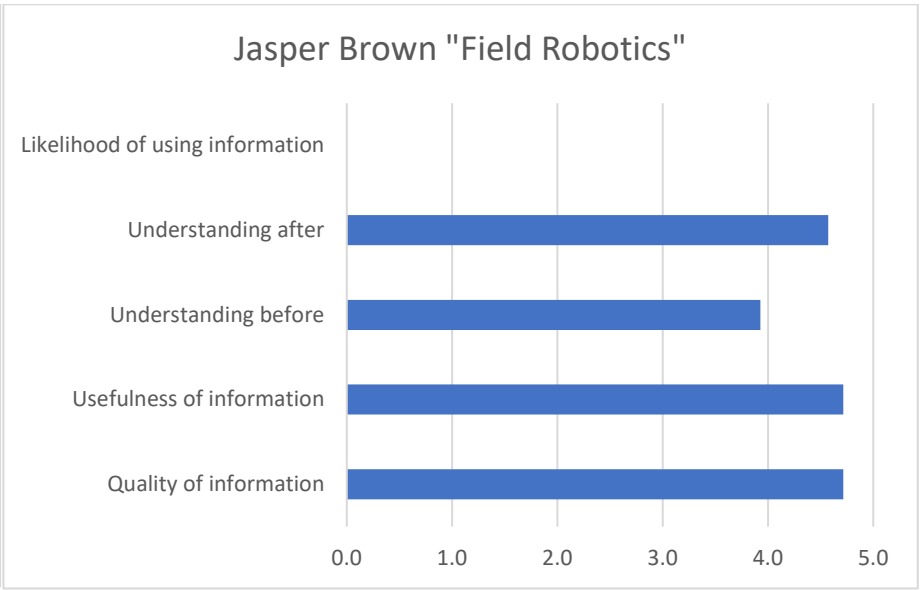





Tony Koselka "Vision roboitics"
Q5. Likelihood of using information
Q4. Understanding after
Q3. Understanding before
Q2 .Usefulness of information
Q1. Quality of information
0.0
1.0
2.0
3.0
4.0
5.0

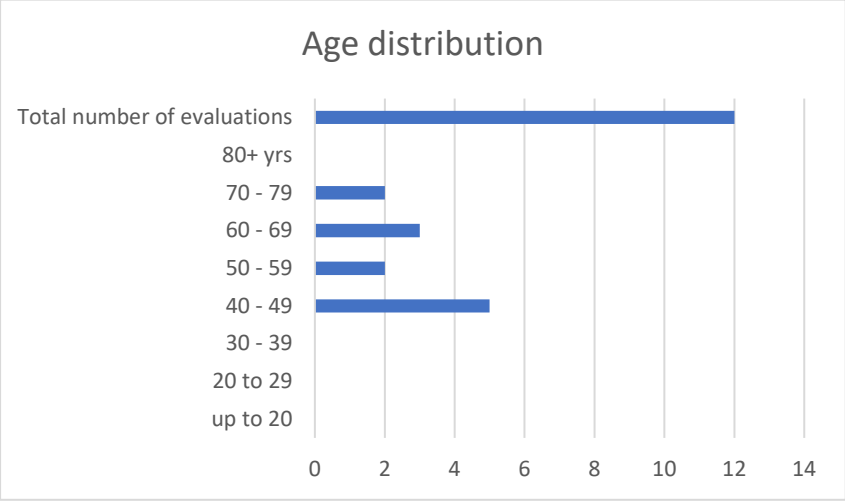

Rod Trigg "Trigg Industries"
Likelihood of using information
Understanding after
Understanding before
Usefulness of information
Quality of information
0.0
1.0
2.0
3.0
4.0
5.0

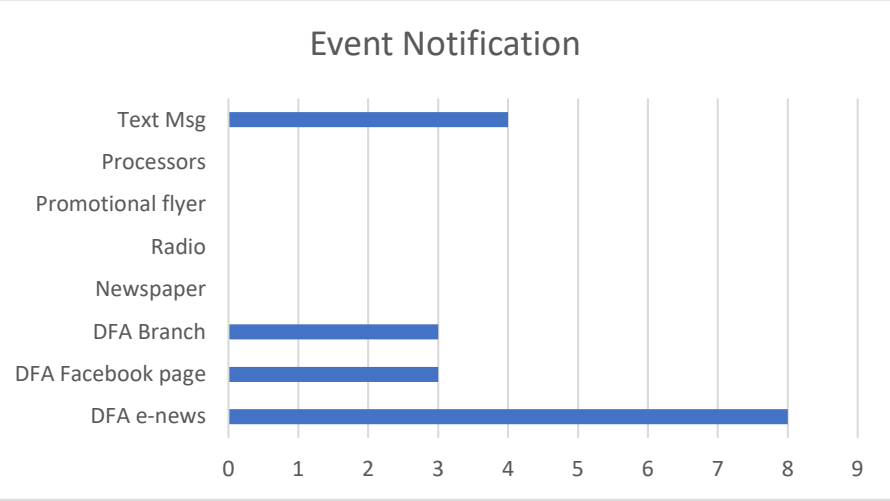

John Fielke 4 "USA"
Likelihood of using information
Understanding after
Understanding before
Usefulness of information
Quality of information
0.0
1.0
2.0
3.0
4.0
5.0

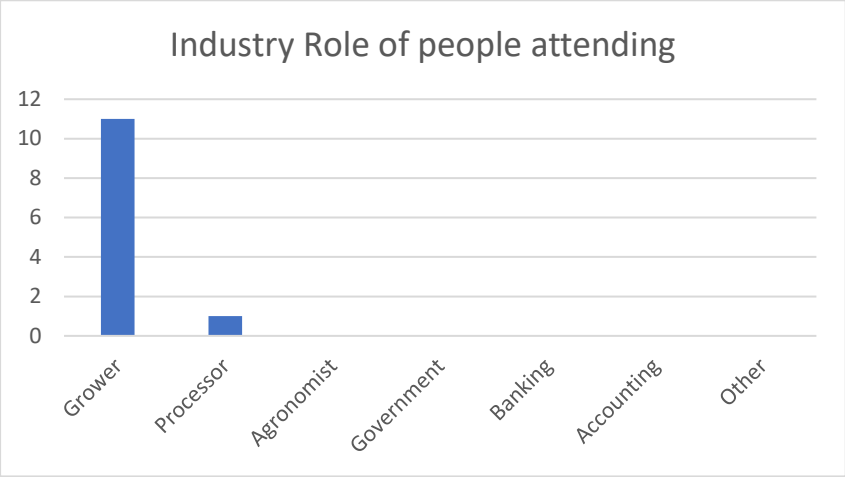

Jasper Brown "Field Robotics"
Likelihood of using information
Understanding after
Understanding before
Usefulness of information
Quality of information
0.0
1.0
2.0
3.0
4.0
5.0

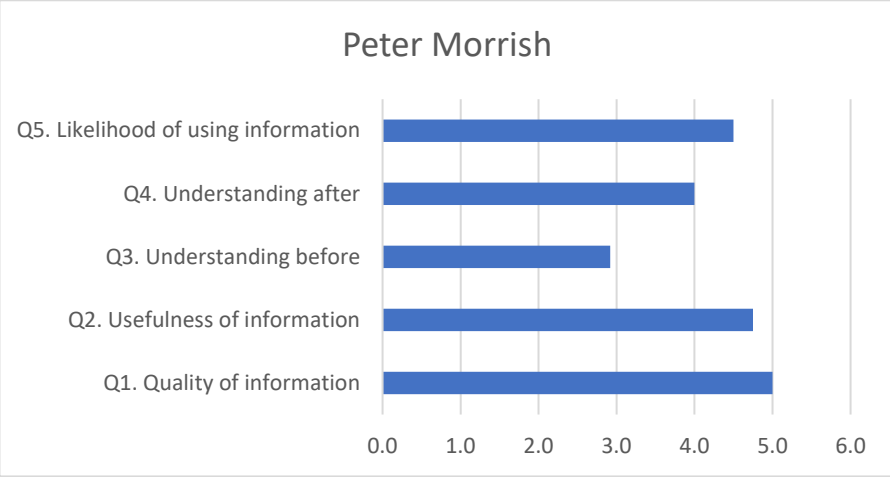
Water Trading Discussion. July 17, 2018 Evaluation Data.

- 15 Attended
- 12 Evaluations





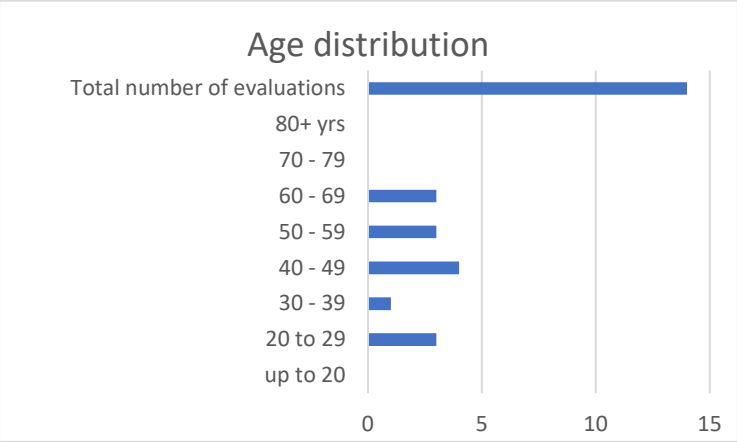


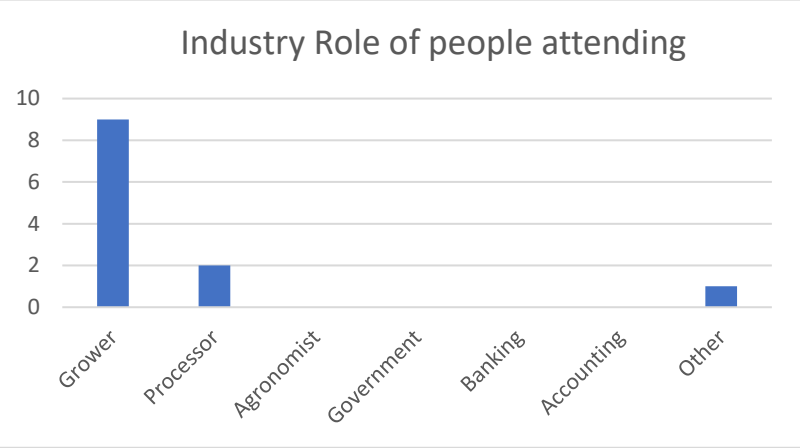


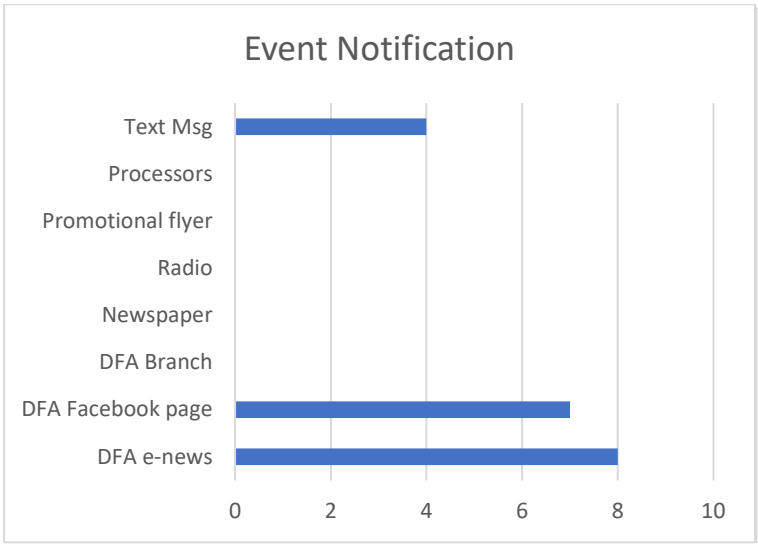
	Peter Morrish
Q1. Quality of information	5.0
Q2. Usefulness of information	4.8
Q3. Understanding before	2.9
Q4. Understanding after	4.0
Q5. Likelihood of using information	4.5

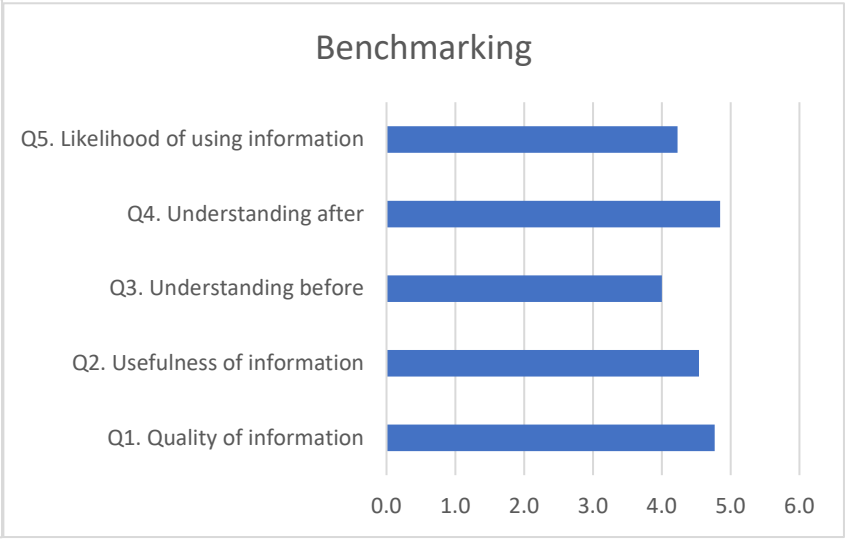
Farm Security and Benchmarking field walk. August 02, 2018 Evaluation Data.

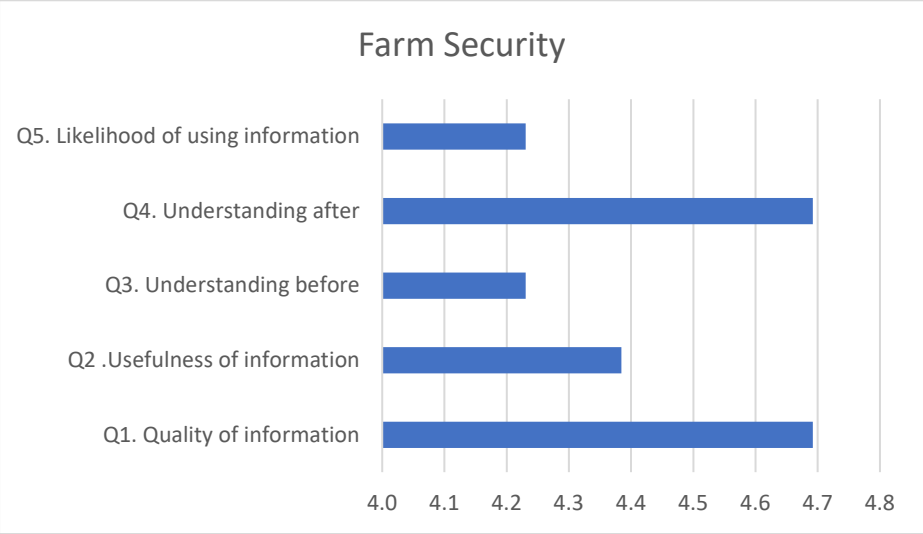
- 16 Attended
- 12 Evaluations

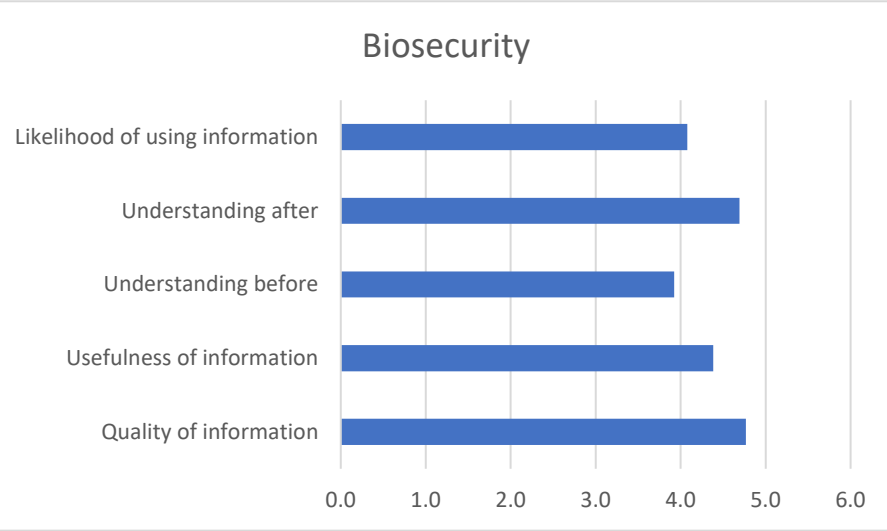





Event Notification
Text Msg
Processors
Promotional flyer
Radio
Newspaper
DFA Branch
DFA Facebook page
DFA e-news
0
2
4
6
8
10


Benchmarking
Q5. Likelihood of using information
Q4. Understanding after
Q3. Understanding before
Q2. Usefulness of information
Q1. Quality of information
0.0
1.0
2.0
3.0
4.0
5.0
6.0

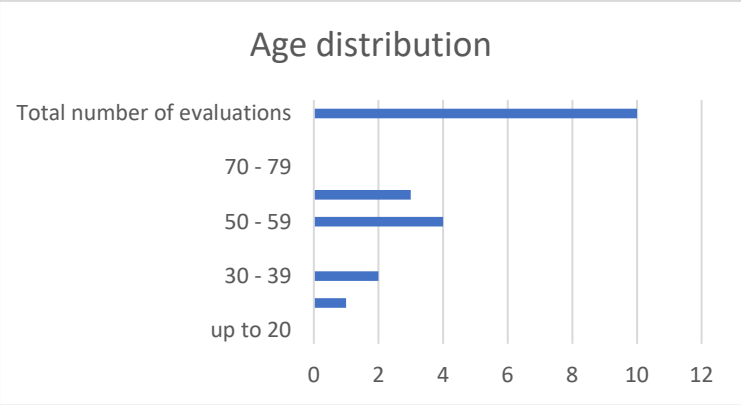


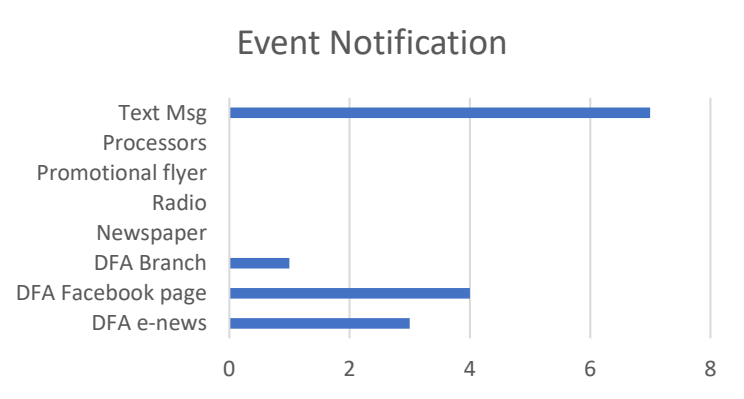


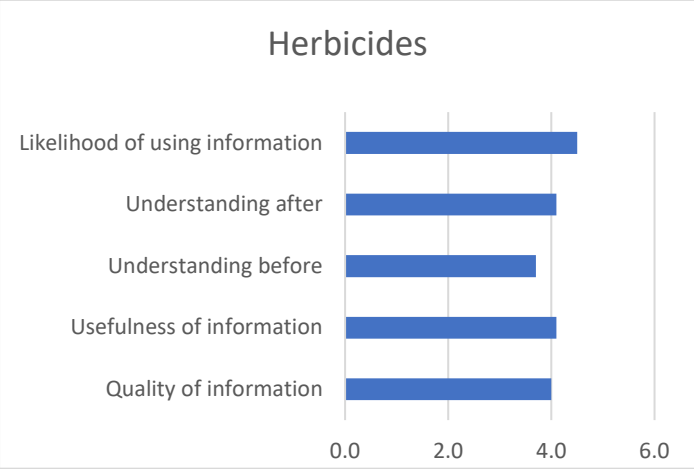
	Biosecurity		Benchmarking		Farm Security
Quality of information	4.8		4.8		4.7
Usefulness of information	4.4		4.5		4.4
Understanding before	3.9		4.0		4.2
Understanding after	4.7		4.8		4.7
Likelihood of using information	4.1		4.2		4.2

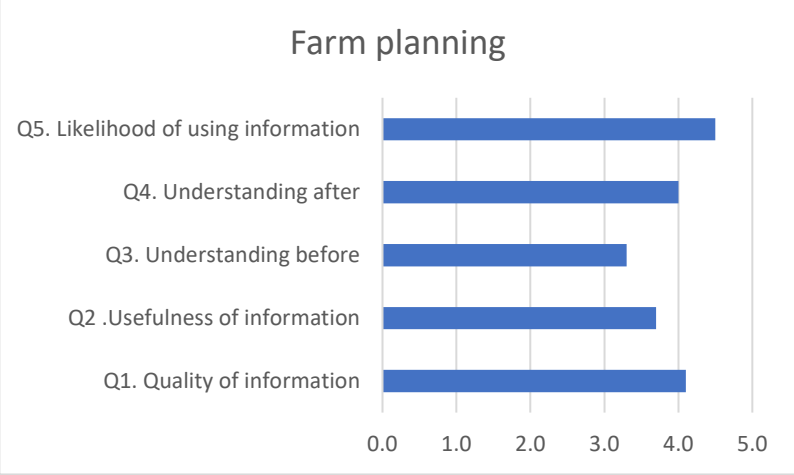
Farm Planning and herbicide and Benchmarking field walk. September 12, 2018 Evaluation Data.

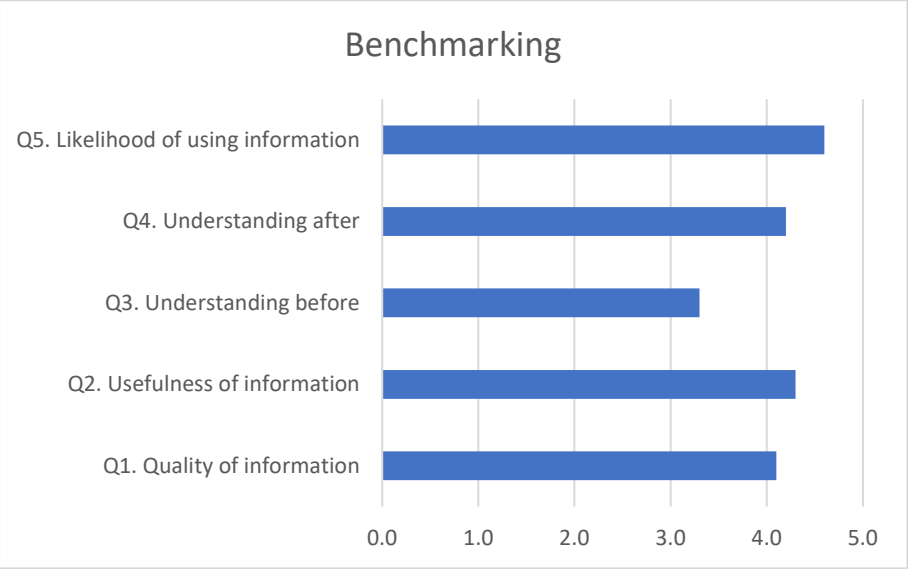
- 10 Attended
- 10 Evaluations







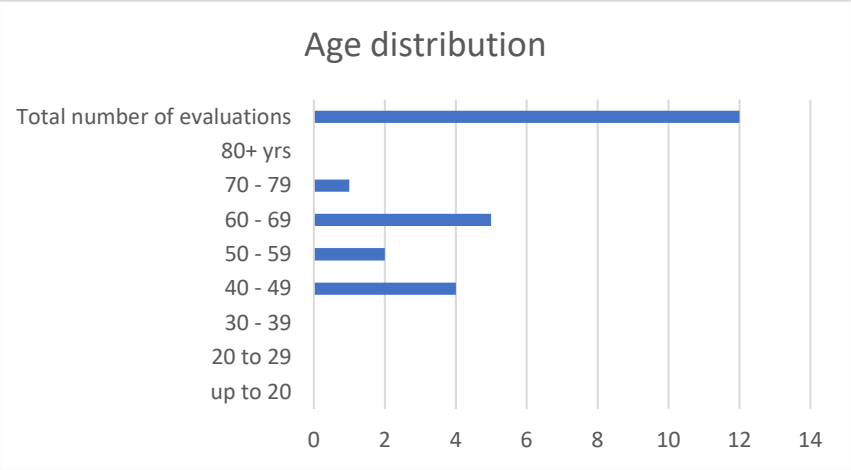


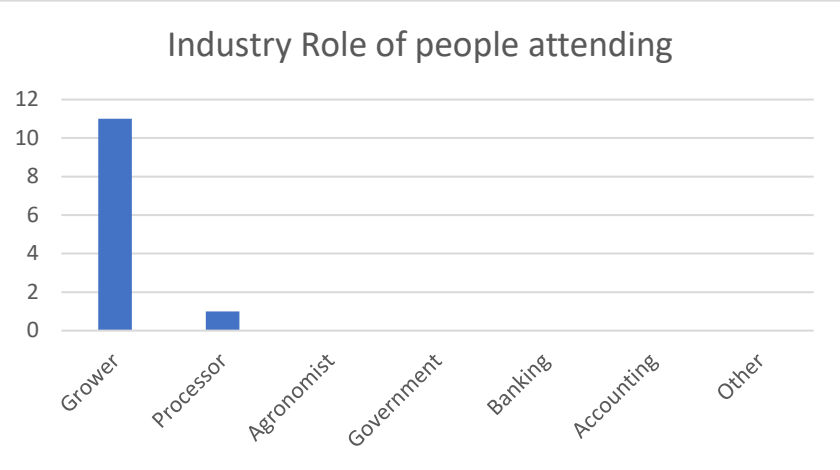


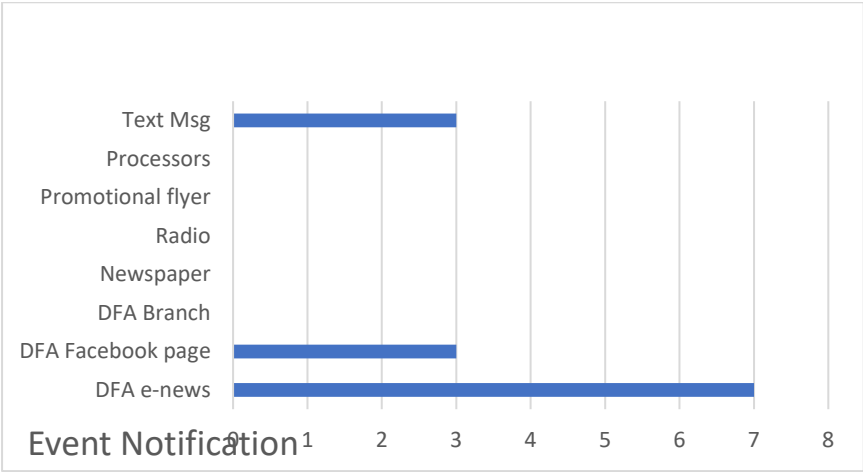
	Herbicides	Benchmarking	Farm planning
Quality of information	4.0	4.1	4.1
Usefulness of information	4.1	4.3	3.7
Understanding before	3.7	3.3	3.3
Understanding after	4.1	4.2	4.0
Likelihood of using information	4.5	4.6	4.5

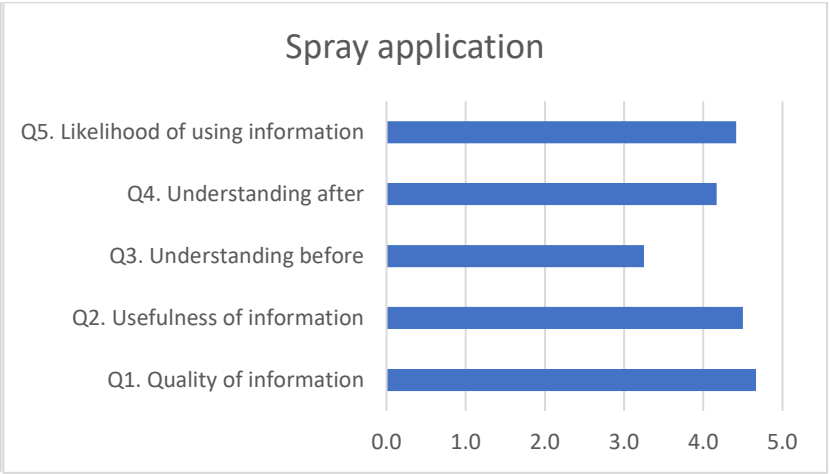
Spray application and Benchmarking field walk. November 01, 2018 Evaluation Data.

- 12 Attended
- 12 Evaluations





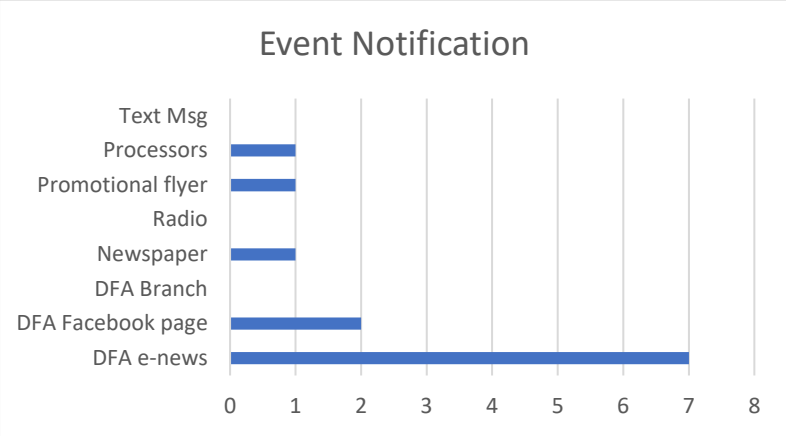


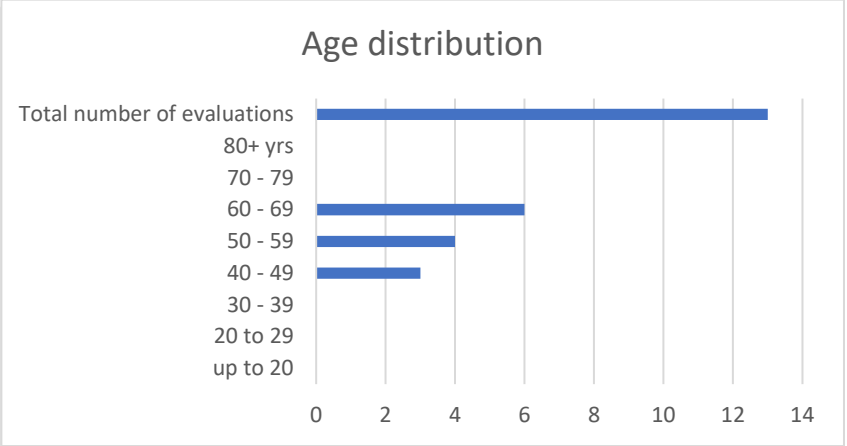


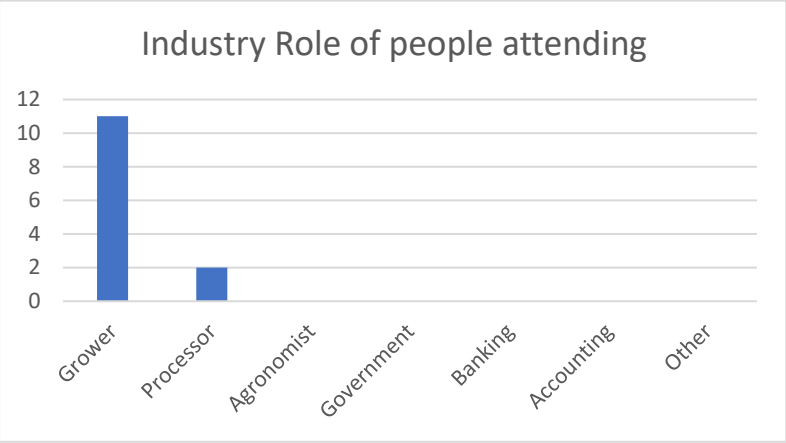
	Spray application
Q1. Quality of information	4.7
Q2. Usefulness of information	4.5
Q3. Understanding before	3.3
Q4. Understanding after	4.2
Q5. Likelihood of using information	4.4

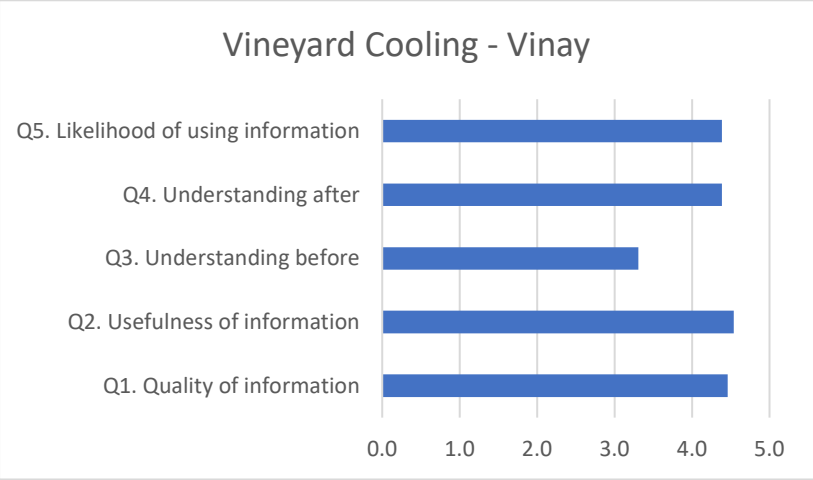
Irrigation and Benchmarking field walk. November 07, 2018 Evaluation Data.

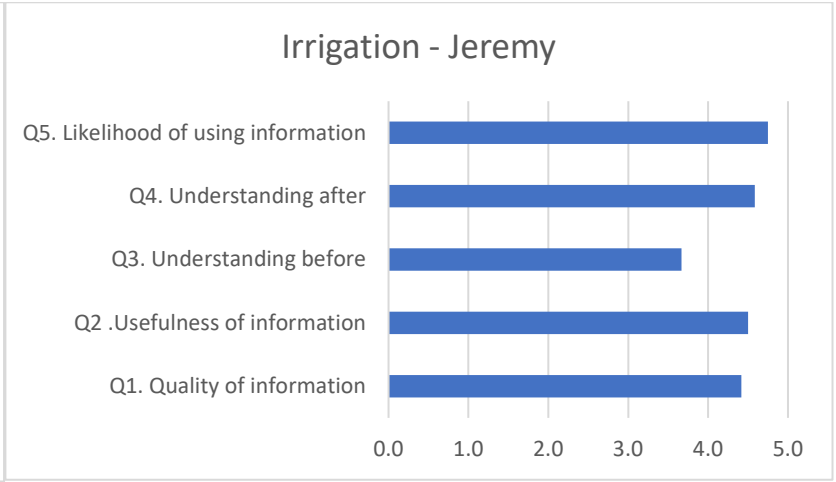
- 13 Attended
- 13 Evaluations







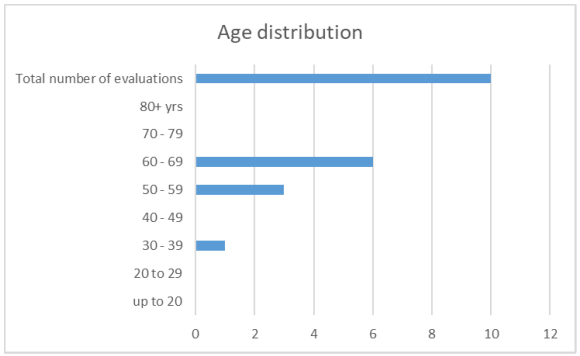


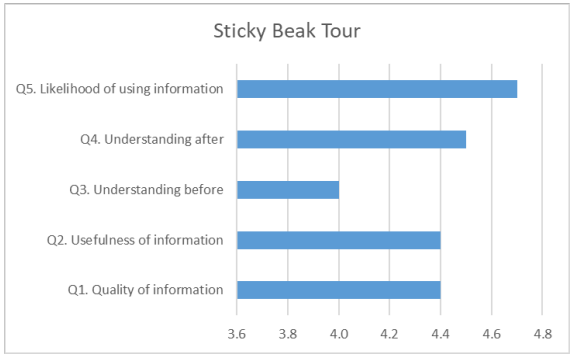


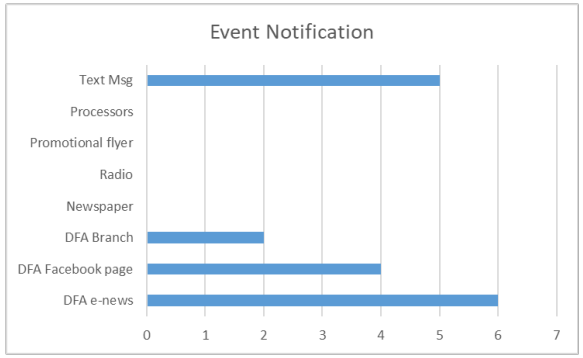
	Vineyard Cooling - Vinay	Irrigation - Jeremy
Q1. Quality of information	4.5	4.4
Q2 .Usefulness of information	4.5	4.5
Q3. Understanding before	3.3	3.7
Q4. Understanding after	4.4	4.6
Q5. Likelihood of using information	4.4	4.8

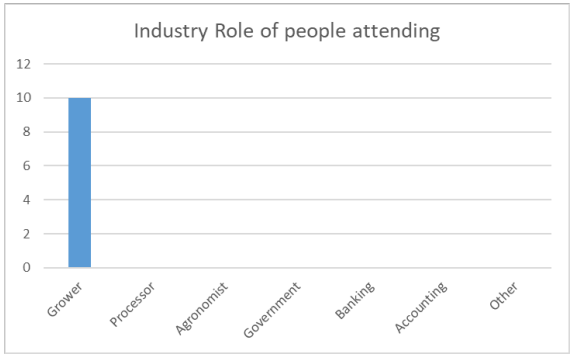
Sticky Beak field walk. December 20, 2018 Evaluation Data.

18 attended
10 evaluations



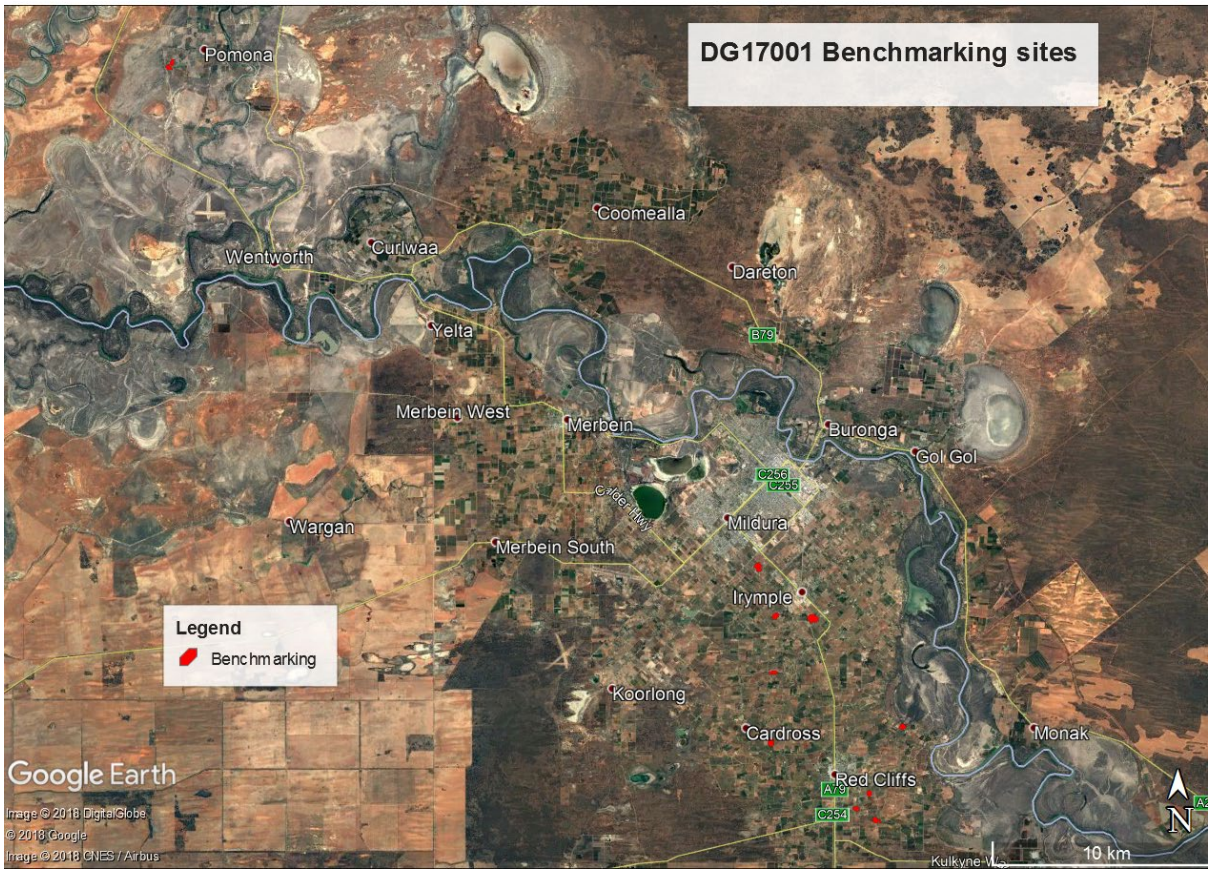






Q1. Quality of information	4.4
Q2. Usefulness of information	4.4
Q3. Understanding before	4.0
Q4. Understanding after	4.5
Q5. Likelihood of using information	4.7

APPENDIX 3: Location of Benchmarking sites and results for pruning activities



Patch	King - Sunglo	Johnstone - SunGlo	Lyons - Sunmuscat	Treeby - Sunmuscat	Hunt - SunGlo	Hunt - Sunmuscat	King - Sunmuscat	Johnstone - Carina	Gardner - Currants	Lloyd - Sultana	Lloyd - Sunmuscat	Long - Salma Pete
Row Spacing	3.3	3	3.05	3.66	3.3	3.3	3.35	3.05	3.3	3.66	3.66	2.1
Vine Spacing	3	3	4.27	4	4	4	3.05	3.66	4.8	3.05	3.05	3.2
Number of Vines	1010	1111	768	683	758	758	979	896	631	896	896	1488
Area(Ha)	2.1	3.6	3.45	2.79	2.6	2.51	1.41	8.14	1.11	2.42	3.10	5.00
Est total row len	6.57	12.36	11.66	7.90	8.14	7.86	4.35	27.50	3.47	6.85	8.78	24.31
Row Direction	E/W	NE/ SW	NW/SE	East West	N/S	E/W	N/S	NE/ SW	E/W	NE/SW	nw/se	e/w
Variety	Sunglo	SunGlo	Sunmuscat	Sunmuscat	sunglo	Sunmuscat	Sunmuscat	Carina	Carina	Sultana	Sunmuscat	Salma Pete
Rootstock	1103 Paulse		Paulsen	Ramsey / paulsen	Paulsen	Paulsen		Ramsey	Ramsey	Ramsey	Paulsen 1103	Ramsey
Year planted	2016	2016	2005	2000	2012	2010		2002	2007	1999	2001	2010
Activity	**Pruning**	**Pruning**	**Pruning**	**Pruning**	**Pruning**	**Pruning**	**Pruning**	**Pruning**	**Pruning**	**Pruning**	**Pruning**	**Pruning**
Action	Cane Stripping	cane stripper	Cutter bar run 1	Pull out	Cutting old canes	Cutting old canes	Cane stripping	Cane stripper	Stripping bottom wire Cane slapper	Cane Stripper	Cane Stripper	Pre cutting
Date			30/04/2018									April
Hours	2.59	0.00	2.91	35.00	6.42	6.20	1.74	15.00	3.00	5.00	6.50	20.00
Hr/Km Cordon	**0.39**	**0.00**	**0.25**	**4.43**	**0.79**	**0.79**	**0.40**	**0.55**	**0.86**	**0.73**	**0.74**	**0.82**
Action	Cordon pruning	pulling out canes by hand	Cutter bar run 2	Slash	Remove canes - tyre slapper	Remove canes - tyre slapper	Cordon Pruning	Pulling out canes	Pull out by hand	Pull out	Pull out	Pulling out
Date			30/04/2018									May
Hours	31.08	0.00	1.94	4.00	1.93	1.86	43.50	55.00	6.00	16.13	20.66	176.00
Hr/Km Cordon	**4.73**	**0.00**	**0.17**	**0.51**	**0.24**	**0.24**	**10.00**	**2.00**	**1.73**	**2.35**	**2.35**	**7.24**
Action	Tipping trellis	Cordon Pruning	Cane Stripping run 1	Tipping trellis	Cordon Pruning	Pruning Cordon	Tipping trellis	Cordon Pruning	Tipping over trellis	Slashing	Slash	Tipping Trellis
Date			30/04/2018									May
Hours	22.45	52.00	2.91	30.00	136.00	133.00	21.75	240.00	3.00	6.00	10.02	37.00
Hr/Km Cordon	**3.41**	**4.21**	**0.25**	**3.80**	**16.71**	**16.93**	**5.00**	**8.73**	**0.86**	**0.88**	**1.14**	**1.52**
Action	Rolling on	tipping trellis	Cane stripping run 2	Cordon Pruning	Clean up Sweeping and slashing	Sweeping and mulching	Rolling on	tipping trellis	Cordon pruning	Cordon Pruning	Cordon Pruning	Cordon Pruning
Date			30/04/2018									July
Hours	14.43	5.00	2.33	40.41	3.00	3.00	17.79	24.00	35.00	66.00	84.59	253.00
Hr/Km Cordon	**2.20**	**0.40**	**0.20**	**5.11**	**0.37**	**0.38**	**4.09**	**0.87**	**10.07**	**9.63**	**9.64**	**10.41**
Action	Slashing	Finishing off rolling on	Unclip frames	Rolling on	sweep	Sweeping	Slashing	finishing off and rolling on	Rolling on	Tipping	Tipping	Roll on
Date												8-10 August
Hours	1.30	94.50	5.08	40.00	1.00	1.00	0.87	266.50	31.00	10.00	12.00	115.00
Hr/Km Cordon	**0.20**	**7.65**	**0.44**	**5.06**	**0.12**	**0.13**	**0.20**	**9.69**	**8.92**	**1.46**	**1.37**	**4.73**
Action		Sweeping	Swing over and lock in		Tipping trellis	Tipping trellis		Sweeping	Placing lock down wire	Rolling on	Rolling on	Slash
Date		21-Jul						13-Aug				15-Aug
Hours		2.00	29.14		10.00	9.65		4.00	2.00	61.98	79.00	2.00
Hr/Km Cordon	0.00	**0.16**	**2.50**	0.00	**1.23**	**1.23**	0.00	**0.15**	**0.58**	**9.04**	**9.00**	**0.08**
Action		Mulching	Clean up under high side with slasher					Slashing	Mulch	Sweeping and mulching	Sweep and Slash	Rotary Hoe
Date		21-Jul						14-Aug				16-Aug
Hours		1.50	0.89					7.00	1.71	3.00	5.01	5.00
Hr/Km Cordon	0.00	**0.12**	**0.08**	0.00	0.00	0.00	0.00	**0.25**	**0.49**	**0.44**	**0.57**	**0.21**
Action			Cordon Pruning									Cane Sweep
Date												15-Aug
Hours			114.50									3.00
Hr/Km Cordon	0.00	0.00	**9.82**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.12**
Action			topping under bottom wire									Cane Sweep
Date												27-Aug
Hours			1.94									6.00
Hr/Km Cordon	0.00	0.00	**0.17**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.25**
Action			Clean out by hand									Slash
Date												28-Aug
Hours			24.28									3.00
Action			Placing foliage wire									
Date												
Hours			9.71									
Hr/Km Cordon	0.00	0.00	**0.83**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hrs / patch	71.85	155.00	195.66	149.41	158.35	154.71	85.65	611.50	81.71	168.10	217.78	620.00
Hrs / ha	34.21	43.06	56.71	53.55	60.90	61.64	60.75	75.12	73.62	69.46	70.25	124.00
Hrs/ Km of cordon	**10.93**	**12.54**	**16.79**	**18.91**	**19.46**	**19.69**	**19.69**	**22.23**	**23.52**	**24.53**	**24.80**	**25.50**

APPENDIX 4: Report, "Reducing cost of winter pruning in dried grape production"

Hort Innovation / DFA Workshop results

"Reducing cost of winter pruning in dried grape production"

27th -28th June 2018

The outcome of the workshop was the development of nine key areas for potential investigation. Several of them are interrelated and while the priority of the workshop was the development of a mechanised winter pruning system, analysis of the key areas indicates that the first priority of any investment program should be the investigation of the potential impact on the viticultural system. For that reason, the first priority activity is "Setting a standard of how we want to prune (how close to the cordon do canes need to be cut)". Key areas that are linked to the first priority are 2 and 3 and as such should be considered after area 1 has been dealt with.

Key areas five through to nine could be considered separately on their own merits.

1. Setting a standard of how we want to prune (how close to the cordon do canes need to be cut)

The health and longevity of the cordon is critical to the success of winter pruning. Currently the remains of the previous season's fruiting canes are pruned as close to the cordon as possible so that the cordon maintains as much of its lineal nature as possible. However, it is vitally important for the ability of the cordon to sustain cane and fruit growth that none of its sap flow capabilities are damaged by errant cuts into the cordon.

Despite growers' efforts to keep cordons linear they often develop lumps and bumps along their length. At the workshop discussion focused on the possibility that a mechanised cutting system may not be able to follow these bumps accurately and quickly enough to cut the canes at the base against the cordon while at the same time not damaging the cordon.

The conclusion from this discussion was that, to deal with its perceived inability to follow the bumps on a cordon, a mechanical system may operate at a minimum, but as yet undefined, distance from the cordon, only moving horizontally for the more extreme variations along the cordon. Hence it would leave a small section of the previous year's fruiting canes protruding from the cordon. This created concerns that;

- there was no understanding of how this would affect the cordon's ability to produce productive fruiting canes in future years,
- the cordon may grow too much and be difficult to prune in subsequent years,
- the cordon may become a harbour for pest and disease and
- the cordon may become too large in diameter to allow easy swinging over of the trellis heads

The other key question this discussion raised was what other tasks, commonly completed as part of pruning, can be economically and viticulturally done away with. These included;

- pruning out some canes on the fruiting side,
- wrapping down and positioning fruiting canes so that they remain in position during harvest at the end of the season and
- Can all required canes be trapped effectively by a wire pulled over the trellis to pin them down before pruning the non-fruiting side

This section of the discussion links with the issues identified in item 6 'Refining the deskilling of winter pruning"

Suggested action;

- Review published and "grey" literature and grower experience for evidence of impacts of mechanised pruning of cordon based viticultural systems on dried grape production systems.
- Establish a four-year trial to simulate mechanical pruning at a set distance from the cordon. This would allow a minimum of two seasons of simulated mechanical pruning on each side of the cordon. The trial must be statistically sound to ensure trade-offs in yield and cost can be accurately assessed.

2. Simple solutions to get to 80 % of the job done (i.e. automation of a cutter bar – not replicating hand pruning)

Development of a mechanical cutting system that can get most of the winter pruning job done was a key outcome of the workshop. It was though that the replication of the job done by hand pruning would be too costly because of the high price of the technology required in the precise sensing for and actuation of the cutting tool.

Hence the aim coming from the workshop was to develop a precise control of a cutting tool that could follow the cordon using some type of guidance system. This could also be assisted by GPS control for tractor steering

The new system would need to be able to achieve a change in pruning rates from 1,270 meters of cordon per day per person (0.4 ha or 1 ac/ day/person @3.3 m row spacings) to 6,600 meters of cordons per day per person (2 ha or 5ac /day/person @3.3 row spacings). This would reduce labour costs from $500/ha (3,300 meters of cordon) down to $100/ha (3,300 meters of cordon).

It was thought that there is existing technology that can be applied to finding the solution to this issue. Most of the time would be in the development of the programming and sensing technology.

Workshop participants estimated that the development costs would be $50,000 plus the costs of equipment required.

It was noted that the cutting system would need to deliver a clean cut to avoid excessive sites for disease ingress to the plant. Any project may need to consider the development of a concave cutting tool able to cut up to 180 degrees around the cordon.

The available technologies would likely dictate how close to the cordon the cutting implement would be able to operate. The primary concern being cutting the remains of previous season's fruiting canes of as close as possible to the cordon without damaging it.

Suggested action;

- Develop a mechanised winter pruning system capable of cutting canes within 5mm of the cordon, not damaging the cordon and cutting 2ha per day

3. Can we get more of the winter pruning job done when we do summer pruning

The key issue identified here cam from those not involved in growing grapes and was simply the observation that lead to the question "why we are pruning the same side of the cordon twice in the same season?".

An outcome that results in only one pruning pass per year can only follow on from a successful conclusion of issues 1and 2. Assuming a mechanical cutting system is developed the chief consideration with regard to it being used in summer pruning will be the cutting rate. Cutting rate is very important because of need to manage the risk of rain damage at harvest time. The system probably needs to be capable of cutting at 1.5 - 2 km per hour.

The other key element to the success of the system will be the ability of its sensing systems, that keeps it from damaging the cordon, to deal with the extra foliage and canes present at summer pruning.

The cost of shoot thinning early in the season could also be a consideration as some growers believe that this makes cutting at harvest a much easier operation because of the foliage reduction in the cutting zone. Hence it may be a way of speeding up the operation when using a far more accurate cutting system.

Suggested action;

- Consider the extra requirements (speed and sensing through a canopy) for summer pruning in the development of the mechanical pruning system.
- If a mechanical cutting system is developed for winter pruning it should be trailed with summer pruning.

4. Maximise efficiency of current pruning practices ($1200/ac down to $600 /ac)

Information gathered during the workshop indicated that there was a large range in participants' cost for pruning $1200/ ac - $600/ac) indicating that there could be a significant range in the efficiencies of pruning practices currently used in the industry.

Suggested action;

- Use benchmarking data from existing Hort. Innovation / DFA project to define the types of pruning processes that currently exist and their relative costs and produce a series of comparative pruning case studies for circulation to industry.

5. Refine deskilling of winter pruning system

On the swing arm system canes can be trapped with minimal rolling on required. Spacing out of canes may not be required. Assuming that once canes have been trapped on the high side of the trellis all remaining canes need to be removed as part of the winter pruning process and virtually no other work is required in terms of cane positioning and rolling on. This could reduce the time taken to prune as well as the time taken to train new employees in the pruning process

Suggested action;

- A three-year trial aiming to; design, implement and, compare to current practice a pruning system that has minimal labour input. The trial would need to be run over three years to account for vines ability to adapt to the new system and the trial must be statistically sound to ensure trade offs in yield and cost can be accurately assessed.

6. Develop low cost autosteer pruning platform

Time taken to for the pruner to move current pruning platforms along the row as pruning progresses may be reducing the overall efficiency of the pruning process. Assuming a pruning platform is 5 meters long it would require to be moved 20 times in 100 meters of cordon. One measurement of pruning across a patch indicates it takes about 100 "person minutes" for a pair of pruners working simultaneously on two rows with the one pruning platform to prune 100 meters. Assuming it takes 10 seconds to move the platform each time, that adds up to 6.6 minutes of lost time per 100 meters. Hence the automation process could reduce overall pruning time by ~ 6%. There are other benefits of the electric drive including quite operation, power source or recharge capability for electric secateurs and a renewable power source through the addition of solar panels.

It was proposed in the workshop that it may cost about $20,000 adapt an existing platform to get a prototype of an automated pruning platform working with auto steer and speed control using electric motors and solar panels. Electric motors would be more suitable because of their "infinite"

speed control capabilities. Once developed existing platforms may be able to be converted for about $10,000.

Suggested action;

- Convert one existing pruning platform to electric drive, speed control and auto steer. Trial this platform against an existing one under the same conditions

7. Keep track of development of mechanisation and data capture technology.

Obviously, the technology available for the development of mechanical pruning systems will evolve rapidly over time. This could be in the sensing technologies or the actuation technologies.

Suggested action;

- Some consideration should be given to reviewing these types of technologies and their potential impact on any aspect of dried grape production as some regular intervals, perhaps once every 3 years.

8. Review overall vineyard layout to better suit mechanised pruning.

Workshop participants also raise the question of what could be done in the development of a new or replanted vineyard to assist mechanisation of the winter pruning system. This issue discussed included use of GPS technology to improve accuracy of lay out, different management practices to produce straighter cordons or just ensuring cordon height above the immediate ground surface is consistent across the vineyard.

Suggested action;

- Should work progress on the mechanisation of pruning any key vineyard layout issues that are identified as part of the research and development process should be documented as part of the work so that they can be addresses as part of the work or as future work, or simply communicated to growers as part of the extension program

9. Can we spray out unwanted canes (like the lettuce thinning sprayer)

The workshop participants looked at the operation of lettuce thinning spray system that passed over a row of newly emerged lettuce plants and applied herbicide to unwanted plants so that an even planting density is achieved. Workshop participants suggested that young canes on the non-fruiting side of the cordon may be sprayed out much like cordon bunches are. This would need to be done in such a way as to leave canes spaced evenly along the cordon.

This raised some key issues;

- Does an even spacing of canes along the cordon improve production compared to retaining all the canes.
- Can canes be effectively removed by a spray application or other means
- Can sensing technology effectively identify individual canes.

Resolution of the first issue in this list would also assist in the resolution of items 1 “setting a new standard of how we want to prune” and 6 ‘Refining the deskilling of winter pruning”

Suggested action;

- Review any data on the yield impact of evenly spacing canes along the cordon as compared to retaining all the canes
- If a benefit if thought to exist, run a two year trial comparing evenly place canes capered to retaining all canes. The trial must be statistically sound to ensure trade-offs in yield and cost can be accurately assessed.
- If there is a confirmed benefit, then it should provide the scope for development of a system to remove those unwanted non fruiting canes early in the season

DG 17001, Reporting against 2019 Innovation and Adoption program.

Topic	Activity	Timing / Location	Comments
Drying oil application systems. • Application systems • Effectiveness of coverage	Tech Transfer event 1 Farm tour of wetting applications	February Run during harvest and advertised on a "turn up if you can" basis at several locations and times	**Completed:** 31 attendances at five different locations between February and April. Thanks to Tony Martin, Allan Long, Ashley Johnstone, John Hunt and Daryn Gardner for hosting. Video of wetting and harvest operations loaded to facebook and You tube channels (1100 views to date) https://www.facebook.com/pg/DriedFruitsAustralia/videos/?ref=page_internal https://mailchi.mp/a5db2ecf4466/special-edition-of-dfas-currant-news-592477 https://mailchi.mp/ed78b1627324/your-fortnightly-currant-news-624761
Harvest • Harvest systems • Minimising contamination	Tech Transfer event 2 Farm tour of harvest operations	March Run during harvest and advertised on a "turn up if you can" basis at several locations and times	
Promotion of 2019 activities	Media release 1	April "The Vine"	**Completed:** https://www.driedfruitsaustralia.org.au/wp-content/uploads/2019/03/2019-vol-15-iss-2-apr-jun-the-vine.pdf
2019 season pest and	Tech Transfer event 3	29th of April	**Completed:** 20 people attended

Topic	Activity	Timing / Location	Comments
disease "Tune-Up" • Snails • Weeds • Downey mildew • Powdery Mildew • Spray application			Industry experts Peter Boutsalis (weeds and herbicide application), Michael Nash (snail identification and control) and Rachael McClintock (pest and disease control programs) presented the latest industry information and discussed issues with growers. 3 presentation videos available on DFA facebook and You Tube channel (260 views to date) https://www.facebook.com/pg/DriedFruitsAustralia/videos/?ref=page_internal https://us15.campaign-archive.com/?u=51a7c0c0fe618f9af27dd44a7&id=f3b9794149
Industry coordination of Certificate III Production Horticulture (Dried Fruit)	Tech Transfer event 4+5 - Includes: • establishment of course by April and • assistance with the design of individual units and sourcing technical specialists for course delivery - 5 units over 2019	May – Dec. Various on farm locations	**In progress:** Course advertised to DFA members in Currant News. Participants from Duxton and MRO have enrolled in course. Course outline has been agreed. Completed sessions include: • AHCCHM304 Transport and store chemicals AHCCHM307 Prepare and apply chemicals to control pest, weeds and diseases • AHCPHT305 Regulate crops • AHCPCM301 Implement a plant nutrition program • AHCWHS301 Contribute to work health and safety processes • AHCPMG301 Control weeds Contribution from this project to the running of the course has included • Ivan Shaw was included as an industry expert for the pruning program. • Linked course delivery with the pruning field day on the 18th of July • Coordinated industry expert presenter, Peter Magarey, for the pest and disease session in December. • Linked course delivery to the disease component of the sunglo filed day. • Coordination of industry liaison has continued with 3 meetings between TAFE and industry participants to ensure the training program continues to meet industry needs. • Coordinated field visit program for the fertigation component of the nutrition program

Topic	Activity	Timing / Location	Comments
2019 season Pruning "Tune Up" • Launch of minimal pruning demonstration	Tech Transfer event 6 Workshop and benchmarking vineyard walk	18th July	**Completed:** 34 People attended to view and discuss the "minimal" pruning demonstration set up at Ashley Johnstone's property. Listen to Micheal Treeby Discuss vine nutrition and Stuart Putland discuss "Working out Piece Rates" Event was swapped with the irrigation event panned for August (see below) Thanks to Ashley Johnstone for hosting the event. https://mailchi.mp/b6128657081b/your-fortnightly-currant-news-664617
Industry tour	Tech Transfer event 7 NSW tour Prune Industry, wine grape research and river Murray operations.	29th – 31st of July	**Completed:** 7 industry people attended. The group first visited the Griffith Prune industry to look at Solar and conventional drying systems and the use of Dendrometers on tree trunks to monitor irrigation needs at the properties of Michael Zalunardos and Ann Furner. The second stop saw some impressive viticultural research capabilities at Charles Stuart University Wagga. We heard from researchers, Dr Regina Billones-Baaijens on Eutypa trunk disease, Julia Gouot on the impact of heatwave condition on fruit ripening and Dr Dr Sijing Li about Benchmarking regional and subregional influences on Shiraz fine wines. The following day the tour stopped for a look at the Barmah Choke and met with Andrew Shields from Goulbourn Murray water to discuss river operations and seasonal conditions. Finally, we were presented with an overview of the Torrumbarry irrigation area by Matt Hawkin from Agriculture Victoria and visited an irrigated dairy farm to discuss water issues. https://mailchi.mp/e0b8f6709f38/your-fortnightly-currant-news-654621 https://www.facebook.com/DriedFruitsAustralia/photos/a.198449423612399/1180527375404594/?type=3&theater https://www.facebook.com/DriedFruitsAustralia/photos/a.198449423612399/1181839478606717/?type=3&theater

Topic	Activity	Timing / Location	Comments
Benchmarking	Collection of final 2018/19 season data	June Mildura	**Completed:** This activity has taken longer than planned but is now completed for the 2018/19 season across 12 sites. A session with participants to compare and discuss results is planned for the 12th of September
Report on industry tour	Media release 2	July "The Vine"	**Complete:** Article changed to highlight the events that have been completed and the videos that are available for those that couldn't attend. https://www.driedfruitsaustralia.org.au/wp-content/uploads/2019/06/2019-vol-15-iss-3-jul-sep-the-vine.pdf
Facilitated meeting with Mallee research and Innovation Centre researchers	Activity in addition to the March 2019 innovation and adoption plan	July 16th.	**Completed:** In conjunction with Rebecca Wells of Mallee Research and Innovation Centre facilitated a meeting with LaTrobe University Engineering researchers, Dr Robert Ross, Dr Ed Kazmierczak and Mr Erik Van Vulpen, to look at developing a project to build a mechanical winter pruning system for cordon-based vine systems. This a direct follow on from the outcome of the workshop held as part of this project in 2018. See attached the concept proposal that will be used to discuss further progress.
Presentation on 2018/19 benchmarking program outcomes & Vine nutrition seminar	Tech Transfer event 8 Workshop and vineyard visit	July Mildura	**Completed:** Vine Nutrition topic integrated with pruning session (See event 6, above) 1st year of Industry benchmarking results presented at Annual members forum. See attached powerpoint slides from presentation25 people attended (See event 12, below)

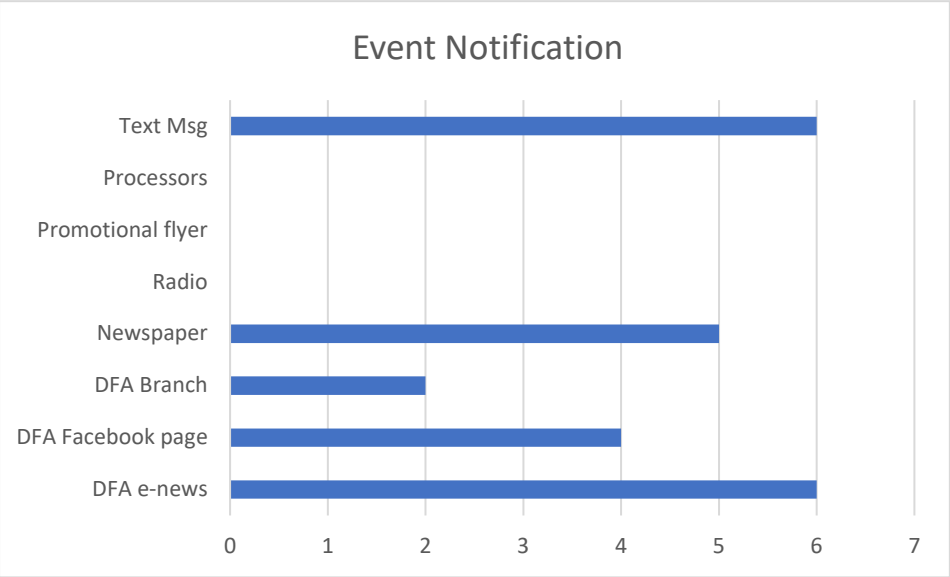
Topic	Activity	Timing / Location	Comments
Irrigation and soils • Water market update • Variety specific irrigation monitoring experience • Matching soil and irrigation	Tech Transfer event 9 Workshop and benchmarking vineyard walk.	August	**Completed:** 29th of May, 20 people attended. https://mailchi.mp/0151844fc3af/your-fortnightly-currant-news-643661 The program included: Matching soil, plants and water: Kym Luitjes, Sunraysia Environmental 2019–20 season allocation outlook: Tyson Milne, Lower Murray Water Current water market trends: Phil Grahame, Ruralco Water Planning decisions for a low allocation season: Jeremy Giddings, Agriculture Victoria and Stephanie Ferdelja Rural Financial Counselling Service Victoria – North West,
Cordon Bunch removal Technical discussion and demonstration.	Tech Transfer event 10 Farm. Workshop and benchmarking vineyard walk.	September, Mildura	**Completed:** 10th of October - 6 growers attended a farm walk at Ashley Johnstone's to look at Cordon Bunch Spraying equipment in operation. 21st of November - 3 growers attended a farm walk at John Hunt's property to look at cordon bunch spraying equipment in operation https://www.facebook.com/events/2327450354031231/
Benchmarking	Round 1 data collection 2019-20 season	September, Mildura	**Completed**
Cordon bunch removal. **Post spraying- how well did it work?**	Tech Transfer event 11 Farm tour	October	**Completed:** 18th of October - 8 growers attended a farm walk at Ashley Johnstone's to look at Cordon Bunch Spraying outcome. https://www.facebook.com/events/1360178314134877/

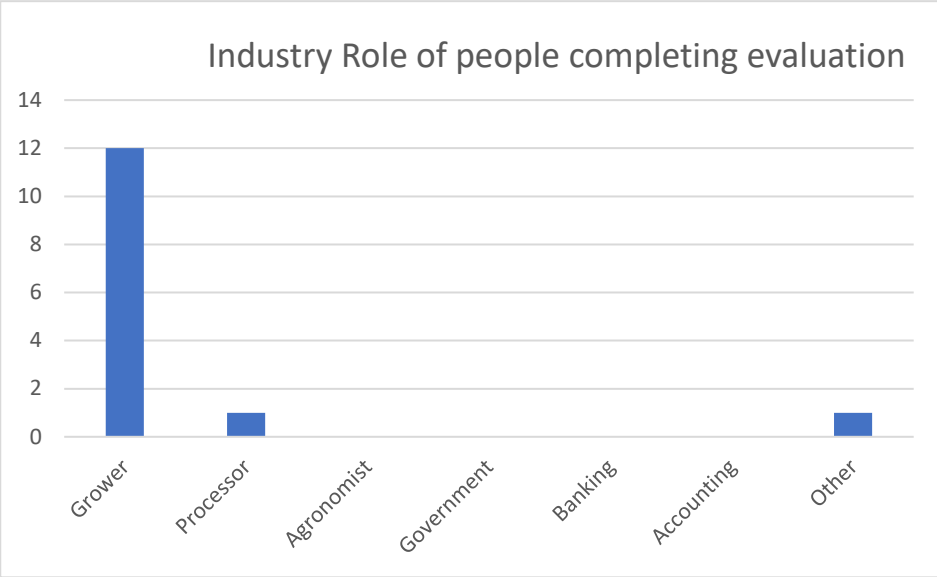
Topic	Activity	Timing / Location	Comments
Facilitated meetings to deal with Chlormequat MRL concerns	Activity in addition to the March 2019 innovation and adoption plan	October 3rd. November 29th.	**Completed:** Reviewed all available literature and discussed Chlormequat use in setting Carina currant variety with all available researchers. Prepared trial design and facilitated discussion with industry processor representatives on the 10th of October at DFA office Mildura. Outcome was to establish an industry funded demonstration trial to investigate reduced and "no use" of Chlormequat. Presented information to 10 Sunbeam growers on how Chlormequat works and how to minimise use this season on the 29th of November at Sunbeam offices in Irymple. See attached powerpoint presentation on Chlormequat literature review and trial design.
DFA Members forum	Tech Transfer event 12 Seminar	October Mildura	**Completed:** 25 growers attended the forum with key presentations from two key regional water authorities on the status of water supply across the region. A presentation from Sunrise mapping on documenting the size of the dried grape industry and a presentation form Sunrysia Tafe on their Smart Farm project and how it can link in with the DFA/HIA programs. https://www.driedfruitsaustralia.org.au/water-and-industry-future-focus-of-grower-forum/ The two water presentations were recorded and made available on Facebook. To date they have, collectively, been viewed over 200 times. https://www.facebook.com/DriedFruitsAustralia/videos/729462440853276/ https://www.facebook.com/DriedFruitsAustralia/videos/714688929053623/
Industry statistics	Report collated on 2018/19 season production, import and export figures from ABS and Processors figures	October in DFA annual report	**Completed:** Report available in the DFA Annual report Pages 15 – 19 (see report extract below)

Topic	Activity	Timing / Location	Comments
Summary of 2018/19 benchmarking report	Media Release 3	October "The Vine	**Completed:** Article written and waiting publication in "The Vine". First edition of the Vine under the new Hort Innovation contract is scheduled for early Feb 2020.
Benchmarking	Round 2 data collection	December	**Completed:**
Annual Focus group review	Tech Transfer event 13 Focus Group	December Mildura	**Completed**: IDO and project participants A review of the year was completed, and ideas gathered for the following seasons program. Key issues to be considered; • Business planning in the face of low water allocations using benchmarking information • Avoiding chemical residue issues • Use of "irrisat" water use tool • Managing weeds without glyphosate A full plan will be developed by March 2020.
Review of the project for the year	Media Release4	December "The Vine	**Completed:** https://www.driedfruitsaustralia.org.au/vine-magazine-february-2020/
Sunglo variety field walk	Activity in addition to the March 2019 innovation and adoption plan	December 11th.	**Completed:** 22 growers attended this field day across fiver growers' properties to look at how to successfully grow the sunglo variety. They also heard from plant pathologist Peter Magarey about a new disease modelling service that will soon be made available to the dried grape industry https://www.driedfruitsaustralia.org.au/learn-tips-for-successful-sunglo-management/

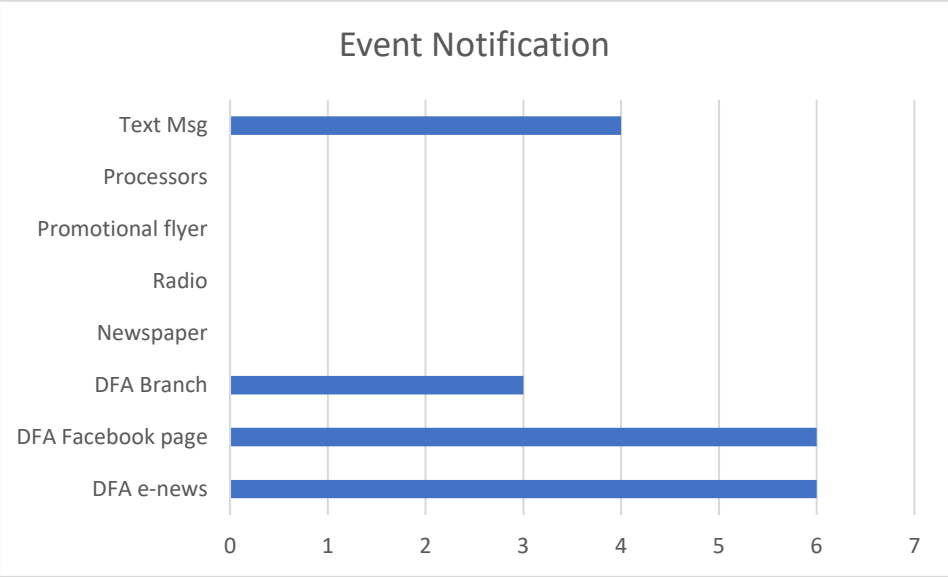
Key Event Evaluations

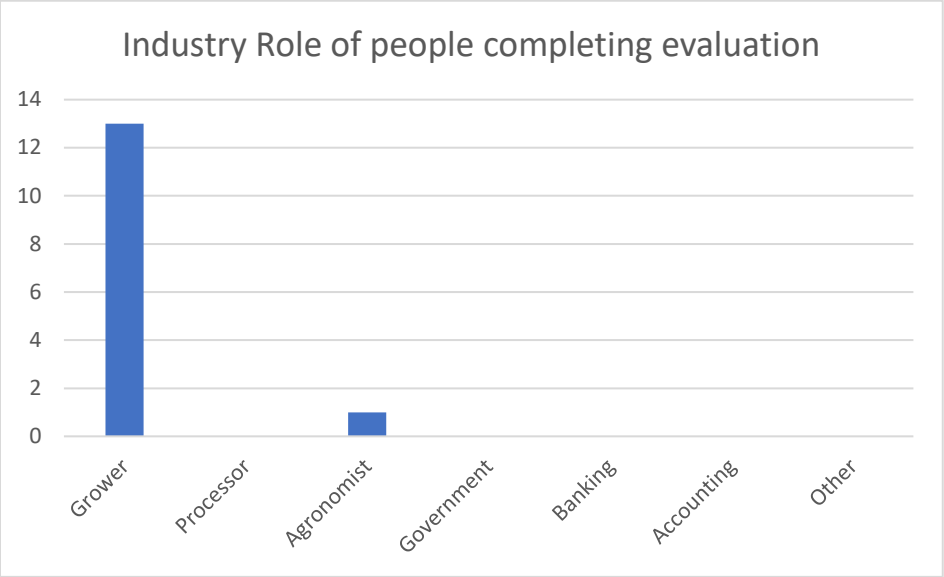
Pest and Disease Tune up 20 Attendees 14 evaluations	Snail Management	Herbicides and Weeds	Pest and Disease
Quality of information	4.4	4.7	4.6
Usefulness of information	4.3	4.9	4.6
Understanding before	3.2	3.6	3.9
Understanding after	4.4	4.5	4.5
Likelihood of using information	4.1	4.6	4.6



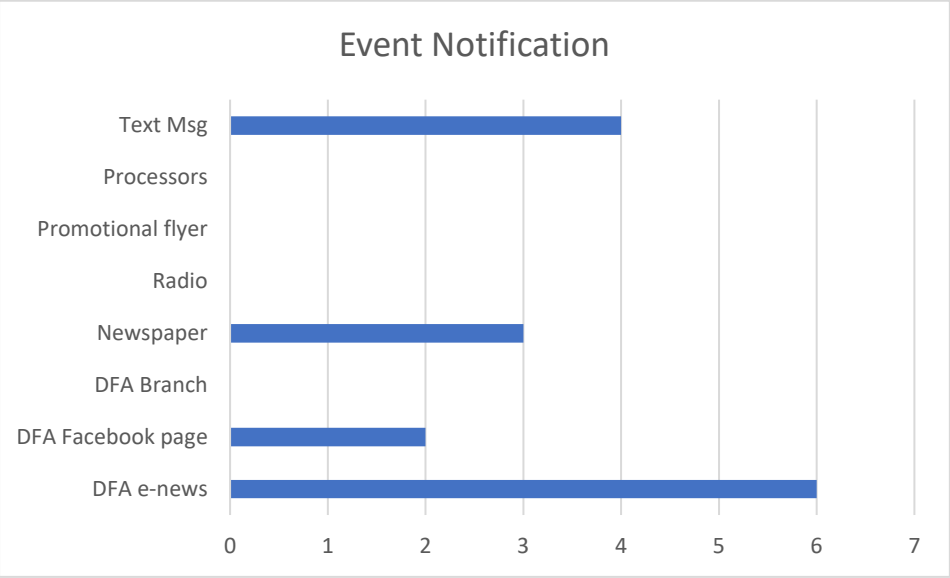


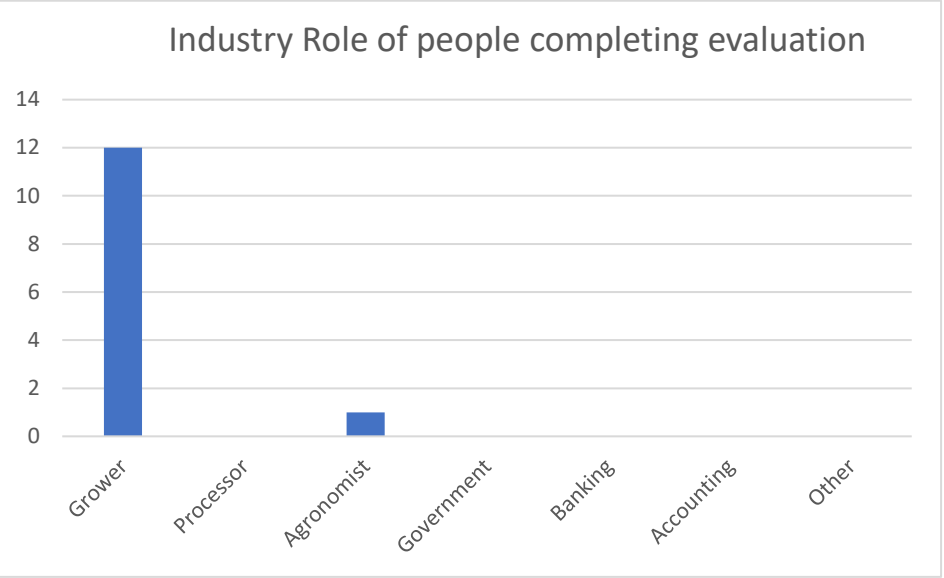
Irrigation and Soils workshop 20 Attendees 14 evaluations	Irrigation planning	Soils and Irrigation	Water Allocation	Water Market
Q1. Quality of information	4.5	4.7	4.7	4.7
Q2. Usefulness of information	4.3	4.9	4.5	4.6
Q3. Understanding before	3.3	3.8	3.5	3.3
Q4. Understanding after	4.4	4.5	4.5	4.3
Q5. Likelihood of using information	4.1	4.5	4.5	4.4



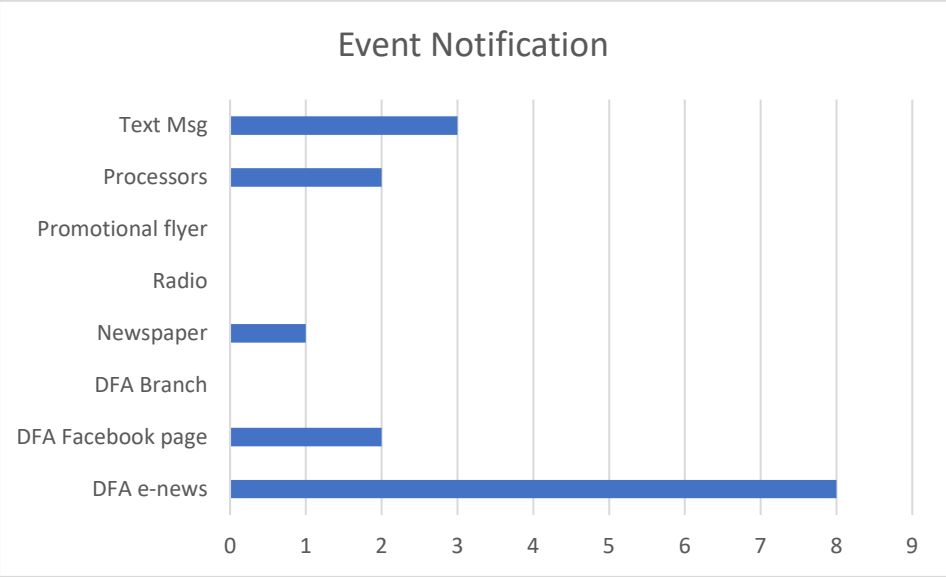


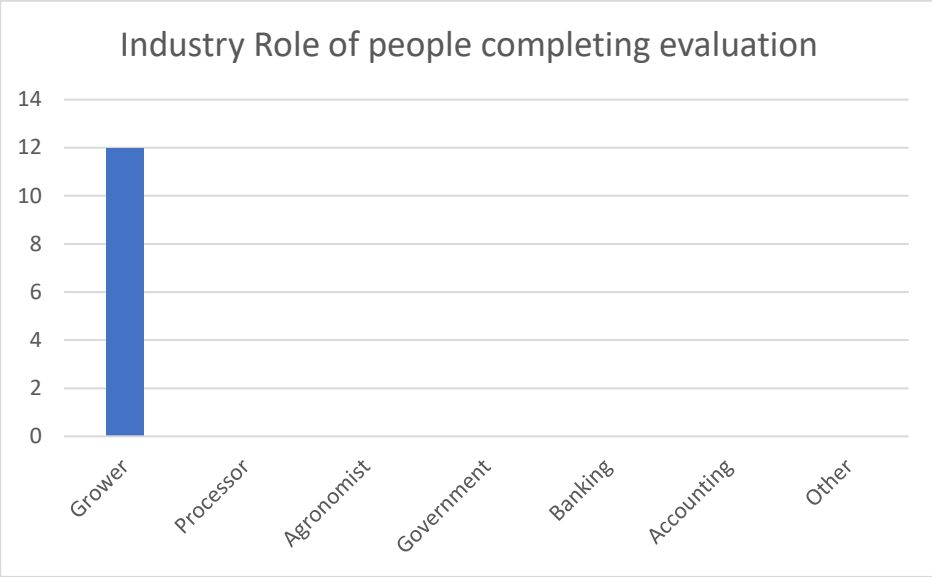
Pruning Field Day 34 Attendees 13 evaluations	Pruning trial – Stuart Putland, Ashley Johnstone	Nutrition - Michael Treeby	Piece Rates – Stuart Putland
Q1. Quality of information	4.7	4.5	4.5
Q2. Usefulness of information	4.6	4.5	4.4
Q3. Understanding before	4.2	4.3	3.8
Q4. Understanding after	4.4	4.5	4.4
Q5. Likelihood of using information	4.4	4.3	4.5



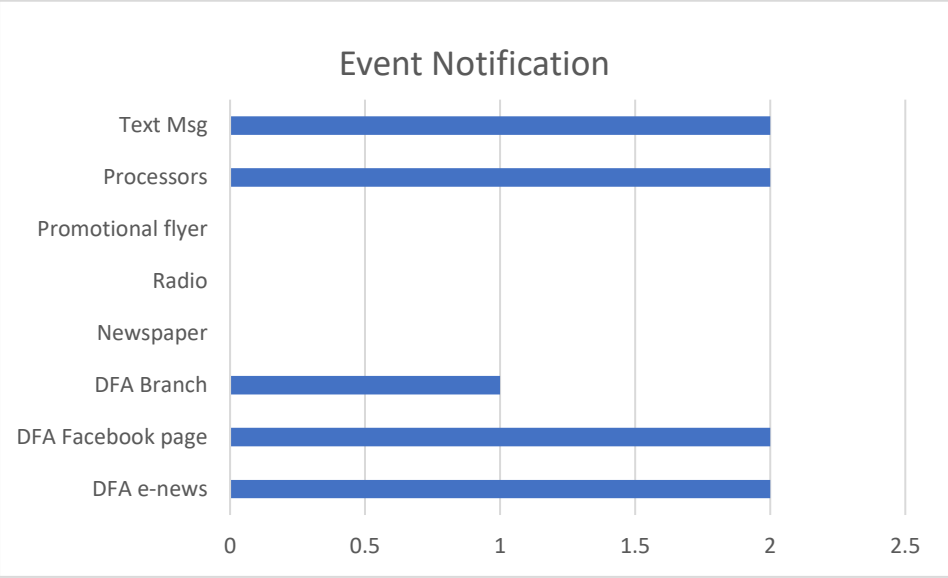


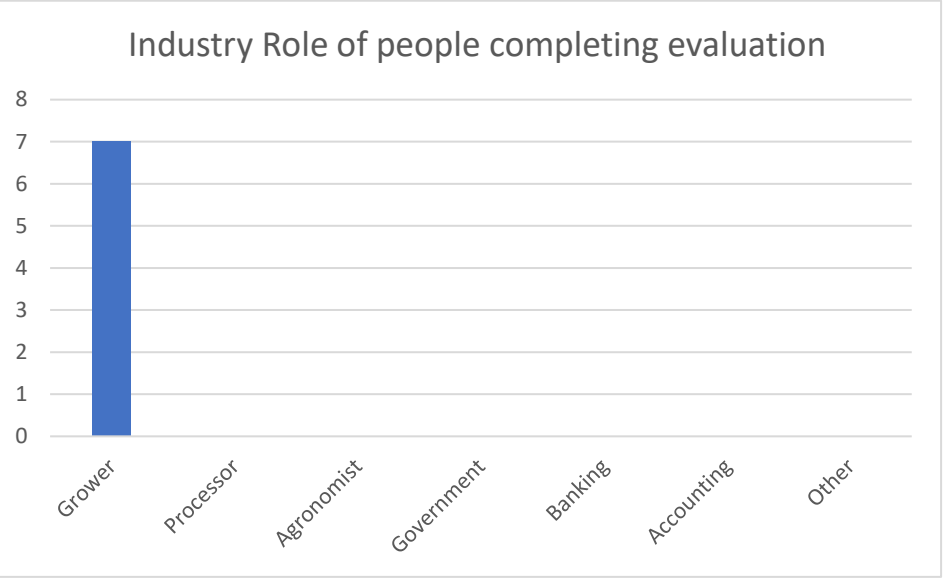
DFA Forum 25 attendees 12 evaluations	Sunrise Mapping - Sue Argus	Lower Murray Water - Anthony Carupis	Western Murray Irrigation - Judith Damiani	Australian Premium Dried Fruits - Craig Greenwood	Murray River Organics - Val Tripp	Sunbeam Foods - Grant Leyden
Q1. Quality of information	4.3	4.2	4.0	4.1	4.3	4.2
Q2. Usefulness of information	4.3	4.5	4.1	4.2	4.5	4.4
Q3. Understanding before	4.0	4.1	3.5	4.1	3.9	4.1
Q4. Understanding after	4.6	4.4	4.4	4.2	4.5	4.7
Q5. Likelihood of using information	4.1	4.4	4.2	4.3	4.7	4.5





Sunglo field walks 22 Attendees 7 Evaluations	Sunglo field walks	Peter Magarey
Q1. Quality of information	4.6	4.5
Q2. Usefulness of information	4.0	4.2
Q3. Understanding before	3.6	4.2
Q4. Understanding after	4.7	4.7
Q5. Likelihood of using information	4.3	4.5





Chlormequat meetings presentation

driedfruits australia

Chlormequat on Carina

Hort Innovation
Strategic levy investment

DRIED GRAPE FUND

Release of Carina

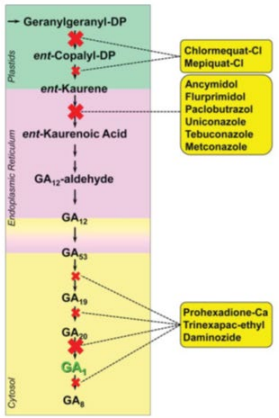
- Antcliff 1975
  - Only produces female flowers
  - Should be enough pollen in the region to pollinate properly
  - Caps don't fall off properly in unfavourable weather at flowering (Wet / high Humidity?)
  - "Standard GA_3-Chlormequat growth regulator spray used on Zante currant also appears to be effective in promoting good yield and even sized fruit"
  - "Physical removal of Calyptras by stroking inflorescences has effectively overcome the problem on a small scale"

How does Chlormequat work

- Plant growth retardants are synthetic compounds which:
- Reduce shoot length of plants in a desired way without changing developmental patterns
- By reducing cell elongation and lowering the rate of cell division.
- growth retardants are antagonistic to gibberellins (GAs) and auxins, the plant hormones that are primarily responsible for shoot elongation.

How does Giberellic acid work

- At present, 125 different GAs are known to occur in higher plants and/or GA producing fungi.
- The main hormonal functions of GAs are:
  - the promotion of longitudinal growth, the
  - induction of hydrolytic enzymes in germinating seeds,
  - the induction of bolting in long-day plants, and the
  - promotion of fruit setting and development.
- However, some of the many GAs might have functions that are still unknown.



Chlormequat and GA_3

- What's Chlormequat being used for
  - Reduce shoot growth
  - Target is the leaves
  - Stopping the vine putting its resources into leaf growth and put it into fruit growth
- What's GA_3 being used for
  - Berry growth
  - Perhaps berry setting (but I'm not clear about that)

How have these been used

- Single Spray - GetSet label (El-Zeftawi & Weste 69-71,Considine & El-Zeftawi 1971- Zantie)
  - 75ppm Chlormequat sprayed at 70 - 100% cap fall 1100 -1700 l/ha
- Double spray - Progibb Label (El-Zeftawi & Weste 69-71,Considine & El-Zeftawi 1971 - Zantie)
  - 100ppm Chlormequat & 1ppm GA_3 @ 100% capfall
- Split Spray - Progibb Label (Whiting and Hardie 1977 unpublished - Carina)
  - 100ppm Chlormequat@ 7 days after bunch droop
  - 1ppm GA_3 at 100% cap fall
  - 200ppm Chlormequat@ 7 days after bunch droop
  - 1ppm GA_3 at 100% cap fall
  - 300ppm Chlormequat@ 7 days after bunch droop
  - 1ppm GA_3 at 100% cap fall

Other Work

- Considine & Cass 2009 (Zantie)
  - "These observations are further evidence that the use of plant growth regulators is secondary to other management issues in the dried fruits industry, invigorating weak or aged vineyards and shifting the balance towards reproductive growth in excessively vegetative vineyards. Enlarging berries by the application of a growth regular in vegetatively weak vineyards has little or no impact on dried yield. The growth regulator CCC, evidently, can play a role in vegetatively dominant vineyards by shifting the balance towards the accumulation of harvestable dry matter, and quite likely, enhancing bud fruitfulness (Menary 1979). In such vines, its application may lead to a sustained shift in vine balance (state), but it too is ineffective in vegetatively weak vineyards."

Other Work

- Considine and Cass 1994 - unpublished (Carina)
  - CCC had little beneficial effect on set and development though it seemed, from two of the experiments, that treatment before full bloom led to a greater chance of a positive response than did treatment at full bloom. Also, early treatment gave better control of vegetative growth and would make it easier to ensure full coverage of bunches with the GA spray. It may be that the poor results achieved by some workers and growers with GA for this crop may be caused by the use of unreliable spraying equipment or lack of appreciation of the need to wet every flower. This is not such a problem with 4-CPA because it is effective even applied only to leaves.
  - The results obtained with GA3 were unexpected because in all other cases known to us (Considine, 1983), application of gibberellin at full bloom caused reduced fruit set. This is the first report to our knowledge of a positive fruit set response and may be associated with a high natural set of non-developing ovaries which develop normally if treated with GA.

Other Work

- Singh & Treeby 2009 (sunmuscat)
  - Competition for assimilates is important in determining number of berries per bunch
  - Management practices that have the potential to limit carbon assimilation need to be avoided
  - If carbon allocation is addressed then spraying B, Ca and / or Zn has a positive effect on berries per bunch.

Other work

- Downey Etal 2013
  - Overall Chlormequat applications only increased economic yield in one of the three seasons of the trial. - 2011 a very wet and humid year during flowering
  - Did not see an impact of B Zn and CA application in one year of the trial

Trial design

- Split spray program
  - 0ppm Chlormequat after bunch droop and 1ppm GA3 @ Full bloom
  - 50ppm Chlormequat after bunch droop and 1ppm GA3 @ Full bloom
  - 100ppm Chlormequat after bunch droop and 1ppm GA3 @ Full bloom
  - Replicate inflorescence stroking results
  - Micronutrient impacts
- Two sites
  - Half row trial repeated every fourth row (October)
  - Repeat across two properties
  - Collect data on berries per bunch (December)
  - Collect data on Chlormequat residue in dried grapes (April)
  - Maybe Tebuconazole ???????

Industry statistics extract from DFA annual report

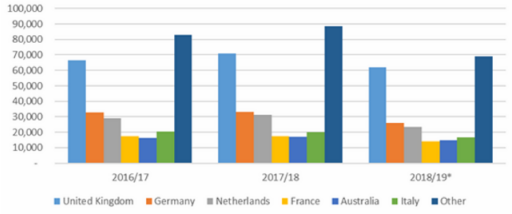
GLOBAL TRADE REPORT

TURKEY

In 2019/20, Turkish sultana raisin production is expected to recover back to 310,000 MT from a planted area of 74,000 hectares thanks to favourable weather conditions. This recovery comes after a drastic decrease in yields in 2018/19.

Source: USDA report

Turkey's top export markets

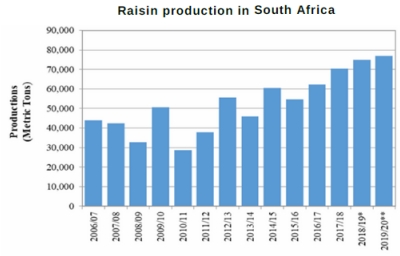


SOUTH AFRICA

South African raisin production will increase by 3% to 77,000 MT in the 2019/20 marketing year due to the rise in area planted, new orchards coming into full production, wine grapes being diverted for raisin production, normal weather conditions, and the continued availability of irrigation water.

Source: USDA report

Raisin production in South Africa



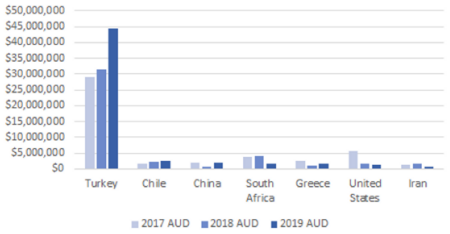
IMPORTS

AUSTRALIAN DRIED GRAPE IMPORTS

In the 12-month period ending June 2019, a total of 20,817 tonnes ($55,275,158) was imported, compared to 22,189 tonnes ($43,709,809) the previous year.

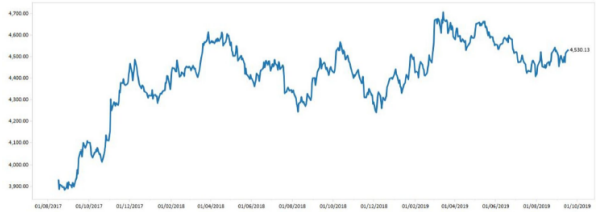
Main suppliers

- Turkey – 17,372t ($44,338,211)
- Chile – 772t ($2,645,029)
- China – 833t ($1,931,501)
- South Africa – 592t ($1,822,147)
- Greece – 404t ($1,661,538)
- US – 254t ($1,270,070)
- Iran – 299t ($806,038)

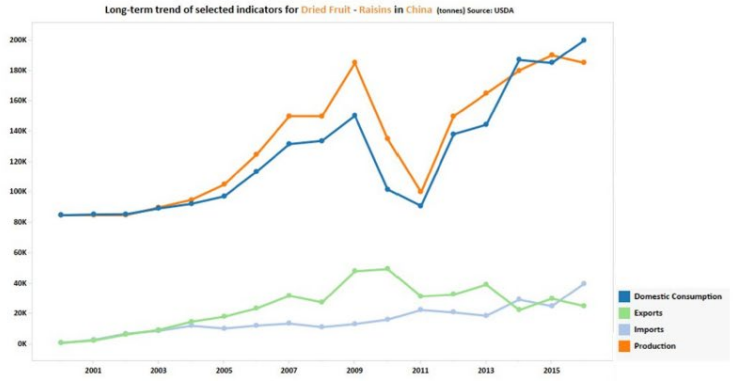


SULTANA PRICES (AUSTRALIAN 5-CROWN, CIF UK)

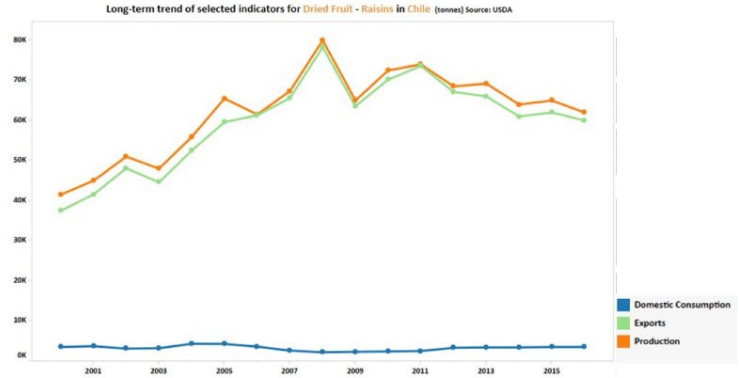
Prices displayed in AUD; UOM: Metric Ton



CHINA



CHILE

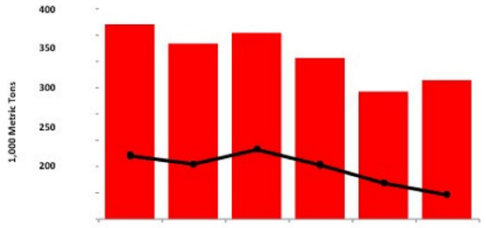


UNITED STATES

United States production is forecast up 22,000 tons to 263,000. Exports are forecast up 2,500 tons to 110,000 on slightly higher shipments to the European Union. Despite declining 6,000 tons from last year's record, imports are forecast to remain elevated at 30,000 tons. Ending stocks are expected to plummet one-third to 46,000 tons.

Source: USDA report

US ending stocks to continue declining despite uptick in production



Bulk California Thompson raisin prices are falling as raisin packers compete to move tonnage. With good quality and availability on the current 2018/19 California Thompson raisin crop, we suspect the principal drivers of low shipments to be related to demand as a result of high prices.

Other raisin growing origins, including Turkey, South Africa and Chile, picked up market share from California last year when California struggled with a short and rain-damaged crop.

The opening prices for the current 2018/19 California crop – which were especially high due to the record field price set by the Raisin Bargaining Association this year – helped incentivise some raisin importers to stay with non-California origins even when California offers the highest quality available globally.

Source: Anderson Exports

Benchmarking presentation – DFA Forum

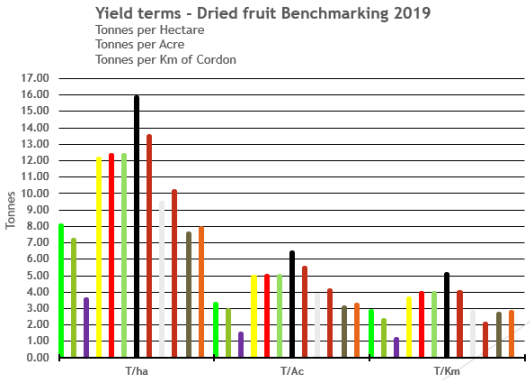
driedfruits australia

Year in review

Hort Innovation
Strategic levy investment

DRIED GRAPE FUND

Benchmarking



Benchmarking

Item	Cost Per Ha
Labour	$ 3,000.00
Water pumping	$ 1,800.00
Tractor	$ 1,200.00
fertiliser	$ 600.00
Chemical	$ 400.00
Total cost BI	**$ 7,000.00**

Range of labor costs

- Fully mechanised range between $2000 and $2700/ha
- Hand cutting and crown bunch picking just over $4000/ha

Dried Grape Adoption and Innovation Program 2018-2021.

APPENDIX THREE: DG 17001 Year 2020 only

Topic	Event	Timing	Partners	
Introducing the years events	Vine Article	**Completed:** April	IDO	https://issuu.com/vine-magazine/docs/2_vinemag_vol16iss2_fin_digital2?fr=sZGRlNTE0MjI2MDM
Review of minimal pruning demonstration. • View outcomes of minimal pruning treatment at harvest.	Online	**Completed:** April	Local grower, and IDO demonstrating the impact of saving time at pruning on the effectiveness of harvest.	A new pruning system, demonstrated at a field walk in June last year, reduced pruning time by 13 per cent but a final field day to look at how this system impacted on the cutting and harvest operations had to be cancelled due to Covid restrictions. The final piece of information was distributed to dried grape growers via Currant News highlighting two videos on the DFA you Tube channel because of Covid restrictions. https://www.driedfruitsaustralia.org.au/currant-news-13-march-2020/ https://www.driedfruitsaustralia.org.au/currant-news-10-april-2020/ The videos clearly demonstrated that the more efficient pruning system created not problems for the cutting process in preparation for trellis drying and the harvesting process after trellis drying. https://youtu.be/EcdNInuhjGo 133 views https://youtu.be/t_J7DLsIAYs 136 views
Coordination of mechanised pruning research project • Finalising project agreement. • Liaising with researchers to find suitable trial sites.	Meetings/ on line, phone	**Completed:** April – Dec Note, that this will continue as part of the 2021 program.	IDO, Drying For Profit Committee, La Trobe University, Mallee Regional Innovation Centre	Initial project funding submission under that Innovation Connections Facilitation program is underway. This has established a successful project between DFA and LaTrobe University through the work of the "Mallee Regional Innovation Centre" Initial trials with LaTrobe University were run June 23 at John Hunt's property. A select industry group was invited to participate in the trial.

• Coordinate feedback to industry.				Three cutting head types (circular saw, reciprocating blade and router bit) were trialled with all three showing promise for further development in the project. Tony Martin a local grower and DFA board member has also come up with a prototype of his own. While it still needs a bit more development, it looks very promising. It was pruning the cordon at about 1 km per hour. This prototype will now be integrated into the work being developed by La Trobe. Video of Tony's prototype is available here : https://youtu.be/sZDeeNHQOsk (375 views) LaTrobe university are currently working on the visioning systems to control the cutting head. Support for this project will need to continue through until June 2021.
Review of Best Practice Guide. • Content reviewed for reprinting or use in online format.	Content preparation	**Completed:** April - December	IDO, Drying for Profit Committee, Various expert reviewers.	A survey of growers has been completed by 10 growers with clear comments about what needs to be updated, removed and added to the guides as part of the review process. Results are available here; https://www.surveymonkey.com/stories/SM-QHCTBJZD/ Text has been reviewed for the three guides and is now ready for layout development. The plan is for these to be available as searchable PDF documents that can be downloaded from the DFA website on to growers' smart phones with embedded links back to more technical content on the DFA web site. See final draft of content attached to this report.
Pruning and Nutrition event (Note; this was an extra event added into the annual at growers' request)	On site field day	**Completed:** June	IDO industry experts	A pruning and nutrition field day was held at the Red Cliffs benchmarking site with 11 people attending this socially distanced event. The focus was on the benefits implication of pruning efficiencies as seen by Ashley Johnstone application of last year's pruning trial results across his whole property including the Irymple benchmarking site and David Lyons' results with mechanically pruned sultanas. Evaluation results from the field day can be found here; https://www.surveymonkey.com/stories/SM-HF6HLQZD/
Video training packages • Development of a video to train pruners • Development of a video to outline	Online video	**Completed**	IDO, Industry experts, DFA communications officer	Video footage for pruning has been captured and final editing is under way. There will be a soft launch in January 2021 and a more intense promotion in May 2021

pruning strategy for managers/ owners				
Benchmarking Data collection • Final collection season 2019/20	Email and phone	**Completed:** May	IDO	Information collected for the 2019/20 season and presented to growers via The Vine magazine. Site visits have been included in other field-based events where possible.
Industry review of Carina Currant trial data investigating European Union MRL requirements for Chlormequat setting sprays	Workshop / email and phone	**Completed:** May	IDO, industry packers and processors	Online session held with industry representatives to review data collected at part of the trial program. Industry communication was via an article in The Vine. Pages 26 &27 https://issuu.com/vine-magazine/docs/3_vinemag_vol16iss3_findigital A continuation of the trail for the 2020/21 season has been established at the same two sites.
Benchmarking report	Vine Article	**Completed:** July	IDO	This was changed to focus on the results of the Chlormequat trial work. (see above) Benchmarking results were reported in "The Vine "November 2020. The report highlighted the potential of these sites to consistently produce at or above 10 tonnes per hectare, which is a key turning point in production levels resulting in significant profitability for the industry. The report also demonstrated the financial benefits of the minimal pruning system (see above) which reduced pruning costs by 28%. The article can be found in this issue.https://www.driedfruitsaustralia.org.au/vine-november-2020/
Coordination of 2020 TAFE Cert III in Dried grape production steering committee. • Coordinate presenters for the final sessions. • Review Course and determine future course needs	Meetings	**Completed:** April - December	IDO	Delivery of final components did not go ahead as planned due to covid restriction. Consultation with large scale vineyards indicates that there will not be sufficient demand for a second course.
Irrigation management • Update on seasonal allocations. • Discussion on water budgeting.	Farm Visit or webinar format	August **Completed**	Water Broker, IDO, MEA staff member.	An online seminar was held on the 13th of August with presentations from Measurement Engineering Australia on soil moisture monitoring with capacitance probes using the green brain software. Phil Grahame from Rural Co water also gave an overview of the current water market.

• Discussion session about using "Green Brain" irrigation monitoring systems.				It was advertised in "Currant News" https://us15.campaign-archive.com/?u=51a7c0c0fe618f9af27dd44a7&id=b0e89826f9 and as a DFA Special News event https://us15.campaign-archive.com/?u=51a7c0c0fe618f9af27dd44a7&id=2d37881266 There were 19 participants and 23 people in total online, including presenters and DFA staff. Here is the link to the video of the presentation https://www.youtube.com/watch?v=0QLQ18Ig4ao (71 views) The session ran smoothly and was well received. Evaluation results can be found here: https://www.surveymonkey.com/stories/SM-BHYNVQZD/
Spring sticky beak tour • Key benchmarking and best practice demonstration sites across the region. • Disease modelling demonstration.	Farm Visit or webinar format	**Completed:** September	IDO, Dried Grape Growers, Peter Magarey	Due to Covid restrictions this session was not able to be run as planned. Instead, Peter Magarey presented an online session on disease modelling and how dried grape growers can access and use this information, particularly for Downey Mildew and Botrytis disease outbreak predictions based on in field microclimate monitoring using the Growcare website. This event was recorded and made available on the DFA You Tube channel for those growers that couldn't log in for the live event. https://www.youtube.com/watch?v=basXiQFNT-g (56 views on YouTube) Evaluation https://www.surveymonkey.com/stories/SM-99797X92/ Evaluation responses indicated the session was well presented and useful to growers who indicated they were keen to use the information in their business.
Water use and irrigation	Vine Article	**Completed:** September	IDO	This was changed to allow production of the benchmarking program information in two page spread in "The Vine" magazine https://www.driedfruitsaustralia.org.au/vine-november-2020/
Satellite imagery for Irrigation management. • Using Irrisat.	Workshop or webinar format	**Completed:** May (was planned for September)	Agriculture Victoria Staff, Dried Grape Grower.	Delivery of this was brough forward as it was able to be delivered online. There were 8 people set to participate. Technical difficulties on the day prevented two of those people attending despite trial runs with the video conferencing software prior to the event.

				Event was promoted in the May 8 edition of Currant News https://mailchi.mp/driedfruitsaustralia/cn8may2020 The session has been recorded and made available on the DFA You Tube Channel. This was promoted in the June 5 edition of Currant News https://mailchi.mp/driedfruitsaustralia/currantnews5june This is the link directly to the video. https://www.youtube.com/watch?v=KfdwUfsIg3I&t=43s (55 views) Evaluation of the event indicated participants learned a great deal during the presentation. Link to evaluation results is attached. https://www.surveymonkey.com/stories/SM-H8KSM59D/
DFA forum • Farm Business Models • Impact of Climate change on Dried Grape Production • Benchmarking report • Presentation of annual industry statistics • New varieties	Forum or webinar format	**Completed**: October	John Gladigau – Bulla Burra Graeme Anderson- Agriculture Victoria, IDO, CEO.	Due to covid restrictions this was broken into 3 different online events over the month of October. All events were recorded and made available on the DFA YouTube channel for industry participants who weren't able to log on for the events. John Gladigau presented on the Bulla Burra collaborative farming story. https://www.youtube.com/watch?v=TI-tibzT6ZI (34 views on YouTube). This presentation was further highlighted by an article in "The Vine" https://www.driedfruitsaustralia.org.au/vine-november-2020/ Evaluation https://www.surveymonkey.com/stories/SM-KR3FVX92/ Evaluation responses indicated the session was well presented and useful to growers who indicated they were keen to use the information in their business. Rachael McClintock presented information on potential new dried grape varieties from Sheehan genetics. https://www.youtube.com/watch?v=jPBTN087iuw (108 views on YouTube) Evaluation https://www.surveymonkey.com/stories/SM-8JJ6LX92/

				Evaluation responses indicated the session was well presented and useful to growers. Because the varieties under discussion weren't immediately available to industry growers indicate they were unsure about suing this information in their businesses Australian premium Dried fruits, Sunbeam and Murray river Organics, presented information on the 2019/20 season from a processing and marketing point of view. https://www.youtube.com/watch?v=AUofiR8aT-4 (97 views on YouTube) Industry statistics were presented in the annual report made available via DFA website. https://www.driedfruitsaustralia.org.au/dfa-annual-report-2020/
Meet the researchers • Visit to Adelaide and South Australian Riverland to meet key viticultural researchers. • Apple and Pear industry in the Adelaide Hills • Possible fresh market tour	Tour and farm visit. Assuming boarder is open again	November	IDO	This was not able to be organised within the timelines available under changing covid restrictions at the end of the year. Instead DFA collaborated on a Mallee Sustainable Farming Project looking at area wide weed management across dryland farming and irrigated horticulture. DFA assisted MSF and Frontier Farming Systems to locate and implement a herbicide trial site at a dried grape grower's property in Irymple. Initial results prepared by Frontier Farming are presented here. https://driedfruitsaustralia.us15.list-manage.com/track/click?u=51a7c0c0fe618f9af27dd44a7&id=e15bc37283&e=d44e1fda32 These results were discussed at a field day organised by DFA on the 9th of December. The field day was advertised in currant news https://www.driedfruitsaustralia.org.au/currant-news-4-december-2020/ 15 growers attended the event and the evaluation results indicated that the information would be readily used https://www.surveymonkey.com/stories/SM-XPSK3772/

				Results of the research trial were published in "The Vine" https://issuu.com/vine-magazine/docs/17_4_vinemag_fin2lr The field day also included information from Ceres Imaging on the use of Aerial Imaging including NDVI, water stress and heat in the management of dried grapes with examples from four dried grape sites. Evaluation indicated that this information was of significant interest to the growers that attended but that they are yet to see themselves adopting this technology.
Summer sticky Beak Tour • Key benchmarking and best practice demonstration sites across the region	Farm Visit	December	Completed	A final tour was held on the 18th of December starting at Duxton's vineyard at Liparoo and continuing through three other vineyards at Red Cliffs and Merbein, including two in the benchmarking program. The program was advertised in Currant News https://mailchi.mp/driedfruitsaustralia/specialnews11dec?e=d44e1fda32 12 people attended the tour and the evaluation indicated that there were elements of the production systems that growers were interested in adopting as a result of the day. Results of the evaluation survey are available on the link below. https://www.surveymonkey.com/stories/SM-FYTM9C7J/
Year in review	Vine Article	December	Completed	https://issuu.com/vine-magazine/docs/17_4_vinemag_fin2lr
Annual Focus group review	Focus Group	December	IDO	Completed as part of the last two face to face events for the year. Ideas that have been highlighted for next year out of the is process include. • Sessions introducing information on soil biology including how to monitor it and its impacts on vine nutrition, water holding capacity and vine health. • A planning session on future research needs for the industry. • Further information on efficacy of weedicide spray application in light of a concerning finding regarding the prevalence of herbicide resistance.

				• Managing late season Botrytis infections in light of recent MRL restrictions on fungicide use.

APPENDIX FOUR: Dried Grape Adoption and Innovation Program 2018-2021.

DG 17001 Year 2021 only

Topic	Event	Timing	Presenters	Comment
RD&E planning forum for the Dried Grape industry • Facilitated workshop to help industry participants to identify key issues for future RD&E	Facilitated Workshop	**Completed:** 21st January	IDO	Event planned and delivered with a cross section of 22 industry participants. The three major themes from the day were 1. New equipment and automation 2. New trellis design and management systems 3. Education and Training The first one was more immediately focussed on harvesters. The main focu of this work was coordinating design/ building of new harvesters that may be required in coming seasons. This work has been completed as part of this project. The other two issues have been developed further and presented to the DFA board. Hort Innovation attended the day and are incorporating the outcomes into their strategic planning for the dried grape industry.
Botrytis Field day • Discussion on botrytis management • Review of trial of new botrutis spray	Workshop / field walk	**Completed:** 20th January	IDO, Industry experts	A trial using a late season application of Botector was set up at David Lyons and Daryn Gardner's properties. The field day was held at David Lyon's property where participant heard from Dr Bob Emmet, plant pathologist, and Will Cllow from Nu Farm. Unfortunately Botryitis incidence was low so there was little to be seen in terms of impact from the

				trial. However, participants were given a very good understanding of how to use this relatively new and very different Botector product. This can be seen in the positive evaluation results https://www.surveymonkey.com/stories/SM-M2QRVC7J/
Coordinating harvester design • Linking new vineyard developments with harvester production and updated design information.	Meetings and Introductions	**Completed:** January - May	IDO	Potential demand for new harvester builds has been assessed across key businesses. Where necessary people new to the industry have been given an operational overview of harvester design and linked up with existing growers who can assist with building design issues.
Introducing the years events	Vine Article	**Completed** April	IDO	https://www.driedfruitsaustralia.org.au/may-vine-magazine/
Coordination of mechanised pruning research project • Facilitation of prototype trials. • Demonstration of prototype pruning tool	Meetings/ on line, phone Field demonstration.	**In Process:** April -May	IDO, Drying For Profit Committee, La Trobe University, Mallee Regional Innovation Centre	The project is focussing on using the cutting head design developed by Tony Martin. The first trial took place as early as possible after harvest (14th and 15th April) It did not go as well as hoped but has give the LaTrobe university build team some very clear directions for the specification of the next generation protype planned for trials in early June. This will still allow time for a third prototype, if required, to be available late in this pruning season. Improvement to be made for the next prototype are listed below • Swap Electric Motor for Hydraulic motor • Make blade double the length • Make 3 types of blades: straight through, 25degrees, 45 degrees • Make blade wider with a larger cutting region

				• Reduce length of main bar by 300mm • Increase Linear actuator velocity • Increase linear actuator depth (6" -> 8") • Upgrade Guide Rods (possibly a well greased U-Section inside another U section or a 4-bar mechanism) • Extend guide rods backwards rather than forwards • Use steel rather than aluminium (final build) • Mount camera system higher • Select vision processing system (NVIDA JETSON or Raspberry Pi) Planned run for next prototype testing is June 24
Benchmarking Data collection • Final collection season 2020/21 • Final review meeting with participants.	Email and phone	**Completed**	IDO	Final data collection completed and discussion session held with participants on the 10th of June. This identified key messages for the industry from the program. These will be rolled out in articles in "The Vine"
Chlormequat review workshop • Industry review of Carina Currant trial data investigating European Union MRL requirements for Chlormequat setting sprays	Workshop / email and phone	**Completed**	IDO, industry packers and processors	Trials have been completed and the data collected. For a second year running the data indicates that there is no benefit from applying Chlormequat. A discussion session with processes, researchers and DFA staff on the 28th of April agreed that one more year of trials is required and may include a scaled up demonstration.
Mildura Field Days **Focusing on** • Industry benchmarking results • GrapeInvest industry investment analysis • Prototype pruning machine	Field Day display	**Completed**	IDO	DFA had a stand within the large display area managed by Agriculture Victoria. We have found in previous years that this location bring more traffic through the site making the effort more worthwhile. The focus this year was on the potential of the industry for new investment

Annual Focus group review	Focus Group	**Completed with Benchmarking review meeting**	IDO	
Benchmarking report	Vine Article	**In Process:**	IDO	Article being completed for publication in the August edition of the vine
Project review	Vine Article	**In Process:**	IDO	Article being completed for publication in the August edition of the vine
Review of Best Practice Guide. • Facilitation of final Layout of best practice guide update	Content preparation	**In Process:** June	IDO, Drying for Profit Committee, Various expert reviewers.	Final edits have been completed on all three guides and a new has been finalised.

Variety	T/Ha 21	T/Km Cordon 21	$/Ha 21	$/Km cordon 21	T/Ha 20	T/Km Cordon20	$/Ha 20	$/Km cordon 20	T/Ha 19	T/Km Cordon 19	$/Ha 19	Income / Patch 2019	$/Km Cordon 19
Sunmuscat	7.49	2.64	$15,731	$ 5,554.32	5.71	$ 2.02	$11,998	$ 4,236.17	8.06	2.85	$16,935	$47,250	$5,980
Sunglo	3.33	1.06	$7,000	$ 2,236.21	2.86	$ 0.91	$6,000	$ 1,916.75	7.14	2.28	$15,000	$31,500	$4,792
Sunmuscat	3.55	1.15	$7,447	$ 2,413.82	2.84	$ 0.92	$5,957	$ 1,931.05	3.55	1.15	$7,447	$10,500	$2,414
Sunmuscat	8.96	2.65	$18,809	$ 5,566.86	11.45	$ 3.39	$24,043	$ 7,116.22	12.10	3.58	$25,419	$87,696	$7,523
Sunmuscat	9.28	2.97	$19,494	$ 6,227.52	10.56	$ 3.37	$22,171	$ 7,082.80	12.35	3.95	$25,936	$65,100	$8,286
Sunglo	11.20	3.58	$23,520	$ 7,513.65	10.38	$ 3.32	$21,808	$ 6,966.64	12.31	3.93	$25,846	$67,200	$8,257
Carina	11.05	3.53	$23,214	$ 7,415.74	14.04	$ 4.49	$29,493	$ 9,421.68	15.86	5.07	$33,297	$36,960	$12,015
Carina	11.06	3.27	$23,219	$ 6,872.10	11.44	$ 3.39	$24,018	$ 7,108.80	13.51	4.00	$28,378	$231,000	$8,399
Sunglo	11.11	3.24	$23,333	$ 6,796.12	8.50	$ 2.48	$17,850	$ 5,199.03	9.44	2.75	$19,833	$71,400	$5,777
Salma Pete	13.52	2.78	$28,392	$ 5,839.69	12.80	$ 2.63	$26,880	$ 5,528.70	10.14	2.09	$21,294	$106,470	$4,380
Sultana	4.50	1.59	$9,450	$ 3,336.58	8.72	$ 3.08	$18,310	$ 6,464.82	7.55	2.67	$15,853	$38,364	$5,597
Sunmuscat	7.42	2.62	$15,581	$ 5,501.17	8.71	$ 3.08	$18,290	$ 6,457.90	7.90	2.79	$16,583	$51,408	$5,855
Annual Avera	8.54	2.59	17932.41	5439.48	9.00	2.76	18901.60	5785.88	9.99	3.09	20985.25	70404.00	6606.16

year Ave T/Ha		Pruning	Fertiliser	Disease Control	Weed Control	Canopy management	Wetting	Cutting	Harvest	All Activities
7.09	Total time (Hrs)	69.00	3.00	4.13	18.00	18.00	5.16	16.00	51.00	184.29
	Total time/ha	24.73	1.08	1.48	6.45	6.45	1.85	5.73	18.28	66.06
	Total time/ km of Cor	8.73	0.38	0.52	2.28	2.28	0.65	2.02	6.45	23.32
	Labour cost/Ha	$643.01	$27.96	$38.52	$167.74	$167.74	$48.09	$149.10	$475.27	$1,717.44
	Labour cost/ Km Cord	$227.03	$9.87	$13.60	$59.23	$59.23	$16.98	$52.65	$167.81	$606.39
	Machinery Hours	4.00	0.00	4.13	4.00	0.00	2.58	0.00	19.00	33.71
	Machinery Hrs/ha	1.43	0.00	1.48	1.43	0.00	0.92	0.00	6.81	12.08
	machinery Hours / Kn	0.51	0.00	0.52	0.51	0.00	0.33	0.00	2.40	4.27
4.44	Total time (Hrs)	71.85	2.00	11.51	6.38	2.82	2.19	3.29	4.93	104.97
	Total time/ha	34.21	0.95	5.48	3.04	1.34	1.04	1.57	2.35	49.98
	Total time/ km of Cor	10.93	0.30	1.75	0.97	0.43	0.33	0.50	0.75	15.97
	Labour cost/Ha	$889.53	$24.76	$142.54	$79.02	$34.88	$27.13	$40.69	$61.04	$1,299.60
	Labour cost/ Km Cord	$284.17	$7.91	$45.54	$25.24	$11.14	$8.67	$13.00	$19.50	$415.17
	Machinery Hours	3.89	0.00	8.63	6.38	2.82	2.19	3.29	4.93	32.13
	Machinery Hrs/ha	1.85	0.00	4.11	3.04	1.34	1.04	1.57	2.35	15.30
	machinery Hours / Kn	0.59	0.00	1.31	0.97	0.43	0.33	0.50	0.75	4.89
3.31	Total time (Hrs)	24.36	2.00	8.97	4.90	0.62	1.45	2.90	4.35	49.55
	Total time/ha	17.28	1.42	6.36	3.48	0.44	1.03	2.06	3.09	35.14
	Total time/ km of Cor	5.60	0.46	2.06	1.13	0.14	0.33	0.67	1.00	11.39
	Labour cost/Ha	$449.21	$36.88	$165.43	$90.35	$11.46	$26.74	$53.47	$80.21	$913.76
	Labour cost/ Km Cord	$145.61	$11.95	$53.62	$29.29	$3.71	$8.67	$17.33	$26.00	$296.19
	Machinery Hours	2.61	0.00	6.73	4.90	0.62	1.45	2.90	4.35	23.56
	Machinery Hours/ Ha	1.85	0.00	4.77	3.48	0.44	1.03	2.06	3.09	16.71
	machinery Hours / Kn	0.60	0.00	1.55	1.13	0.14	0.33	0.67	1.00	5.42
10.84	Total time (Hrs)	191.38	9.00	30.00	16.00	23.33	17.48	17.50	25.90	330.59
	Total time/ha	55.47	2.61	8.70	4.64	6.76	5.07	5.07	7.51	95.82
	Total time/ km of Cor	16.42	0.77	2.57	1.37	2.00	1.50	1.50	2.22	28.36
	Labour cost/Ha	$1,442.32	$67.83	$226.09	$120.58	$175.81	$131.70	$131.88	$195.21	$2,491.42
	Labour cost/ Km Cord	$426.89	$20.07	$66.92	$35.69	$52.03	$38.98	$39.03	$57.78	$737.39
	Machinery Hours	123.16	0.00	30.00	16.00	10.89	17.48	6.00	77.71	281.23
	Machinery Hrs/ha	35.70	0.00	8.70	4.64	3.16	5.07	1.74	22.52	81.52
	machinery Hours / Kn	10.57	0.00	2.57	1.37	0.93	1.50	0.51	6.67	24.13
10.73	Total time (Hrs)	154.71	9.99	5.59	2.57	83.75	7.86	20.00	24.80	309.26
	Total time/ha	61.64	3.98	2.23	1.02	33.36	3.13	7.97	9.88	123.21
	Total time/ km of Cor	19.69	1.27	0.71	0.33	10.66	1.00	2.55	3.16	39.36
	Labour cost/Ha	$1,602.57	$103.48	$57.92	$26.64	$867.49	$81.39	$207.17	$256.88	$3,203.54
	Labour cost/ Km Cord	$511.95	$33.06	$18.50	$8.51	$277.13	$26.00	$66.18	$82.06	$1,023.39
	Machinery Hours	5.86	9.99	5.59	2.57	7.75	7.86	20.00	24.80	84.41
	Machinery Hrs/ha	2.33	3.98	2.23	1.02	3.09	3.13	7.97	9.88	33.63
	machinery Hours / Kn	0.75	1.27	0.71	0.33	0.99	1.00	2.55	3.16	10.74
11.30	Total time (Hrs)	158.35	12.09	5.72	2.63	83.47	8.14	20.00	25.69	316.08
	Total time/ha	60.90	4.65	2.20	1.01	32.10	3.13	7.69	9.88	121.57
	Total time/ km of Cor	19.46	1.49	0.70	0.32	10.26	1.00	2.46	3.16	38.84
	Labour cost/Ha	$1,583.49	$120.87	$57.21	$26.28	$834.69	$81.39	$200.00	$256.88	$3,160.79
	Labour cost/ Km Cord	$505.86	$38.61	$18.27	$8.39	$266.65	$26.00	$63.89	$82.06	$1,009.74
	Machinery Hours	4.93	12.09	5.72	2.63	11.47	8.14	20.00	25.69	90.66
	Machinery Hrs/ha	1.89	4.65	2.20	1.01	4.41	3.13	7.69	9.88	34.87
	machinery Hours / Kn	0.61	1.49	0.70	0.32	1.41	1.00	2.46	3.16	11.14
13.65	Total time (Hrs)	80.87	5.50	10.37	1.16	58.08	0.00	6.00	12.00	173.98
	Total time/ha	72.85	4.95	9.34	1.04	52.32	0.00	5.41	10.81	156.73
	Total time/ km of Cor	23.27	1.58	2.98	0.33	16.72	0.00	1.73	3.45	50.07
	Labour cost/Ha	$1,894.22	$128.83	$242.87	$27.13	$1,360.44	$0.00	$140.54	$281.08	$4,075.11
	Labour cost/ Km Cord	$605.12	$41.16	$77.59	$8.67	$434.60	$0.00	$44.90	$89.79	$1,301.82
	Machinery Hours	3.87	0.50	6.52	0.58	2.08	0.00	0.00	12.00	0.00
	Machinery Hrs/ha	3.49	0.00	5.87	0.52	1.87	0.00	0.00	10.81	22.56
	machinery Hours / Kn	1.11	0.00	1.88	0.17	0.60	0.00	0.00	3.45	7.21
12.00	Total time (Hrs)	403.12	13.00	29.88	13.08	13.82	0.00	34.00	52.00	558.91
	Total time/ha	49.52	1.60	3.67	1.61	1.70	0.00	4.18	6.39	68.66
	Total time/ km of Cor	14.66	0.47	1.09	0.48	0.50	0.00	1.24	1.89	20.32
	Labour cost/Ha	$1,287.61	$41.52	$95.45	$41.77	$44.15	$0.00	$108.60	$166.09	$1,785.20
	Labour cost/ Km Cord	$381.10	$12.29	$28.25	$12.36	$13.07	$0.00	$32.14	$49.16	$528.37
	Machinery Hours	51.27	0.00	26.15	13.08	13.82	0.00	34.00	52.00	190.32
	Machinery Hrs/ha	6.30	0.00	3.21	1.61	1.70	0.00	4.18	6.39	23.38
	machinery Hours / Kn	1.86	0.00	0.95	0.48	0.50	0.00	1.24	1.89	6.92
9.69	Total time (Hrs)	172.95	17.77	15.63	7.25	1.95	10.00	18.00	20.00	263.56
	Total time/ha	48.04	0.00	4.34	0.00	0.54	2.78	5.00	5.56	66.26
	Total time/ km of Cor	13.99	94.00	1.26	10.44	0.16	0.81	1.46	1.62	123.74
	Labour cost/Ha	$1,249.08	$0.00	$112.90	$0.00	$14.11	$72.22	$130.00	$144.44	$1,722.76
	Labour cost/ Km Cord	$363.81	$174.60	$32.88	$0.42	$4.11	$21.04	$37.86	$42.07	$3,217.22
	Machinery Hours	39.12	0.00	13.68	0.00	1.95	10.00	8.00	20.00	92.76
	Machinery Hrs/ha	0.00	0.00	3.80	0.18	0.54	2.78	2.22	5.56	15.08
	machinery Hours / Kn	0.00	0.00	1.11	0.00	0.16	0.81	0.65	1.62	4.34
12.15	Total time (Hrs)	423.00	21.00	13.80	10.00	15.00	24.00	187.00	35.00	728.80
	Total time/ha	84.60	4.20	2.76	2.00	3.00	4.80	37.40	7.00	145.76
	Total time/ km of Cor	17.40	0.86	0.57	0.41	0.62	0.99	7.69	1.44	29.98
	Labour cost/Ha	$2,199.60	$109.20	$71.76	$52.00	$78.00	$124.80	$972.40	$182.00	$3,789.76
	Labour cost/ Km Cord	$452.42	$22.46	$14.76	$10.70	$16.04	$25.67	$200.00	$37.43	$779.48
	Machinery Hours	12.00	19.00	0.00	8.00	15.00	24.00	0.00	35.00	113.00
	Machinery Hrs/ha	2.40	3.80	0.00	1.60	3.00	4.80	0.00	7.00	22.60
	machinery Hours / Kn	0.49	0.78	0.00	0.33	0.62	0.99	0.00	1.44	4.65
6.92	Total time (Hrs)	119.85	1.14	0.00	6.00	3.02	2.45	1.96	9.08	143.49
	Total time/ha	49.52	0.47	0.00	2.48	1.25	1.01	0.81	3.75	59.29
	Total time/ km of Cor	17.49	0.17	0.00	0.88	0.44	0.36	0.29	1.32	20.93
	Labour cost/Ha	$1,287.61	$12.27	$0.00	$64.43	$32.44	$26.30	$21.04	$97.50	$1,541.60
	Labour cost/ Km Cord	$454.63	$4.33	$0.00	$22.75	$11.46	$9.29	$7.43	$34.43	$544.30
	Machinery Hours	15.84	1.14	0.00	3.43	1.71	2.45	1.96	9.08	35.60
	Machinery Hrs/ha	6.55	0.47	0.00	1.42	0.71	1.01	0.81	3.75	14.71
	machinery Hours / Kn	2.31	0.17	0.00	0.50	0.25	0.36	0.29	1.32	5.19
8.01	Total time (Hrs)	153.52	1.46	0.00	7.68	3.73	3.14	2.51	11.63	183.67
	Total time/ha	49.52	0.47	0.00	2.48	1.20	1.01	0.81	3.75	59.25
	Total time/ km of Cor	17.49	0.17	0.00	0.88	0.42	0.36	0.29	1.32	20.92
	Labour cost/Ha	$1,287.61	$12.27	$0.00	$64.43	$31.27	$26.30	$21.04	$97.50	$1,540.42
	Labour cost/ Km Cord	$454.63	$4.33	$0.00	$22.75	$11.04	$9.29	$7.43	$34.43	$543.89
	Machinery Hours	20.29	1.46	0.00	4.39	2.19	3.14	2.51	11.63	45.61
	Machinery Hrs/ha	6.55	1.46	0.00	1.42	0.71	1.01	0.81	3.75	14.71
	machinery Hours / Kn	2.31	0.17	0.00	0.50	0.25	0.36	0.29	1.32	5.19
9.18	Ave Labour/ Ha	$1,317.99	$57.16	$100.89	$63.36	$304.37	$53.84	$181.33	$191.18	
	Ave Labour/KM Cord	$401.10	$31.72	$30.83	$20.33	$96.68	$15.88	$48.49	$60.21	

	Pruning	Fertiliser	Disease Control	Weed Control	Canopy management	Wetting	Cutting	Harvest	All Activities
Total time (Hrs)	149.41	0.00	5.27	54.00	132.00	14.00	40.00	19.00	413.68
Total time/ha	53.55	0.00	1.89	19.35	47.31	5.02	14.34	6.81	148.27
Total time/ km of Cor	18.91	0.00	0.67	6.83	16.70	1.77	5.06	2.40	52.35
Labour cost/Ha	$1,392.35	$0.00	$49.09	$503.23	$1,230.11	$130.47	$372.76	$177.06	$3,855.06
Labour cost/ Km Cord	$491.61	$0.00	$17.33	$177.68	$434.32	$46.06	$131.61	$62.52	$1,361.14
Machinery Hours	4.00	0.00	5.27	40.00	0.00	14.00	0.00	19.00	82.27
Machinery Hrs/ha	1.43	0.00	1.89	14.34	0.00	5.02	0.00	6.81	29.49
machinery Hours / Kn	0.51	0.00	0.67	5.06	0.00	1.77	0.00	2.40	10.41
Total time (Hrs)	71.85	2.00	11.51	6.38	2.82	2.19	3.29	4.93	104.97
Total time/ha	34.21	0.95	5.48	3.04	1.34	1.04	1.57	2.35	49.98
Total time/ km of Cor	10.93	0.30	1.75	0.97	0.43	0.33	0.50	0.75	15.97
Labour cost/Ha	$889.53	$24.76	$142.54	$79.02	$34.88	$27.13	$40.69	$61.04	$1,299.60
Labour cost/ Km Cord	$284.17	$7.91	$45.54	$25.24	$11.14	$8.67	$13.00	$19.50	$415.17
Machinery Hours	3.89	0.00	8.63	6.38	2.82	2.19	3.29	4.93	32.13
Machinery Hrs/ha	1.85	0.00	4.11	3.04	1.34	1.04	1.57	2.35	15.30
machinery Hours / Kn	0.59	0.00	1.31	0.97	0.43	0.33	0.50	0.75	4.89
Total time (Hrs)	85.65	2.00	8.97	4.90	1.86	1.45	2.90	4.35	112.09
Total time/ha	60.75	1.42	6.36	3.48	1.32	1.03	2.06	3.09	79.50
Total time/ km of Cor	19.69	0.46	2.06	1.13	0.43	0.33	0.67	1.00	25.77
Labour cost/Ha	$1,579.44	$36.88	$165.43	$90.35	$34.38	$26.74	$53.47	$80.21	$2,066.91
Labour cost/ Km Cord	$511.96	$11.95	$53.62	$29.29	$11.14	$8.67	$17.33	$26.00	$669.97
Machinery Hours	2.61	0.00	6.73	4.90	1.86	1.45	2.90	4.35	24.80
Machinery Hours/ Ha	1.85	0.00	4.77	3.48	1.32	1.03	2.06	3.09	17.59
machinery Hours / Kn	0.60	0.00	1.55	1.13	0.43	0.33	0.67	1.00	5.70
Total time (Hrs)	195.66	3.50	21.50	11.00	25.75	16.29	8.50	13.50	295.70
Total time/ha	56.71	1.01	6.23	3.19	7.46	4.72	2.46	3.91	85.71
Total time/ km of Cor	16.79	0.30	1.84	0.94	2.21	1.40	0.73	1.16	25.37
Labour cost/Ha	$1,474.53	$26.38	$162.03	$82.90	$194.06	$122.79	$64.06	$101.74	$2,228.48
Labour cost/ Km Cord	$436.42	$7.81	$47.96	$24.54	$57.44	$36.34	$18.96	$30.11	$659.57
Machinery Hours	10.02	0.00	21.50	11.00	13.25	16.29	8.50	13.50	94.07
Machinery Hrs/ha	2.90	0.00	6.23	3.19	3.84	4.72	2.46	3.91	27.27
machinery Hours / Kn	0.86	0.00	1.84	0.94	1.14	1.40	0.73	1.16	8.07
Total time (Hrs)	154.71	9.99	5.74	2.57	19.75	7.86	12.00	24.00	236.62
Total time/ha	61.64	3.98	2.29	1.02	7.87	3.13	4.78	9.56	94.27
Total time/ km of Cor	19.69	1.27	0.73	0.33	2.51	1.00	1.53	3.05	30.11
Labour cost/Ha	$1,602.57	$103.48	$59.47	$26.64	$204.54	$81.39	$124.30	$248.61	$2,451.00
Labour cost/ Km Cord	$511.95	$33.06	$19.00	$8.51	$65.34	$26.00	$39.71	$79.42	$782.99
Machinery Hours	4.86	9.99	5.74	2.57	11.75	7.86	12.00	24.00	78.77
Machinery Hrs/ha	1.94	3.98	2.29	1.02	4.68	3.13	4.78	9.56	31.38
machinery Hours / Kn	0.62	1.27	0.73	0.33	1.49	1.00	1.53	3.05	10.02
Total time (Hrs)	158.35	12.09	5.88	2.63	11.47	8.14	12.00	14.00	224.55
Total time/ha	60.90	4.65	2.26	1.01	4.41	3.13	4.62	5.38	86.36
Total time/ km of Cor	19.46	1.49	0.72	0.32	1.41	1.00	1.47	1.72	27.59
Labour cost/Ha	$1,583.49	$120.87	$58.76	$26.28	$114.69	$81.39	$120.00	$140.00	$2,245.46
Labour cost/ Km Cord	$505.86	$38.61	$18.77	$8.39	$36.64	$26.00	$38.33	$44.72	$717.33
Machinery Hours	4.93	12.09	5.88	2.63	11.47	8.14	12.00	14.00	71.12
Machinery Hrs/ha	1.89	4.65	2.26	1.01	4.41	3.13	4.62	5.38	27.36
machinery Hours / Kn	0.61	1.49	0.72	0.32	1.41	1.00	1.47	1.72	8.74
Total time (Hrs)	80.87	8.57	6.52	0.58	58.08	0.00	6.00	12.00	172.61
Total time/ha	72.85	7.72	5.87	0.52	52.32	0.00	5.41	10.81	155.51
Total time/ km of Cor	23.27	2.47	1.88	0.17	16.72	0.00	1.73	3.45	49.68
Labour cost/Ha	$1,894.22	$200.70	$152.62	$13.56	$1,360.44	$0.00	$140.54	$281.08	$4,043.16
Labour cost/ Km Cord	$605.12	$64.11	$48.75	$4.33	$434.60	$0.00	$44.90	$89.79	$1,291.62
Machinery Hours	3.87	0.91	6.52	0.58	2.08	0.00	0.00	12.00	0.00
Machinery Hrs/ha	3.49	0.00	5.87	0.52	1.87	0.00	0.00	10.81	22.56
machinery Hours / Kn	1.11	0.00	1.88	0.17	0.60	0.00	0.00	3.45	7.21
Total time (Hrs)	611.50	6.00	52.30	9.46	13.46	0.00	37.00	59.00	788.72
Total time/ha	75.12	0.74	6.42	1.16	1.65	0.00	4.55	7.25	96.89
Total time/ km of Cor	22.23	0.22	1.90	0.34	0.49	0.00	1.35	2.15	28.68
Labour cost/Ha	$1,953.19	$19.16	$167.05	$30.22	$43.00	$0.00	$118.18	$188.45	$2,519.26
Labour cost/ Km Cord	$578.09	$5.67	$49.44	$8.95	$12.73	$0.00	$34.98	$55.78	$745.63
Machinery Hours	266.00	0.00	52.30	9.46	13.46	0.00	17.00	59.00	417.22
Machinery Hrs/ha	32.68	0.00	6.42	1.16	1.65	0.00	2.09	7.25	51.26
machinery Hours / Kn	9.67	0.00	1.90	0.34	0.49	0.00	0.62	2.15	15.17
Total time (Hrs)	155.00	6.00	27.36	12.01	1.95	10.00	32.00	22.00	266.32
Total time/ha	43.06	1.67	7.60	3.34	0.54	2.78	8.89	6.11	73.98
Total time/ km of Cor	12.54	0.49	2.21	0.97	0.16	0.81	2.59	1.78	21.55
Labour cost/Ha	$1,119.44	$43.33	$197.58	$86.72	$14.11	$72.22	$231.11	$158.89	$1,923.42
Labour cost/ Km Cord	$326.05	$12.62	$57.55	$25.26	$4.11	$21.04	$67.31	$46.28	$560.22
Machinery Hours	55.50	0.00	27.36	12.01	1.95	10.00	24.00	22.00	152.82
Machinery Hrs/ha	15.42	0.00	7.60	3.34	0.54	2.78	6.67	6.11	42.45
machinery Hours / Kn	4.49	0.00	2.21	0.97	0.16	0.81	1.94	1.78	12.36
Total time (Hrs)	638.00	15.00	12.30	8.00	9.00	27.00	228.00	188.00	1125.30
Total time/ha	127.60	3.00	2.46	1.60	1.80	5.40	45.60	37.60	225.06
Total time/ km of Cor	26.24	0.62	0.51	0.33	0.37	1.11	9.38	7.73	46.29
Labour cost/Ha	$3,317.60	$78.00	$63.96	$41.60	$46.80	$140.40	$1,185.60	$977.60	$5,851.56
Labour cost/ Km Cord	$682.37	$16.04	$13.16	$8.56	$9.63	$28.88	$243.86	$201.07	$1,203.55
Machinery Hours	13.00	11.50	0.00	8.00	9.00	27.00	0.00	188.00	256.50
Machinery Hrs/ha	2.60	2.30	0.00	1.60	1.80	5.40	0.00	37.60	51.30
machinery Hours / Kn	0.53	0.47	0.00	0.33	0.37	1.11	0.00	7.73	10.55
Total time (Hrs)	194.70	1.14	0.00	3.43	1.71	6.78	4.78	16.21	228.75
Total time/ha	80.45	0.47	0.00	1.42	0.71	2.80	1.98	6.70	94.53
Total time/ km of Cor	28.41	0.17	0.00	0.50	0.25	0.99	0.70	2.37	33.37
Labour cost/Ha	$2,091.78	$12.27	$0.00	$36.82	$18.41	$72.80	$51.38	$174.20	$2,457.66
Labour cost/ Km Cord	$738.56	$4.33	$0.00	$13.00	$6.50	$25.70	$18.14	$61.51	$867.74
Machinery Hours	21.53	1.14	0.00	3.43	1.71	6.78	4.78	16.21	55.58
Machinery Hrs/ha	8.90	0.47	0.00	1.42	0.71	2.80	1.98	6.70	22.97
machinery Hours / Kn	3.14	0.17	0.00	0.50	0.25	0.99	0.70	2.37	8.11
Total time (Hrs)	217.78	1.46	0.00	4.39	2.19	8.68	6.13	20.77	261.41
Total time/ha	70.25	0.47	0.00	1.42	0.71	2.80	1.98	6.70	84.33
Total time/ km of Cor	24.80	0.17	0.00	0.50	0.25	0.99	0.70	2.37	29.77
Labour cost/Ha	$1,826.58	$12.27	$0.00	$36.82	$18.41	$72.80	$51.38	$174.20	$2,192.46
Labour cost/ Km Cord	$644.92	$4.33	$0.00	$13.00	$6.50	$25.70	$18.14	$61.51	$774.11
Machinery Hours	21.53	1.46	0.00	4.39	2.19	8.68	6.13	20.77	65.15
Machinery Hrs/ha	6.95	1.46	0.00	1.42	0.71	2.80	1.98	6.70	21.02
machinery Hours / Kn	2.45	0.17	0.00	0.50	0.25	0.99	0.70	2.37	7.42
Ave Labour/ Ha	$1,727.06	$56.51	$101.54	$87.85	$276.15	$69.01	$212.79	$230.26	
Ave Labour/KM Cord	$526.42	$17.20	$30.93	$28.90	$90.84	$21.09	$57.19	$64.85	

	Pruning	Fertiliser	Disease Control	Weed Control	Canopy management	Wetting	Cutting	Harvest	All Activities
Total time (Hrs)	149.41	0.00	5.27	54.00	132.00	14.00	40.00	19.00	413.68
Total time/ha	53.55	0.00	1.89	19.35	47.31	5.02	14.34	6.81	148.27
Total time/ km of Cor	18.91	0.00	0.67	6.83	16.70	1.77	5.06	2.40	52.35
Labour cost/Ha	$1,392.35	$0.00	$49.09	$503.23	$1,230.11	$130.47	$372.76	$177.06	$3,855.06
Labour cost/ Km Cord	$491.61	$0.00	$17.33	$177.68	$434.32	$46.06	$131.61	$62.52	$1,361.14
Machinery Hours	4.00	0.00	5.27	40.00	0.00	14.00	0.00	19.00	82.27
Machinery Hrs/ha	1.43	0.00	1.89	14.34	0.00	5.02	0.00	6.81	29.49
machinery Hours / Kn	0.51	0.00	0.67	5.06	0.00	1.77	0.00	2.40	10.41
Total time (Hrs)	71.85	2.00	11.51	6.38	2.82	2.19	3.29	4.93	104.97
Total time/ha	34.21	0.95	5.48	3.04	1.34	1.04	1.57	2.35	49.98
Total time/ km of Cor	10.93	0.30	1.75	0.97	0.43	0.33	0.50	0.75	15.97
Labour cost/Ha	$889.53	$24.76	$142.54	$79.02	$34.88	$27.13	$40.69	$61.04	$1,299.60
Labour cost/ Km Cord	$284.17	$7.91	$45.54	$25.24	$11.14	$8.67	$13.00	$19.50	$415.17
Machinery Hours	3.89	0.00	8.63	6.38	2.82	2.19	3.29	4.93	32.13
Machinery Hrs/ha	1.85	0.00	4.11	3.04	1.34	1.04	1.57	2.35	15.30
machinery Hours / Kn	0.59	0.00	1.31	0.97	0.43	0.33	0.50	0.75	4.89
Total time (Hrs)	85.65	2.00	8.97	4.90	1.86	1.45	2.90	4.35	112.09
Total time/ha	60.75	1.42	6.36	3.48	1.32	1.03	2.06	3.09	79.50
Total time/ km of Cor	19.69	0.46	2.06	1.13	0.43	0.33	0.67	1.00	25.77
Labour cost/Ha	$1,579.44	$36.88	$165.43	$90.35	$34.38	$26.74	$53.47	$80.21	$2,066.91
Labour cost/ Km Cord	$511.96	$11.95	$53.62	$29.29	$11.14	$8.67	$17.33	$26.00	$669.97
Machinery Hours	2.61	0.00	6.73	4.90	1.86	1.45	2.90	4.35	24.80
Machinery Hours/ Ha	1.85	0.00	4.77	3.48	1.32	1.03	2.06	3.09	17.59
machinery Hours / Kn	0.60	0.00	1.55	1.13	0.43	0.33	0.67	1.00	5.70
Total time (Hrs)	195.66	3.50	21.50	11.00	25.75	16.29	8.50	13.50	295.70
Total time/ha	56.71	1.01	6.23	3.19	7.46	4.72	2.46	3.91	85.71
Total time/ km of Cor	16.79	0.30	1.84	0.94	2.21	1.40	0.73	1.16	25.37
Labour cost/Ha	$1,474.53	$26.38	$162.03	$82.90	$194.06	$122.79	$64.06	$101.74	$2,228.48
Labour cost/ Km Cord	$436.42	$7.81	$47.96	$24.54	$57.44	$36.34	$18.96	$30.11	$659.57
Machinery Hours	10.02	0.00	21.50	11.00	13.25	16.29	8.50	13.50	94.07
Machinery Hrs/ha	2.90	0.00	6.23	3.19	3.84	4.72	2.46	3.91	27.27
machinery Hours / Kn	0.86	0.00	1.84	0.94	1.14	1.40	0.73	1.16	8.07
Total time (Hrs)	154.71	12.61	4.31	3.86	19.75	7.86	12.00	24.00	239.09
Total time/ha	61.64	5.02	1.72	1.54	7.87	3.13	4.78	9.56	95.25
Total time/ km of Cor	19.69	1.61	0.55	0.49	2.51	1.00	1.53	3.05	30.43
Labour cost/Ha	$1,602.57	$130.64	$44.60	$39.95	$204.54	$81.39	$124.30	$248.61	$2,476.61
Labour cost/ Km Cord	$511.95	$41.74	$14.25	$12.76	$65.34	$26.00	$39.71	$79.42	$791.17
Machinery Hours	4.86	12.61	4.31	3.86	11.75	7.86	12.00	24.00	81.24
Machinery Hrs/ha	1.94	5.02	1.72	1.54	4.68	3.13	4.78	9.56	32.37
machinery Hours / Kn	0.62	1.61	0.55	0.49	1.49	1.00	1.53	3.05	10.34
Total time (Hrs)	158.35	12.09	5.88	3.94	57.00	8.14	12.00	14.00	271.39
Total time/ha	60.90	4.65	2.26	1.52	21.92	3.13	4.62	5.38	104.38
Total time/ km of Cor	19.46	1.49	0.72	0.48	7.00	1.00	1.47	1.72	33.35
Labour cost/Ha	$1,583.49	$120.87	$58.76	$39.42	$570.00	$81.39	$120.00	$140.00	$2,713.91
Labour cost/ Km Cord	$505.86	$38.61	$18.77	$12.59	$182.09	$26.00	$38.33	$44.72	$866.98
Machinery Hours	4.93	12.09	5.88	3.94	57.00	8.14	12.00	14.00	117.97
Machinery Hrs/ha	1.89	4.65	2.26	1.52	21.92	3.13	4.62	5.38	45.37
machinery Hours / Kn	0.61	1.49	0.72	0.48	7.00	1.00	1.47	1.72	14.49
Total time (Hrs)	80.87	9.48	6.52	0.58	58.08	0.00	6.00	12.00	173.53
Total time/ha	72.85	8.54	5.87	0.52	52.32	0.00	5.41	10.81	156.33
Total time/ km of Cor	23.27	2.73	1.88	0.17	16.72	0.00	1.73	3.45	49.94
Labour cost/Ha	$1,894.22	$222.10	$152.62	$13.56	$1,360.44	$0.00	$140.54	$281.08	$4,064.56
Labour cost/ Km Cord	$605.12	$70.95	$48.75	$4.33	$434.60	$0.00	$44.90	$89.79	$1,298.45
Machinery Hours	3.87	1.83	6.52	0.58	2.08	0.00	0.00	12.00	0.00
Machinery Hrs/ha	3.49	0.00	5.87	0.52	1.87	0.00	0.00	10.81	22.56
machinery Hours / Kn	1.11	0.00	1.88	0.17	0.60	0.00	0.00	3.45	7.21
Total time (Hrs)	611.50	6.00	52.30	9.46	13.46	0.00	37.00	59.00	788.72
Total time/ha	75.12	0.74	6.42	1.16	1.65	0.00	4.55	7.25	96.89
Total time/ km of Cor	22.23	0.22	1.90	0.34	0.49	0.00	1.35	2.15	28.68
Labour cost/Ha	$1,953.19	$19.16	$167.05	$30.22	$43.00	$0.00	$118.18	$188.45	$2,519.26
Labour cost/ Km Cord	$578.09	$5.67	$49.44	$8.95	$12.73	$0.00	$34.98	$55.78	$745.63
Machinery Hours	266.00	0.00	52.30	9.46	13.46	0.00	17.00	59.00	417.22
Machinery Hrs/ha	32.68	0.00	6.42	1.16	1.65	0.00	2.09	7.25	51.26
machinery Hours / Kn	9.67	0.00	1.90	0.34	0.49	0.00	0.62	2.15	15.17
Total time (Hrs)	155.00	6.00	27.36	12.01	1.95	10.00	32.00	22.00	266.32
Total time/ha	43.06	1.67	7.60	3.34	0.54	2.78	8.89	6.11	73.98
Total time/ km of Cor	12.54	0.49	2.21	0.97	0.16	0.81	2.59	1.78	21.55
Labour cost/Ha	$1,119.44	$43.33	$197.58	$86.72	$14.11	$72.22	$231.11	$158.89	$1,923.42
Labour cost/ Km Cord	$326.05	$12.62	$57.55	$25.26	$4.11	$21.04	$67.31	$46.28	$560.22
Machinery Hours	55.50	0.00	27.36	12.01	1.95	10.00	24.00	22.00	152.82
Machinery Hrs/ha	15.42	0.00	7.60	3.34	0.54	2.78	6.67	6.11	42.45
machinery Hours / Kn	4.49	0.00	2.21	0.97	0.16	0.81	1.94	1.78	12.36
Total time (Hrs)	699.50	4.00	22.50	5.00	17.00	31.00	201.00	55.00	1035.00
Total time/ha	139.90	0.80	4.50	1.00	3.40	6.20	40.20	11.00	207.00
Total time/ km of Cor	28.77	0.16	0.93	0.21	0.70	1.28	8.27	2.26	42.58
Labour cost/Ha	$3,637.40	$20.80	$117.00	$26.00	$88.40	$161.20	$1,045.20	$286.00	$5,382.00
Labour cost/ Km Cord	$748.14	$4.28	$24.06	$5.35	$18.18	$33.16	$214.98	$58.82	$1,106.97
Machinery Hours	25.00	4.00	22.50	5.00	5.00	31.00	0.00	55.00	147.50
Machinery Hrs/ha	5.00	0.80	4.50	1.00	1.00	6.20	0.00	11.00	29.50
machinery Hours / Kn	1.03	0.00	0.93	0.21	0.21	1.28	0.00	2.26	5.90
Total time (Hrs)	159.10	1.14	10.53	3.43	1.71	6.78	4.78	16.21	203.69
Total time/ha	65.75	0.47	4.35	1.42	0.71	2.80	1.98	6.70	84.17
Total time/ km of Cor	23.21	0.17	1.54	0.50	0.25	0.99	0.70	2.37	29.72
Labour cost/Ha	$1,709.38	$12.27	$113.11	$36.82	$18.41	$72.80	$51.38	$174.20	$2,188.36
Labour cost/ Km Cord	$603.54	$4.33	$39.94	$13.00	$6.50	$25.70	$18.14	$61.51	$772.66
Machinery Hours	61.98	1.14	1.32	2.28	0.86	6.78	0.00	16.21	90.57
Machinery Hrs/ha	25.61	0.47	0.54	0.94	0.35	2.80	0.00	6.70	37.42
machinery Hours / Kn	9.04	0.00	0.19	0.33	0.13	0.99	0.00	2.37	13.05
Total time (Hrs)	217.78	1.46	12.36	4.39	2.19	8.68	6.13	20.77	273.77
Total time/ha	70.25	0.47	3.99	1.42	0.71	2.80	1.98	6.70	88.31
Total time/ km of Cor	24.80	0.17	1.41	0.50	0.25	0.99	0.70	2.37	31.18
Labour cost/Ha	$1,826.58	$12.27	$103.68	$36.82	$18.41	$72.80	$51.38	$174.20	$2,296.14
Labour cost/ Km Cord	$644.92	$4.33	$36.61	$13.00	$6.50	$25.70	$18.14	$61.51	$810.71
Machinery Hours	21.53	1.46	9.27	4.39	2.19	8.68	6.13	20.77	74.43
Machinery Hrs/ha	6.95	1.46	2.99	1.42	0.71	2.80	1.98	6.70	24.01
machinery Hours / Kn	2.45	0.17	1.06	0.50	0.25	0.99	0.70	2.37	8.48
Ave Labour/ Ha	$1,721.84	$55.79	$122.79	$88.75	$317.56	$70.74	$201.09	$172.62	
Ave Labour/KM Cord	$520.65	$17.52	$37.82	$29.33	$103.67	$21.44	$54.78	$53.00	