Final Report

Supporting the adoption of best management practices for pistachio growers through on-farm demonstrations and regional discussion groups

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Pistachio Growers' Association

Project code:

PS20000

Project:

Supporting the adoption of best management practices for pistachio growers through on-farm demonstrations and regional discussion groups (PS20000)

Disclaimer:

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Public summary

A key objective of the Pistachio Growers' Association Strategic Plan 2021-2026 is to 'Develop and maintain effective information extension and technology transfer'. PS20000 addressed this objective. Run over 3 years, the project continued the success of previous extension projects, PS17002 and PS13003. Local and international information and technology was shared with existing and new pistachio growers through field days and Spring symposia, seasonal notes, technical bulletins, fact sheets and an online chat room. Specifically, this involved:

- 13 Pistachio Information Transfer (PIT) Groups on grower properties across the pistachio growing regions of Riverland SA, Sunraysia Victoria and Tooleybuc/Kyalite NSW with a total of 408 participants across the life of the project.
- Two Spring Symposia with a total of 81 attendees
- A total of 47 presentations by 20 Australian industry researchers or specialists
- Four seasonal notes covering relevant orchard management issues
- Four Technical bulletins/factsheets
- 2 online Grower Çhat Rooms
- One Nutgrower Magazine article
- Occasional email alerts on various matters

Topics covered a range of extension activities including on orchard management (chill, pruning, disease, birds and insect pests, sanitation, cover crops, mulching), industry yield and quality data, domestic and international research updates, benchmarking, and new technologies (aerial imaging, on-farm equipment).
Feedback from PIT group participants (including Spring symposia) was very positive, with average rounded scores of 8.5 out of 10 for both satisfaction with an individual session and for overall quality of the program. Final feedback from participants, especially from growers, has been valuable for shaping the next Extension project for the pistachio industry.

Keywords

Pistachio, Extension, Field Days, PIT Groups

Introduction

This project follows on from project PS17002: *Technology transfer for pistachio growers*. In PS17002, the Pistachio Growers' Association (PGA) delivered practical technology transfer that led to improved profitability and sustainability of individual growers and the industry overall. The success of project PS17002 (and previously PS13003) was the field day format with many of the events held on grower properties, allowing the participants to hear presentations and then discuss issues within the orchard. These field days took the form of Pistachio Information Transfer (PIT) groups, comprising presentations and field walks on grower properties across the growing regions of Riverland in SA, Sunraysia and Swan Hill in Victoria and Tooleybuc/Kyalite in NSW. The final survey of the project showed that growers highly valued the PIT Groups, as well as the technical sheets and seasonal notes, with a majority of growers having made positive changes in their business directly attributable to the knowledge gained from the project. Based on the strong grower response, the 'PIT' Group concept was built into the Pistachio industry's R&D priorities, and then translated into this project PS20000. It was determined that the focus of PS20000 would be on establishing regional grower groups and supporting those groups with speakers/advisers as an effective way of technology transfer.

The overall objectives of this project (PS20000) were to:

- Further develop the strong and effective grower networks and on-farm learning environments for growers, through engaging and involving industry experts, leading growers and researchers in a range of planned activities, events and training opportunities.
- Identify and share with growers the latest research and development (R&D) outcomes from pistachio and other relevant nut crops and horticultural industries.
- Synthesise research outputs into key best management practices for pistachio growers and extend this knowledge and experience through grower events, newsletters and social media.

Methodology

PS20000 focussed on extending appropriate information to growers with mature orchards, as well as those with new plantings, and new or potential entrants to the industry.

The following approach to delivering the project was undertaken.

Grower Meetings

- The PGA database of current, new and prospective growers was utilised to communicate to growers and industry stakeholders in each of the regional areas. Whilst maintaining the privacy of individuals, PIT Groups were advertised through the PGA newsletter and by personalised invitation to all growers and industry stakeholders on the database. As new and potential growers in these regions become known to the PGA they were added, with their permission, to both the broad list and each of the regional lists. At appropriate times regional media releases and advertising were undertaken to promote the regional 'Tech Groups' to the regional communities with the aim of contacting any new growers currently not known to the PGA.
- The timing and topics of PIT group field days was determined based on the seasonal, regional and situational (e.g. disease prevalence) concerns of growers, as well as the availability of appropriate presenters. As well as field days, a full-day grower symposium was held at the Grand Hotel in Mildura in 2022 and 2023 and online 'chat rooms' for growers to talk with each were other held in 2022.
- A draft program for each grower meeting was presented to the Pistachio R&D Committee (which also serves as the Pistachio SIAP) for review and sign-off. Each program aimed to:
    - Provide a mix of seasonal topics and new information/technology.
    - Include an R&D report from the PGAI researcher and at least one other expert
    - Include presentations from growers on orchard management practices.
- The M&E and planning of the grower meetings has been undertaken though the collecting of post meeting surveys on the relevance, quality and adoptability of the information provided, and well as though feedback from the Pistachio R&D Committee.
- Each Field Day and Symposium was video recorded.

Digital Communications

- A written report on each PIT Group and symposium.
- Seasonal notes on topical issues, such as chill, fertiliser and disease management recommendations were complied and emailed to growers at relevant times.
- Technical bulletins, comprising existing and new technologies, both domestic and international, were compiled by the with input from consultants and the PGA researcher and emailed to growers
- Three videos on central leader pruning
- 'Email blasts' were sent to growers informing them of new additions and updates to the website.
- Management of communications via the PGA website has been managed under this project. This includes:
    - tracking on a six-monthly basis to measure the grower usage and percentage change.
    - All videos, PowerPoint presentations and reports from Field days and Symposia
    - Seasonal notes, technical bulletins, fact sheets

Outputs

Table 1 summarises the contractual outputs compared to the those delivered, and Tables 2 and 3 specify key points on each output. Full reports on 'PIT Groups' are in Appendix 1 and key written outputs are in Appendices 2-11.

Table 1. Comparison of contracted deliverables compared to that delivered.

Deliverable	Contractual	Actual	Met contract requirement?
Grower meetings			
Field days	6 plus 6 for new entrants	13	Yes. Exceeded
Attendance	85% of growers attend at least 1 field session	>95% of growers attended at least one session	Yes Exceeded
Special PIT Groups (Symposia)	3	2	No. Did not have symposium in the first year but exceeded in regional PIT Groups
Videos	Each face-to-face event	Each face-to-face event	Yes
Webinars	3	1 formal Webinar plus 2 Chat Rooms	Yes
Event Surveys	After selected events	After selected events	Yes
Written/Digital Communications			
Report on grower meetings	Each meeting (6+6)	Each meeting (13)	Reports compensated for the under-delivery of Technical bulletins and Seasonal notes
Technical Bulletins	12	4 specific to pistachios plus 7 that included three other nut industries	11 instead of 12, but covered in PIT Meeting reports
Seasonal Notes	12	4	Not specifically, but covered in PIT Meeting reports
Nutgrower Magazine article	Not specified	1 Nutgrower Magazine article	N/A
Additional Technical Videos	3	3 (Central Leader pruning)	Yes
Website			
Videos and presentations	All videos and presentations uploaded to web page	All videos and presentations uploaded to web page	Yes

Table 2. Summary of Grower Meetings. Field days, Symposia, Webinars and Chat Rooms, are marked with 'F' and 'S' 'W' and 'C', respectively after the date, respectively. Attendance refers to number of growers and industry stakeholders, not including PGA staff. The Appendix refers to that of the meeting report. Reports of the Field days are in Appendix 1.

Date	Location	Topics	Attendance
6 July, 2021, F	Bannerton, Vic	Pruning, self-assessment tools	33
2 Nov 2021, F	Paringa, SA	R&D update. Hort Innovation update, Market update, Dieback, Storm Damage	25
3 Nov 2021, F	Kyalite, NSW		14
19 May 2022, F	Robinvale, Vic	R&D Update, Aflatoxin, Seasonal update, aerial imaging	46
27 Jul 2022, F	Vinifera, Vic	Benchmarking results, fertiliser management, orchard sanitation, potential pests, Tenias harvester (SA only)	45
28 Jul 2022, F	Cobdogla, SA		
22 Sep 2022, S	Mildura, Vic	Season update. R&D update, climate change modelling and adaptation, One basic CRC and water, agrichemicals, Aflatoxin, Biosecurity	36
9 Nov 2022, F	Bannerton, Vic	Dieback, Carpophilus beetle and Carob moth, cuticle protection, disease management, big bag recovery	48
10 Nov 2022, F	Waikerie, SA		
24 Nov 2022 W	Online	Sustainability, Benchmarking, Juvenile Dieback, Male Dieback, AF36 program	9
22 Dec 2022, C	Online	Irrigation pumps, Pest and Disease Manual, Weather forecasts	5
20 Jun 2023, F	Lake Powell, Vic	Dieback, Update from USA Congress, 2023 Harvest update, winter pruning, young shoot death, Aflatoxin and AF36	73
21 Jun, 2023 F	Renmark, SA		
20 Sep, 2023 S	Mildura Vic	Season update, R&D update, benchmarking, bird ecology and management, Murray Darling basin roadmap, Victorian water entitlements, fungal disease detection., PGA website, nutrition and irrigation	45
16 Nov, 2023 F	Kyalite NSW	Drone technology, 'Bioscout' disease detection technology, tree nutrition, Aflatoxin and AF36, Spain and Sicily study tour, Grower survey via Google Forms	75
17 Nov 2023, F	Waikerie, SA		
2 May 2024, F	Merbein, Vic	Polymers, Post Harvest report, Freshcare auditing, cover crops, farm sanitation, fungicide resistance management	49

Table 3. Summary of the Seasonal Notes and Technical Bulletins delivered in the project.

When	Type of Communication	Topics	Appendix
Summer 2021/22	Seasonal Notes	Pre-harvest consideration	2
Winter 2022	Seasonal Notes	Harvest, oil application, benchmarking, disease management, pruning, orchard sanitation	3
Autumn 2023	Seasonal Notes	Managing damage to male trees	4
Winter 2023	Seasonal Notes	Damage to male trees	5
February 2022	Technical Bulletin	Harvest Decision Making	6
Summer 2022	Technical Bulletin	Chemical Management	7
Autumn 2023	Technical Bulletin	Land IQ for surveying acreage	8
November 2023	Technical Bulletin/Factsheet	Aflatoxin and AF36	9
Various	Technical Bulletin	Bird Management Fact sheets x 7	10
Winter 2023	Nutgrower Magazine	Pistachio meet	11

Photos/images/other audio-visual material

Figure 1. Representative Photos of the PIT Groups meetings, November 2023. (a) Andrew Bowring discussing pruning at Kyalite Pistachios on 16 November 2023. (b) Brian McCarthy presenting to the Waikerie growers on FalconUAV drones and what they could achieve on 17 November 2023. Photos taken by Craig Feutrill.

Outcomes

The Outcomes of the project are summarized in Table 4, with particular reference to the Grower surveys conducted in 2022, 2023, and 2024 (Appendices 13-15).

Table 4. Outcome summary

Outcome	Alignment to fund outcome, strategy and KPI	Description	Evidence
Increased Grower Participation at 'Tech Groups'	Outcome 3: Improved capability and an innovative culture in the Australian pistachio industry maximises investments in productivity and demand. Strategy 1: Deliver extension and communication capabilities to support industry achievement of priorities across the other outcome areas KPI: Establishment of a baseline and then increased share of industry with positive change in KASA and practice and implementation of targeted high priority areas Strategy 2: Provide the opportunity for required engagement levels for industry across industry members and relevant stakeholders to innovate through trusted relationships KPI: Demonstrated growth in cooperation within industry and across industries leading to business and industry innovations	Overall Increasing grower participation at Tech Groups, including Field days and Symposia provided growers with connection to other growers in their region, and opportunity for accessing best practice and cutting edge knowledge delivered by both industry and research experts.	PIT group Attendance records (Table 1 and Figure 2) PIT Group Surveys (Table 5; Appendices 13-15)
Increased grower awareness, understanding and utilisation of the latest R&D		Every Grower Meeting involved expert growers and/or advisors and well as researchers. Videos were made and high number of website hits on these videos and presentation uploads after PIT Group meetings. Annual Grower surveys show significant increases in knowledge, understanding and intention[1] or actual adoption of practices arising from the PIT Groups meetings and the communications.	Surveys taken throughout the project show that growers have gained significant knowledge understanding and utilisation, both through the Grower meetings and the written communications. Evidence is from website usage Appendix 12) and Grower Surveys (Table 5; Appendices 13-15)
Enhanced exposure to international R&D and technology expertise/information		International R&D has been communicated through Australian researchers who keep up to date with the latest research, as well as through communication of grower visits overseas and practical demonstrations of new practices and technologies by international companies with bases in Australia. Videos, PIT Group reports,	See Tables 1-3, 5, Appendices 12-15

[1] Adoption of new practices can significantly lag behind knowledge transfer and hence 'intention to adopt' was asked in the surveys.

Outcome	Alignment to fund outcome, strategy and KPI	Description	Evidence
		and Technical bulletins on R&D and Technology received a high number of website hits after PIT Groups meetings.	
Australian Pistachio Growers understand and contribute to the Hort Innovation investment pipeline.		Hort Innovation invited to participate in all of the PIT Group sessions. There was only one presentation given, which was in Nov 2021. Hort Innovation was acknowledged correctly in all presentations and publications.	The voluntary Contributions by Growers remains at about 95% of all growers. This is at least in part due to the communication of Hort Innovation as a funding partner in all R&D outputs through PS20000.

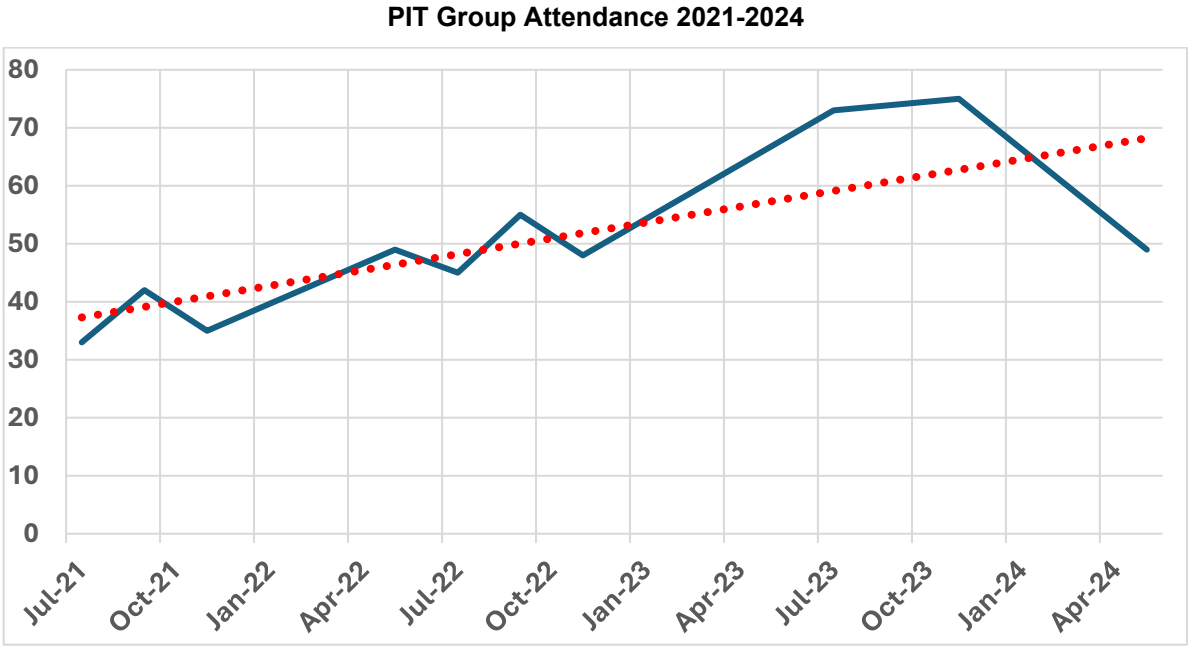

Figure 2. PIT Group meeting attendance throughout the project. The line of best fit shows that there is an overall increase in attendance at the Group meetings over the life of the project, even though there is a drop in May 2024.[2].

[2] The drop in May 2024is because there was only a single PIT Group meeting due to shortages in PGA staffing at the end of the project.

Table 5. Summary of Grower Surveys. Results, including scores and representative quotes from grower surveys at the end of PIT Group meetings over three years. Scores are averages out of 10. The final row on what has been adopted is from the final PIT Group survey in May 2024.

November 2022 (n = 15)	**November 2023 (n=28)**	**May 2024 (n= 29)**
Value of the day		
Score: 8.4 • Disease session was most useful • Good for pests and diseases • Great information on the fungal diseases • Very informative • Vital information was given in regard to disease management • Good information about insects and fungus • Wide ranging topics • Disease management and interaction with other growers • The section on fungal infections – concise, knowledgeable presenter • Fungal diseases and Carpophilus Beetle and Carob Moth • Topical and current	Score: 8.7 • New products • Overseas growers and how the do things • Technology and meeting growers, sharing knowledge • Presentations good, field walk fantastic • Spain tour information • Other growers • Biodisease monitoring • Pest & diseases • Nutrition • Exchange of experiences between Pistachio growers in different areas. • Drone information	Score 8.3 • Grower meeting and engagement • Well structured and varied information • New to industry still learning who's who • Industry led, experience and first hand knowledge • There's not many pistachios close to me so any info is always helpful[3] • New pest management. • Large range of topics Open discussions. • Made new contacts and learned about new developments • Always great content speakers and engagement • Useful knowledge and contacts • It's been very helpful, I have to learn more • Love coming to the pit meeting • Very interesting Speakers • Well presented • I learnt a lot about the tree structure • PIT meetings keep you focused, informed and inspired!!!
Value of the overall program		
Score: 8.5 • Very good speakers • Well executed and catered • High quality, knowledgeable speakers • Some sessions not really relevant to me given Im new to industry • Very informative • Very interesting about sprays	Score 8.7 • It is really useful and interactive • Networking • Clarifying industry updates • It is very useful for the transfer of information • Informative, interesting and involving	Score 8.4 • Chill hours research • Meeting other growers and discussing • Communicating with other growers and also came to know about the latest innovations going with in the industry

[3] Came to Merbein Victoria from WA

November 2022 (n = 15)	November 2023 (n=28)	May 2024 (n= 29)
• Excellent speakers – world class • Sharing of information • Well planned, well run, focussed on helping growers grow nuts for best returns • Community of growers and excellent speakers • Grower participation • Spruiking collective knowledge	• New technologies and other growers • Great information for new growers • PIT groups are a perfect opportunity to interact with different grower of the area to exchange information and recent experience about tree management. • Gets you thinking outside the box about different technologies and standards • The experience of the guest speakers • I'm new and we have used all the resources • Discussions	• Update on industry challenges and 2024 harvest • I'm a new grower and find any extra information very helpful • Technical information. • Meeting growers and resellers in the industry and getting valuable info on season wrap ups etc • Terrific information and engagement and interaction on Pistachio crops, soil, etc. • New technology, spraying • Everything • All aspects have been informative • Other peoples thoughts • Keeping up with the best grower information
What more is wanted		
• Relevant information for time of season • All OK. • Bird control with drones, etc • Oil trials • Training your trees • More grower presenters	• Repeat this location • Irrigation & fert programs • Better lunch! • Nut size eg early nutrition • Cost savings	• Industry analysts speakers • Pruning • Orchard walks • Fertiliser efficacy studies. Liquids vs Solids/Solubles, Chelates vs Sulphate • Oil sprays • Water • All technology water probs • Visit to pistachio processing factory. • More work on alternate bearing
Intention to adopt information from the session		
• Inspecting trees for fungal lesions • Spray programs for fungal infections • Drum/bag recycling program • Orchard hygiene	• Irrigation schedule • Yes, get more info on Spain on some things I saw in photos • Nutrition • Possibly drone technology	• Cover crop • Freshcare and spray diary • Chilling and technical things • Improved fungicide usage • PLENTY TO WORK WITH ! • Polymer spraying • Insect management, next season • Delay pruning of trees
Adoption of farm practices attributable to PS20000 project outputs (n = 17)		
NA	NA	• Many • Understanding what our manager has done and why • Central leader pruning method

November 2022 (n = 15)	November 2023 (n=28)	May 2024 (n= 29)
		• Lasers • Disease control • Fertigation • Chill management • Adding extra dripper lines • Cover crops • Improved oil spray • Bird control • Spray program • AF36 aflatoxin risk mitigation

Monitoring and evaluation

Because PS20000 has been an extension project the Key Evaluation Questions are align closely with the intended outcomes of the project and the M&E has been partly covered off in the previous section.

Table 6. Key Evaluation Questions

Key Evaluation Question	Project performance	Continuous improvement opportunities
The extent to which the industry is better informed and engaged in the funded RD&E program - trends in: attendance rate; reach & access; database contacts	Attendance rates have increased overall over the life of the project, noting that the May 2024 PIT meeting was held in only one location due to the loss of staffing. The database has continued to expand as new growers are made aware of the PGA and the extension program, particularly the PIT Groups. The final grower feedback survey showed that even though a grower would typically[4] not need to travel more than 150 km to a PIT group, growers are willing to travel a considerable distance to these meetings because of the value that they bring. In the survey, 25% of grower were willing to travel more than 300km, 45% more than 200 km and all growers were willing to travel >100 km to attend a meeting (Appendix 15).	The new project will expand on the regions covered to include the Riverina. There will be more frequent written communications. The PGA website is undergoing a significant refresh which will make information easier to access.
Extent to which growers and broader industry are aware of relevant research and key communication messages.	The surveys over 3 years showed that growers are increasingly aware of key basic messages. Examples of key messages that have come from	The new project will improve its monitoring of grower awareness of key messages. In the last two PIT Groups a real time survey was

[4] The May 2024 was an exception as there was only one meeting held due to lack of staff.

Key Evaluation Question	Project performance	Continuous improvement opportunities
	international and local research, and established best management practices that and have been delivered though practical demonstration at field days includes disease monitoring and correct chemical use, central leader pruning, chill management, fertigation.	delivered before growers leave via via Google Forms using a participant's mobile phone, which significantly increased the number of growers responding to the survey (seen n values in Table 5). This approach will continue, with more targeted questions and analysis around uptake of messaging.
Extent of adoption as influenced or supported by the communication program.	Table 5 (summarized from Appendices 13-15) reports that 17 growers of 38 growers that attended (the 49 that attended included non-growers) reported on adopted practices attributed to knowledge gained from the project. That's 45% of growers. Noting that some of the attending growers are new to the industry and not yet producing, the percentage is higher than this. Apart from this, growers reported on the intention to adopt in multiple areas. This could have been followed up on more closely.	There will be improved monitoring of grower status and adoption practices going forward.
Extent of productivity and economic gain based on adoption influenced and calculated gains.	There is evidence of productivity and economic gains based on increases in the following: • Growers joining the PGA • Growers supplying nuts to the APPC processing facility at Robinvale (24 to 45 growers over the life of the project) • Plantings have increased from 1000 ha to 3,000 ha over the life of the project • Increase in production to a record 4650 tonnes in 2024	The new project will be able to draw on the Benchmarking work under PS22000 to have more informed data about productivity changes attributable to the extension project.

Recommendations

- Continue to deliver Grower Meetings though field days (PIT Groups) and Symposia, ensuring that a mix of research, new technology and growers with expertise that is relevant to the season and issues facing growers
- Ensure that as the pistachio industry grows that events are expanded regionally for accessibility
- Continue to communicate relevant current and emerging information to growers and allied stakeholders (agronomists, researchers, consultants, other industries) through newsletters, fact sheets and other means, as appropriate.
- Develop a social media platform to support greater engagement between growers between events
- Further develop a robust M&E program for Extension.
- Ensure that Extension personal work closely with the Project lead and Research Officer of PS22000: Pistachio Production Research Program to provide targeted and clear information on local research findings to growers.
- Upgrade the PGA website, including refreshing the growers' section and adding new fact sheets, newsletters, PIT Group and symposia presentations and any other relevant material.
- Network with other stakeholders, including agronomists, IDOs for almonds and other tree crops, and those in the supply chain as appropriate, to maximise learnings and developments that align with the pistachio industry's strategic plan.

Refereed scientific publications

N/A

Journal article

N/A

Whole book

N/A

Chapter in a book or paper in conference proceedings

The PGA Researcher published the following conference paper and it was presented to growers in this project but the primary finding for the Researchers' work comes from project PS22000.

Mahadevan, M. Joyce, C. Ranford, T and Sadras, V. (2023) Dynamics of chill accumulation in Australian pistachio growing regions. ISHS Conference California 2023.

Intellectual property

'No project IP or commercialisation to report

Acknowledgements

The project and PIT Groups would have been possible without the teamwork of Craig Feutrill and Ben Thomas. Particular thanks to all the growers who made their properties available for the Field days, and to those who gave their time to present at the meetings. James Simpfendorfer generously gave his time to video all of the Grower meetings.

Appendices

Appendix 1 PIT Group Meeting Reports

Appendix 2 Seasonal Notes Summer 2021-22

Appendix 3 Seasonal Notes Winter 2022

Appendix 4 Seasonal Notes Autumn 2023

Appendix 5 Seasonal Notes Winter 2023

Appendix 6 Technical Bulletin - Harvest Decision Making

Appendix 7 Technical Bulletin - Chemical management

Appendix 8 Technical Bulletin - World Supply of Pistachios

Appendix 9 Technical Bulletin - Aflatoxin factsheet

Appendix 10 Technical Bulletins x 7 Bird management

Appendix 11 Nutgrower Magazine Article Spring 2023

Appendix 12 Website hits for PIT Groups 2022

Appendix 13 Grower Feedback Survey Nov 2022

Appendix 14 Grower feedback Survey Nov 2023

Appendix 15 Grower Feedback Survey May 2024

"P T"

Groups

Pistachio Information and Technology Groups - Report

MECHANICAL PRUNING DEMONSTRATION

Meeting Date and Venue

CMV Farms Robinvale: *Tuesday 6th of July, 2021 12 Noon sharp*

Address: **CMV Farms, 3067 Murray Valley Hwy, Bannerton Vic 3549**

TOPICS:

- Mechanical skirting and tipping of mature pistachio trees
- Input from Phil Hewett from CMV Farms and Andrew Bowring, Kyalite Pistachios
- Pistachio Dieback – grower observations and input needed!

Due to the ongoing Covid-19 pandemic in Australia, we were very lucky to be able to hold the July 2021 PIT Group meeting during a brief open border period between South Australia and Victoria on the 6th of July at CMV Farms at Bannerton near Robinvale in Victoria.

33 pistachio growers and PGAI staff were able to cross the SA/Victoria border or from near border communities/areas in NSW with the requisite travel permits to attend this PIT Group meeting.

Covid-19 safety/recording and social-distancing procedures were followed during the course of the meeting. All SA/NSW growers were able to return home before the borders closed once again.

After a splendid barbeque lunch, the welcome and introduction spoke about the beginning of the third PIT Group project with grower and Hort. Innovation funding, what we were going to see today and future PIT Group meetings. This included the need to research 'Pistachio Dieback' that had been seen in previous years.

"When trees begin to produce a harvestable crop in years six through eight and are full bearing, pruning helps maintain a canopy that intercepts maximum light and produces efficiently harvestable annual quality yields.

Beginning at years six through eight, a pistachio tree benefits from canopy management to capture light and facilitate photosynthesis, keeping the tree trunk accessible to harvest equipment without contacting the branches, controlling canopy height and volume, directing branch and shoot orientation, and producing new bearing surfaces, all with net profit in mind.

Mechanical pruning uses annual topping to control tree height in every other row, every other year hedging for light interception. If needed for light interception and air circulation, every-other-row middle cross hedging can also be done. Mechanical pruning should be followed by limited hand pruning, specifically steps two and three detailed in the hand pruning directions above; thinning cuts to remove low flat branches that do not shake well and interfere with the harvester and thinning cuts within the canopy center, the 'snakes' that block light.

Dr Louise Ferguson, UC Davis Department of Plant Sciences, cited retired UCCE Kings County Farm

Advisor Bob Beede's mechanical pruning trial conducted from 2012 to 2017. The data reaffirmed an earlier trial's demonstration that mechanical pruning can mitigate alternate bearing in trees on an Atlantica rootstock by topping and hedging before the low crop year."

Phil Hewett from CMV Farms demonstrated the 4-bladed hedging machinery (static) used for skirting, tipping and topping of mature pistachio trees. The growers were shown topped orchards, cut at 55 degrees along the tops, and side trimmed to allow machinery access for harvest. The growers were shown various aged trees that had been mechanically topped/tipped and skirted and the benefits of undertaking these procedures.

The growers also were introduced to a large mulching machine that shredded quite large tree cuttings – mostly from the previously seen hedging machine.

Orchard sanitation – or lack of it - is a problem for propagating diseases from old rachis and kernels that remain on the tree or the orchard floor after harvest. This large mulcher turned trimmings into matchwood.

James Simpfendorfer filmed all proceedings from the day and they are available to growers who could not attend the PIT Group on the PGAI website under the PIT Group tab.

The 4-bladed hedging/tipping/topping/skirting machine.

Phil Hewett from CMV farms explaining the cuts conducted by the hedging machine and the benefits.

The bespoke mulching machine.

The mulched orchard floor.

Hort Innovation
Strategic levy investment
PISTACHIO FUND

This project has been funded by Hort Innovation using the pistachio research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

"P T" Groups

Pistachio Information and Technology Groups.
SPRING SESSIONS

PISTACHIO BRANCH/SHOOT DIEBACK AND R&D UPDATE.

November 2021 - **Meeting Dates and Venues**

This round of PIT Group meetings is an update and information Q&A session on Pistachio Branch Dieback. We will look at answers to the grower survey and possible research pathways. The Pistachio Industry's new researcher, Dr Maha Mahadevan will also present a research update.

Paringa: ***Tuesday 2nd of November, 12 Noon sharp***

Address: **Martin Simpfendorfer's property,** Permedah Fruits,

21731 Sturt Highway, Parings, South Australia, 5340

Kyalite: ***Wednesday 3rd of November, 12 Noon sharp***

Address: **Kyalite Pistachios/Kyalite Pub**, 99 Kyalite Road, Kyalite NSW 2715

Starting with a Zoom meeting and lunch at the Kyalite Pub at noon, and then moving to the Kyalite Orchard.

TOPICS (for both meetings):

• Pistachio Branch/Shoot Dieback	Dr Maha Mahadevan
• Pistachio Research Update	Dr Maha Mahadevan
• Horticulture Innovation	Dr Jay Cummings
• 2021/22 Market Update	Chris Joyce/Trevor Ranford
• Storm Damage Assessment	Trevor Ranford

The November 2021 'Spring Sessions' round of PIT Groups were still influenced by the ongoing Covid-19 requirements of social distancing and border closures. While it looked promising that the South Australian/Victorian border would be reopened, it did not eventuate, so the Wednesday 3rd Kyalite (NSW) Pit Group meeting was a combination of Zoom meeting for the presentations, followed by a field session at Kyalite Pistachios run by Andrew Bowring.

That 25 growers attended the Paringa PIT Group meeting and 14 the Kyalite meeting shows the importance of the Pistachio Dieback problem on farms in the 2021/2022 season and the necessity of discussing this and initiating a research program.

The meeting format consisted of a barbeque/lunch to start the day at noon (both days) then an introduction to the days' events.

Trevor Ranford delivered the Pistachio Market Update in South Australia, and Chris Joyce delivered the talk at the Kyalite meeting.

In South Australia, Dr Jay Cummings talked about Horticulture Innovation and the management of the PGAI project PS20000.

Dr Maha Mahadevan gave a presentation on pistachio research undertaken or continued from Dr Subha Abeysinghe's work. This included the chill requirements per region and what was attained,

work on polymers to mitigate low chill areas, bud opening and nut set, bud break survey, benchmarking and updating grower farm details.

The main part of the meeting was a presentation on Pistachio Dieback and what we know about it to this date - and looking for grower input into what they are seeing on their farms.

After the presentations there was an extended field walk in the pleasant Paringa heat, through the Simpfendorfer's Permedah property looking at various blocks with different aged trees suffering from dieback. Some dieback was identified as bacterial in nature as when the shoots/branches were cut; there was a strong odour similar to wine lees. Others appeared to have begun to shoot then stopped and the shoots/branched withered and died back.

Trevor Ranford delivering the Market Update presentation.

Martin Simpfendorfer and Dr Maha Mahadevan discussing pistachio dieback at Permedah Orchards at Paringa.

Dieback on a mature pistachio tree.

PIT GROUP NOTES – KYALITE – November 3rd, 2021 - Andrew Bowring

- Comprehensive market report by Chris Joyce.
- General research summary report by Maha
- Branch Dieback presentation by Maha.

Observations/discussion during field walk:

First stop was in Delta stage 1 where there are two rows missed with winter oil.

- These rows area at least two weeks later in development to adjacent oil sprayed rows. This is a known effect of not applying oil and has been observed many times before. The delayed leafout effect is greatest in a low winter chill year, and typically would only see a slight or no difference in a good winter chill year. This starts another interesting discussion about the relevance of our Dynamic Units chill model. This winter our dynamic units to the end of August were high, but hours below 7C were VERY low.
- The rows missed with Winter oil have NIL incidence of Juvenile Shoot Dieback, they are just VERY late. Any branches that have still not completely shot, are still healthy. Adjacent rows do have incidence of dieback, but at a "mild" level. This raises a discussion about Winter Oil being involved in WSD, but clearly other factors are involved. (Note AB previous report October).
- Discussion was had regarding the part of the branch that is normally affected. The growth that occurred late in the season is generally the only part affected, and sometimes can still be seen as less mature. This later growth may have different status of nutrient/carbohydrate.

Second stop was Delta stage 2, adjacent the same location as 2019 Delta 1 PIT stop dieback area.

- In D1 where JSD was quite severe in 2019, this year is "mild - moderate". In 2020 this area had virtually NIL JSD.
- In D2 JSD is "moderate". This area had no JSD in either 2019 or 2020.
- Vigour in this area was high in 2020-21 growing season, and it is these long whips that are affected most. Vigour is again high this year, and aside from the JSD the trees are growing well.
- There are signs of "partial" JSD, with veg buds trying to push but really struggling. In the past we have not seen much of this, and it has usually been either nil effect or shoot death, but very little "in between".
- Jeff Dickinson made a comment it looks like 2,4-D herbicide damage (i.e., inversion layer drift from somewhere). An interesting thought, and we do sometimes smell 2,4-D in the air on still spring mornings. However, for various reasons I don't think this is involved.

Third stop – Delta stage 2 – very severe JSD

- This area of Delta stage 2 has the most severe JSD we have seen at Kyalite.
- One individual row is particularly bad, but we can't find a cultural pattern explaining this.
- Oil spraying was done across the D1/D2 headland, so both D1 and D2 received identical oil treatment. However, damage in D1 is moderate, but D2 severe.
- Andrew discussed how KP now has tracking devices on the sprayers, so we can see the history of exact date/time this area was sprayed. When we correlate this to the KP weather station data we can see air temperatures were very low at time of spraying (1.7c to 6c), and RH was high (76-91).
- Pip raised that this winter, Ryan Norton cautioned against applying winter oil at temperatures below 5c, as oil may become unstable and de-emulsify. **This I think is a very good point.** In the past we usually cease oil spraying as the trees start to become damp with dew but have not really considered air temperatures. **Worth investigating further**. You would think water temperature was more critical, and pumped water via irrigation system will be a long way above ambient air temperature. But maybe the oil de emulsifies after it leaves the sprayer, and the effect is on the tree? It could explain some of the randomness of damage. Ryan may be able to add to this conversation.

- On Tuesday Nov 2nd Chris and Andrew visited CMV, Peter Holt, Josh Boram, and Chislett's Narrung. There were some differences between these orchards in style of tree, Levels of JSD, and % of winter oil applied.

CMV

- Moderate JSD
- High vigour in 2020-21 season
- 5% Winter Oil 2021

Peter Holt

- Nil to perhaps occasional JSD
- Moderate to high vigour 2020-21 season
- 3% winter oil

Josh Boram

- Nil JSD
- Moderate vigour 2020-21 season
- 3% winter oil

Chislett Narrung

- Nil JSD
- Moderate vigour 2020-21 season
- 3% winter oil

Delta Pistachios

- Moderate - severe JSD
- High vigour in 2020-21 season
- 5% Winter Oil 2021

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"PIT" Groups

Pistachio Information and Technology Groups - Meeting Report May 2022

R&D UPDATE AND MODIFIED CENTRAL LEADER PRUNING REVIEW

Meeting Date and Venues

Robinvale Golf Club Resort: *Thursday 19th of May, 2022, 10.00AM sharp*

Address**: 4240 Murray Valley Highway, Robinvale VIC 3549**

Then, CMV Farms Robinvale:

Address: **CMV Farms, 3067 Murray Valley Hwy Bannerton Vic 3549**

TOPICS:

- R&D Update - Dr Maha Mahadevan
- Permit AF36 (Aspergillus flavus AF36 Prevail) to control Afflatoxin in Pistachios. – Chris Joyce and Trevor Ranford
- Aerial Imaging. The imagery is processed using crop-specific data models to generate specific and actionable insights that assist on-farm decision-making, - Scott Gillett, CERES imaging - *Via Zoom*
- Update on Season 2021/22 - Chris Joyce - *Via Zoom*

The first PIT Group meeting after the 2022 harvest was held at the Robinvale Golf Club for 4 presentations then a field walk at CMV Farms, Bannerton to assess the Modified Central Leader pruned blocks.

This meeting was very well attended with **49 growers and industry personnel** attending both the presentations and field walk.
James Simpfendorfer filmed proceedings at the Golf Club and during the field walk and spliced in the presentations. These will be posted on the PGAI website as soon as possible with this reports and the presentations in PDF format.

PGAI researcher, **Dr. Maha Mahadevan** kicked off the presentations after an introduction by Trevor Ranford. Maha presented a summary of her research to date including;

- Chill measurements
- Oil and polymer sprays to offset lack of chill, and
- Pistachio Dieback

Trevor Ranford spoke on a Permit for AF36. AF36, a sterilized grain product that carries spores of an atoxigenic strain of the fungus *Aspergillus flavus.* This fungus species occurs naturally in orchard soils and has both toxigenic and atoxigenic strains. The atoxigenic AF36, spread on orchard floors, displaces the toxigenic strains that can cause formation of aflatoxin when the nuts are damaged.
Themis Michailides, UCCE plant pathologist at the UC Kearney Agricultural Research and Extension Center and a lead researcher on the efficacy of AF36, has been conducting research on AF36 for the past eight years. Field studies in both pistachios and almonds achieved aflatoxin reduction of up to 45% in crop samples. Displacement rates in the soil reached 90 to 95%.
In his research, Michailides said effectiveness of AF36 is measured by the displacement of the toxigenic strains and also by the lower frequency of rejected loads in export markets.

In pistachios, application of AF36 in orchards is recommended every year, usually mid-July to mid-August (in the USA, Mid January, to mid-February in Australia). In almonds, Michailides' research showed that the first year it is applied in an orchard, the biocontrol strain reaches very high levels and can survive for a second year in high levels. Research suggests AF36 is more effective when used every year as it helps build up the population in the soil. Michailides said if applications ceased, it is likely that the competitive effect would diminish. Nearly all California pistachio acres are treated annually with AF36, said Bob Klein, manager of the California Pistachio Research Board.
PGAI has a successful permit application for using AF36 in Australian Pistachio orchards, and has 40,000lbs being shipped to Australia.

Scott Gillett from CERES Imaging spoke via Zoom on aerial imaging for pistachio orchards.
Scott has been part of Ceres Imaging since 2018, where he works with Australian customers to ensure that the imagery and data they receive contributes to improving their production and sustainability
Remote sensing and smart data systems will help us make better decisions in real time, while irrigation automation, robotic harvesting and yield estimation are just part of a new generation of agtech tools that will let us grow smarter and more sustainably.

How it works

Fixed-wing aircraft are flown over the property taking high resolution multi-spectral images that provide more accurate, higher resolution images than satellite-based services.
The imagery is processed using crop-specific data models to generate specific and actionable insights that assist on-farm decision-making.

How it can be used on your property

Using advanced analytics and high-resolution aerial imagery, Ceres Imaging delivers irrigation management solutions including:

- detection of clogs, leaks and pressure failures before the issue affects your crop
- analytics tools to quantify and track progress so you can make the right decisions and on-farm investments
- improved farm level strategy through:
    - correction of overwatering and underwatering to improve water use efficiency and crop uniformity
    - matching irrigation system design and scheduling to terrain and soil conditions
    - creation of accurate, precise variable-rate zones to reduce costs through targeted applications.

Ceres Imaging integrates seamlessly with farm management software and is mobile friendly so you can easily view imagery on your phone or tablet

Chris Joyce presented and early assessment of the 2022 harvest via Zoom. A bumper year with 3,600 tonnes harvested, with no major dark stain problems. Some light stain and some growers getting better than 5 tonne/heactare with the best around 7 tonnes. This highlights the fact that a good fertilizer and watering regime – particularly during nut fill leads to good yields. This will be looked at in more detail in an upcoming PIT Group meeting.

After lunch the attendees drove to CMV farms Bannerton where, although too early to actually prune the pistachio trees, Phil Hewett, Andrew Bowring and Pip Crawford went through pruning techniques and what they were trying to achieve with modified central leader pruning. The format was slightly different to previous years where the discussion was led by questions posed by growers. Several blocks were looked at that had undergone modified central leader pruning for a number of years.

Modified Central Leader Pruning:

In California, pistachio trees pruned using a modified central-leader training system are performing better than conventionally pruned trees, according to UCCE Integrated Orchard Management Specialist Bruce Lampinen.
In reporting on research that he and co-principle investigator Fresno County Nut Crops Farm Advisor Mae Culumber are conducting in grower orchards, Lampinen said unpruned pistachio trees and those pruned under a modified central-leader training system are yielding better in the early years than conventionally pruned trees. And what may have longer term ramifications, the research is showing that unpruned trees and those pruned on a modified central-leader training system have better branch angles, stronger connections and are less prone to breakage.

“We haven’t seen any breakage in grower orchards trained with the modified central-leader system up to seven years of age,” Lampinen said.

Photo Gallery:

Figure1: Trevor Ranford presenting to a full room at the Robinvale Golf Club

Figure 2: Phil Hewett from CMV Farms answering questions on modified central leader pruning on young trees

Figure 3 and 4: Phil Hewett and Pip Crawford from CMV Farms, as well as Andrew Bowring from Kyalite Pistachios answering questions on modified central leader pruning on older trees

Figure 4.

For more information please ring Craig Feutrill on 0437 307 590

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"P T" Groups

Pistachio Information and Technology Groups - Sessions Report July 2022

BENCHMARKING, GROWING PISTACHIOS FOR PROFIT AND ORCHARD SANITATION SESSIONS

Meeting Date and Venues

Session 1: Jeff Dickinson's Farm: *Wed 27th of July, 2022 12.00 Noon sharp*

NOTE: We will be starting with lunch and presentations at the **Nyah West Grand Hotel, 12 Station St, Nyah West VIC 3595.** Then, out Jeff's farm for a farm walk.

Farm Address: **2403 Murray Valley Highway Vinifera, Victoria, 3591**

Session 2: Ian McFarlane's Farm: *Thurs 28th of July, 12.00 Noon sharp*

NOTE: We will be starting with a BBQ and presentations, then a farm walk and a look at Ian's new Spanish built Tenias harvester.

Farm Address: **22 Elephant Trunk Road Cobdogla, South Australia, 5346**

TOPICS:

- Benchmarking Results - Dr Maha Mahadevan, PGAI Research
- Getting the Best from your Orchard – Jake Butler, Swan Hill Chemicals (Victoria only)
- Orchard Sanitation – Craig Feutrill
- Pests (Potential) of the Australian Pistachio Industry
- The Tenias Pistachio Harvester – Ian McFarlane (South Australia Only)

The second round of PIT Group sessions for 2022, were held at the Grand Hotel Nyah West, then Jeff Dickinson's property at Vinifera in Victoria and the second meeting at Ian McFarlane's property at Cobdogla in South Australia.

Both PIT Group sessions were well attended, with a total of 45 growers and industry personnel attending across both venues.

James Simpfendorfer filmed proceedings at the Cobdogla session and during the field walk and spliced in the presentations. These will be posted on the PGAI website as soon as possible with this report and the presentations in PDF format.

PGAI researcher, **Dr Maha Mahadevan** kicked off the presentations at both sessions. Maha presented a summary of her research to date, future research plans and the latest industry benchmarking data. Dr Mahadevan's talk covered topics including;

- Regional chill measurements
- Oil and polymer spray trials to offset lack of chill and
- Industry Benchmarking
- Future research plans

Benchmarking is a common practice and sensible exercise to establish baselines, define best practices and identify improvement opportunities. Utilising the yearly benchmarking data into your farming enterprise will

encourage discussion and sparks new ideas and practices. At its best, it can be used as a tool to help you evaluate and prioritize improvement opportunities.

Jake Butler from Swan Hill Chemicals (SHC) spoke on how to get the best from your pistachio trees using various fertilisers, chelates and monitoring/management techniques. Specifically:

- The program focuses on a combination of fertiliser applications through the ground via irrigation as well as foliar applied.
- Product selection based off a similar Almond fertiliser program which have seen above average yields in the Sunraysia/Mallee region.
- Focusing mainly on liquid products when possible, for ease of mixing and OH & S reasons.
- Targeting seasonal Pistachio NPK requirements from Californian Pistachio data, with 90% in the growing season & 10% post harvest.
- Soil microbial and root stimulant products to promote root health, soil health and microbial activity.
- Adjusting to half rates for unestablished or non-bearing trees.
- Encouraging regular sap & leaf nutrient analysis throughout the season to allow for timely adjustments.
- Annual or Bi-Annual soil testing to monitor nutrient levels and pH trends.

At the Cobdogla meeting, the SHC talk was quickly run through with Dr Mahadevan and Craig providing comments.

Swan Hill Chemicals pride themselves on being industry leaders in horticulture with a presence in the Swan Hill region for over 30 years. The horticultural team is experienced and enthusiastic to ensure your farm and crop gets the best care all the way through to the packing shed.

Craig Feutrill spoke on the need for orchard sanitation in pistachios as a preventative measure for diseases and 'if' any potential pest insects invade orchards.

Part of Good Agricultural Practices (GAP) is orchard sanitation post-harvest. Removing mummy nuts from trees during post-harvest, and the gathering and destruction (flailing) of nuts on the ground is important in the US to control Navel Orangeworm and also helps reduce *Botryosphaeria* inoculum, which can splash up into the trees during heavy storms.
Sanitation efforts should begin following harvest and should be wrapped up by late August.

Craig Feutrill also presented at both meetings, although greatly extended at the Cobdogla meeting, the finalised chapter on 'Potential Insect Pests of Australian Pistachio Orchards'. This chapter will be part of the grower's manual currently being produced. Craig also provided information on a trial 'chat room' that will be for grower initiated discussion. The link to the chat room will be sent to all growers with a designated time when Dr Maha Mahadevan, Craig, and Trevor Ranford will be available for Q&A.

In South Australia at Cobdogla we had the bonus discussion with host Ian McFarlane on his new Tenias pistachio harvester. Ian had the harvester delivered from Spain one week prior to the 2022 harvest. It is an enormous machine as can be seen in the picture below; Figure 3.

Benefits, Specifications and Tree Requirements for the Tenias Pistachio Harvester:
Efficiency through design

- Smooth and efficient harvest up to 9 trees per minute. (Contact your Sales Representative for details)
- Superior shaking with a grounded shaker head allows continuous harvesting.
- Easy operation thanks to the automated tree sensing and shaking system.
- Unique one-piece machine makes for faster turns, less fruit lost, and easier movement around the field.
- Increased harvesting time between unloads due to twin nut storage hoppers, one mounted to each side of the harvester.
- Unload the hopper without stopping the harvester.
- Comfortable operator station with and ergonomic design, air conditioning, suspension seat, cup holders, and rear-view camera.
- Harvest day or night with confidence and comfort.

Cost saving features

- 3 harvest operations with only 1 person and 1 machine.
- Improved productivity through nonstop harvesting.
- Harvest with less machines and less passes compared to conventional practices.
- Improved fuel efficiency per harvested acre completing the shaking, sweeping, and pick-up operations with a single engine.

Improved nut quality

- Exceeding current food safety standards for the nut industry with superior shaking, catching, and cleaning systems.
- Leaf cleaning fans eliminate leaves and other debris from the nut material.
- Fallen branches removed and discharged infield by the Stick Rake System. (only available on Continuous Unloading Hopper models).
- Pre-cleaning system removes foreign material improving delivered product quality (contact your sales representative for more details).
- Shaker frequency optimized by the proprietary grounding leg system, better vibration with less force preventing damage to next year's buds.

ORCHARD REQUIREMENTS

Recommended planting spacings

- The valid planting patterns are between 18 x 8 and 23 x 13 ft (for other patterns, please enquire). The most recommendable planting pattern is 20 x 10 ft.
- At the end of the row there must be a space of at least 35 ft, so that the harvester can turn around.

Trunk and berm dimensions

- The free height of the trunk must be at least 35 in. To this end, it is recommended that the cross be cut at 35 in to 44 in.
- The maximum permitted height of the berm is 8 in.

Alignment of the orchard

- Trees must be in full alignment.
- Elements such as irrigation systems and other obstacles must be aligned with the rest of the row.

Maximum tree size

- For pistachio trees, these dimensions are a height of 16 ft metres and a width of 13 ft.

After lunch and presentations at the Grand Hotel Nyah West, the attendees drove to Jeff Dickinson's farm to look at the trees and discuss his 2021/22 fertiliser and management program with him and Jake Butler from SHC.

Photo Gallery:

Figure1: Dr Maha Mahadevan presenting Benchmarking data at the Grand Hotel Nyah West in Victoria.

Figure 2: Jeff Dickinson at his Vinifera property in Victoria discussing dieback and new growth.

Figure 3: The Tenias Pistachio Harvester at Ian McFarlane's property, Cobdogla.

Figure 4: Ian McFarlane discussing the Tenias harvester.

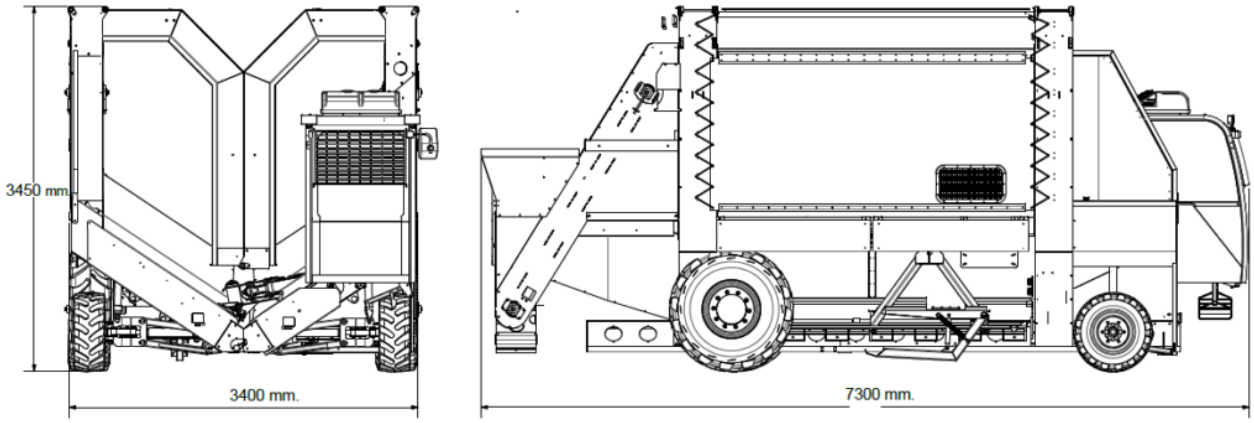

Figure 5: Specifications of the Tenia Pistachio Harvester (minus collection hoppers on each side)

For more information please ring Craig Feutrill on 0437 307 590

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"P T" Groups

Pistachio Information and Technology Groups.

Report on November 2022 PIT Group Sessions at Bannerton, Victoria and Waikerie, South Australia.

Session themes: BAD BUGS, BAGS, AND CUTICLE PROTECTION, 2022/23 DISEASE PRESSURE - SPRING SESSIONS

<u>Meeting Date and Venues</u>

Meeting 1: CMV Farms: Wednesday 9th of November,
Farm Address: CMV Farms, 3067 Murray Valley Hwy Bannerton Vic 3549

Meeting 2: Rob Hayne's Farm: Thursday 10th of November, 12.00 Noon sharp Farm Address: 32 Francis Road, Waikerie, South Australia, 5330

TOPICS:

- PGAI Intoduction – Trevor Ranford and Chris Joyce
- Pistachio Dieback – Dr Maha Mahadevan, PGAI Researcher.
- Carpophilus Beetle and Carob Moth - Dr David Madge, AgVic
- PARKA, cuticle protection – Russell Fox
- Big Bag Recovery – Stewart Ford
- Beware the Sleeping Menace – Barbara Hall, Plant Pathologist

We managed to find a couple of reasonable days among the incredibly wet days of November to hold the Spring PITGroup Sessions in Victoria and South Australia. Although 59 people had indicated that they would attend, a change in venue in Victoria and the threat of flooding from the Murray River, and the need to build levee banks on properties saw the total number of attendees drop to 48 over the two days – 22 in Victoria and 28 in South Australia.

Both meetings had the same agenda, although Dr David Madge Zoomed in for the second meeting in Waikerie. It was a full afternoon of presentations which included a field walk in Waikerie after the presentations.

The meetings were opened by PGA Executive Officer, Trevor Ranford and a presentation by President Chris Joyce followed.

PGAI Researcher Dr Maha Mahadevan spoke on Pistachio Dieback for the 2022/23 season and the need to get information back to her so she could plan research activities into this problem.

Dr David Madge spoke on Carpophilus Beetle and Carob Moth, which have both proved very troublesome and costly to the Almond industry in recent years. Infestation and damage by the relatively new species, *Carpophilus truncatus* was found to commence at hull split, with damage levels increasing rapidly thereafter – indicating the need to harvest and disinfest crops as early as possible to minimise damage. This pest went from being noted in the almond orchard in very low numbers to become a major pest in only a few seasons. Residual and mummy nuts in almonds are seen to be a major source of the damaging Carpophilus species, with potential to support massive population increases of the pest. Destroying the remaining nuts through orchard hygiene practices is a critical factor for success in managing Carpophilus, regardless of other management options currently implemented.

These pests, although not currently a problem in pistachio crops pose a potential threat if there is a biotype

alteration to the genetics of the insect or possibly the effects of climate change. No matter what, vigilance in the orchard is paramount for ***any*** pest or disease outbreak!

Russell Fox spoke on Parka, a proprietary product of Cultiva, has been shown to protect crops from the effects of excessive water, heat and even damage from smoke as a result of environmental conditions creating raging wildfires. Parka is composed of food-grade phospholipids that supplement the plant cuticle - a plant's first line of defence between the environment and the epidermal cells.
Spray application forms an elastic, protective shield to maintain the integrity of fruit and foliage even as the crop develops.

Stewart Ford spoke on the Big Bag Recovery program which is an Australian Government Accredited Product Stewardship scheme for plastic bags over 15kg/l of contents (sacks and bulk bags). The program only includes recyclable bags that are woven polypropylene (wPP) and low-density polyethylene (LDPE). The program allows for two sizes: sacks and bulk bags. Most importantly, Big Bag Recovery takes on the responsibility of collecting and recycling your waste packaging and this includes all associated activities such as logistics, marketing, consumer education, compliance and reporting. The pistachio industry will provide information to Stewart to establish a collection protocol in each state where possible.

Plant Pathologist Barbara Hall spoke enthusiastically on the potential fungal diseases that could infest orchards this growing season. The very wet start of the 2022/23 growing season for pistachios is very similar to the 2010/11 season, which saw anthracnose devastate the crop. Whilst we now have a better understanding of that disease and fungal spray programs, there is always the chance that some other disease will take off causing crop losses. Barbara covered anthracnose, panicle and shoot blight (or 'Bot' as it is better known to growers), Alternaria, monitoring via BUDMON and ONFIT. Management was also covered including:

1. Sanitation –reduce inoculum load
2. Canopy management –aeration to reduce leaf wetness
3. Avoid damaging young nuts
4. Manage weeds and irrigation (especially for Alternaria)
5. Monitor? Disease and weather!
6. Adjust harvest times?

Use an effective fungicide program – remember the Three 'T's

- Treatment
- Timing
- Technique

An integrated management approach to disease control is seen as critical to success.

Photo 1: Rob Haynes, on right, from Waikerie discussing his tree management.

Hort Innovation Strategic levy investment | PISTACHIO FUND

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"P T" Groups

Pistachio Information and Technology Groups.

WINTER SESSIONS

PISTACHIO MALE TREE DIEBACK, 2023 HARVEST, WINTER PRUNING, CALIFORNIA CONFERENCE, and FIELD WALK

June 2023 - Meeting Dates and Venues

This round of PIT Group meetings is an update on male tree dieback, a report on the 2023 harvest, Dr Maha's report on the Pistachio Conference in California and winter pruning and much more…….

Lake Powell: ***Tuesday 20th of June, 12 Noon sharp for BBQ***
Address: **Peter Holt's property**,
76 Zara Lane, Lake Powell, **Victoria**, 3597

Renmark: ***Wednesday 21st of June, 12 Noon sharp for BBQ***
Address: **Bob Hodgson's property,**
315 Renmark Avenue, Renmark. On the main road into Renmark from Berri.
There is a service road on the eastern side opposite Olivewood.

TOPICS (for both meetings):

- Update on Male tree die-back – Dr Len Tesoriero (NSW Pathologist)
- Update from USA Congress and delivered paper – Dr Maha Mahadevan
- Update of 2023 harvest – Chris Joyce
- Winter pruning (Renmark)
- Young tree shoot death
- AF36

The Winter Session PGAI PIT Group meetings were very well attended with 73 growers and Industry personnel attending across both the Victorian and South Australian meetings.

The meetings began, at both venues, with the traditional BBQ and informal chat and catch-up.

After an introduction by PGAI Executive Officer Trevor Ranford, the meeting began with a report from Dr Maha Mahadevan on her journey to the USA for the VIII International Symposium on almonds and pistachios at the University of California, Davis campus.

Maha teamed up with some Spanish Pistachio researchers for a pre-conference tour of properties, nurseries and research facilities in and around Los Angeles and Fresno. Maha delivered a paper at the symposium titled: Dynamics of chill accumulation in Australian pistachio growing regions. The paper was delivered and explained at the PIT Group meeting with detailed analysis a dynamic chill units for the various production regions in Australia.

Chris Joyce spoke about the difficulties of the 2022/23 season and subsequent harvest with total volume of nuts harvested and delivered well below expectations. Harvest 2023 had the worst yields from mature trees in over a decade – the wet/disease year of 2010/11 being the last.

The season started with marginal chill, and had good Dynamic Units, but fewer hours <7 degrees C. There was rain during pollination in October and this probably caused the young trees to only have a good crop rather than a great crop.

Then there was cold, wet weather in October, November and December delaying maturity, with some orchard flooding.

It was the latest start ever to harvest. There was very uneven maturity resulting in very high Adhering Hull and high Dark Stain – this raised grading costs in the processing plant.

Several orchards did not harvest.

Domestic demand for in-shell pistachios is flat following the 2020/21 spike during Covid, this will be reflected in the price paid.

Chris Joyce spoke further on AF36 (Aflatoxin Strain 36).

AF36 is strain of the aspergillus mould that does **NOT** produce aflatoxin. It was the 36thstrain tested, hence the name AF36.

The mould builds up in the orchard and becomes the dominant strain of aspergillus in orchard. It "out competes" the toxic strains and is widely used in USA for cotton, corn, pistachios and now almonds. It costs about $A47/ha, plus application costs, is easily applied using a seed spreader and is applied Nov/Dec before rain. For the best bet on-going protection it should be applied annually to build the protection. New orchards should start the year before first harvest.

Dr Len Tesoriero, a speciallist Plant Pathologist from Crop Doc Consulting (previously of NSW DPI/Ag) reported on his investigations into the problem of male pistachio tree dieback.

What do we know so far? The problem has occurred in the previous extremely wet year 2011 although it affected mainly female trees. This current problem has affected mostly older male trees. It is not always associated with poor drainage and it has been noted that male flowers had stayed attached.

Pathologically there is evidence of Anthracnose infection – black necrotic lesions on leaves & petioles and evidence of vascular staining & lenticel rupture on shoots.

There is no clear causal pathogenic organism determined to date – other than *Colletotrichum acutatum (*Anthracnose) + Botryosphaeria sp.

Len is currently testing roots for pathogens – particularly Verticillium & Phytophthora spp. (+ others)

There is possible internal trunk necrosis is associated with anoxic (anaerobic) conditions in root zone – stress – ethylene release – IAA - defoliation

There was a discussion on the problem and the current and future fungicide program following Len's presentation.

At the Renmark meeting there was a Winter Pruning discussion and field walk with host Bob Hodgson providing various powered shears for a demonstration.

Photo1: Trevor Ranford with the capacity crowd at Renmark

Photo 2: Dr Len Tesoriero (left) viewing the root pit of an effected male tree (dieback)

Photo 3: Bob Hodgson (armed with powered shears) about to demonstrate winter pruning.

Hort Innovation
Strategic levy investment
PISTACHIO FUND

This project has been funded by Hort Innovation using the pistachio research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

"P T"
Groups

Pistachio Information and Technology Groups.

SPRING SESSIONS

PRECISION AGRICULTURAL DRONES, AUTOMATED DISEASE DETECTION, FEEDING YOUR PISTACHIO TREES, AF36 – USE AND APPLICATION AND FIELD WALK

November 2023 - Meeting Dates and Venues

This round of PIT Group meetings is an opportunity to find out about agricultural drones and the scope of their abilities, automated disease detection, how, and why to provide nutrition for your trees and the use of AF36. A fact sheet will be presented at the meeting.

Kyalite: ***Thursday 16th of November, 12 Noon sharp for Lunch***

Address: ~~**Tooleybuc Sporting Club – then Kyalite Pistachios**~~, 99 Kyalite Road, Kyalite NSW 2715

Waikerie: Lunch **Friday 17th of November, 12 Noon sharp for BBQ**

Address: **Paul Wurst's property, Waikerie**

10 Walter Road, Waikerie, SA. 5330

TOPICS (for both meetings*):

- Advancements in Vineyard & Orchard Management using Drone Technology – Falcon UAV/Luke Weekley
- * Automated Agricultural Disease Detection –Bioscout/Edward Gubbins (Kyalite only)
- Feeding Pistachio Trees – Dr Ben Thomas
- AF36 fact sheet and application video – Craig Feutrill
- * Spain and Sicily Study Tour – Andrew Bowring (Kyalite only)
- R&D Baseline survey – Brenda Kranz (PGAI EO)

The Report:

The Spring PGAI PIT Group sessions were very well attended (despite a couple of late venue changes) with 75 growers and Industry personnel attending across both the NSW (Kyalite) and South Australian (Waikerie) meetings.

The meetings unusually, began differently, with sandwich platters at the Tooleybuc Sporting Club on the Thursday and the traditional BBQ and informal chat and catch-up at the Waikerie venue on the Friday.

The Kyalite session began with Ed Gubbins from Bioscout talking about the Bioscout spore sampling technology:

BioScout is an agricultural start up, founded through the University of Sydney, revolutionising treatment of disease-ridden crops. The BioScout sensor collects airborne fungal spores to analyse the morphological and colour signatures of the spores against their database of agricultural diseases. Due to early detection, farmers may apply appropriate quantities of fungicides to plants before they exhibit symptoms of disease; improving crop yield and reducing fungicide expenditure.

Driven by the current devastating statistic that 20% loss of crops is due to fungal infections, BioScout are improving disease management practices for farmers by eliminating the need for biweekly sprayings of both infected and uninfected crops. BioScout have developed an innovative to detect airborne fungal spores before crop disease even develops. Ultimately, this technology has the potential to improve crop yield by 18% and reduce fungicide sprayings by 75%. BioScout Samplers may be installed at various points around a farm, where it utilizes machine learning algorithms to identify the types of crop fungal infection through images of the fungal spores. BioScout is the first company to take accurate images of fungal spores on a nanometer scale in an agricultural setting.

The BioScout Sampler precisely intakes atmospheric samples through a narrow opening where biological particulates are filtered out of the airstream and collected onto an adhesive cassette. A specially designed and automated microscopy system embedded within the box then images the biological particles and uploads it to the BioScout database where potential spore targets are analysed and identified. The BioScout Sampler is linked to the BioScout app which tracks and sends notifications on crop spraying patterns, spraying frequency and pathogen outbreaks.

Bioscout sensors are currently deployed in vineyards and with 2 diseases identified for pistachio and more to come are expected to be deployed in participating pistachio orchards in the next 12 months or so.

Andrew Bowring, Farm Manager of Kyalite Pistachios spoke on his study tour through Spain and Sicily in September of 2023.

Following visits from two Spanish groups to Australian pistachio orchards in March 2023, we now see opportunities to collaborate with the rapidly expanding Spanish industry on a range of topics. The Sicilian industry, although less technologically advanced than Australia, has 3,500 to 4,000 hectares of pistachios, producing up to 4,000 tonnes in a single season. So there is potential to learn from both these countries on a range of matters.

One of the first things that amaze you driving between Bronte and Biancavilla is that pistachios seem to be everywhere! Growing right up to roadsides almost like weeds, which is in fact how their life began. The slopes of volcano “Mt Etna” provided ideal conditions for wild seeds of Pistacia terebinthus to germinate, on which farmers grafted *Pistacia vera cv Bianca.*

Despite a low average rainfall of about 150mm, the orchards of Mt Etna are not totally free of disease. Septoria Leaf Spot is the “major” pathogen issue, but at the time we were there the symptoms were only mild, and the impact on the tree I thought minimal or nil. Some farmers will apply (by hand) a Strobilurin based fungicide if the problem appears to be continuing.

The Spanish pistachio industry is expanding rapidly at 8-9,000 hectares per year, but is currently only producing around 4,500 tonnes, or similar to Australia's anticipated production in 2024. However over 60% of the industry is dryland, and some new areas are continuing to be planted as dryland, or supplementary irrigated only. Those orchards that are irrigated have access to 4-5 ML/ha of water only, and this is not likely to increase in the future.

A number of videos were shown illustrating planting and harvesting pistachios.

Neither Andrew Bowring nor Ed Gubbin presented at the Waikerie Session. Although some of Andrew's videos were shown.

Craig Feutrill spoke on AF36 and its application in pistachio orchards and distributed the new PGAI AF36 Factsheet.

AF36 is a strain of Aspergillus flavus that occurs naturally but does not produce aflatoxin. When AF36 is applied to pistachio orchards at the appropriate time, it actually competes with other strains of Aspergillus flavus that do produce large amounts of aflatoxin and, in doing so limits or reduces the amount of these high aflatoxin producers that become associated with the crop.

Aflatoxins are toxic chemicals produced by various strains of the common fungi Aspergillus flavus and Aspergillus parasiticus. Aflatoxins cause cancer in certain experimental animals at very low concentrations (1 part per billion). Aflatoxins are also associated with human liver cancer.

Because AF36 is a living biological control agent, it functions best under moist sheltered conditions out of full direct sunlight.

Chris Joyce spoke on voluntary contributions for non-producing orchards at the Kyalite meeting and PGAI Executive Officer addressed the issue at the Waikerie Session.

The pistachio industry is almost unique in Australian agriculture in that its research and operating budgets are met by the voluntary contributions of growers rather than government-controlled levies. That almost all growers elect to make this voluntary contribution each season shows that growers support the work being done by the PGA for the industry.

In the last few years, the focus has been on managing young trees. Numerous PIT group meetings have been on the pruning and management of young trees. A major focus of current PGA research has been on Young Tree Shoot Death that affects vigorous shoots on trees 3 to 7 years old.

In 2024, the PGA is planning to extend its extension services to growers by the appointment of an Industry Development and communications person. This will party be financed by the expanding crop from producing growers. It will also need the contributions from non- producing growers.

At the recent AGM, it was unanimously resolved by the grower members that the contribution rates for 2024 be:

Producing growers	$0.07/kg (merchantable yield)
	$0.07/kg (fresh in hull) Non-
producing growers	$20/hectare

These are the same rates as resolved for the 2023 season. GST will be added to these fees. Feedback from growers with non-producing orchards was sought at each session.

Brian McCarthy from FalconUAV spoke on the various drones and services available.

FalconUAV have a focus on land improvement and management strategies with clients. Our 5 step precision plan is available as a service to incorporate into your operation or as a complete program of works you can own and operate yourself. Our team are dedicated to ensure you are supported through the process.

These images can also be output into a Variable Rate treatment map. Using precision spray equipment such as Raven's Hawkeye Controller, allows the ultimate in precision agriculture . We are fully insured and follow all CASA regulations. Operator's Certificate 0427

Planning is essential for aligning our professional services to your requirements that comprises a mixture of activities that take place on site or remotely.

Determining the right UAV is selected for the outcome and requirements is the first step to then plan the flights and payload types (cameras, Bird scarers) necessary to carry out the job. At this stage we identify optimal flight paths, risks, and data to be collected to design a program that will perform to meet your requirements.

Drones are deployed as per the flight plan using the camera or payload appropriate for the mission using the right software and survey grid for accurate filming or photography.

During this time we perform as many manual or automated flights necessary to capture information required or cover the physical area of interest. A suitable launch location for take off and landing is safely established, we deploy the drone to complete the mission via a pre-determined flight path and survey grid. Where necessary, drones can be flown manually as an override. Flights are monitored live in real time at base station with video and consistent imagery continuously being captured. Flights are in accordance with CASA regulation at all times, batteries charged on site and all data backed up on microSD cards, laptops and other devices. Data from the flight captured is checked with clients to ensure correct areas are covered and we have a sufficient area to create good quality orthomosaic maps. If necessary, we will adjust a grid survey and repeat the flight if we need to adjust or expand our survey area.

Processing can take place at the site depending on internet activity or back at our offices with turnaround time between minutes or 24-48 hours depending on the size of the property surveyed, and information formats required from the captured imagery for use in variable rate sprayers, spray drones or tractors software (Trimble). Otherwise in a format suitable for your agronomist. Falcon UAV can otherwise provide a network of suitable agronomists to analyse the data to recommend a sufficient solution to rectify any mineral deficiencies or stressed pastures.

Reporting can take a number of forms depending on what you want to achieve and the type of information collected. For example, raw or edited video footage and photographs, updated reports with annotated maps highlighting stress levels of pastures, interpretations and/or recommendations for further crop scouting or damage inspections.

By referencing the data from previous seasons with the current data captured and comparing results from the same developmental stage from one season to the other, you can obtain insightful data enabling increased yields and lower input costs.

Brian conducted survey flights with a fixed wing drone at both sessions and also demonstrated a large quadcopter at the Waikerie session.

Finishing each presentation session, PGAI EO Brenda Kranz led the growers through an online survey for the R&D programme and the current PIT Group session.

Dr Ben Thomas led a field-based nutrition discussion at Kyalite and presented at Waikerie

Photo 3: Andrew Bowring discussing minimal pruning at Kyalite.

Photo 4: Brian McCarthy presenting to the Waikerie growers on FalconUAV drones and what they could achieve.

Hort Innovation Strategic levy investment | PISTACHIO FUND

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Pistachio Growers' Association

BEN THOMAS CONSULTING

ABN 88 173 348 039

PISTACHIO SEASONAL REMINDERS
SUMMER & PRE-HARVEST
2021/2022

Welcome to 2022! As always, hopefully you all had a good Festive period and had some time off to refresh in preparation for the rest of the 2021/2022 season.

COVID continues to dominate headlines and our lives and has led to major changes in the way we live and interact. The PGAI is no different with border closers affecting grower meetings. Even so, the PGAI was able to conduct PIT group meetings in July 2021 and November 2021 along with virtual meetings for the Pesticide Evaluation and Review Program.

Hopefully, with COVID border restrictions easing, we can get back to more in-person meetings starting with a pre-harvest pistachio industry dinner planned for 3rd February 2022 in Mildura. This dinner provides an opportunity for growers to come together (under COVID requirements), network and recognise the long and important contribution by Dr Robinson to the PGAI and the pistachio industry in general. A flyer for this function is attached.

THE 2021/2022 SEASON TO DATE

It has been an interesting season to date. Winter chill was somewhat variable across the pistachio growing regions this season. The PGAI continues to provide regular chill newsletters during winter and this season, regions east of Swan Hill had sufficient chill whilst the Riverland had inadequate chill. As for the Sunraysia, different chill modelling methods gave different results this season with the region receiving sufficient dynamic chill portions but hours <7^{o}C were below normal. In this situation, most growers opted to apply winter oil to mitigate the effect of insufficient winter chill.

Spring 2021 was somewhat unusual with cooler than expected conditions across many pistachio growing regions which resulted in slower than expected growth and vigour for many growers. Despite this, I observed good vigour, leaf colour and fruiting buds on many orchards during my travels in December. Many growers are reporting promising crop potential with many trees exhibiting on-crop open fruit clusters. Fruit size also seems okay although the cooler spring conditions may see smaller fruit and nut size at harvest.

MANAGEMENT DURING NUT FILL

We are now in the nut fill period of the pistachio production cycle which is a critical phase of the pistachio production cycle when the kernel grows and causes the shell to split. Good management during this phase will maximise kernel growth and shell splitting. Key issues at this time are understanding kernel development, managing irrigation and nutrition and preparing the orchard for harvest. This is also the time for leaf analysis and budding young trees.

- **<u>Kernel development</u>**. During the nut fill period, the kernel within fruit start to grow and fill the shell. The start of this period varies each season and flowering and fruit set was variable this season for many growers. As such, understanding the range of kernel development is very important when considering irrigation and fertiliser applications as well as being very valuable when estimating the start of harvest.

In the past, I have commented on the kernel development protocol recommended by Bob Beede. This protocol is repeated below for your convenience.

Step 1
Randomly collect 10 entire clusters from a selected area of the orchard. Make sure there are clusters from the north, south, east and west quadrants of trees.

Step 2
Strip the nuts from the rachises

Step 3
Using secateurs, cut each fruit in half. This can be done either horizontally or lengthwise.

Step 4
Rate each fruit for kernel fill ranging from 0 (no fill) to 5 (complete fill). Record the results and calculate percentages.

Step 5
Repeat the process every fortnight and record progress. This information will help when planning harvest.

***Bottom line**: Develop a good understanding of kernel development during the nut fill period by routinely cutting open developing fruit. For example, Photos 1 & 2 show pistachio fruit at about 25% nut fill and 100% nut fill respectively.*

Photo 1: Approx. 25% nut fill

Photo 2: 100% nut fill

- **<u>Irrigation</u>**. Pistach) wat fill period (from late December to harvest). Shell splitting is particularly sensitive with water stressed trees having reduced kernel growth, fewer properly split nuts and more narrow or non-split nuts resulting in lower returns to growers.

***Bottom line**: Pay particular attention to irrigation during the nut fill period up to harvest to avoid water stress, maximise kernel growth and hence the percentage of nuts that split properly.*

- **Nutrition**. Studies have shown that almost all current season potassium uptake by a pistachio tree occurs during the nut fill period. They also take up considerable amounts of nitrogen at this time.

***Bottom line**: Ensure trees are well supplied with potassium fertiliser during the nut fill period. The rates applied should be matched to expected yields. Nitrogen fertiliser applications are also important for kernel growth but care is needed to avoid stimulating vegetative vigour. Again, the rates applied should be matched to expected yields.*

- **Disease management**. Most growers have been applying fungicides during the growing season. However, continued monitoring is important to avoid disease outbreaks. With harvest approaching, care is needed to observe withholding periods.

***Bottom line**: Keep a look out for disease symptoms. Pay particular attention to and observe withholding periods.*

HARVEST PREPARATION

In the past I have commented on the issues to consider when preparing for harvest including orchard preparation, harvest machinery, understanding fruit maturity, contract harvesting, transport and processing. My comments are repeated below for your convenience.

- **Orchard preparation**. Remove low lying and/or fallen limbs that may interfere with tree access for the shaker and/or receiver. Prepare the orchard floor by mowing weeds, filling holes etc.

***Bottom line**: Ensure access for the shaker and receiver to maximise removal and catch of fruit.*

- **Harvest machinery**. It is important that harvest machinery is in good working order prior to the harvest period commencing and plenty of spare parts are available as breakdowns do occur.

***Bottom line**: Ensure harvest machinery is in good working order. Review spare parts on hand and order additional spare parts if required.*

- **Understanding fruit maturity**. For most efficient use of harvest machinery, it is important to be able to determine when pistachio fruit are mature and ready for harvest. This occurs when the fruit changes colour and separates cleanly from the tree with a gentle shake. At full maturity, the hull also separates cleanly from the shell – otherwise known as hull-slip (Photo 3).

Note that pistachio fruit do not mature/ripen evenly throughout the tree meaning there will be mature and immature fruit present (Photo 4). After the first shake, growers allow the remaining fruit to ripen further and then reshake the trees.

Photo 3: Hull slip in pistachio

Photo 4: Pistachio fruit ready for harvesting. Note presence of mature and immature fruit

***Bottom line**: Growers should assess fruit maturity carefully to determine when enough fruit is fully mature and ready to harvest. Late harvest increases the risk of nut damage and reduced value through fungal infection, increased shell staining and adhered hull.*

- **Contract harvesting**. Many smaller growers use a contract harvester. For those growers, work closely with your contract harvester to ensure trees are harvested at the optimum time.

***Bottom line**: Maintain regular contact with your harvest contractor aiming to harvest trees at the optimum time.*

- **Transport**. With pistachio, shell staining increases with increased temperature and storage time. Therefore, it is critical to ensure fruit is delivered to the factory as soon as possible (preferably within 24 hours) following harvest.

***Bottom line**: Discuss your requirements with your transport contractor stressing the need for fruit to be delivered to the processor as soon as possible following harvest. Be sure to inform your transport contractor of traffic requirements at the processor.*

- **Processing**. All growers have been sent the '*Pre-crop circular for the 2022 pistachio season*' from the Australian Pioneer Pistachio Company (APPC) which outlines the services provided by APPC along with details/policies regarding scheduling deliveries to the processor, delivery of in-hull pistachios, aflatoxins and foreign matter.

***Bottom line**: With only one major pistachio processor in Australia, it is critical that growers liaise closely with the processor to develop a schedule which best fits your needs and the needs of all growers. Of most importance is keeping the processor informed of deliveries especially if there are unexpected delays.*

SHOTGUN PELLETS

We wish to reinforce the issue of shotgun pellets being found inside nuts by metal detectors at APPC during processing and packing. Growers need to remember to shoot away from trees and reduce the risk of shotgun pellets contaminating fruit and nuts. The following comments provided by APPC highlight that this continues to be an ongoing issue.

> *"Shotgun pellets inside nuts are regularly being found by the metal detectors at APPC during packing. Whilst the APPC equipment is first class, there is always the risk that one is missed and a consumer will break a tooth.*
>
> *The supermarket auditors are questioning the frequency of the detection of the pellets and expressing concern that one may be missed.*
>
> *There is also the cost associated with metal detectors rejecting the package and the subsequent sorting with packets of pistachios needing to go back through the machine to find the individual pellet in the individual nut. This is slow and expensive.*
>
> *Pellets can only get into a nut if the shot is fired below the shoulder into the tree. This is a dangerous orchard practice.*
>
> *Growers need to ensure that shooters are fully brief on the danger of shooting below the shoulder not only for orchard safety but also for the food safety of our product."*

LEAF ANALYSIS

For pistachio, conventional leaf analysis is conducted in the month prior to harvest. The plant part sampled is a single leaflet from 1 of the 2 subterminal leaflets (not a terminal or end leaflet) from a fully expanded leaf in the middle of non-bearing shoots (Photo 5) located about 1.5 – 2m above the ground.

Photo 5: Pistachio leaf sampling. Arrow shows correct leaflet to sample.

Research conducted in California recommends collecting 8 leaflets from 18 trees to represent a planting/block allowing 30m between trees sampled.

For more information on leaf analysis, contact Ben Thomas Consulting on 0417 143 797 or benthomasconsulting@bigpond.com

BUDDING YOUNG TREES

Rootstocks planted in spring 2021 should soon be ready for budding. Budding can continue as long as there is sap flow and the bark on the rootstock 'slips' allowing insertion of the bud. Note that when trees are budded later in the season, it is possible that the new bud will remain dormant. Do not try to force growth from such buds as the young growth will then be susceptible to frost damage in late autumn and winter. These dormant buds generally survive and start growing in the following spring.

Some other considerations regarding budding of young pistachio trees are:

- *Do I use a contractor to bud the trees?* Contractors, whilst more expensive, typically provide some guarantee of success. If you are not confident budding trees, consider using a contractor.
- *Where do I source budwood?* At this stage, the Australian pistachio industry does not have a budwood depository. Instead, budwood is sourced from existing orchards.
- *Can smaller trees be budded?* Smaller trees can be budded but, generally speaking, rootstocks with diameters of at least 1cm will take a bud better than smaller trees.
- *How many male trees should I have?* Pistachio trees are dioecious meaning they have separate male and female trees with the female trees bearing the fruit. Pistachio trees are also wind pollinated and there needs to be sufficient male trees to produce enough pollen to fertilise the female trees. Traditionally, about 8-10% of the trees in an orchard were male but more recent plantings have seen fewer male trees planted (4%) which appear to yield as well as older plantings.
- *Which male trees should I have?* There are 3 types of male pistachio trees used in Australia which vary in flowering time – early, mid and late. I recommend including male trees of each type in a planting.
- *What planting pattern do I adopt?* Most growers opt for a rectangular planting pattern meaning there are male trees evenly spaced in a grid pattern.

For more details or to discuss any of the issues raised in this seasonal reminder, contact

Ben Thomas on 0417 143 797 or benthomasconsulting@bigpond.com

or

Craig Feutrill on 0437 307 590 or cfeutrill@bigpond.com

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SEASONAL REMINDERS - WINTER 2022

Welcome to the 2022/2023 pistachio season!
In this edition of Seasonal Reminders, we reflect on the 2021/2022 harvest and look at chilling and Winter preparation required for the 2022/2023 season.

The Harvest:

With harvest over, the 2022 crop was a good 'on-crop' of approximately 3,600 tonnes. This is the largest ever Australian crop, comfortably beating the 2018 crop and reflects good yields and increased production areas.
The overall quality was good with most growers achieving slight levels of dark staining. Light staining, however, had increased levels.
Rain caused heavy Light Stain. Over 10% Light Stain within 6 days, some late loads had greater than 50%. Light Stain for 2022 had an average over 15%, whereas this is usually less than 8%
Nut size was larger this season and this highlights that large crops do not produce small nuts. The challenge we have is to maintain this large size.

International prices are down a little due to the expectations of a record Californian crop in September. Consumption in Australia, after the Covid surge in financial year 2021, financial year 2022 consumption has dropped to 2020 levels
For the 2021/2022 harvest, grower returns will be lower. Prices are similar to 2021 but because the quality is down, grading costs are higher resulting in lower net returns. Expanding world production could put further downward pressure on future prices.

Chill and Dormant Oil Applications:

Pistachios have a high winter chill requirement. Insufficient chill can result in uneven opening of vegetative and flower buds, poor pollination and fruit set, uneven harvest and reduced yields.
The PGA monitors accumulated winter chill using the Dynamic Model and each season produces a series of newsletters for growers. These newsletters provide an update on the amount of winter chill in various locations as well as some very useful information on winter chill and use of dormant winter oil sprays. If you have not been receiving these newsletters, please contact Trevor Ranford on 0417 809 172 or sahort@bigpond.com

So, if we have good winter chill numbers, should growers still apply dormant winter oil sprays to assist with bud break? Bob Beede from California who conducted much of the research investigating the effect of dormant winter oil applications on pistachio questions the value of applying dormant winter oil sprays to mature trees in a good chilling year. Work in Australia by Jianlu Zhang and continued in recent years has shown that applying dormant winter oil sprays in good chill years does not result in increased yields. However, in my opinion, dormant

winter oil sprays are still worth considering even in good chill years as they may lead to more even bud break.

Some larger growers use a 3% spray on years where chill accumulation has reached requirement, and 5 or 6% for years when the chill requirement is below threshold.
It has also been suggested that growers avoid winter oil application at temperatures below 5 degrees. As Winter Oil is potentially phytotoxic, caution needs to be taken around tank agitation and application in general, so adding low temperatures to this caution is a wise move.

In any case, dormant winter oil sprays are required for control of scale insects. Bear in mind that for pistachios in Australia, mid-late August is the best time for dormant winter oil application. Research in California has shown that the effect of later winter oil applications on bud break is not as consistent. Finally, dormant winter oil sprays should not be applied if there is any bud swell so check your trees before spraying.

Benchmarking:

Growers supplying their crop to APPC will shortly receive their 2022 benchmarking report. These reports are prepared by PGAI Researcher, Dr Maha Mahadevan utilising the data from APPC.
Growers are encouraged to review their results and look how they might make adjustments over the coming period to improve their overall results.

Disease Management:

Many growers have BUDMON tests conducted on buds by SARDI in late winter to assess the risk of panicle and shoot blight (caused by *Botryosphaeria* sp.), anthracnose (caused by *Colletotrichum acutatum*) [Budmon does not cover Xt]. This provides an insight into to disease load for the coming season. Detailed information on these diseases and management options are available in the members section of the PGA website (www.pgai.com.au). occurring in their orchard at harvest. For more details contact SARDI Diagnostic Services on (08) 8303 9585.

Pruning

Pistachio trees pruned using a modified central-leader training system are performing better than conventionally pruned trees, according to UCCE Integrated Orchard Management Specialist Bruce Lampinen. The goal of the central leader is to promote a dominant upright branch from where the main structural branches form - there is no in-season tipping and much less severe dormant season heading cuts with this approach.
In reporting on research that he and co-principle investigator Fresno County Nut Crops Farm Advisor Mae Culumber are conducting in grower orchards, Lampinen said unpruned pistachio trees and those pruned under a modified central-leader training system are yielding better in the early years than conventionally pruned trees. And what may have longer term ramifications, the research is showing that unpruned trees and those pruned on a modified central-leader training system have better branch angles, stronger connections and are less prone to breakage.

On the PGAI website there is a video series showing techniques for winter pruning of pistachio trees at Kyalite Pistachios. The trees are modified central leader from year 1 through to year 4 with Andrew Bowring sharing his knowledge.
Follow this link to view the videos: https://www.pgai.com.au/pruning

Orchard Sanitation:

Orchard sanitation is an ESSENTIAL part of reducing pest and disease levels.
What should I be doing now to minimise the risk of disease reinfection?
Insect pests and Fungal diseases like *C. acutatum* (Anthracnose) survive over winter in pistachio buds, and in lesions on infected fruit, rachises, leaves and twigs that remain on the tree, or on the orchard floor.

The following SHOULD become standard orchard management sanitation

- ***This is very important, albeit expensive.***
    - Re-shake to remove all infected nuts and rachises.
    - Remove mulch and/or incorporate under-tree debris (so fungus is not splashed from under canopy to lower limbs and leaves in spring).
- ***Don't prune during rain***

It is not yet clear if a forced leaf drop (as with urea or zinc) and fungicide application after rain would deliver economic benefits in affected orchards.

- ***Understand the underlying threat for next season***

Monitor the fungi in dormant buds. (BUDMON tests can detect *Botryosphaeria* and *Colletotrichum* infection in buds. With knowledge of bud infection levels, and the relative susceptibility of pistachio tissue, we could utilise free moisture, humidity, temperature data to predict disease outbreaks. This would assist growers in optimising the timing and placement of fungicide applications. Several contact and systemic fungicides are effective against *Colletotrichum* spp. on other hosts. Some also have reported efficacy against other pistachio fungal pathogens, including *Botryosphaeria sp*. (panicle and shoot blight) and *Alternaria spp*. (Alternaria late blight)

Mulchers such as those in use at CMV Farms are useful in minimising orchard floor contamination sources:

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Pistachio Growers' Association

SPECIAL EDITION
SEASONAL NOTES – MAY 2023

Managing Damage to Male Trees occurring in the 2022-23 Season

Summary:
Many male trees displayed severe damage during the 2022/23 season. The symptoms were evident across the growing regions and were first reported in November 2022.
Whilst there is not consensus of the exact cause, it is probable that it is a combination of anthracnose (fungal pathogen *Colletotrichum acutatum*) accentuated by the spring rain causing additional stress at root level in some orchards. Similar conditions conducive to *C acutatum* were experienced in 2010-11 but female trees and the nuts were those most severely affected.
This season, the PGA commissioned a pathologist Dr Len Tesoriero to look at the trees, provide an opinion on the cause and recommend a course of action.
Further to that, various orchards sent shoot and flower samples to SARDI. Each was identified to be infected by *C. acutatum*.

Recommended post-harvest action:

- ***The dead wood in the affected males be removed by pruning as soon as possible after harvest (but not during wet weather). i.e., before the usual pruning time.***

- ***This early pruning is also the strong recommendation of growers who suffered from dead female tree branches in the last La Niña season of 2010-11. The early pruning allows easy identification of the damaged wood. Also, should there be more undisclosed damage as there was in female shoots in 2011, the recovery process can commence in spring 2023 rather than the following season (as occurred in 2010/11).***

Background
The impact of anthracnose predominantly on male trees is not something that anyone in the industry has seen before. There seems no mention of it in the literature. The only significant damage from *Colletotrichum acutatum* around the pistachio world was in Australia in 2010-11. In that season there was significant damage to the nuts and subsequently in the shoots in female trees in the eastern end of the growing range, but not in the Riverland.

Damage in the males started to appear in November 2022 with typical *Colletotrichum* symptoms in leaves and young shoots, and unusually, also in spent male flowers remaining on the tree. Then shoots that had already put on leaves for the season

started to die back. The damage ranged from a minor impact of dead flowers to dead trees. Young flower bearing males suffered this season, but to an inconsistent and minor extent. Fully mature males were the worst affected with the shoot die back, and a few trees died completely. No damage in young, unflowered male trees was reported this season. This suggests that fungal infection was via the flower. It is noteworthy that in 2010-11, only flowered female trees suffered. Immature female trees were not damaged.

Some male trees displayed additional signs of ‘stress’ by the abnormal setting of new flowers in December and January.

The photos below show the range of damage observed in 2022-23.

After the rain stopped in December, there appeared to be no further development of new symptoms in male (or female) trees or expansion of the existing damage. In fact, some affected shoots appeared to be reshooting.
The male trees by harvest in March 2023 appear stable, with flower buds on undamaged shoots appearing normal in their development. It is reasonable to assume they have the potential to bloom in spring, but there is no certainty.

PHOTO: Damage in male trees

PHOTO: Retained Male flowers

PHOTO: Fungal damage in leaves – November 2022

PHOTO: Fungal damage in leaves – November 2022

PHOTO: Retained male flowers; dead end shoots - November 20222

PHOTO: Leaves and shoots dying back – November 2022

PHOTO: Stressed male pushing new flowers in January 2023

PHOTO: Stressed male pushing new flowers in January 2023

PHOTO: Dead Male – February 2023

PHOTO: Healthy Blue Male in the same block as the dead male above – February 2023

PHOTO: Telopea Downs had severe damage.

Pathology Report:
The PGA commissioned Dr Len Tesoriero to visit Sunraysia and the damaged trees.

His full report is available from the PGA. (Email Trevor Ranford for a copy – sahort@bigpond.com)

His main conclusions are:

- *Male trees (excepting some younger ones) with dieback symptoms – necrotic shoots with attached flowers. Internal tissue had turned grey-brown with no obvious sectoring. Shoot samples were collected that included the diffuse boundary between living and dead tissue.*
- *A few leaves had a black necrotic lesions on midribs and petioles, and in one case also on adjoining female tree – suggests Anthracnose disease. Lenticels on shoots were enlarged, ruptured and calloused - suggesting exposure to extended periods of excess moisture in the root zone, and possibly waterlogged and anoxic conditions.*

He took 24 different samples for laboratory analysis but did not find *Colletotrichum acutatum* or other pathogens in the dead tissue.

- *Colletotrichum acutatum was consistently recovered from a necrotic petiole, midrib and some stem tips. However, most of the internal necrosis of stems associated with dieback symptoms were negative for significant pathogens. In fact, many tissue pieces yielded no fungi after a fortnight of incubaton. It may be possible that C. acutatum infection of the male flowers released a phytotoxic metabolite that moved into stems causing the dieback symptoms*

but I could not find any supporting evidence in the international literature of that scenario. C. acutatum is know to be associated with tip and shoot dieback in olives but it is due to infection of that tissue and therefore recoverable in agar cultures.

Dr Tesoriero concludes:

- *The lack of consistent pathogen recovery from affected stems suggests a physiological cause is a more likely primary cause and probably associated with previous waterlogging and anoxic conditions in the root zone. Such conditions are known to cause damage to feeder roots and promote infection of minor (root-nibbling) pathogens. This in turn reduces water uptake and movement of sugars and photoassimilates stored in roots to actively growing shoots. These conditions are also known to prevent the uptake of key nutrients such as calcium and boron which are also required by growing shoots. Tissues lacking these nutrients often display necrotic symptoms.*

Andrew Bowring has also prepared a detailed report of his observations at Kyalite. Kyalite and other orchards sent samples to SARDI and all identified *Colletotrichum* presence. At Kyalite, the damage was always associated with male flowers. Young males with no flowers showed no or very minor damage. The association with trees under water stress was not consistent. Some heavily flooded males were unscathed.

A copy of Andrew's report is available from Trevor Ranford – sahort@bigpond.com

There remains the question of why the females do not appear to have suffered any damage this season, albeit any impact may not become visible until spring 2023.

The fungicide program developed after the 2011 season by the PGA research program with assistance from the Australian government through the then Horticulture Australia Ltd seemed to have been successful at least on the female trees. Most growers seem to have followed the program and there were no reports of massive fruit damage as occurred in 2011. The overall level of Dark Stain was above average but not disastrous.

The PGA Research Committee is convening a special sub-committee to discuss this problem now that harvest is complete.

The advice of the pathologists and the growers who suffered similar damage to females in 2010/11 is to prune out the damaged wood as soon as possible whilst the damage can be clearly seen and to encourage the recovery from Spring 2023 rather than the following season as occurred in 2010/11 when the damaged female shoots did not start regrowth until Spring 2012.

Chris Joyce
Chair, Research Committee
Pistachio Growers Association

Hort Innovation Strategic levy investment | PISTACHIO FUND

This project has been funded by Hort Innovation using the pistachio research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Pistachio Growers' Association

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Seasonal Notes - Update July 2023

Damage to male trees

Further investigations have been undertaken in June 2023 by Dr Len Tesoriero on the die back in male trees during the 2022/23 season. This involved taking further samples of the damaged tissue and also the excavation of the root systems of damaged trees.

"No significant pathogens were consistently isolated from roots from affected male trees.

Colletotrichum acutatum was recovered on agar media from necrotic stems. Fungal growth was also observed on humidified stems and dead male flowers. The fungal pathogen Botrytis cinerea was also observed consistently on the humidified dead male flowers. Both these latter records suggest that the dead wood and flowers are harbouring inoculum of these fungal pathogens.

The results above support the suggestion that the male tree dieback was primarily caused by infection of male flowers and underlying wood by Colletotrichum acutatum.
There was corroborating evidence since this fungus was also associated with shoot dieback on almonds in the NSW Riverina last season. Minor root rot pathogens isolated here may have contributed to the dieback symptoms but are unlikely to be the primary cause."

This finding supports the practice of winter pruning the dead wood from trees affected with the dieback symptoms. A following protectant fungicide application (copper +/- mancozeb) may also be useful to reduce carry-over of these pathogens.

The recommendations of Dr Tesoriero are: -

- **Prune out the dead wood in the damaged trees.**
- **A protectant fungicide application (copper + mancozeb) to be applied after pruning and before the likely oil spray.**
  These should be applied at label rates and not before or after a rain event.

Chris Joyce
Chair, Research Committee
Pistachio Growers Association

HARVEST DECISION MAKING

Pistachio Grower Association Inc.

The harvest time decision is very important for pistachio production.

Growers spend the whole growing season pruning, irrigating, fertilizing and spraying for weeds and pests. And, then must make the most critical decision of them all – when to harvest.

When harvest arrives, if the timing decision is not correct, it may lead to damage to the crop and hence damage to income. Early harvest may lead to too many green nuts in the bins. This may increase nuts with adhering hull, i.e., more pick outs. At this early stage, kernel development is insufficient and narrow splits and close shell can be high. Late harvest may result in stained shells, i.e., more pick outs. Too late harvest may also result in many nuts adhering onto the trees and those nuts cannot be shaken down, i.e., loss of crop. All these will reduce income.

Getting the timing of harvest correct is obviously important.

Photo 1 Pistachio nut maturity process

Photo 1 shows nut appearance changing during the maturity period.

The first stage is called “green”. The hull cannot be removed by rubbing with the fingers. At this stage nuts have not reached maturity. The nut will not have split, or perhaps just be beginning to split under the hull.

Then it is “ripening”. Nuts start to mature and green becomes yellow. At this stage, the hull is still firm. With an effort, the hull can be removed from the shell by rubbing with the fingers. There may be a split but it is likely to be narrow and incomplete.

The next stage is called “smooth”. The nuts are further matured but hull is still intact. However, comparing with “ripening”, hull becomes soft at this stage. The hull can easily be removed with the fingers. The nut split is present. It has been noted (but not proven) that the kernel is not fully mature and stable at this point – the kernel seems to shrink back a little on drying after harvest, i.e., there can be some loss of weight of the crop on drying.

Then the hull starts to break down and becomes “feathered”. The hull is very easily removed with the fingers and the nut is well split. For a single nut, this is the optimal timing for harvest. Kernels have fully developed and will remain the same size after drying. It is at this stage that closed shell and narrow splits are minimised. The nuts are mature so there are no adhering hull pick outs. The hull has not broken down sufficiently to stain the shell. This is the point in the maturity cycle to maximise first grade splits and minimise pick outs, closed shell and narrow splits.

Next stage is called “broken”. The hull shows serious deterioration; the hull may be broken into a few layers. The hull will easily fall off the nut and there is a good split. Staining of the nut shell is likely to have commenced. As the biological breakdown of the hull is well underway, this breakdown will accelerate in the bin on the way to the huller, accelerating the shell staining, i.e., increasing the pick outs.

The last stage is “shrivelled”. At this stage, some nuts will adhere on the trees and are difficult to be shaken down. Those that can be removed from the tree will almost certainly be stained and the staining will accelerate in the bin on the way to the huller.

Of course, maturity on the tree is a continuous and uneven process. These six stages are defined here for explanation. There is transition between the stages.

The photos show the progression of maturity under dry conditions. Rain during maturity will accelerate the breakdown of the hull dramatically. Rain at the green hull stage or earlier will have little impact on the hull. Rain at the smooth hull stage or later will reduce the time from

smooth hull to shrivelled hull to only a few days. The presence of fungus will accelerate the hull deterioration and shell staining. In particular seasons, some orchards started harvest earlier than they would have otherwise when confronted with an adverse weather forecast.

In evaluating crop maturity, growers need to be cautious of blanks, i.e., nuts that do not set a kernel. These nuts will remain in the green stage for the entire harvest period. They can be the fools gold of pistachio farming. If they do not have a kernel by late February, they will not have a kernel this season. When evaluating maturity, growers should carry their secateurs to cut green nuts to identify the blanks.

As well as estimating when the crop will be at optimal maturity, the grower will have other constraints such as the availability of the harvest crew and a delivery slot at the huller. Nothing will be perfect.

Sirora is not an evenly maturing variety. There will be a mix of maturities between trees and even within a single tree.

The optimal time to single harvest will be when the majority of the nuts are in the feathered and broken hull stage. Leaving the crop until this late stage is risky as if there are any delays at this time such as the harvest crew not arriving on time, the staining damage will rapidly increase. So, the safe time to plan for a single shake harvest is perhaps when most of the nuts (that are going to mature, i.e., are not blanks), are at the smooth hull going into the feathered hull stage.

Pistachio harvests have started as early as the third week of February and as late as the third week of March.

Kyalite Pistachios has developed a model that cuts nuts and evaluates maturity from early January. This model has been quite accurate for predicting the harvest commencement at Kyalite. Dr Zhang developed a model for the PGA having noted that temperatures between 10th January and 5th February strongly influence maturity. In reality, both models only provide a guide.

Since the 2013 harvest onwards, the PGA has issued predictions to growers in early February for an early, or a mid, or a late harvest. Growers will still have the tough decision to make – when to actually start shaking.

Chris Joyce
Chair
Pistachio R&D Committee

CHEMICAL MANAGEMENT

The experience of 2010/11 has shown that Australian orchards are susceptible to fungal diseases. Several orchards in 2010/11 lost the total crop and most orchards had extensive losses. Overall, the 2011 Australian crop lost close to 85% of its value, i.e. Australian growers lost $15 million. The cost of full crop protection is not cheap, but it is not $15 million!

In the 1990s the northern part of California lost several consecutive crops to diseases caused by *Botryosphaeria* spp. Many orchards were about to be abandoned. The disease was spreading south. The researchers developed a fungicide-based crop protection program, and increased awareness of cultural practices and weather condition responses that assisted orchard protection. The integrated program is extensive and expensive – but it works, and pistachio production in California remains profitable.

Whilst most of the damage in 2010/11 was caused by (*Colletotrichum acutatum*), *Botryosphaeria* was also detected. Both of these fungi are spread by splash, i.e. raindrops hit the spores and launch them to other locations on the trees, leaves and developing fruit. Despite the best efforts of those growers who undertook the recommended sanitation program during the 2011 winter, the spore presence in orchards remained very high. For those growers who did not undertake the removal of racemes and mummy fruit, the spore populations would be even higher. High spore loads imply that the risk of fungal damage in the 2011/12 season is very high, even if we return to only average summer rain. Both fungi may infect fruit early in the season although the damage to nuts may not manifest until the end of the season at harvest time.

Californian experience with *Botryosphaeria* has shown that **a spray program running over the entire growing season with multiple applications of different fungicides**, is essential together with orchard sanitation.

Prior to 2011 in Australia, Anthracnose had not been previously reported as a significant disease of pistachios. There is no hard research on how to control Anthracnose during a growing season. The PGAI developed recommendations following research during the winter of 2011 and advice from California. Orchards that followed this advice during the wet season of 2011/12 had no significant damage from Anthracnose. The practical results so far support the PGAI recommendations that are included in this Manual as Technical Information Sheets.

The fungicide suggestions contained in this manual flow from research commissioned by the PGAI. The PGAI research has been financed by the voluntary contributions of Australian pistachio growers supported by matching funds from the Australian government through Horticulture Australia Ltd.

- The laboratory work of SARDI conducted over the 2011 winter
- The literature review conducted by Dr Prue McMichael of Scholefield Robinson Horticultural Services
- The advice of Californian researchers and growers gained during the PGA study tour of California by Dr McMichael and Andrew Bowring.

It must be appreciated that any suggestions at this time are only interim and based on the best possible and most current knowledge and information. We will continue to learn over the coming seasons from further trials and research, but also from **you** – and the observations and treatments you make. Please record them (and leave some "controls" where possible).

The SARDI laboratory trials were not totally conclusive. Copper was shown to be ineffective against both Anthracnose and *Botryosphaeria* spp. However copper has been included in the proposed program for nutritional reasons and for its general antifungal effects, as there are other fungi that threaten pistachios, but are not specific targets of this suggested program. *Botrytis* sp. for example is likely to cause problems if it rains during bloom, as was the case in spring 2000 affecting the 2001 crop. Captan was tested *in vitro* and was effective at label rates. It has also been shown to provide protection against almond Anthracnose. Laboratory trials with mancozeb gave mixed results. It was very effective *in vitro* but less so when tested on plant material. It has been included because of its *in vitro* success and because it is a registered, contact fungicide available for use on pistachios.

There are two critical aspects of fungal control. The first is orchard **sanitation**. The second is **crop protection (field spraying)**.

Spray Program

The program for these diseases includes both systemic and contact fungicides. The rotation of fungicides in different groups reduces the risk of resistance development.

Systemics	Contacts
Switch™	Adama Captan®
Pristine™	Mancozeb
Octave	Copper

The Contact Fungicides:

- Only provide protection where the spray droplets land; good coverage is critical.
- Need to be applied with a 7-14 day interval to keep new growth protected, and may need reapplication sooner, if rain occurs post-application.
- Can be mixed with a systemic fungicide.

The Systemic Fungicides:

- Provide 10-21 day protection depending on rain events post application.
- Are best applied when leaf area is sufficient to maximise the uptake.

General Crop Protection Advice

- Ensure your spray equipment is correctly calibrated before you start spraying.
- Best to apply fungicides prior to major rain events. Watch the weather forecast.
- Multiple rain events may shorten the protection period of contacts and systemics.
- Follow label rates for each chemical. Switch and mancozeb have emergency use approvals and therefore application rates for pistachios are not on the labels.
- Follow label recommendations regarding use of surfactants and water volumes.
- Do not breach the harvest with-holding periods shown on the APVMA permit.
- Test application coverage - e.g. measure with water sensitive paper, or “Surround”.
- Ensure tractor speed matches your canopy size and equipment. The experience of Californian pistachio and Australian olive growers is that slower tractor speeds (~ 3-4 km/hr) are critical for ensuring complete coverage (and optimised efficacy of fungicides).

A suggested spray program follows overleaf. The tree development stages are merely a guide. It is critical that the weather (especially, rain) be the dominant guide to the choice and timing of the applications.

Fungicide Programme			
Fungicide	**Mode of Action**		
Copper	Contact		
Captan	Contact	Max 5 applications /season	
Mancozeb	Contact	Max 6 applications /season	
Switch	Systemic	Max 2 applications /season	
Pristine	Systemic	Max 3 applications /season	
Crop Stage	**Approximate Date**	**Fungicide**	**Comments**
Bloom – early	Late September	Farmoz Captan or Mancozeb	Contact protection only
Bloom – full	Early October	Switch and/or Copper	Adequate leaf area required for systemic uptake of Switch
Full leaf	Mid October	Farmoz Captan or Mancozeb	
	Early November	Switch or Farmoz Captan and/or copper	Switch if conditions wet, Farmoz Captan as protection if dry
	Mid November	Mancozeb	
	Early December	Pristine or Farmoz Captan	Use Farmoz Captan if conditions still dry since last application
	Mid December	Mancozeb	
	Early January	Pristine	Consider Farmoz Captan or Mancozeb if low disease pressure to preserve Pristine
	Mid January	Mancozeb	
	Late January	Pristine	Only apply the 3rd Pristine if extreme disease conditions

This schedule is based on a 14-day interval, but the required protection period may be 10-21 days. The interval may need to be at the low end of the range if rain is persistent, and if contact products have been used, e.g., if a protectant had been applied prior to a rain event re-application of the fungicide may be necessary in fewer than 14 days; whereas if a systemic had been applied, the full protection period may still apply.

If the protection period of systemic fungicides has been uninterrupted by rain, and the forecast is for continued dry conditions, the next, intended systemic fungicide application may be replaced by a cheaper contact fungicide. This decision however relies on a sound weather forecasts and understanding of the biology of the target fungi.

Pistachio Growers' Association

PGA Newsletter

Increasing world pistachio supply is not far away.

At the recent American Pistachios Growers Conference Land IQ presented the results of its satellite/land study on the area of pistachios planted in California.

Land IQ has developed a program that allows the measurement of areas planted to particular crops from satellite data validated by on-ground inspections. By scanning identified blocks back over the years, it can also identify the age of the trees. Land IQ has worked with the Almond Board of California for the last decade and its results for Californian almonds are now regarded as very reliable and claims an accuracy of over 98%.

The results presented to the APG conference highlight the massive expansion of the Californian pistachio plantings over the past decade. Most of these plantings are still immature. The impact on production and world supply will only become reality in the next few years.

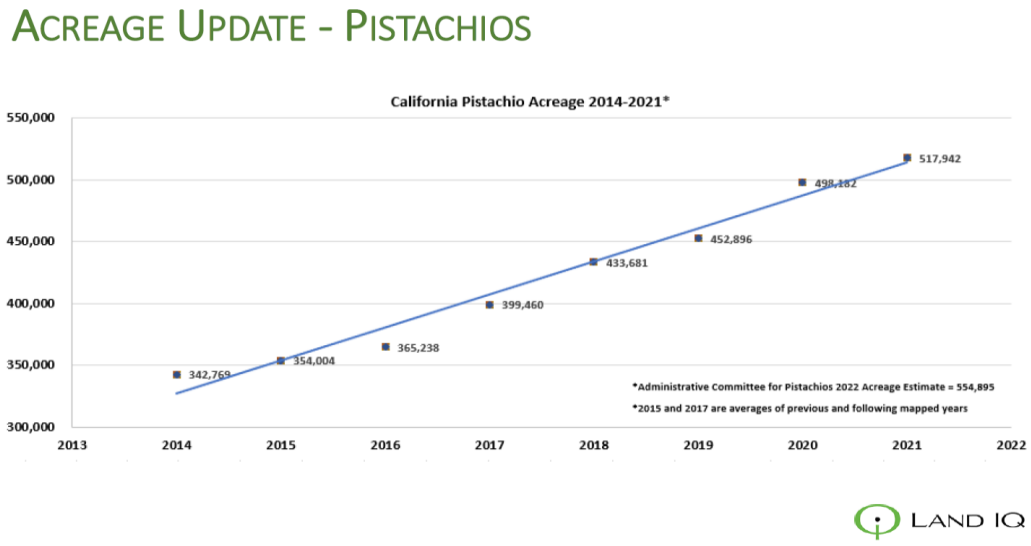

Chart 1: Source - Land IQ presentation to American Pistachio Growers Conference, March 2023

Chart 1 is up to 2021. Other reports suggest a further 20,000 acres were planted in 2022. This would increase the total current Californian pistachio hectares to about 220,000 hectares.

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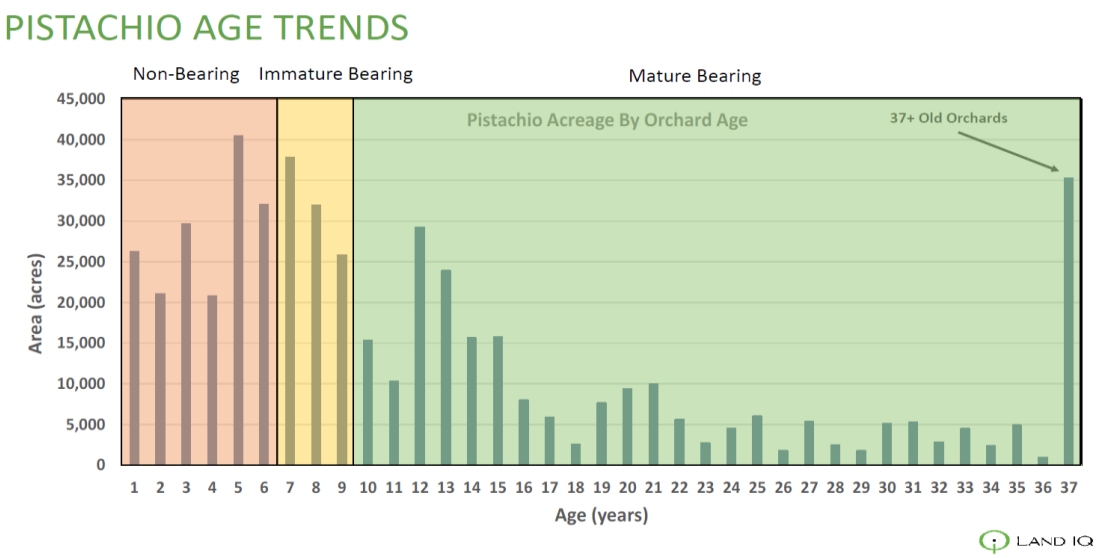

Chart 2: Source - Land IQ presentation to American Pistachio Growers Conference, March 2023

Chart 2 shows that about half of the current planted area is non-bearing or immature. When mature, the 220,000 ha could produce an average, over the on/off crop cycle, about 770,000 tonnes. The 2022 Californian crop was 450,000 tonnes which is also about the average of the last 4 years.

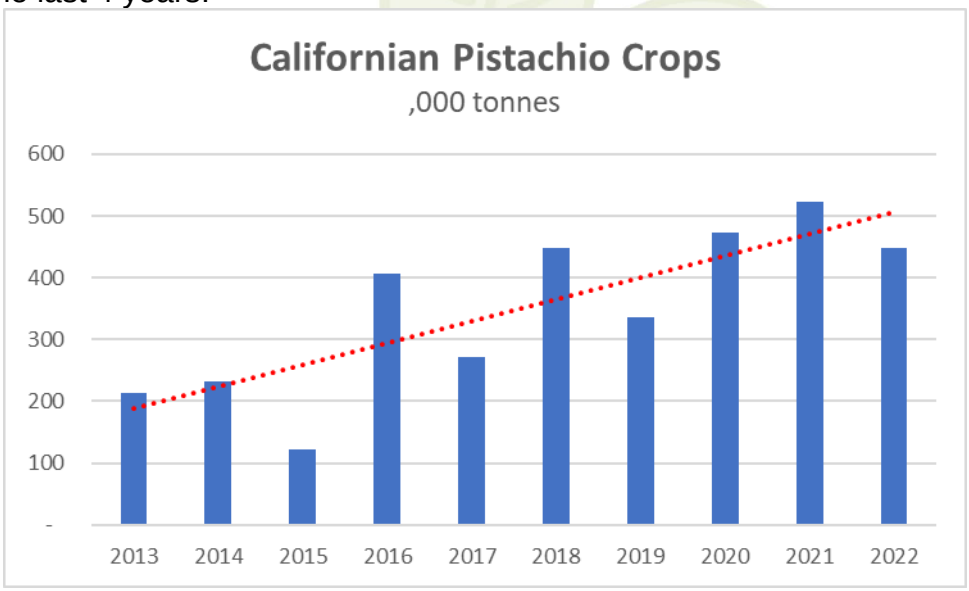

Chart 3: Source - Annual crops from the Administrative Committee for Pistachios

Whilst Californian exports figures for the current season are strong (up 14%), there has been a decline in USA domestic shipments (down 10%). Iran had a very poor 2022 crop providing easier opportunities for Californian 2022 exports. Despite early reports of frost damage, the 2023 Iranian crop is reported to be a healthy on-crop. If the Iranian reports are correct, California will have fewer export opportunities for its 2023 crop.

At a recent grower meeting for its growers, the President of Wonderful, the largest processor and marketer of pistachios in the world, remarked upon the impact of the coming surge in supply upon prices. Stuart Resnick is reported to have advised growers that a price decline is inevitable. He is reported to have said that prices below USD2.00/lb should be expected for the medium term. This is AUD6.50/kg based on USD0.67 = AUD1.00. US grower prices are usually expressed for unstained splits, after hulling, grading and marketing costs. Usually, it does not include closed shell and shelling stock, unlike Australian prices that are usually

expressed as the net return for all grades. It is not certain to which basis Mr Resnick was referring.

Spain has been planting pistachios over the last decade. It is reported that by *Fresh Plaza*, April 2023, that 70,000ha have now been planted, almost all are immature or non-bearing. Most of these hectares are small areas, about 5ha or less and rely almost totally on rain fall. The expectations are for very low yields of less than 2,000kg/ha. However, there has also been substantial plantings by large commercial farmers, 100ha and up, using irrigation. Spanish production in 2022 was reported at 3,500 tonnes, about the same as the 2022 Australian crop. There are predictions by *Fresh Plaza* of a Spanish crop of 30,000 tonnes by 2030. Spain commenced with the Kerman variety but recently there have been large plantings of Sirora.

Chris Joyce
Chair, Research Committee,
Pistachio Growers' Association May 2023

PESTS AND DISEASES

Pistachio nuts in visible and UV fluorescence, showing the possible presence of aflatoxin on some of the nuts.

Courtesy of: https://www.imagingtheinvisible.com/photo_15429881.html#photos_id=15429881

Aflatoxin—What is it?

There are many things to consider when sorting and grading Australian pistachios. One of these is the level of Aflatoxin in pistachios.
Pistachio nuts as well as some other tree nuts, are highly susceptible to contamination by aflatoxins, harmful substances that are produced by certain moulds such as *Aspergillus flavus* and *Aspergillus parasiticus*. Not only are the mould derived aflatoxins known to cause cancer, they have also been linked to a wide variety of other diseases.

Moulds such as *Aspergillus flavus* can produce aflatoxins including the highly toxic B1 strain in pistachio nuts

Pistachios appear to be particularly susceptible to contamination by aflatoxins[1]. A 1993 Japanese study that looked at the aflatoxin levels in over 3,000 samples of foods or foodstuffs, found that pistachios had the highest levels of aflatoxin B1 among the tested samples. Aflatoxin B1 is considered the most dangerous and the most abundant type of aflatoxin found in foods
Studies have also shown, shelled and damaged nuts tend to contain more aflatoxins than unshelled nuts[2]

Australian Pioneer Pistachio Company (APPC) has a policy for aflatoxin monitoring of incoming, in process, and outgoing stock. Aflatoxin in pistachio usually occurs in the growing phase and frequently in 'early splits'. It is also more likely to occur in deliveries late in the season when the hulls have started to break down and the kernel exposed to the air with the increased risk of mould infestation.

Research is strongly of the view that if the hull remains intact, the mould cannot reach the pistachio kernel.
The major sources of hull damage are:

- Early splits—research suggests that these are largely caused by water stress in spring/early summer,
- Physical damage such as hail, particularly later in the growing season,
- Insect damage unusual in Australia but common in Iran and California. Carob Moth and carpophilus beetle are possible aflatoxin vectors,
- Late harvest natural hull break-down of overripe nuts exposes the kernel to fungal invasion.
- Very dry conditions will increase the opportunities for the growth of *aspergillus flavus,* the mould that actually produces aflatoxin. The dry conditions for the 2015, 2016 and 2018 harvests probably attributed to the increase in aflatoxin presence.

All pistachio nut loads delivered to APPC will be tested for the presence of aflatoxin.
In Australia Schedule S19—5 of the Australia New Zealand Food Standards Code (the Code) specifies the maximum level (ML) for aflatoxin in pistachios at 0.015 mg/kg

Australian pistachios have a clean reputation in the market for aflatoxin. It is essential this market status is maintained.

AF36 AFLATOXIN

Utilising AF36 To Manage Aflatoxins in Pistachios

What is AF36?

AF36 is a naturally occurring strain of the Aspergillus mould that **does not produce aflatoxin,** making it "atoxigenic."

AF36 is a fungus grown on sterilized wheat seed (or sorghum) which serves as both a carrier and a nutrient source for fungal growth.
AF36 does not directly reduce aflatoxin. When AF36 is applied to pistachio orchards at the appropriate time, it actually competes with other strains of *Aspergillus flavus* that do produce large amounts of aflatoxin and, in doing so limits or reduces the amount of these high aflatoxin producers that become associated with the crop.

Research Results of AF36 Application in Pistachio Orchards

In the USA, extensive field testing on 1,200 Hectares of pistachios from 2008 through 2011 conclusively demonstrated[3]:

1. AF36 was effective in displacing other strains of fungus that produce aflatoxin.
2. AF36 tends to build up in orchard soils with annual applications.
3. AF36 applications do not result in increased levels of kernel decay.
4. Nuts from AF36 treated orchards are less likely to be contaminated with aflatoxin than those from untreated orchards

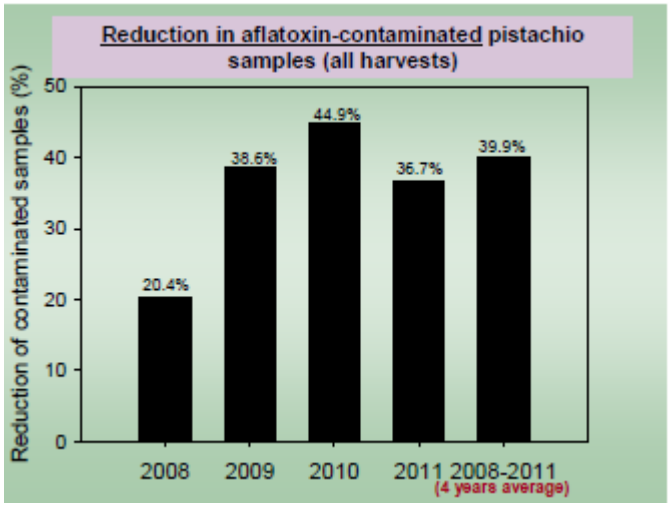

Figure 1: Reduction in aflatoxin contamination in pistachios following treatment with AF36.

The use of AF36 acts to change the soil community profile of fungi associated with the treated crop so that AF36 becomes very common and the incidence of aflatoxin producing fungi is greatly reduced.
It has been noted that the influence of AF36 treatments can extend beyond the treated crop. AF36 treatments may provide beneficial displacement even in orchards adjacent to those treated over multiple years. In the US, cumulative effects have resulted in areas that underwent an area wide aflatoxin management program.
Because background aflatoxin levels vary greatly from year to year, best results are achieved where single applications of AF36 are made annually, according to the label.

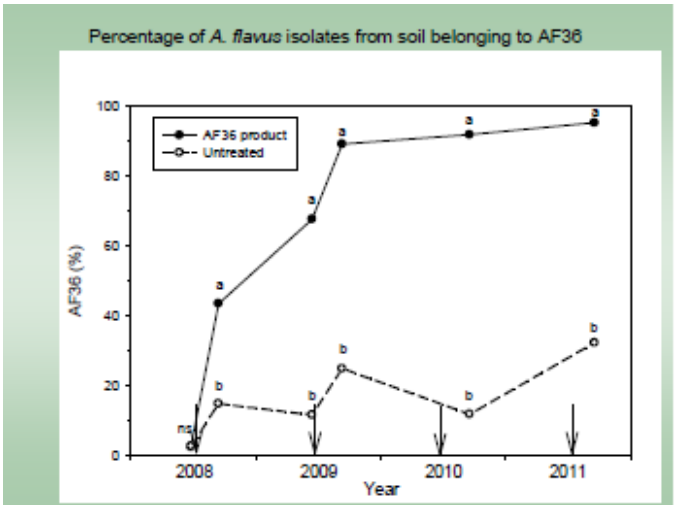

Figure 2: Build up of AF36 in soil over time following annual treatments 2008 through 2011.

How to Apply AF36.

AF36 is best applied by ground in the tree line wet zone where either drip lines or micro sprinklers are placed. In the US, ATV's equipped with adapted ant bait spreaders have proven to be an effective and inexpensive means of application.
An application rate of 10.2 kg. of AF36 per planted hectare is recommended.
The Californian experience shows that it works most effectively when applied every year on the entire orchard. The effectiveness is further improved if neighbours are also using it on their nut crops.

From the AVPMA Permit for AF36 – PER90768 (this can be found on the PGAI website: https://www.pgai.com.au/wp-content/uploads/2022/05/PER90768.pdf

- Apply Aspergillus flavus AF36 (Prevail) to the surface of the soil under the plant canopy with a granular applicator. DO NOT cover the applied product with soil.
- Adjust the applicator to optimize delivery of Aspergillus flavus AF36 Prevail under the canopy and to minimize delivery of Aspergillus flavus AF36 Prevail to areas that do not get wet.
- Aspergillus flavus AF36 Prevail has been shown to be effective when applied from late November to early January.
- Rain or irrigation within 3 days after application of Aspergillus flavus AF36 Prevail will improve results.

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bird management
TECH Bulletin

Evaluation of Bird Management Options

Article provided by Philip Farnell – Wellwood Wallace Walnuts

This is the first in a series of articles on the Evaluation of Bird Management Options for orchard tree crops.

When it comes to the protection of valuable crops from bird damage, there are several alternatives, depending upon the crop being protected and the type of birds causing losses.

For Walnut crops, the sulphur crested Cockatoo is the most prevalent and problematic to control.

Ranging from minor walnut forage, to total crop loss, there are many factors to consider "when and how", to control Pest birds. The amount of crop damage may determine whether to 'salvage what's left behind' verses trying to protect anything left after a major bird invasion.

In this series of articles, several methods will be discussed and evaluated for their relevant cost, crop protection benefits, advantages over other methods and their effectiveness in protecting valuable farm crops from bird damage.

Walnut tree crops.

Walnuts can be described as "like a toy kinder surprise; inside the shell is a tasty treat, much like a chocolate is to a child". The parent birds have taught their young about this tasty treat, and to break this learning cycle, would take many years to un-educate younger birds.

Cockatoos can live between 70 and 90 years of age. To break this habit could take several generations of young birds, hence this seems to be near impossible. These birds are monogamous, having only one 'marriage for life' partner, hence removing either one of the parents, will eliminate any more young being educated about the tasty walnut treat. Whilst the size the bird brain is small, Cockatoos have good skills and abilities, making them valuable pets that can be trained to perform tricks and can be made to talk. They have a very strong beak and can break open somewhat hard nuts and shells. Other similar birds however, do not have this same ability, hence forage on more edible farm produce or forage together with Cockatoos, scavenging on the remnants of walnuts.

To the Walnut farmer, these birds are the number one pest, along with Galahs, Corellas and Crows.

Permits for the destruction of birds.

In Victoria, the Department of Environment ruled that a farmer can eradicate such birds causing damage to crops, including Cockatoos, Corellas and Galahs without the need to obtain a permit. In other States however, a Permit to destroy these birds must be obtained. Failure to do so can result in prosecution under the Protection of Wildlife Act.

The method of destruction will be stipulated in such permits and includes shooting by Shotgun only. The use of a single bullet via a rifle is not permitted. The use of Poisons, trapping or harm in any other manner is an offence under the Wildlife Act. Permits are free to obtain, but can sometimes be denied. Allow sufficient time for the permit to be issued, well before the birds become a seasonal problem.

Variety of Control methods.

Several control methods cause neighbour complaints due to repeated noise impacts of shooting or gas cannons, others are impracticable due to the size of trees needing protection via protective nets, and some are considered inhumane or 'socially unacceptable such as trap netting and poisoning.

Damage caused by these persistent pests range from structural tree and bud damage, to early fruit peck and drop, late in the ripening season. Fruit at this early stage is prior to the Packing tissue brown stage, thereby rendering the crop a total loss as it has not yet ripened enough to be 'salvaged' for early drying. The Husk has not yet separated enough to salvage the nut crop, leaving immature nuts scattered on the orchard floor for birds to later eat. To the Cockatoo, this is then a nut more easily eaten from off the ground, where it will gradually dry or rot. These nuts later become contaminants in the following harvest, possibly contaminated with bird faeces and bird diseases. To the Walnut farmer, this is unacceptable and represents a total loss.

Nuts and branches pecked off by Cockatoos and dropped onto the orchard floor. Wellwood 2019

Damage later in the Walnut ripening season sees nuts being eaten straight off the tree or 'stolen from the orchard' and taken elsewhere to be eaten.

Shooting by gunfire.

Shooting is by far the most effective method of eradication and must be done in such a manner that is humane and in accordance with the use of firearms. However, Cockatoos are not easy to approach within shotgun range, typically less than 80 m, and quickly become aware of the presence of shooters and fly out of range of most shotguns.

A "choke" added to the gun barrel can confine the shots to a narrower pattern, but not increase its effective killing range. Cockatoos have tough outer feathers. A Number 4 or 6 shotgun cartridge is an effective pellet size and humane.

Injured birds should be euthanized. A shotgun cartridge is around 64 cents each, so is reasonably costly to miss and just make a noise. A good double barrel shotgun can cost between $1000 and $3000. A registered shooter can cost $35-70 per hour. A typical orchard patrol in the morning and afternoon can take 2 hours, with 1-10 shots likely to "move the birds on". Depending upon how keen your registered shooter is, you may get the labour cost for free. However, the cost of gun ownership, travel, gun replacements and ammo is likely to cost you something.

Not all shooters enjoy the "hidden enemy" they create with noise nuisance and gun use amongst society, particularly more noticeable where Walnut farms are neighbours to residential developments and gun conscience good citizens. Multiple gunshots can be mistaken as a 'trigger happy hunter" rather than an effective patrol outing. Be aware and conscious of the neighbours and local inhabitants, although the farm may have been in operation far longer than the recent housing estate was established. Shooting like most other single methods, is effective if combined with other control methods, but is a noise nuisance, socially not well accepted, relatively costly and very time consuming. Next time we'll discuss the regulations and use of Gas powered noise cannons.

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bird management
TECH Bulletin

Evaluation of Bird Management Options - Gas Cannons

Article provided by Philip Farnell – Wellwood Wallace Walnuts

This is the second article in a series of articles on the Evaluation of Bird Management Options for orchard tree crops.

The use of large noises is commonly used to scare various bird types including Cockatoos in Tree nut and many other fruit orchards

Whilst the noise replicates that emitted from a Shot gun, it can be distinguished as a different and unique "Bang", and can be heard for many kilometres.

The use of Gas Cannons or explosive gas devices that originate from a flame and can cause a fire, require precautions to prevent a fire in neighbouring grass.

During the Fire declaration period of "no outdoor fires without a permit", the use of Gas explosive devices or Gas Cannons, requires the issue of a permit from the Country Fire Authority. It is illegal to operate gas cannons during the Summer Fire restriction period without the Permit. These can be easily obtained from the CFA in Victoria and other States, and regulate their use to prevent fires.

In addition to the CFA permit, the use of Gas Cannons or noise emitting devices requires the following of the Noise Abatement requirements of the Environmental Protections Authority – EPA in various States, and may include additional requirements issued by the Local Government Council where you reside. Whilst these are Regulations and not Laws, the lack of compliance to these may result in prosecution if not closely adhered to. In addition, there could be complaints about their use outside of the hours of 7am to 8pm.

Many Walnut orchards have the visiting Sulphur Crested Cockatoo earlier than 7am and after 8pm, where the use of Gas Cannons is not permitted outside of these hours. An application to vary from these hours was rejected in 2019 Season by the EPA Melbourne office, but the use of Shot gun was unlimited. Check with your local Government Council on any concessions, although you will most likely be referred to the EPA Guidelines anyway.

Gas Cannons are relatively cheap and inexpensive bird control devices. They can be set or programmed to run remotely, however, during the declared fire season, gas cannons cannot be left unattended and their use is stipulated within the permit.

Most gas cannons are mechanically or electronically controlled devices. The interval between "Bangs" can be set, but under the EPA Guidelines, cannot operate less than 7 minute intervals, operate between 7am and 8pm, operate no more than 10 hours in any one day, and have no more than 70 Blasts in any one day. This limits their usefulness, particularly when birds arrive earlier than 7am, are persistently hang around all day, begin to ignore or decipher their pattern or frequency, or begin to ignore their effect. Their use combined with other devices is recommended.

Gas cannons are noisy. They therefore upset neighbours and can be heard many kilometres away, and be mistaken for repeated Gun shot. For this reason, under the EPA Guidelines, gas cannons should be located away from residential areas where possible, pointed in another direction, located away from combustible materials, and moved 300 m or more from any complainant. Their use is monitored by the Local Government Council, and any noise complaints are generally handled by Council, following the EPA Guidelines or their own prescribe uses. Check your local Council for any use requirements.

The noise disturbs the Cockatoos, causing them to take flight and move elsewhere, although it may be possible that they "invade another part of the orchard", therefore more than one Gas Cannon is necessary to keep the Cockatoos in flight. Experience has shown that the effective range of Gas Cannons is only 200 metres. Beyond this, some birds may take flight, but most ignore the noise. Several repeated short shots early in the morning may be enough to move the birds elsewhere for a free feed, but generally, the predominant birds or Scouts, quickly re-establish the pack somewhere quieter, hence the problem simply moves somewhere else.

The noise emitted from Gas Cannons replicates that from a Shot gun, so hearing protection by the operator up close, should be worn.

Wellwood 2020. One of 3 Zon brand Gas cannons with extendable tube to vary the amount of gas build-up inside the tube for a louder "Bang". Effective range 200m . Currently not in use with the long grass surrounds

Problems with Gas Cannons.

Again their use is limited between the hours of 7am and 8pm, making them totally useless outside of these times. Their use is regulated in most cases, particularly where the noise may annoy neighbours. On pressure regulated, more mechanical devices, their timing is difficult to set accurately.

The amount of "Bang" can be adjusted, from either a muffled bang through to a large explosion by altering the length of the cannon barrel if fitted with an extendable tube, but this creates more nuisance to neighbours and is insufficient to frighten the birds. Cockatoos in flight will show signs of 'darting away' from the gas cannon percussion, and may remain in flight, and move elsewhere.

Gas cannons are semi-permanent fixtures within the orchards, making them somewhat a predictable noise source from which the Cockatoos quickly establish a 'safe perimeter'. For this reason they should be regularly moved to avoid the birds associating the noise with the device. Surprise is the best key to keeping the birds away from your crop.

Replacement parts that wear out are expensive. This includes the igniter, gas control diaphragm and batteries for those with electronic circuits.

Operational costs include the use of LPG, commonly the 9 kg gas BBQ bottle. For seasonal use, one bottle can last 2 seasons, with regular daily use during the maturation period for Walnuts, or about 3 months of use.

A good brand Gas Cannon can cost between $400 and $1000. They are simple to operate, can be easily maintained and repaired, and operate at a low cost.

bird management
TECH Bulletin

Evaluation of Bird Management Options - Sonic and Ultra Sonic Devices and Drones

Article provided by Philip Farnell – Wellwood Wallace Walnuts

This is the third article in a series of articles on the Evaluation of Bird Management Options for orchard tree crops.

Sonic and Ultra-sonic devices and Drones are covered in this article.

The use of devices that emit birds of prey noises, and other similar noises have commonly been used in orchards to deter birds from foraging on valuable harvest fruit and vegetables. These devices mimic the noises of birds either in distress or those of larger birds known to attack the unwanted birds in the orchard.

The deliberate use of real birds that prey on other birds is prohibited, and heavy penalties can apply due to the cruelty they cause. However, natural birds of prey that may frequent orchards and farmland are to be encouraged and are not considered illegal.

Noises that are emitted from speakers replicate that of natural birds and birds that may prey on your nuisance birds. These devices are normally known as Sonic devices, noises that can be heard by the human ear.

Devices that can also be programmed to emit Ultra-sonic noises, high frequency noise, or noises that cannot be heard by the human ear, but may be heard by dogs and other animals known to be more sensitive to higher frequency noises, are sometimes combined with Sonic devices. These devices emit very high frequency sounds that disturb the unwanted animals or birds. A commonly known device against Kangaroos on roadsides is the "shoo roo", that are mounted on the front of motor vehicles, emitting a very high pitch sound to guard against an animal and vehicle collision. These devices typically have a small effective range and must be pointed in the direction of travel to be effective. The typical range of these devices is less than 300 m, so their effectiveness can be questionable.

The Ultra-sonic devices or high frequency devices for bird control are similarly of low effective range, but can be used in conjunction with Sonic frequency sounds to provide a disturbance for nuisance birds in your orchard. Commonly an animal in distress disturb other healthy birds, therefore deterring others coming near.

Permits are not required to use Sonic and Ultra-sonic devices, making them easy to install and operate and provide an alternative to louder noise devices like shotgun and gas cannons, which have regulated use.

Typically each device has multiple speakers, mounted either at ground level or on high poles to cover the tree canopy of the orchard being protected. The volume and frequency of reoccurring interval of noises is generally the only variable with these devices. Most devices cycle through the range of noises installed. Additional bird noises can be installed by specifying the unwanted bird types when purchasing the device.

Advantages are that these simple devices can be easily mounted on fence posts, trees or more permanent fixtures and operate on either Mains power or 12 Volt portable battery power. Battery life depends upon what load each speaker operates at, and at what time interval, but a small car battery would normally last several weeks before needing to be recharged. A small solar panel is sufficient to recharge the small car battery, making these devices highly suitable for most small farms without any maintenance tasks that are associated with other noise emitting devices, and can be left unattended to operate according to the programming.

Costs.
Prices vary depending upon the number of "bird calls" and whether the device is "sonic and ultra-sonic", but typically start from less than $1000 to several $000's . The number of speakers supplied vary but to cover a circle of effective range 300 metres, 4 speakers are considered suitable. Increasing the number of speakers simply enables a more effective circle to be adequately covered, but does not increase the effect.

Disadvantages.
Typically these devices are bird calls or noises that are known to annoy the unwanted birds. After a period of use, the Sulphur Crested Cockatoos becomes familiar with the device, and alternative noises are required to frighten the Cockatoo. Like most other devices, each has its limitations, hence a series of other bird scarer devices needs to be maintained to be effective. The effective sound range is small, particularly when dense foliage limits the penetration of noise. For this reason, locating the speaker above the tree canopy is preferred.

Like all other bird scarer devices, each can be programmed to start and stop during times when the birds are known to inhabit the orchard. Early morning and late afternoon are therefore the most common times of their use, and operating them during the day can annoy neighbours or other animals such as dogs when Ultra-sonic noises are being emitted. Check with your local Council for any limits on their use, but generally, there are no restrictions on their use.

Picture 1. Sonic and Ultra-sonic Bird scarer at Wellwood

Experienced birds can remain outside of the effective range of these devices, making them less effective than other, noisier devices like gas cannons and shot guns. From experience with one device at Wellwood during the 2020 Walnut season, birds soon became familiar with the device, hence its effectiveness waned after several days of continued use. The instructions suggest the device be moved regularly and operate non-continuously to be most effective. To cover entire orchards with these devices, many units will be needed or be strategically placed where the birds are likely to roost when first entering the orchard.

There are no licences nor permits required to purchase or operate these devices, making them perhaps the most readily sourced noise emitting devices. The bird noises emitted are not unfriendly to humans, and a cycle of noises can break up the nuisance to neighbours these devices make. If neighbours are likely to be affected by other noises, these devices are possibly the most suited for bird controls.

Drones.
These are a relatively new technology to control the presence of birds. Several models of drones are available for purchase, and can start as low as $600 ranging up to $15,000 for more sophisticated multi-purpose drones. Beware the smaller drones that are required to be 'flown by an experienced flyer'.

Picture 2. Phantom 4 Pro Drone

The Phantom 4 Pro (pictured) is an easy to fly drone, has a 7 km range, 30 minutes available battery life and is affordable. The drone has a "return to home" function should anything go wrong during the flight and is programmed to return to the take off point automatically when the remaining battery life is running low.

To provide additional bird scarer noise, the drone can be fitted with a remote Siren for additional 'bird scaring" capability, but this has to be fitted by the user. This feature enabled by the user provides an additional 120+ dB of siren to scare birds away, particularly helpful for those Cockatoos that try to ignore the noise and presence of the drone. At Wellwood, the drone has been an effective and affordable alternative to moving the Cockatoos well off the property and assists in other aerial farm activities and photographs.

All business related drone use is required to be registered with CASA by 28th January 2021 irrespective of its weight. Commercial users are required to be flown by licenced Pilots or those with a licence to fly remotely piloted aerial vehicles (RPA – Remotely Piloted Aircraft). The Civil Aviation Safety Authority (CASA) have information on the safe and responsible use of drones, including restrictions on where they can be flown. Fines of up to $11,100 apply for non-registered use of drones. Certificates of registration are free until 30th June 2021.
For agricultural operations, permission to overfly other properties needs to be obtained. Privacy issues surround the use of Drones when photographs are being taken, otherwise, the limitations for agricultural use are easy to follow. Drones have many other agricultural uses and can provide valuable overhead pictures of the orchards, not easily seen from below the tree canopy. Drones can be pre-programmed to fly automatically, but the rules of use are such that the user must be in control of the drone at all times, hence non-attendance is not permitted.

bird management
TECH Bulletin

Evaluation of Bird Management Options
Artificial Bird Scarers – Flying Kites

Article provided by Philip Farnell – Wellwood Wallace Walnuts

This is the fourth article in a series of articles on the Evaluation of Bird Management Options for orchard tree crops.

Artificial bird objects can provide an additional deterrent for birds that forage on tree fruits and nuts.

Firstly they are inexpensive, easy to setup and relocate, and provide a physical deterrent to birds wishing to move closer to a food source where there is a large moving object within their sights. Whilst these kites are trying to mimic the movement of a bird of prey, most do not emit any noise of the preying bird, hence may become a redundant source of scaring very quickly. However, coupled with a recording of the actual birds of prey or a suitable wind whistle, these become more effective in providing a barrier for birds entering the orchard.

The fabric these are constructed from must be light, colourful and durable to become airborne and 'flap' in light winds. The mounting and tethering onto a pole or similar structure should be strong and suitably placed to ensure that the kite does not become entangled with the supporting structure. This can become a problem and is an on-going maintenance item. Our experience at Wellwood Wallace Walnuts is that the kite becomes entangled with nearby trees if placed too close, and the fine string becomes entangled with either the supporting pole or the bird structure itself. Due to it being some 7m in the air, this requires the kite to be lowered to the ground and the process of disentanglement takes place.

The Wellwood Kite installed in a clear area away from trees and entanglement objects. The gates keep the pole stable and the sheep away from the pole.

Without wind, these devices hang limp and are not effective. A moderately windy place needs to be found, away from entanglement opportunities and nearby the area being protected. In most Walnut orchards, there are very places where these can be placed. During walnut maturity and harvest, windy days do not exist.

Costs. These are simple devices, hence inexpensive. A typical, well constructed kite including a telescopic fibreglass pole is around $300. To be effective in any orchard, these would need to be placed nearby the point where the offending birds enter the orchard, yet nearby where the protection is needed most. It is likely that several kites will need to be installed to provide protection.

Like all other bird scarer devices, these kites do not work successfully by themselves. Our experience shows that the birds quickly get familiar with the kite, especially if the kite remains static and not moving, typically on non-windy days.

Advantages.
Low cost and ease of installation. Any noise emitting device whether it be the 'flapping' of the bird fabric or any noise that is not recognised by the offending birds, provides a minor scaring of the birds.

Disadvantages.
Durability of the fabric outdoors in windy conditions renders the kite ineffective once it tears, and it becomes inoperable in nil wind conditions. On-going disentanglement becomes a chore in windy conditions although a freewheeling swivel attachment on the attachment chord is so important to install.

bird management
TECH Bulletin

Evaluation of Bird Management Options - Bird Netting & Lasers

Article provided by Philip Farnell – Wellwood Wallace Walnuts

Co-contributors – Mark Jankelson & Patrick Fitzgerald – AWIA Members

This is the fifth article in a series of articles on the Evaluation of Bird Management Options for orchard tree crops.

Bird Netting.

Whilst extensively used on various types of fruit trees and grapes, bird netting is still being trialled on Walnut trees on a medium to large scale (See Photos. Boonderoo – Redesdale). The material netting is the same as that used for other orchards, with Black netting being the most commonly used, although White bird netting still offers the same level of protection against birds.

Not only does netting exclude the Sulphur Crested Cockatoos, other birds are also eliminated from entering the orchard or separate individually covered trees, thereby giving total cover protection against all birds that wish to forage on walnuts or fruits. Fine woven netting may exclude Bees and other desirable insects, so the aperture size needs to be carefully selected although Bees are not needed to pollenate Walnuts.

Netting installed permanently over the entire Walnut orchard is not common, with Walnut trees being generally widely spaced in rows, and heights around 8-15 m common. The cost estimates to cover an entire Walnut orchard can be as much as $1 M per acre! Why? The height needed to cover the larger Walnut trees means significant posts and stainless steel wires are needed, with large open spans being very difficult to achieve.

Cheaper options however include the use of individual nets placed over each tree, which like most small fruit trees found in home gardens, needs to be placed well ahead of the fruit bearing season, cover the entire tree, and be tied securely around the trunk to be effective. Unfortunately, like most other fruit trees, nets have to be removed prior to harvest, and some walnut branches and leaves may have grown through the netting during Spring, hence make the task of removal very awkward and time consuming.

One Walnut grower who has trialled netting reported good results with excluding Cockatoos, but still found that birds were prone to land on the netting in an attempt to find food. Full exclusion netting of an entire orchard, whilst preferred, is extremely expensive and difficult to erect.

Netting must be UV stabilised against sun damage and early deterioration. Manufacturers generally offer a maximum of 10 – 15 years warranty on the fabric, but exclude damage caused by puncture by branches, birds trying to pierce the cover, and any storm or weather damage.

For the smaller walnut orchards with very few trees, netting offers excellent exclusion of birds, but fitting nets over big trees is difficult and very labour intensive. A Cherry picker, Boom lift or purpose built machines is the safest way to install netting over trees, but access into tightly spaced walnut trees may make installation of individual tree netting difficult.

Due to Walnut trees not needing bees to pollenate, the exclusion of birds, possums, bats and other pests is achieved.

Advantages. Nets can last at least 10 years or more, hence give a long period of protection. Nets are impenetrable by birds providing they extend to ground level.

Disadvantages. Nets and their supporting structures are very expensive. Less permanent netting on individual trees will need constant attention to erect then to remove them. Birds are still prone to land on nets in an attempt to get to the Walnuts, but readily learn that the nets are impenetrable. Large and smaller birds can get entangled with nets, however, more expensive nets are designed such that this should not be a problem. Other animals such as Bats, Possums, tree nesting birds and even Humans cannot get access to trees with tightly fitted nets, hence some inspections and maintenance may be still required on a regular basis.

If hail is a prominent event, nets may be damaged by a large quantity of hail self weight, including damage to the suporting structure. Nets do not offer any protection from Frost damage, but offer protection from sunburn.

Nets covering individual walnut trees near Redesdale VIC. Note that each tree has its own netting or in rows and installation is labour intensive and costly. A Cherry Picker, boom lift or purpose built netting machine is required to install and remove individual nets.

Photo supplied by Mark Jankelson – Boonderoo - Redesdale Victoria. Purpose built netting equipment for installing and removal of bird netting.

Mark added that whilst Netting is time consuming and expensive to apply then to remove, it provides his orchards with the ultimate exclusion of Cockatoos. Redesdale is located between two River roosting areas for cockatoo populations, and all other devices available have been trialled and failed to exclude the Bird pests. Netting and tying off the base of trees with zip ties excludes the birds and has been vigorously applied to around 60% of his orchards. Mark also has trialled Lasers and found that the Nets provided a dark background onto which to point the laser, giving a more distinct presence of the laser against birds seeking to come near the orchard.

Permanent bird netting installed over an Apple Orchard in Harcourt Victoria. Access under the sides allows Apple pickers to enter but destroys the protection from birds that manage to find their way in.

Lasers.

These devices are still being evaluated in a few Walnut orchards, and are said to be effective in deterring the Cockatoos from landing in orchards or neighbouring trees. The purchase price of the Laser and their various features vary considerably, and the more expensive Lasers have features that make the operation of the Laser and the ability to 'program and connect' much easier.

Lasers cannot be pointed 'skywards' and must remain focused on the trees being protected. Laser lights are generally very strong and can cause eye damage to Humans. Scientists have said that the time exposure to Birds by Laser lights is not a hazard to the birds vision, and no evidence exists to date of any permanent damage to birds. The Laser use must be such that the movement of the Laser across the Orchard or landscape in the orchard is controlled and does not impinge on neighbours, other residents or farm workers. The 'path of the laser' beam can be individually programmed to scan the orchard being controlled for birds.

The more expensive the Laser, the more 'weigh points' can be added to the Laser path. Mobile Phone apps also enable the Laser to be programmed and controlled. Birds are disturbed by the Laser light, whether it be Green or Red, and the constant movement across the orchard upsets birds wanting to rest and forage on walnuts or other crops. To be effective, the laser light must scan/move through the orchard. The time between scans or sweeps through the orchard depends upon the programming of the laser movement control mechanism.

Most lasers are placed high above the tree canopy, either on poles, buildings nearby or towers constructed for the mounting of the Laser and its movement mechanism.

The weight of the Laser and its mechanisms are substantial, so a sturdy mounting method or tower also has to be substantial, adding additional cost to the installation. Most Lasers operate from Mains electricity, although 12 Volt and Solar powered systems are also available for more remote setups.

Bird Control Hawk Laser MK2 – 80mW or 500mW

A larger permanent Laser installation above an orchard.

Advantages.

Lasers are maintenance free and once programmed, can operate without further attention or adjustment. They are silent, work autonomously, and provide a large degree of orchard coverage. Lasers can operate 24/7 giving the orchard coverage overnight when other devices cannot be used, such as Gas Cannons.

Like most other Bird scarer devices, Lasers may need to be coupled with other devices to be totally effective. Patrick Fitzgerald has combined Lasers with other devices to some success against the ingress of Cockatoos in his Walnut orchards, and has found his Drone to be invaluable for quick Cockie location identification and aerial surveillance of his orchards. There are expensive Laser options, but Patrick found the cheaper units were satisfactory and provided good control over the birds, again used in conjunction with other bird control methods. Due to their permanent locations, no licencing is required, as needed for Hand-held lasers.

Disadvantages.

High initial cost and establishment. Typically Lasers start at less than $5000 and up to $23,000+ They cannot cover the full range of most orchards, hence several Lasers may be necessary to cover the whole orchard. Lasers take a moderate degree of programming and setup time, including the infrastructure to mount in a high position. The effectiveness on Cockatoos and other bird types needs to be explored. Lasers can be dangerous to human eyes, so their location and sweep pattern need to be carefully selected.

There are a number of "Youtube" videos on Lasers in Vegetable growing situations including various Orchards, although none appear to show Walnut orchards. These are relatively 'new devices' for Cockatoo and other bird control, hence some trialling needs to be covered before major installations are undertaken. Lasers are amongst the most expensive Bird deterrent devices.

bird management
TECH Bulletin

Bird Issues in Tasmania - A Grower's Story

Prepared and presented by Phil Dening, Coaldale Walnuts, Tasmania

Our farm is located near Richmond, 35 kms north of Hobart, in the Coal River Valley which runs north for about 40kms. We have been farming walnuts here for 23 years, originally starting in joint venture partnership with Webster Walnuts. We have 4Ha of Chandler with Franquette polenisers, about 1500 trees. There are two other walnut farms within 10kms. The Coal River Valley is known for wine, vegetables, cereals, sheep, stone fruit, seed production.

Which Birds Cause Problems?

- Sparrows, crows, starlings have been reported as pests in soft fruit orchards (variable)
- Skylarks have been reported as a significant threat in poppies, eating capsule seeds
- Green Parrots have been reported as pests in fruit trees generally and wine grapes (always netted though)
- Sulphur-Crested Cockatoos have been reported as pests in:
  a) Agriculture
    - Seedling plantings for brassica seed production December to February.
    - Peas May to August.
    - Carrots February to May.
    - Cereal crops March to May and August to September (when shooting) competing for feed with livestock during droughts and at feedlots
    - Poppy dry crops at harvest
    - Lettuces at spring planting (also corellas, starlings, skylarks, silver eyes)

  b) Horticulture
    - Apricots February to March
    - Walnuts March to May (Little and Long-Billed Corellas also)

Overall, the main issue in Tasmania is Cockatoos. This is my focus from here.

It has long been debated whether the Sulphur-Crested Cockatoo is a native species or not in Tas. The Tasmanian Minister for Primary Industries told me in 2002 that cockatoos were introduced. Recently a local bird expert, Dr Nick Mooney, confirmed early settlers reported Sulphur-Crested Cockatoos in northern Tasmania in the 1820s. They seem to be accepted as natives now and this affects how they can be managed.

Today, flocks of 200 to 500 are common in the Coal River valley, Derwent valley and northern Midlands.

What is the Extent of Damage?

A major meeting was held in Richmond in 2014 involving CSIRO, seed companies, feedlot companies, DPIPWE and grower associations. Good information sharing came out but plans for action failed because the general farming community was not sufficiently involved. However, it did produce a useful paper on the subject.

Damage estimates are patchy due to lack of consistent investigation. However, some individual companies have stated:

Bejo Seeds - 1 Ha crops of brassica seedlings can have up to 50% losses = $30K several times in a season = $100K

Poppy Growers Assoc Tas - Survey in 2014 of Nth Tas growers = $100K in total

Houstons Farms - lettuces $50K in 2014

Powranna Feedlot - biosecurity controls for bird faeces in food and water = $100K

Coaldale Walnuts - about $2000/Ha due to lost and damaged nuts (based on estimates of shell residue and general observations). This translates to $72K across the 3 orchards in this area.

Other damage costs involve time and cost of labour and ammunition in shooting and setting deterrents (eg, scarers).

Response to Losses

CRPA became interested in cockatoos in 2014 after anecdotal reports of increasing numbers over earlier years. Traditionally, farmers were able to obtain permits to shoot up to 50 birds/season. This appeared to satisfy most farmers. A few farmers quietly and illegally poisoned large numbers of birds. Many people use gas guns. One event occurred in 2013 where a trapping project caught about 2000 cockatoos and all were euthanased.

I raised my concern at CRPA Committee in 2016 that Coal River Valley, 30 mins drive north of Hobart and a very popular tourist destination, would risk losing social licence for farming practices if we participated in Cockatoo management practices which were potentially at risk of being regarded by the local city population as inhumane and unsustainable. Members were agreed that we should support measures to protect our social licence. I was authorised to develop a research strategy in collaboration with UTAS and DPIPWE and other relevant parties.

Meetings commenced at UTAS in Dec 2016 and a research project conducted throughout 2017 in the CRV. This resulted in a paper which highlighted the gaps in information and further areas for research to be effective. Unfortunately, it lacked the resources to be more investigative but did form a preliminary basis for further work.

Further work was undertaken by UTAS during 2018 to assess cockatoo management strategies. Shooting was considered to be an effective mechanism if conducted according to several basic principles (eg, constant variation in location, timing) as well as employing a variety of other measures (eg, bird scarers/repellers, decoy feeding). Trapping and euthanasing has also proven effective but has limited application due to need to avoid public exposure. UAVs may be useful but have not been trialled here yet.

In order to advance matters, key participants met with the Minister for Primary Industries and Water in mid-2019 and a strategy was agreed to conduct statewide research with UTAS, DPIPWE, relevant bird experts and farmer groups. This was developed during latter part of 2019 and was to commence at Masters program level in 2020. Unfortunately, the lead academic became critically ill during late 2019 and then COVID struck in early 2020 so all plans have been on hold since then.

Proposed Research

A. Trap cockatoos at 4 sites (Coal River Valley, Derwent Valley, northern Midlands, NW Tasmania),

Mark birds with one distinct colour at each site,

Conduct publicity campaign to encourage public to call in sightings of coloured birds, noting locations, numbers and date/time.

B. Undertake more thorough damage assessment across all areas for two years.

UTAS has access to grant money but this has been stalled by the absence of our key academic. Government is not willing to commit funds at this stage.

Our team is aware that until a wider and deeper picture of damage is obtained, we will be unable to justify serious funding to better clarify population studies and refine management strategies.

This hiatus in research in Tasmania led to my interest in participating in the recently announced grants to study bird pest in nut orchards.

Thank you.

bird management
TECH Bulletin

Sulphur-crested cockatoo (Cacatua galerita)

Other names: White cockatoo; greater sulphur-crested cockatoo.

Photo: M. Bomford.

Birds Australia Atlas (1998–2002)

Field identification

This species is a large (48–55 centimetres head to tail) white bird with a prominent yellow crest that curves forward (downward over the beak when the crest is raised). Both sexes are similar, differing slightly in size and iris colour.
This species has a distinctive uneven flight pattern, with a series of wing beats followed by a glide. Often seen in large flocks and communal roosts, but also occurs in pairs and small groups, particularly in the tropics and during the breeding season. They associate with galahs (Elophus [Cacatua] roseicapilla) and corellas (long-billed (Cacatua tenuirostris), western or little (C. sanguinea)) while feeding. Corellas can be distinguished by their smaller and leaner stature and shallow wing beats during flight.

Voice

A single distinctive screech as a contact call; an occasional high-pitched call while roosting or feeding, and a series of harsh screeches when alarmed.

Habitat

Sulphur-crested cockatoos are common in a variety of habitats in eastern, northern and southern Australia in sclerophyll forests, pine forests and rainforests; Eucalyptus and Casuarina woodland; cultivated areas; parklands; and open savannas. Open pasture and croplands, where vegetation persists along watercourses, are preferred. Hence this species has benefited from clearing, cropping and improved access to water. They often roost in tall, dense stands of Eucalyptus spp. where water is close by, but will move some distance to feeding sites.

Movements

Considered mainly sedentary, this species seldom moves large distances between seasons, although it may occasionally relocate for breeding or food or to escape adverse climatic conditions. Local movements usually occur along watercourses, but flocks can transverse large open areas for food. Despite daily movements of up to six kilometres, they maintain fidelity to roosting sites. They form larger flocks and travel further in autumn, when not breeding. During this period flocks are often more likely to travel into cleared or cultivated areas. Similarly, during the breeding season birds are more dispersed and tend to be resident. Highest densities occur just after breeding.

Foods and feeding behaviour

Sulphur-crested cockatoos have a varied diet of grass and plant seeds, nuts, fruits, green leaves and stems, flowers, bark, roots, bulbs, rhizomes and insect larvae. Where available, seeds, grain and onion grass (Romulea rosea) corms comprise the majority of their diet. Hence birds are mainly observed feeding in open areas. They are also attracted to fruit, seeds and flowers of trees more common in northern parts of Australia.

Larger flocks form while feeding, rather than when day-time roosting or flying, where groups can consist of a few birds to several hundred. Feeding flocks also tend to be larger in more open habitats. The majority of feeding usually occurs in the morning and afternoon. Morning feeding usually takes place around one hour after sunrise and in the afternoon in the two to three hours before sunset. Larger flocks gather during the afternoon session. Feeding forays usually last one to two hours, but this varies with the season and region. For example, in some regions feeding is more common in the middle of the day, especially during the cooler months. Conversely, midday feeding is rare in summer, when temperatures are highest.

Breeding

Breeding normally occurs from July to December.
Hollow entrances and linings are chewed in branches or trunks of mature trees. Most commonly, nest hollows occur at 5–20 metres height in Eucalyptus spp. trees, in close proximity to water. Nesting also occasionally occurs in cliff faces and in mature Melaleuca spp. and Angophora spp. trees. A single pair of cockatoos will nest in each tree despite the regular occurrence of multiple hollows. They have, however, been recorded sharing trees with other species, including galahs, kookaburras (Dacelo novaeguineae), barn owls (Tyto alba) and starlings (Sturnus vulgaris).

Males and females usually visit hollows through- out the year. Both sexes prepare the nest, incubate eggs (which takes about 30 days) and feed the young. Two or three white eggs are laid on a bed of wood chips 2–10 centimetres deep. However, pairs average less than one fledgling per year as a result of egg infertility, egg predation by lace monitors, possums, and carpet pythons, nest occupation by bees and trapping for aviculture. Fledging occurs at around 10 weeks, but juveniles are fed by their parents for a further six weeks after leaving the nest. From banding studies cockatoos are known to live beyond eight years in the wild, but many are likely to be older as captive birds have lived beyond 100 years.

Damage

Damage to horticulture is often to buds, shoots and growing stems, rather than fruit. However, sulphur-crested cockatoos are well known for removing large chunks of, or splitting, pome and stone fruit to get at the seeds. Seeds of citrus fruits are also consumed. The size of the bitten- off pieces can be used to distinguish cockatoo damage from damage by smaller species. Damage to fruit occurs when the birds consume fruit on the branch and knock others to the ground or remove whole fruits and fly to an adjacent roosting tree. They also damage nuts, such as hazelnuts, almonds, walnuts, pecans, chestnuts and pistachios, by cracking the shells.

Cockatoos also chew buds and young shoots including those of cherries, grapevines and peanut shrubs; and they chew bark and foliage and strip it from orchard trees. Significant damage to limbs and fruiting spurs can occur when a flock lands in a single orchard tree, simply due to the weight of the birds. Mature grape bunches are often snipped directly from the vines. The birds also damage a range of cereal grain and oilseed crops (e.g. sunflower, Figure B.13) by digging up sown seed and feeding on seed heads. Vegetable crops are also susceptible to cockatoo damage and the birds can cause havoc in nurseries by damaging seedling stock.

Cockatoo and parrot species chew on various materials to maintain their beaks. Damage to infrastructure such as irrigation systems, coaxial cables, electrical insulators, radio and television aerials and red cedar building materials for beak maintenance is common.

Protection status

Protected, but locally unprotected in some regions (Section 6.1).

Sources and further reading

Harman, I. (1981) Australian parrots in bush and aviary, Inkata press, Melbourne.

Noske, S. (1980) Aspects of the behaviour and ecology of the white cockatoo (Cacatua galerita) and galah (C. roseicapilla) in croplands in north-east New South Wales. Master of Science Thesis, University of New England, Armidale.

Temby, I. (1998) Reducing cockatoo damage in Victoria. Eclectus 5: 20–26.

Pistachio meet

Australia's Pistachio Growers' Association continued their very successful Pistachio Information and Technology (PIT) group meetings over winter.

Back to back meetings were held in Lake Powell in Victoria and Renmark in South Australia with 73 people attending them in total.

After an introduction by PGAI Executive Officer Trevor Ranford, both meetings began with a report from PGA researcher Dr Maha Mahadevan on her journey to the USA for the VIII International Symposium on almonds and pistachios at the University of California, Davis campus.

Maha teamed up with some Spanish pistachio researchers for a pre-conference tour of properties, nurseries and research facilities in and around Los Angeles and Fresno. An article on Maha's paper delivered at the conference is on page 39 of the Nutgrower.

Chris Joyce spoke about the difficulties of the 2022/23 season and subsequent harvest with total volume of nuts harvested and delivered well below expectations. (See box on page 21)

Dr Len Tesoriero, a specialist Plant Pathologist from Crop Doc Consulting (previously of NSW DPI) reported on his investigations into the problem of male pistachio tree dieback, which was extensive over the season.

What do we know so far? The problem has occurred in the previous extremely wet year 2011 although it affected mainly female trees. This current problem has affected mostly older male trees. It is not always associated with poor drainage and it has been noted that male flowers had stayed attached.

Continued on page 21.

STOP PRESS

NEW PGAI Executive Officer

On September 1 Ms Brenda Kranz began as the PGAI's Executive Officer, the role being vacated by Trevor Ranford after nearly 14 years at the helm. Trevor will be working until the end of October to assist in the handover. *More in the December issue.*

Dr Tesoriero said pathologically there is evidence of Anthracnose infection – black necrotic lesions on leaves & petioles and evidence of vascular staining & lenticel rupture on shoots.

"There is no clear causal pathogenic organism determined to date – other than Colletotrichum acutatum (Anthracnose) + Botryosphaeria sp., " he said at the meeting.

Further investigations were undertaken by Dr Tesoriero on the dieback which involved taking further samples of the damaged tissue and also the excavation of the root systems of damaged trees.

"No significant pathogens were consistently isolated from roots of affected male trees."

"Colletotrichum acuatum was recovered on agar media from necrotic stems and fungal growth was also observed on humidified stems and dead male flowers. Botrytis cinerea was also observed on the humidified dead flowers."

"These results support the suggestion that the male tree dieback was primarily caused by infection of male flowers and underlying wood by Colletotrichum acutatum.

The recommendations of Dr Tesoriero are:

- Prune out the dead wood in the damaged trees
- A protectant fungicide application (copper & Mancozeb) to be applied after pruning and before the likely oil spray. These should be at label rates and not before or after a rain event.

At the Renmark meeting there was a Winter Pruning discussion and field walk with host Bob Hodgson providing various powered shears for a demonstration.

Examining the roots of an affected male tree are Dr Tesoriero (l) and his team.

'23 Pistachio harvest a shocker

Research Chair for the PGAI, Mr Chris Joyce, told the PIT meetings that harvest 2023 had the worst yields from mature trees in over a decade – the wet/disease year of 2010/11 being the last.

He said the season started with marginal chill, and there was rain during pollination in October and this probably caused the young trees to only have a good crop rather than a great crop.

Mature trees produced about half a normal off-crop with typical yields 400 to 800kg/ha compared with typical off-crops of 1,500 to 2,500kg/ha. The total crop was below 1500 tonnes, nearly 1,000 tonnes below that of the last off year in 2021.

"While fungi control on females was excellent, damage in mature male trees very high.

"It was the latest start ever to harvest and several orchards did not harvest at all. There was very uneven maturity resulting in very high adhering hull and high dark stain, and many immature nuts were harvested."

Chris Joyce, who is also a director of the Australian Pioneer Pistachio Company (APPC) said the situation resulted in the highest ever APPC processing charges per kilogram.

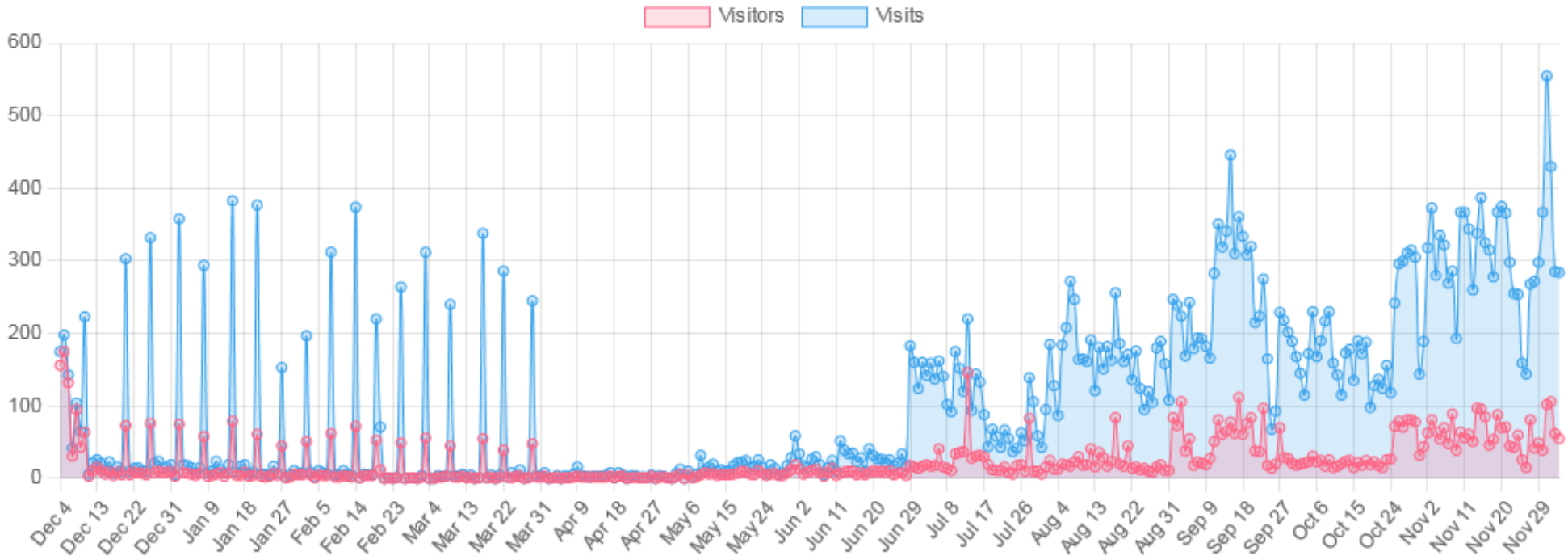
Male tree dieback was a problem this year

"Trash levels were very high, average 3.3%, typically 2% which suggests that the late harvest resulted in more leaf fall. Plant production was slowed by high trash with 22% of loads above the 3% allowed, before surcharges are applied to compensate for the slowing of the plant. Many loads had trash content above 10%, with the highest being 15.8%"

While Chris said this harvest had been a bad one, new Australian planting was booming and the outlook was 'green'; with some concern for future prices.

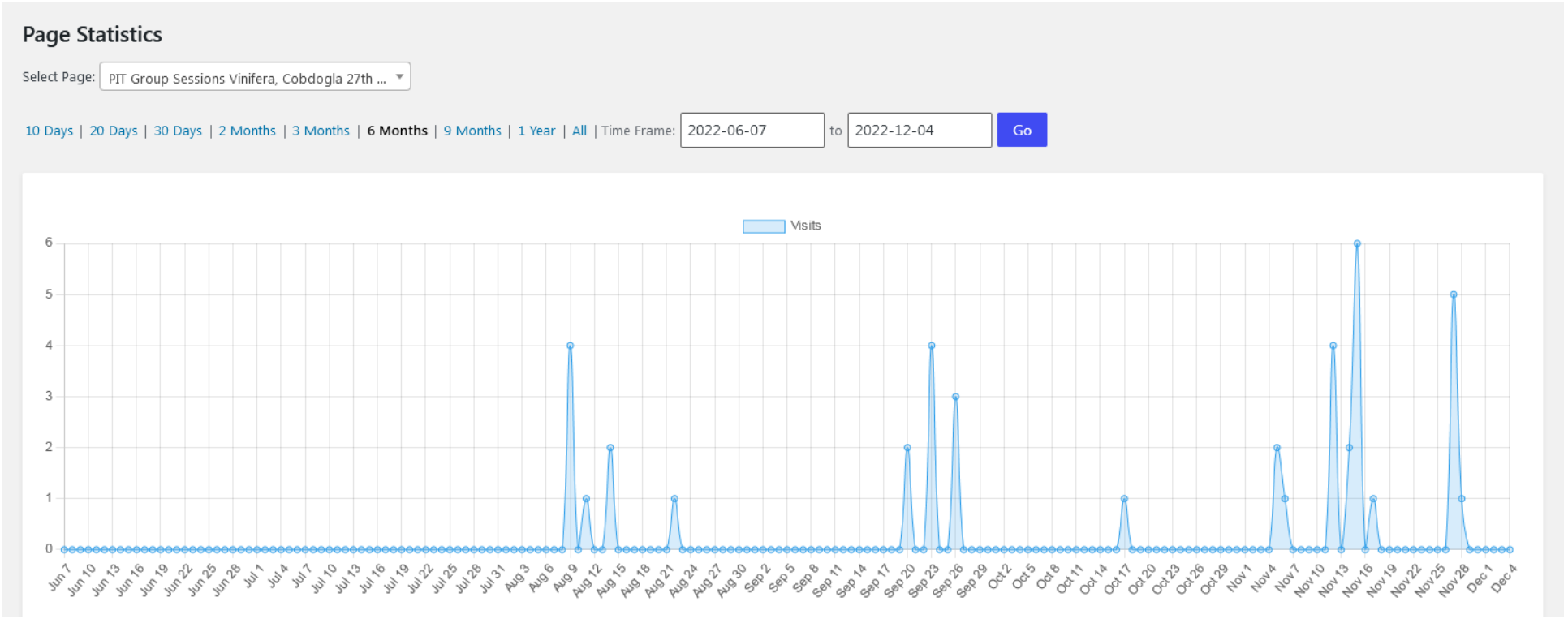
"Nurseries report about 700ha were to be planted in winter 2023 bringing total Australian hectares to over 3,000 and most growers are reporting excellent bud set for 2024 crop. In anticipation of over 5,000 tonnes for the 2024 crop, the new APPC huller is well under construction."

PGAI Hit Statistics



After harvest page hits/searches/video viewing increases.

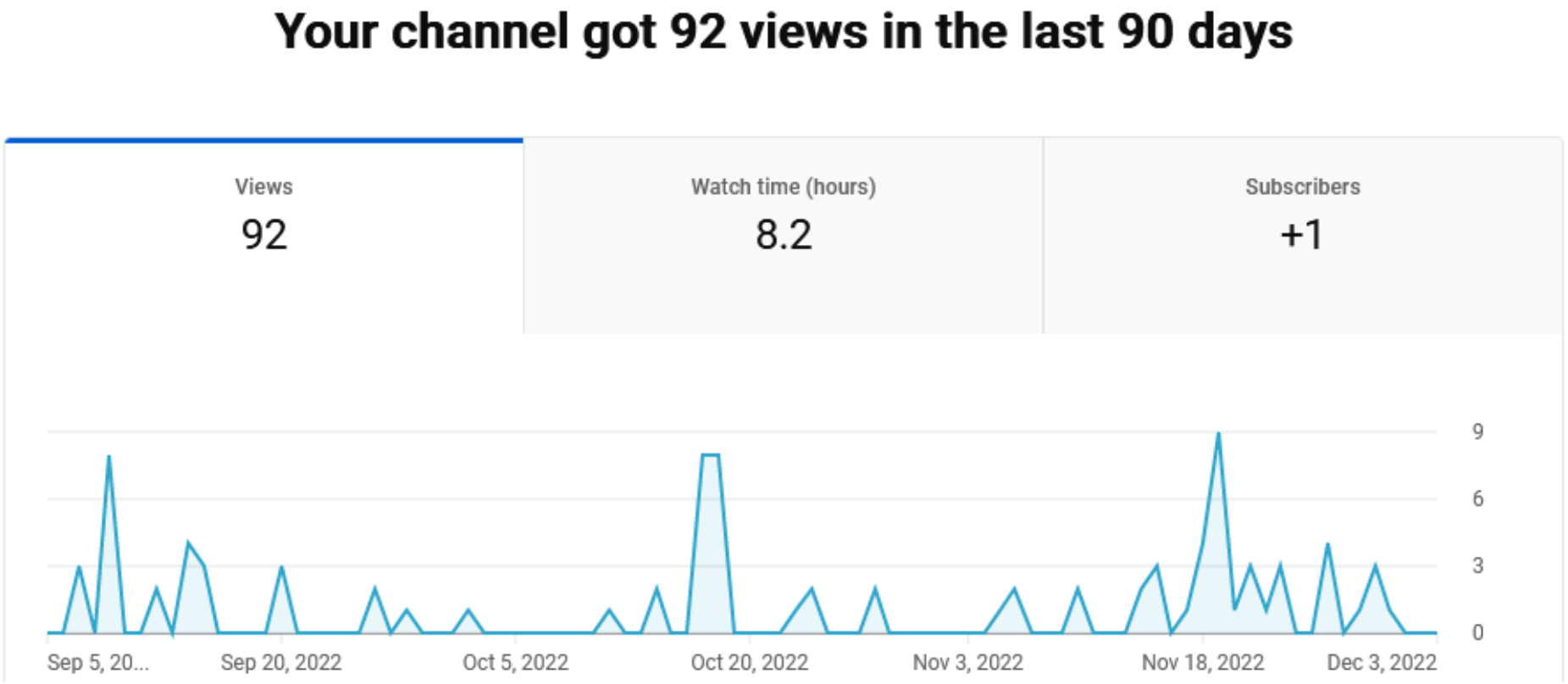
July PIT Group Sessions page/video viewing stats



November PIT Group Sessions page/video viewing stats.

YouTube Channel Views for the last 90 days:

All videos are unlisted – so do not turn up in a search, and are on password protected pages.



Your top content in this period

	Content		Average view duration	Views
1		1st Winter Pruning	3:50 (57.3%)	31
2		2nd Winter Pruning	4:53 (45.3%)	25
3		3rd Winter Pruning	4:54 (35.8%)	12
4		PIT Groups 2022 JULY 28th Video 9	2:15 (6.9%)	4
5		PIT Groups 2022 MAY R&D & Central Leader Pruning 02	1:09 (2.8%)	2
6		PIT Groups 2022 JULY 28th Video 1	15:32 (53.7%)	2
7		PIT Groups 2022 MAY R&D & Central Leader Pruning 07	26:37 (97.4%)	1

8		PIT Groups 2022 MAY R&D & Central Leader Pruning 05	4:51 (24.3%)	1
9		PIT Groups 2022 MAY R&D & Central Leader Pruning 09	14:21 (97.4%)	1
10		PIT Groups 2022 November 10th Waikerie 1	2:02 (36.2%)	1

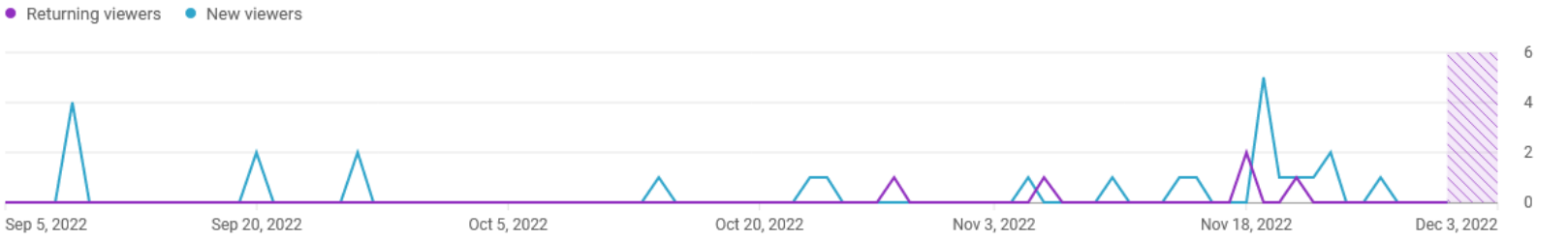
Channel analytics

ADVANCED MODE

Overview | Content | Audience | Research

Sep 5 – Dec 3, 2022
Last 90 days

Returning viewers	Unique viewers	Subscribers
–	43	+1



PROJECT PS20000

PARTICIPATION FEEDBACK SHEET SUMMARY

PIT GROUP MEETINGS – 9th/10th November 2022

Qu 1:

How useful was the day for you? Rating 8.35 out of 10

Why?

- Good content
- Disease session was most useful
- Good for pests and diseases
- Great information on the fungal diseases
- Very informative
- Vital information was given in regard to disease management
- Good information about insects and fungus
- Good information
- Wide ranging topics
- Topical and current

Qu 2:

How would you rate the quality of the program? Rating 8.47 out of 10

Why?

- Generally Ok
- Good presenters
- Well executed and catered
- Very good speakers
- High quality, knowledgeable speakers
- Some sessions not really relevant to me given my stage of development/production
- Very informative
- Very interesting about sprays
- Good mix
- Very informative
- Excellent speakers – world class

Qu 3:

What do you think were the best aspects of the PIT Group sessions?

- Relevant information – especially pest pressures
- Sharing of information
- Well planned, well run, focussed on helping growers grow nuts for best returns
- Tree health was very good
- Variety of Information

- Disease
- Fungal diseases and Carpophilus Beetle and Carob Moth
- Community of growers and excellent speakers
- Disease management and interaction with other growers
- The section on fungal infections – concise, knowledgeable presenter
- Fungal information
- Insect information
- Grower participation
- Fungal disease session
- Spruiking collective knowledge

Qu 4:

Is there anything you learnt at the Session that you intend to adopt on-farm or implement in your farming business? What? Timeframe?

- Reiterate spray programs for fungal infections
- Drum/bag recycling program
- Temperatures conducive to each disease
- Inspect trees for fungal lesions this week
- Spray programs and hygiene
- Keep looking at disease
- Disease control immediately
- Inspect for fungal infection tomorrow
- Orchard Hygiene
- Spray for Anthracnose
- Hygiene, hygiene, hygiene

Qu 5:
What was missing? Any suggestions for future events/activities?

- Relevant information for time of season
- All OK.
- Bird control with drones, etc
- Oil trials
- Training your trees
- Paul audio
- More growers

Qu 6:
Please rate the relevant presentations on a scale of 1 to 10

Introduction/Dieback:	Rating 8.29 out of 10
Carpophilus Beetle and Carob Moth:	Rating 8.12 out of 10
InSense/Cuticle protection:	Rating 8.12 out of 10
Big Bag Recovery:	Rating 7.29 out of 10
Diseases 2022/2023:	Rating 9.18 out of 10

Qu 7:
Where would you like the next Farm Walk to be held?

- Kyalite
- Not sure
- Don't mind
- Factory during harvest
- Paul Wurst – Waikerie
- Paul Wurst
- I will attend no matter where it is.
- Bob Hodgson

Qu 8:
Type of Business/Organisation?

Grower: 12
Marketer: 1
Researcher:
Sponsor:
Speaker:
Government Representative:
Other: 2

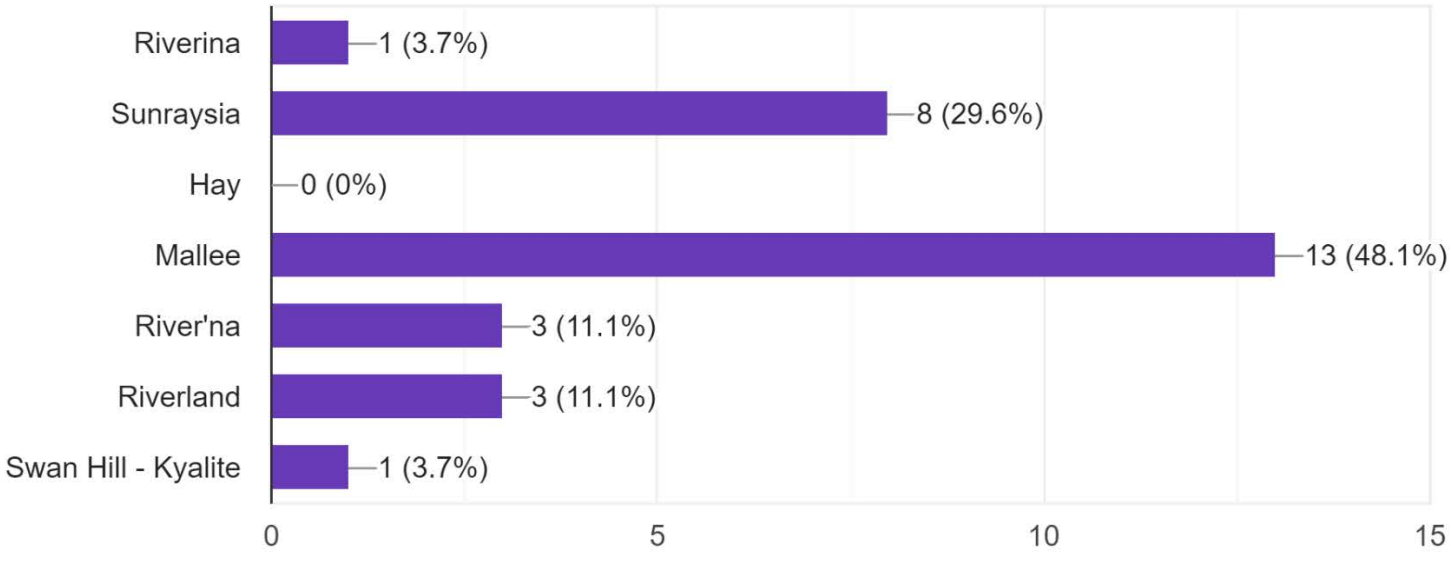
- Agronomist
- Fertiliser sales

Qu 9:
How did you hear about this event?

PGAI e-mail 15
Other Industry E-mail
PGAI Website
Newspaper/Radio
Word of mouth 1
Another PGAI Member
Other

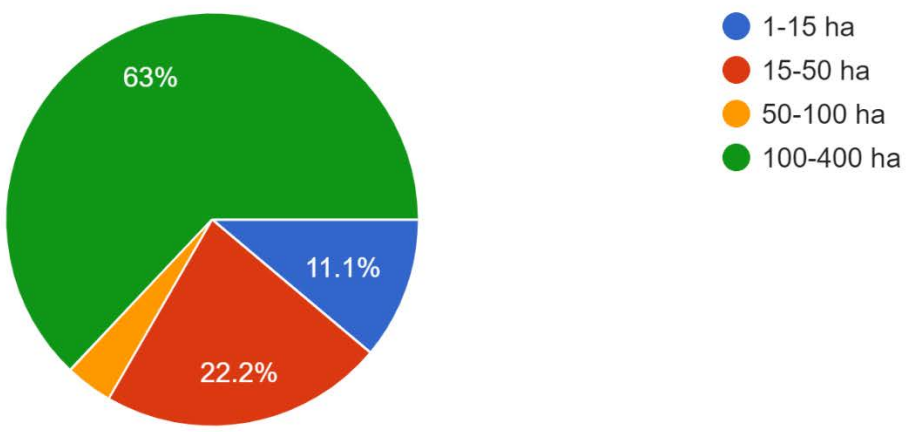
Where is your farm?

27 responses



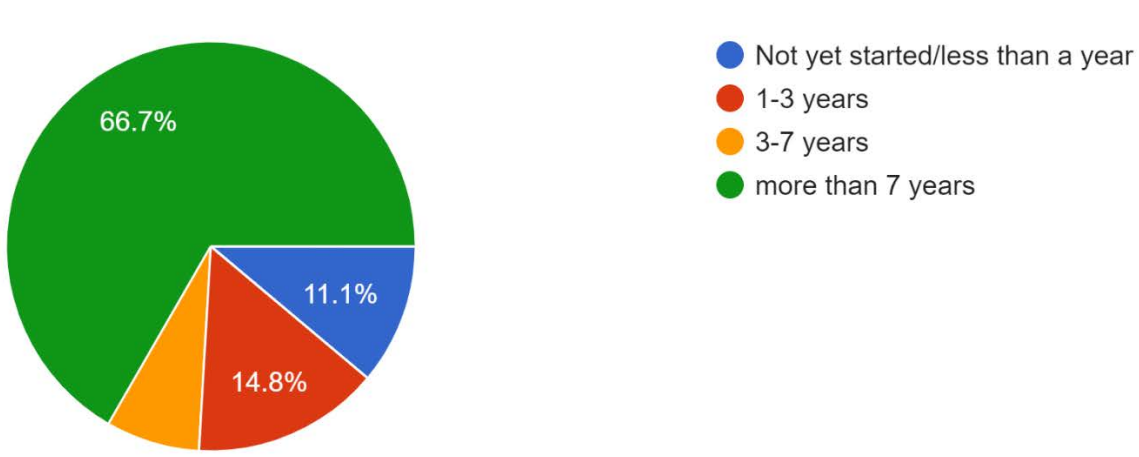
What is the size of your farm?

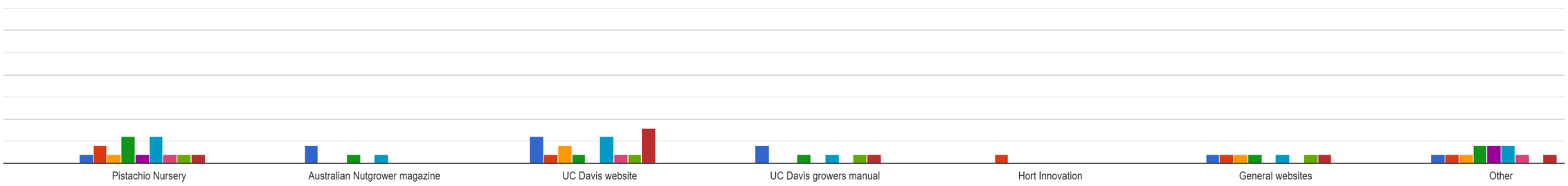
27 responses



How long have your been growing pistachios?

27 responses



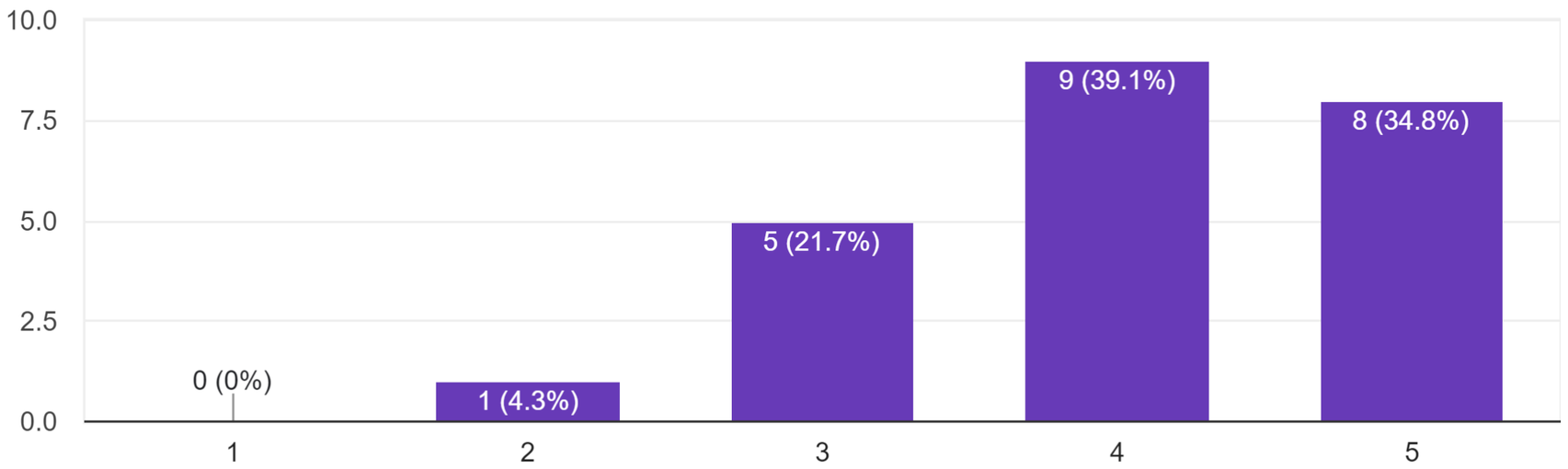

Pistachio Nursery
Australian Nutgrower magazine
UC Davis website
UC Davis growers manual
Hort Innovation
General websites
Other

f you stated 'other' please state where else you get your information.4 responses

Andrew Bowring and Swan Hill Chemicals Horticulture team
Own exoerience
Andrew Bowring
Maha/PGAI Researcher; USA Contacts

How useful is the PGAI website's information in helping you manage your pistachio orchard? Only answer this question if you have used it.

23 responses



How useful are the PGAI chill and other newsletters in helping you manage your pistachio orchard? Only answer this question if you have used it.

25 responses

How useful are talking to other growers at PIT Group meetings and elsewhere in helping you manage your pistachio orchard?

27 responses

How useful are the presentations at PIT Group meetings in helping you manage your pistachio orchard?

27 responses

How useful is your agronomist/consultant/reseller in helping you manage your pistachio orchard? Only answer this question if you use such a service.

25 responses

How useful is your nursery source in helping you manage your pistachio orchard? Only answer this question if you use a nursery.

22 responses

How useful is the 'Australian Nutgrower' magazine in helping you manage your pistachio orchard? Only answer the question if you have read it.

24 responses

How useful is the UC Davis website to helping you manage your pistachio orchard? Only answer this question if you have used it.

19 responses

How useful is the Hort Innovation website in helping you manage your pistachio orchard? Only answer this question if you have used it.

18 responses

What other sources of information do you find helpful in managing your pistachio orchard? 5 responses

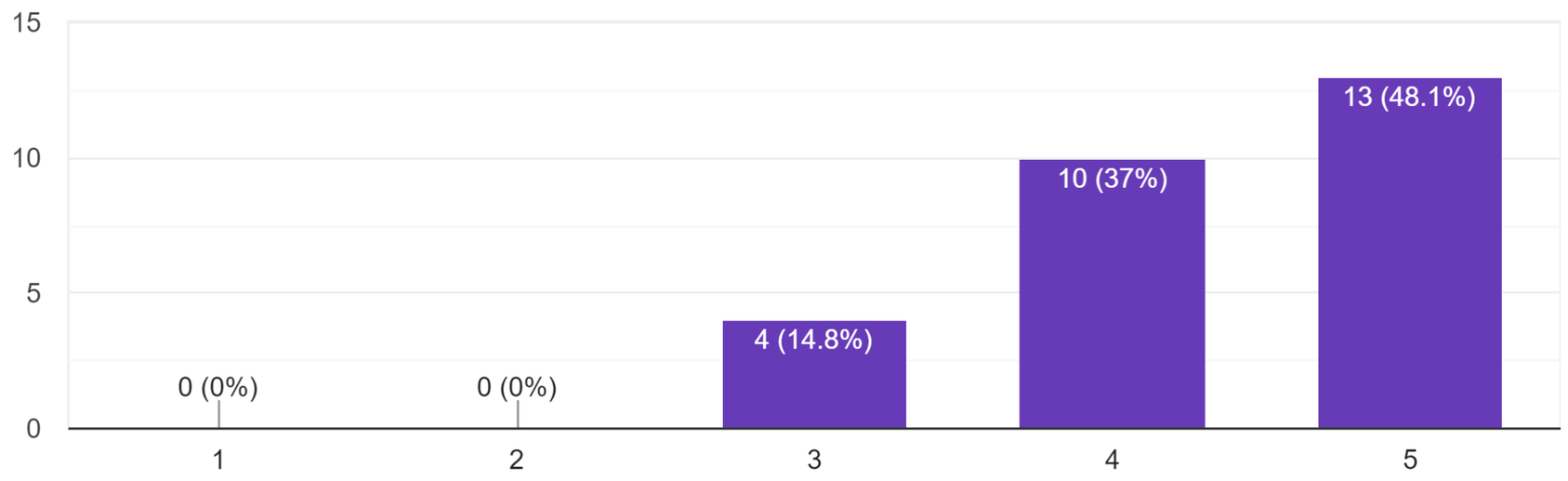
Word of mouth & internet
Youtube
Research publications articles from overseas
General google searches, spray calibration manuals, chemical labels, other crops
Other growers

What information do you need that you are currently not getting from any of the sources listed in the previous questions and how would you like to get it?4 responses

Internet
Research and development carried out by the CSIRO about Sirora during the developing process of the variety.
It would be helpful if the website could be easier to use with updated permits and chemical information
Nutrition

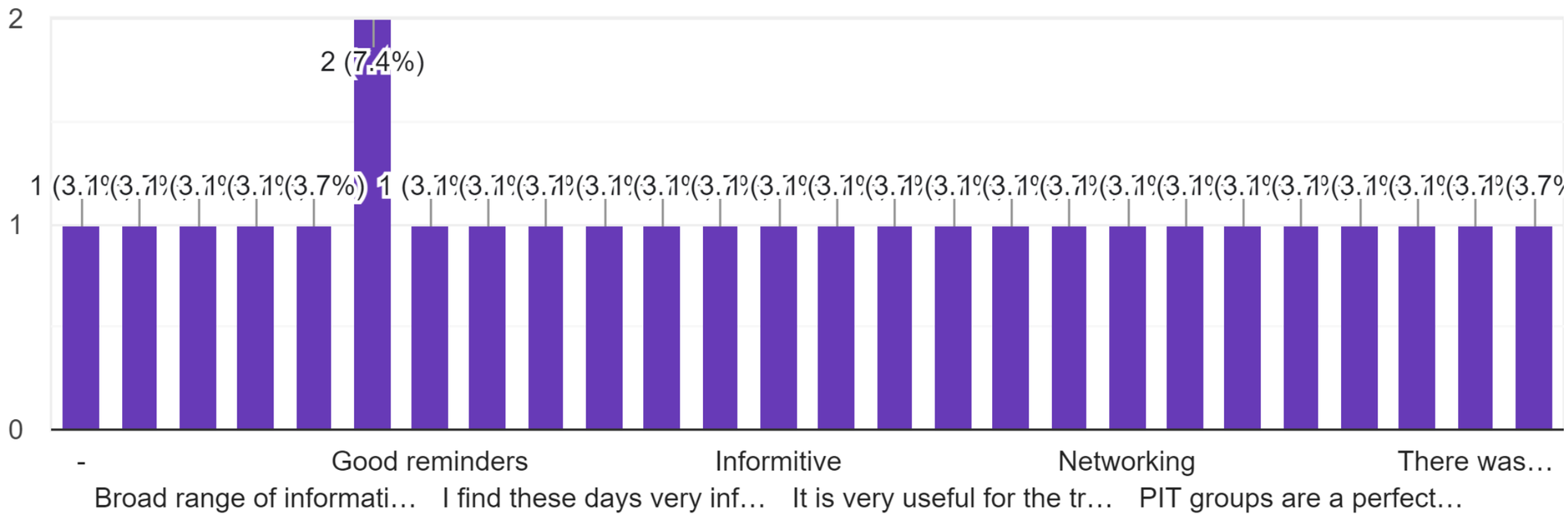
How useful was the day for you?

27 responses



Why do you give this score?

27 responses



What you think were the best aspects of the PIT Group session?

27 responses

New products
Discussion relating to pistachios
Overseas growers and how the do things
Information access
Technology and meeting growers, sharing knowledge
Location was great this time, the presentations were good, field walk at a leading orchard was fantastic
Spain tour information
Other growers
Presentation
Relevancy
Bio disease monitoring
Pest & diseases

Well delivered updated information about Pistachio production.
Field walk
Andy B Spain talk
Tooleybuc Club
Meeting other growers
Nutrition
Exchange of experiences between Pistachio growers in different areas.
Q&a
Drone information
Good setup and communication
Agronomist info
Meet new and old friends
Interacting
no answer

Is there anything you learnt at the Session that you intend to adopt on-farm or implement in your farming business? If so what and what is your intended timeframe?

11 responses

Not yet
Use of drone tech
Not tiday
Irrigation schedule
Take all ideas on board
Yes, get more info from Andy on Spain on some things I saw in photos
No
Nutrition
Yes, nutritional information
Possibly drone technology
Nutrition

Do you have any suggestions for future PIT Group events/activities?

6 responses

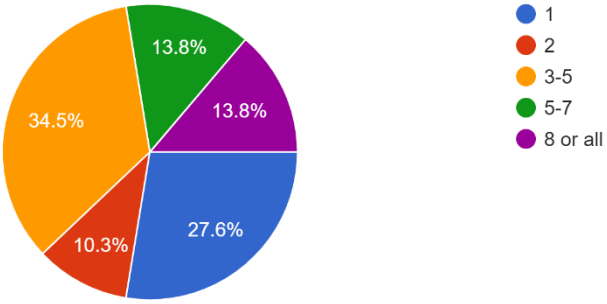
Interstate
Repeat attendance at this location would be great, a good quiet and well catered for event and semi central for growers in this region
Irrigation & fert programs
Better lunch!
Anything maybe relevant to nut size eg early nutrition
Cost savings

Final PS22000 Survey

May 2024

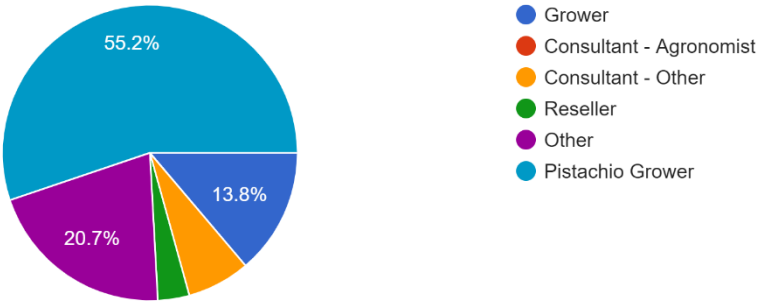
How many of the PIT group meetings, including the annual forum and today, have your been to in the last 3 years (approx. is ok if you don't remember)

29 responses



What describes you best

29 responses

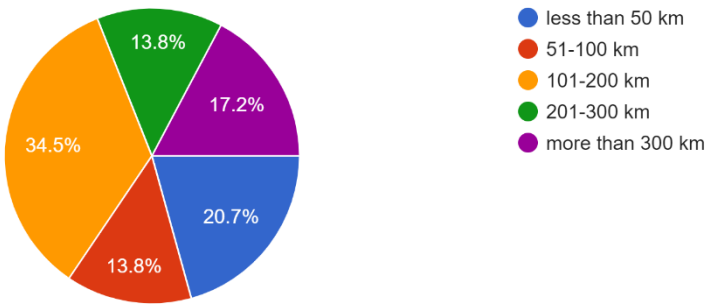


If 'Other' in question above please specify 8 responses

Manager
Proceeser
Wholesale Nutrition Plant Health Liquid Fert
Stoller fertiliser rep
Stoller Fertiliser Representative
Pistachio Researcher
researcher
Manage agricultural projects

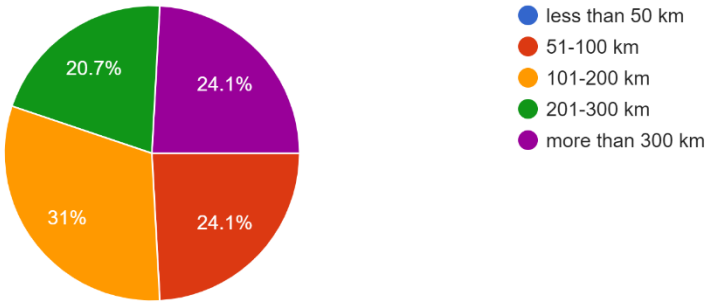
How far have you travelled to come here today

29 responses



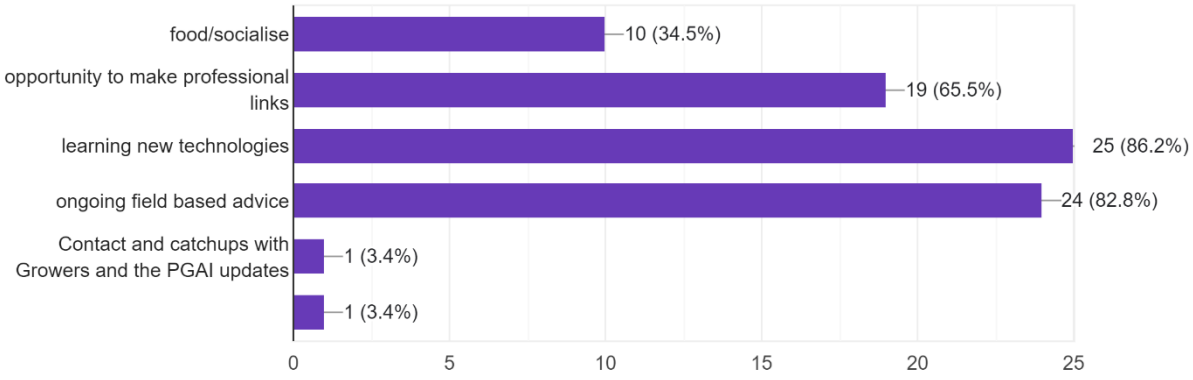
How far would you typically be willing to travel to a pistachio field day event

29 responses



What is it that makes you want to come to the PIT Group meeting(s). Tick all that apply.

29 responses



If 'Other' in question above please specify 4 responses

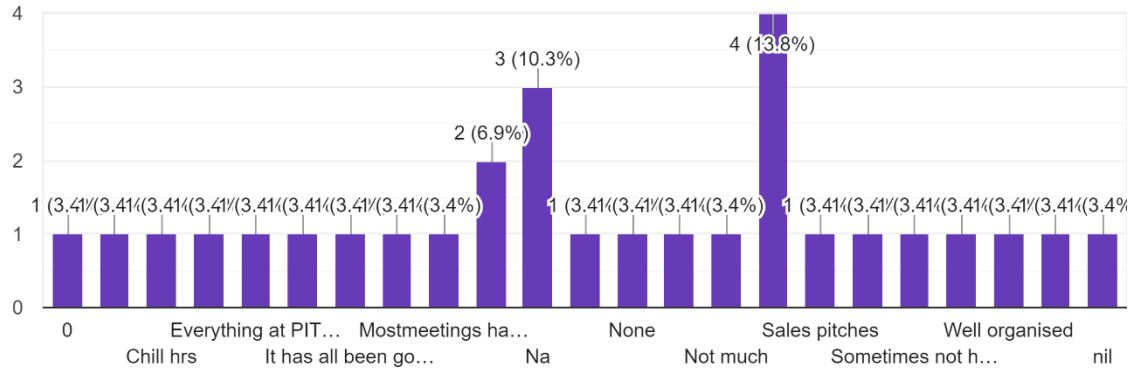
Communicating with other growers and also came to know about the latest innovations going with in the industry
Catchups with Growers, specialists talks, PGAI updates etc.
Field walks
Present research updates

What have you found most useful about the PIT Group meetings

Yes
The discussion
Chill hours research
Meeting other growers and discussing
Meeting growers
Communicating with other growers and also came to know about the latest innovations going with in the industry
Information and meeting with people
Information
Update on industry challenges and 2024 harvest
I’m a new grower and find any extra information very helpful
Technical information.
Meeting growes and resellers in the industry and getting valuable info on season wrap ups etc
Learning from other growers
New ideas
New technologies
Terrific information and engagement and interaction on Pistachio crops, soil, etc.
New technology, spraying
Contact wir
New information & opportunity to meet growers
Learnt a few things
Everything
knowledge
Latest activities of PIT/ research for pistachios/ issues or matters important to pistachio growers
All the speakers
General topics
Hearing how the Pistachio industry is going. New ideas.
All aspects have been informative
Other peoples thoughts
Keeping up with the best grower information

What has not been very useful about the PIT group meetings?

29 responses



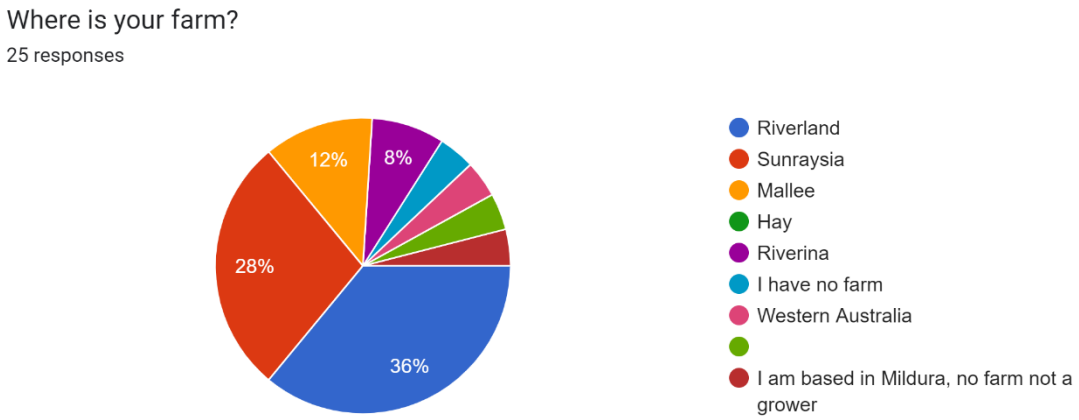
What would you like to have in future PIT Group meetings 29 responses

Nothing much
Unsure
Autonomous technology
More field examples
Same
Nothing
Maintain current format
Nutrition information
N/a
Nutrition. Irrigation. Fungal diseases
Bird control.
A group tour, I remember there was once scheduled but it was unfortunately cancelled.
Research results
The same types of things
Fertiliser inputs
More of the same content, speakers and workshops
Sprayer demonstration
Much iof the same
It's good as it is
Nothing
Keeping up to date with news and information
more research findings
Can’t specify
Spraying plants getting bigger nuts
Irrigation on when and how much water during nut growth
More time on field visits
Keep up the good work
Fertiliser programs
Continued research, grower information and product presentations

What other types of extension would you find helpful in the future29 responses

Not sure
Nothing
Na
-
Unsure
Nil
Industry current program is well explained
More field days
Industry analysts speakers
Pruning.
More talk about typical fertiliser use in pistachios
Orchard walks
As above
Fertiliser used equipment growers use
Fertiliser efficacy studies. Liquids vs Solids/Solbles , Chelates vs Sulphate
Oil sprays
Nothing
Don't know
water
Inclusion in communication activities of any sort
All technology water probs
Unsure
Visit to pistachio Factory.
More work on alternate bearing
Nil
best grower practices

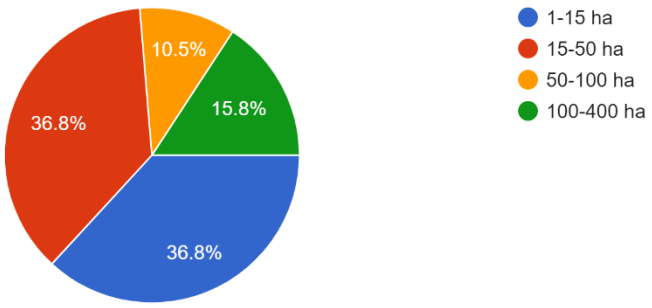
Grower only section



1 from WA

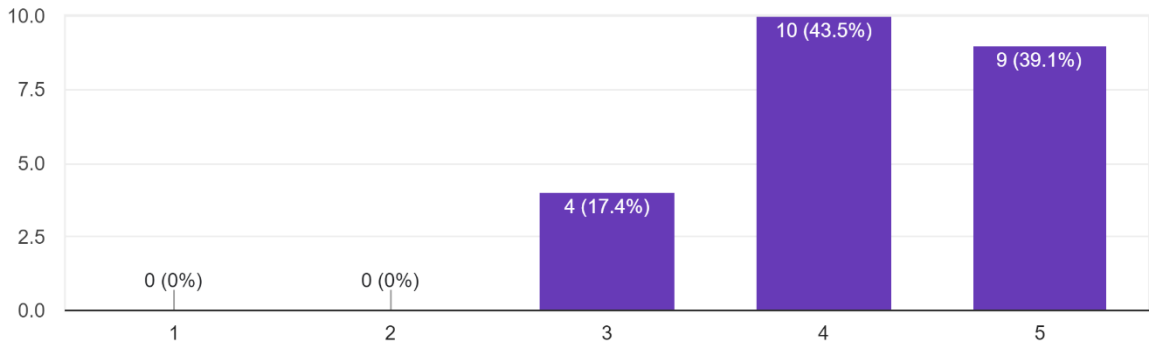
What is the size of your farm?

19 responses



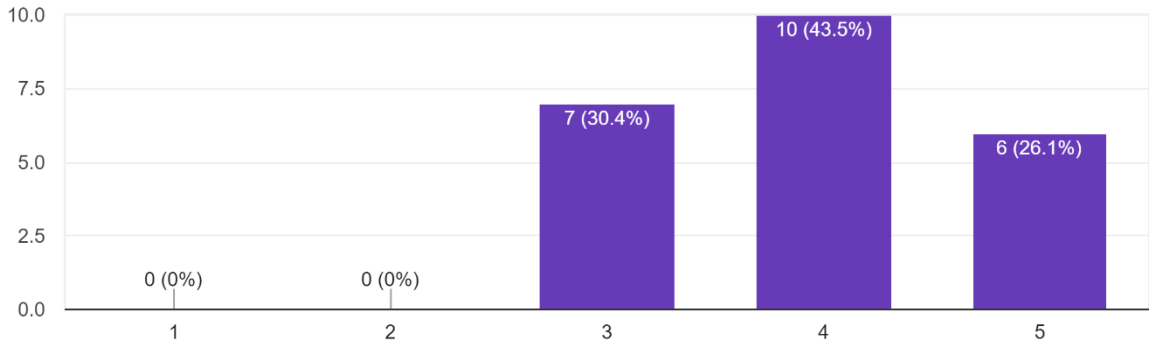
How useful are the field walks at PIT Group meetings in helping you manage your pistachio orchard?

23 responses



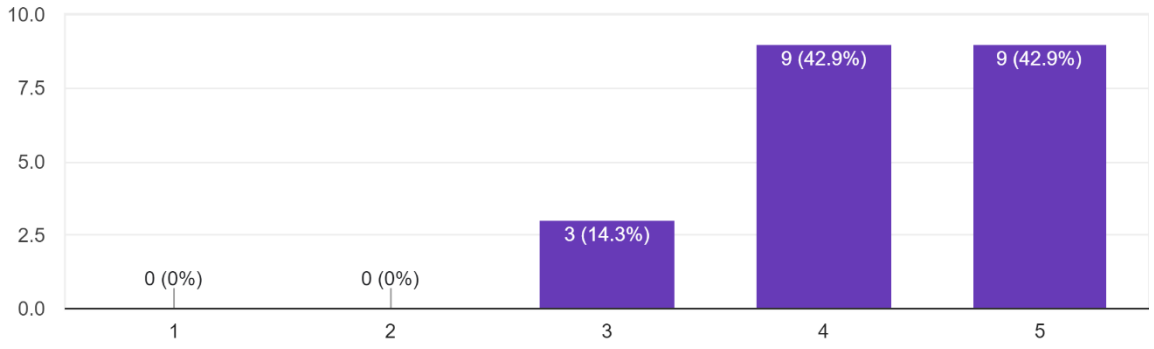
How useful are the presentations in the shed at PIT Group meetings in helping you manage your pistachio orchard?

23 responses



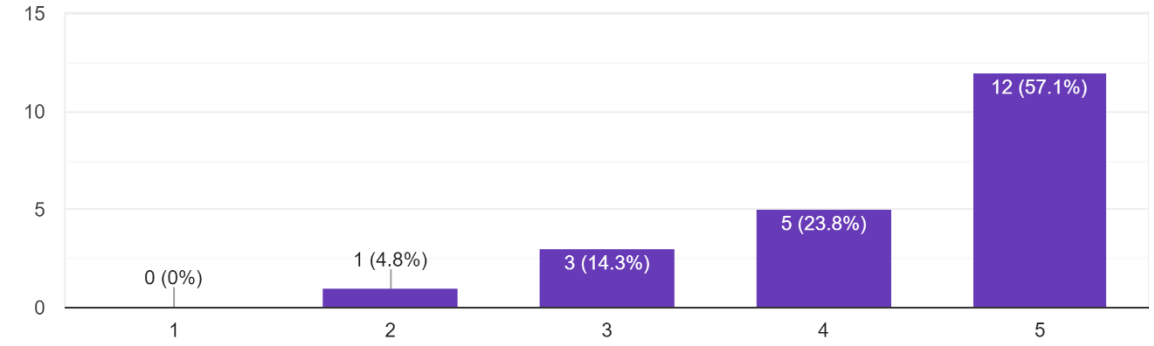
How useful is talking to other growers at PIT Group meetings in helping you manage your pistachio orchard?

21 responses



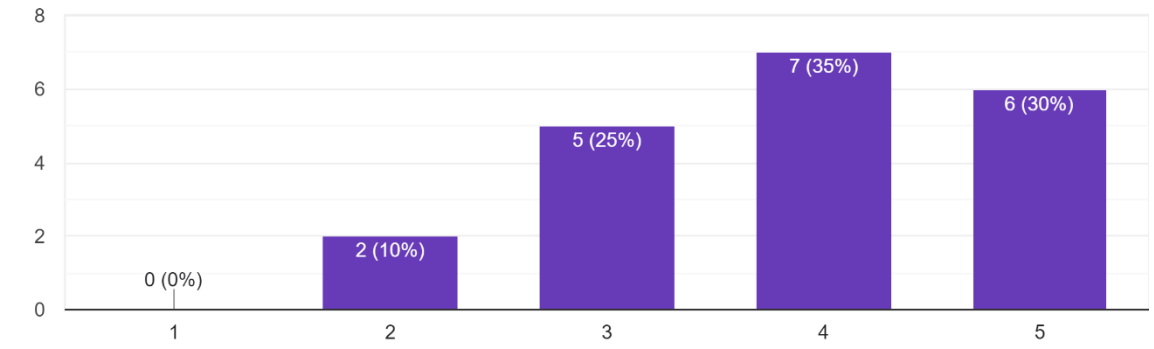
How useful are the PGAI chill and other newsletters in helping you manage your pistachio orchard? Only answer this question if you have used it.

21 responses



How useful is the PGAI website's information in helping you manage your pistachio orchard? Only answer this question if you have used it.

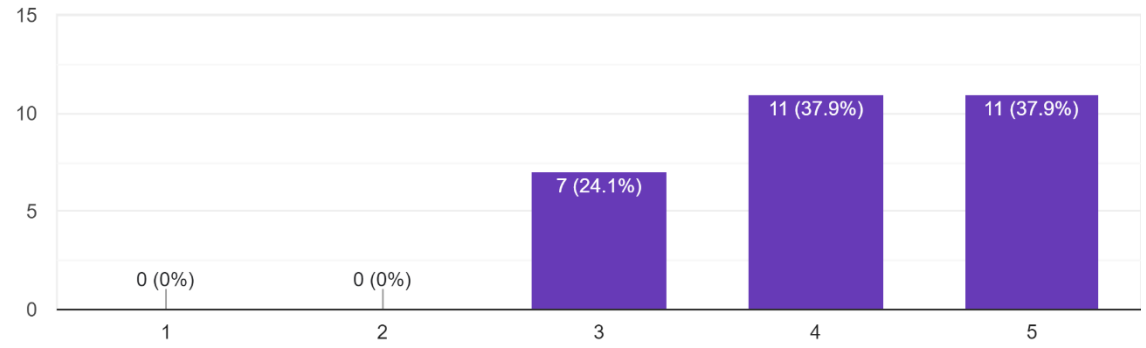
20 responses



What practices have your adopted on your farm in the last 3 years can your attribute to the PIT group, PGA website, or one of the newsletters? Please specify. 17 resposnes

Many
Understanding what our manager has done and why
Central leader method
Na
Lasers, disease control, fertigation.
Low chill mitigation
Adding extra dripper lines
Coer crops
Chill management
Improved oil spray
NA
Pruning brid control
None
Chill units report.Spray program.
The chill factor
AF36 aflatoxin risk mitigation

How useful was the day for you?
29 responses



Why do you give this score?29 responses

-
I found it helpful
First few topics useful last few not so
Grower meeting and engagement
I met the growers and learned about farming
It’s useful and good to know something
Well structured and varied information

New to industry still learning whos who
Industry led , experience and first hand knowledge
There’s not many pistachios close to me so any info is always helpful
New pest management.
Large range of topics covered. I like the open presentations and discussions.
Made new contacts and learned about new developments
Good reports.
Interesting topics
Always great content speakers and engagement
9/10
Good day
Its was good
Mildly interesting
Very happy with any new information
Useful knowledge and contacts
It’s been very helpful, I have to learn more
Love coming to the pit meeting
How I felt
Very interesting Speakers
Well presented
I learnt a lot about the tree structure
PIT meetings keep you focused, informed and inspired!!!

What do you think were the best aspects of today's PIT Group session?

29 responses

Information
Group discard speakers
Chill research presentation
Chris Joyce harvest feedback
Meeting farmers
Industry prospects
Chris’s industry report
Networking
N/a
Chill. Cover crop.
Information.
Open discussions
Presentations
A new place for the meeting
Social networking
Technical discussion, crop/harvest estimates and tree/crop performance
Speakers
Na

Industry update
Food and company
Insect update
contacts
Interaction
Chill
How I felt
Hearing Chris Joyces Report on the Harvest.
Potential Insect issues Chill hours
Talking to other growers
Chris Joyce's talk, Maha and Shane Phillips' talks, Matt Lee's orchard walk Post Harvest
Sanitation talk & the BBQ

Is there anything you learnt at today's Session that you intend to adopt on-farm or implement in your farming business? If so what and what is your intended timeframe?

18 responses

Polymers
Tim Beards cover crops and freshcare
Chilling and technical things
Na
Insect control.
Will look up Freshcare
No
Improved fungicide usage
PLENTY TO WORK WITH !
Polymer spraying
Yes. Insect management , next season
Nothing
This winter
NA
Delay pruning of trees
Be on top of fresh care and spray dairy
Keeping a eye out for that grub in next seasons crop.
Covercrops