

## **Final Report**

# **Australian industry Californian study tour 2022**

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**Delivery partner:**

Almond Board of Australia

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AL22006

**Project:**

Australian industry Californian study tour 2022 (AL22006)

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## Public summary

The development of the Australian almond industry into a major horticultural industry has occurred over the past two decades. It is one of Australia's most valuable horticultural products and is the most valuable horticultural export crop. The industry continues to grow rapidly from 29,000 hectares in 2016 to 65,000 hectares in 2023 with a productive capacity of 185,000 tonnes once orchards are fully mature.

The Almond Board of Australia (ABA) is responsible for the development and implementation of the Australian Almond Industry Strategic Plan which relies heavily on the development of outputs delivered by Hort Innovation funded projects and knowledge and technologies sourced from overseas researchers, growers, and companies. To facilitate the identification of world's best production, processing and marketing practices study tours to major producing countries are an important undertaking. The ABA's industry development program and extension through the communications project and the ABA's Committees, that cover the supply chain, ensures the uptake of valuable practices by industry participants.

During December 2022, the almond industry undertook a study tour to California to visit researchers, equipment manufacturers, a nursery, a major processor / marketer, a downstream user of almond by products, and meet with the Almond Board of California and growers to assess the environment that they were operating in with relation to production challenges, supply growth, the ongoing drought, regulated future water restrictions, and their marketing endeavours.

The itinerary also involved attendance at the three-day California Almond Conference attended by more than 4,000 participants including a broad range of industry suppliers manning trade exhibitions and researchers that were presenting or had posters on their work.

Eighty percent of global production is grown in California and the Australian industry is closely modelled on the US industry with the same varieties and production systems apart from irrigation and nutrition practices, mainly due to differences in soil types and topsoil depths. The US industry is also the leader in developing export markets and currently ships to 100 countries. The size of the US industry also means the Almond Board of California (ABC) has staff specialising in addressing trade and production issues.

With the support of Hort Innovation in funding a study tour project AL22006, the Almond Board of Australia was able to continue to develop a mutually beneficial relationship with the Almond Board of California that manages an annual investment in R&D and market development programs of \$80 million for their \$10 billion industry.

The Australian industry acknowledges that much of the production and processing technology used in Australia was developed by the Californian industry and considering this, the Australian industry has an open policy in relation to sharing the outputs of our research programs and the knowledge of industry participants, which in the areas of drought management, irrigation, nutrition, varietal breeding and orchard and processing equipment is valued by the Californian industry.

The Australian almond industry values the sharing of knowledge in relation to orchard insect pest management, sustainability initiatives, health benefits and food safety / quality research, pollination practices, trade issues management in Europe, India and China, industry statistics, and market analysis.

The 2022 study tour provided the resources to enable the Australian industry, via the ABA's grower directors and staff to interact with the ABC and broader US industry to further develop the network of contacts that provide knowledge in many areas. The project also enabled the US industry to further grasp the dynamic nature of the Australian industry and our commitment to continuous improvement through innovation. The benefits of the study tour extend beyond the direct participants in the engagement program as the transfer of knowledge through the ABA's wide range of communication platforms is integral to the way the ABA services industry members. The visit also identified many contacts that would welcome future visits from Australian industry members and researchers allowed the assessment of US experts that could provide value in visiting Australia's producing regions.

The study tour project successfully met its objectives that were:

- Increased almond industry awareness of the latest R&D and innovation undertaken in the global almond community through representation at an important international conference.

- Establishment and/or improvement of relationships between Australian delegates and their international counterparts and identify areas for cross-industry collaboration.
- Increased understanding of issues and opportunities faced by the international almond industries and how these are impacting or could impact the Australian almond industry.

## Keywords

Almonds, Study tour, California, Conference.

## Introduction

This project will enable the Australian almond industry to continue to build on the international network established in recent years with the Californian almond industry that combined with Australia represent 87% of global production. The US industry is the dominant world producer and invests heavily on research and market development programs.

With the funding support of Hort Innovation in AL16701, the Almond Board of Australia was able to continue to develop a mutually beneficial relationship with the Almond Board of California (ABC) that manages the R&D and Market Development programs for their \$10 billion industry. It is acknowledged that much of the technology used in Australia was developed by the Californian industry. The Australian industry recognizes this contribution that has led to an open policy in relation to sharing the outputs of our research programs, and the knowledge of our industry's participants, which in the areas of drought management, irrigation, nutrition, varietal breeding and orchard and processing equipment is valued by the Californian industry.

The funding of study tour projects by Hort Innovation allows the interaction of Australian industry members with counterparts in California and with US researchers developing knowledge and technologies of interest. The ability to access the knowledge generated by experienced researchers and as importantly the guidance in its use by the ABC staff has delivered a high return on the previous investment from the study tours.

The benefits have extended beyond the direct participants in the engagement program as the information is widely disseminated throughout the industry. Many contacts established during previous study tours have welcomed further visits from Australian industry members and researchers.

The interaction with the study tour participant will continue to enable the US industry to understand the dynamic nature of the Australian industry and our commitment to continuous improvement without being married to past practices.

As a result of this understanding, the ABC has raised the prospect of co-investing with the Australian industry in research projects and are already funding some Australian researchers. As recently as October 2022 the ABA was invited to participate in a review of a million dollar human nutrition study by the University of South Australia and ABC funded projects investigating almond nut dehydration by Plant and Food Research and the development of almond rootstocks by CSIRO.

Hort Innovation has expressed a desire to develop a funding mechanism that would facilitate joint projects between the US and Australia to be undertaken. The ABA / ABC relationship has facilitated discussions towards this goal.

This project will enable the international network to be maintained and expanded and continue to facilitate the exchange of knowledge and technologies into the future.

## Methodology

### 1. Project initiation

The ABA Board has recognised the need to resume the in-person relationship with the Californian almond industry after the hiatus caused by Covid 19. Meetings were undertaken to develop the study tour areas of interest to be investigated as part of the project.

The recommendation from the concluding project AL16701 Almond Study Tour has been considered. This was to investigate immediate ways to enhance pollination with fewer hives as a response to the depletion of hive stocks destroyed in the bushfires impacting Eastern Australia. The recent incursion of Varroa Destructor and its impact on border closures for beekeepers during the 2022 pollination season makes this an ongoing priority having cost the industry more than \$100 million dollars this year.

Opportunities to further develop the trend towards plant-based diets is also an industry priority along with developing a sustainability plan and grower adoption plan for the Australian almond industry to ensure the most efficient use of production inputs and its promotion to the wider community that is becoming increasingly conscience of the way food they consume is being produced.

The past aspects of the study tour program that have proven valuable such as the Californian Almond Conference form a key to the project as will the further development of the linkage with the Almond Board of California. The liaison between the Boards on the increasing concern regarding chemical use and food standards in Europe will also be part of discussions held during the tour.

Additional elements to the study tour program were obtained from the ABA Directors and the industry members that participate on the ABA's supply chain committees and HIA's almond project reference committees. This guidance was valuable in the in developing the proposed itinerary and meetings.

The wide-ranging areas to be covered on the study tour and the structure of the Californian Almond Conference with the multiple sessions coinciding across supply chain topics warranted the number of tour participants.

The following was the itinerary for the Californian Conference and study tour:

#### **Wednesday November 30, 2022**

Travelling to Adelaide, Perth, and Sydney for flight departures the following day.

#### **Thursday December 1**

12.15 Flight departs Adelaide

17.35 Arrives Singapore

19.50 Departs Singapore

18.30 Arrives San Francisco

Pickup hire vehicles at airport and travel to hotel at Pleasanton

#### **Friday December 2**

7.30 Drive to Turlock

8.30 Visit Antles Pollination Services to discuss mechanical pollination

9.30 Visit Flory to inspect orchard equipment and discuss new machinery developments

11.00 Presentations on trade issues, SGMA water regulation, sustainability at Almond Board of California head office in Modesto

13.00 Lunch with ABC staff

13.30 Visit Duarte's nursery to view tissue culturing facility and nursery, and discuss trials and new varieties

15.00 Drive to visit Fowler Brothers Farming to discuss the process and inspect the machinery used in orchard renewal. This element was cancelled due to illness of those to meet with the group so additional time was spent at Duarte's nursery

16.00 Drive to and visit Corigin Solutions in Merced to organic solutions produced from farm wastes

18.00 Drive to hotel at Ripon

19.30 Dinner / Discussion on key learnings

### **Saturday December 3**

8.00 Drive to Folsom Dam  
9.30 Inspect dam at American Rivers Water Education Centre  
11.00 Drive Yuba City  
12.00 Visit Orchard Machinery Company - Inspect orchard equipment including shake and catch machine in development  
13.00 Lunch  
14.00 Grower discussion about issues effecting production including drought conditions  
16.00 Inspect nursery  
17.30 Drive to hotel in Yuba City  
18.30 Discussion on key learnings  
19.30 Dinner

### **Sunday December 4**

9.00 Drive Napa Valley  
11.00 Free day winery visits  
17.00 Drive to hotel in Davis  
19.00 Dinner with ABC CEO, Chief Scientific Officer, and Sustainability Manager

### **Monday December 5**

8.30 Travel UC Davis University  
  
9.00 Meet Prof. Alissa Kendall – Professor Department of Civil and Environmental Engineering to discuss Carbon emission work in California.  
10.00 Visit with Prof. Daniel Sumner - Director Agriculture Issues Center to discuss Californian agriculture challenges.  
11.00 Visit Prof. Chris Simmons to discuss Work on the assessment of almond orchard performance and soil health following biosolarization using almond residue amendments  
13.00 Visit with Prof. Bradley Hanson to discuss Herbicide performance and crop safety evaluations in the conventional almond production system  
14.00 Visit with Assoc. Prof. Brian Bailey to discuss Three dimensional modelling of almond orchards, and the Assessment of almond water status using inexpensive thermal imagery  
15.00 Visit Assoc. Prof. Amelie Gaudin to discuss Management and benefits of covercrops, and managing soil health targets and potential in almond orchards  
16.00 Meet with Prof. Maciej Zwieniecki to discuss Interaction of non-structural carbohydrates (NSC) with biotic and abiotic stresses, management practices, and varieties in assessing its impact on yield  
17.00 Drive to Sacramento hotel  
19.00 Dinner function with Joel Kimmelshue and Land IQ staff, of the US based firm mapping almond orchard areas in California and Australia

### **Tuesday December 6**

8.00 ABC Conference registration  
10.30 Groups go to nominated sessions  
15.30 Trade session and Conference Opening  
19.00 Dinner

### **Wednesday December 7**

8.00 ABC Conference sessions. Groups go to nominated sessions  
11.30 Formal lunch and keynote speaker  
19.00 ABC Gala Dinner

### **Thursday December 8**

ABC Conference  
Groups go to nominated sessions  
Conference concludes 12.00  
13.30 Visit Blue Diamond Sacramento facility  
17.00 Conference key learnings session  
19.00 Dinner

### **Friday December 9**

9.00 Hotel checkout

9.30 Travel San Francisco

12.30 Lunch

13.00 Free afternoon in San Francisco before going to hotel near the airport

19.00 Dinner

### **Saturday December 10**

6.30 Depart hotel for airport

9.30 Flight departure

### **Sunday December 11**

19.05 Arrives Singapore

23.40 Departs Singapore for Adelaide

00.25 Departs Singapore for Perth

00.45 Departs Singapore for Sydney

### **Monday December 12**

Arrivals Adelaide, Perth, and Sydney followed by further travel to homes

## **2. Study tour participants**

The study tour participants were:

***Peter Hayes is the ABA Chair.*** Peter commenced as ABA Chair on February 4<sup>th</sup>, 2020. Peter has extensive experience across education and training, R&D investment and management, viticultural operations, irrigation sector and government and industry affairs in a 30-year career in the wine industry.

Working across the public and private sector, career appointments include Lecturer/Senior Lecturer/Vice Principal, Dookie Agricultural College; State Viticulturist and Statewide Industry Officer (Fruit and Vines), Victoria; Executive Director, Grape and Wine Research and Development Corporation (GWRDC); Acting CEO, Cooperative Research Centre for Viticulture (CRCV); Director of Viticulture, Rosemount Estates; National Viticulturist and Industry Affairs Manager, Southcorp Wines.

He has been an active promoter and developer of personnel training and development activity including short courses on vineyard development, spray machinery operation/calibration, disease monitoring and management and he initiated development of the CRCV's most successful "Research to Practice" series of extension activities.

Industry positions held in the past include Council Member, The Australian Wine Research Institute (AWRI); President, Australian Society of Viticulture and Oenology (ASVO); President and Vice-President of the International Organisation of Vine and Wine (OIV); Chairman of the CRC for Irrigation Futures, Board Member of GWRDC and Independent Chairman of McLaren Vale Grape Wine & Tourism Association amongst others.

Peter is currently an independent wine industry strategist and advisor with activity in Australia, India and recently in the UK. He is also Vice Chancellor of Charles Sturt University (CSU), a Board member of IAL (Irrigation Australia Ltd) and is an Honorary President of the OIV.

Qualifications held are B.Sc. (University of Melbourne), Dip.Ed. (Monash University), B.App.Sci.-Wine Science (Riverina College/CSU); MS-Horticulture (UCD).

***Peter Cavallaro is the ABA Deputy Chair and the Grower Director for Adelaide Region.*** Peter holds a Diploma in Agriculture and has been involved in the Almond Industry since 1973, when the family bought an almond orchard at Angle Vale. He has also been involved in the cut flower industry where growing and marketing were his main responsibilities, and he was a director of the Adelaide Flower Market.

In 1999, Peter developed an almond orchard with his family at Angle Vale and in 2002 seeing the scope of the industry he became involved in developing an almond orchard at Walker Flat of which he is now General



Manager.

Peter is Chairman of the Production Committee and of the Plant Improvement Committee.

**Neale Bennett is an ABA Grower Director for Sunraysia and former ABA Chair.** Neale has been involved with almonds since converting his family farm from vines in 1992. Neale also operates a contract almond harvesting business, Cowanna Harvesting. He was appointed as Secretary, Treasurer and Chairman of the Sunraysia region of the Australian Almond Growers' Association (AAGA) before joining the Board of the ABA.

Neale has participated in study tours funded under AL16701 and has been heavily involved in developing the relationship with the Almond Board of California on a Chair-to-Chair basis. Neale's experience as a grower and harvesting contractor has been valuable in assessing production systems in growing countries. His business linkages to equipment manufacturers in the US has facilitated farm and factory visits.

Neale's Committee positions include Chair of the Conference Committee and is a member of the Water, Pollination, and Almond Centre of Excellence Committees. Neale's property is the site for the whole of orchard recycling trial funded by Hort Innovation.

**Brendan Sidhu is an ABA Grower Director for the Riverland and former ABA Chair.** Brendan is the CEO of Century Orchards a large almond enterprise in Loxton. His skill as a leading producer of almonds is recognised internationally. He is also the Managing Director of Laragon Pty Ltd, an almond processing facility at Lindsay Point and a Board Member of Nut Producers Australia, a marketing company for almonds and pistachios.

Brendan has been involved in the Australian almond industry since 1983, holding positions as both Secretary and Chair of the Riverland region of the Australian Almond Growers' Association (AAGA). In 2007, Brendan was appointed to the ABA Board, holding the position of Chairman from 2009 – 2012 during which period he commenced the development of the closer relationship with the Almond Board of California. He is a member of Hort Innovation's Almond Strategic Advisory Panel (SIAP) and the Chairman of the Australian Nut Industry Council (ANIC).

Brendan holds an Advanced Diploma in Horticulture and is a graduate of the Australian Institute of Company Directors.

Brendan is Chair of the ABA's Market Development Committee, Chair of the ABA's Almond Centre Experimental and Demonstration Orchard Committee and a member of the Water and Conference Committees.

**Darren Minter is an ABA Grower Director for Sunraysia.** Darren is Managing Director of Minter Magic, a large almond, asparagus, and citrus property situated in Iraak, Victoria. Darren is a major shareholder in the Red Cliffs Almond Growers Co-op, started in 1985. He is a former member of the Australian Asparagus Council and a member of Citrus Australia.

He has adapted to the pressures of horticultural production and has grown his business enterprise to meet the need for efficiencies of scale. He is well versed in the marketing of horticultural product and has experience in the water industry having served on advisory bodies to irrigation organisations. His knowledge on irrigation and farm labour matters is well respected.

Darren holds a Diploma of Production Horticulture and was the VFF Victorian Apprentice of the year in 1988 (Fruit Section).

Darren is a member of the ABA's Plant Improvement, Production and Water Committees.

**James Callipari is the ABA Grower Director for the Riverina.** James completed a Bachelor of Applied Science (Agriculture) degree, graduating in 2003 before returning to the family farming business in a formal capacity. He has extensive experience in all aspects of the production of a wide range of fruits, vegetables,

and grains, both irrigated and dryland.

James commenced his involvement in the Australian almond industry with the development of an almond orchard in the Riverina region during 2006 where his past farming experience proved invaluable.

In 2013, James was the recipient of the Phil Watters Award which recognises excellence and service to the Australian Almond Industry.

James chairs the Almond Sustainability Committee.

**Stephen Beckwith is the ABA Grower Director for Western Australia.** Stephen is the General Manager of Indian Ocean Farms, which includes three properties in Western Australia. Stephen joined the almond industry in 2019 after spending six years with the Berry Division of the Costa Group, as Regional Manager Tasmania and Regional Manager Western Australia. Prior to this Stephen was Operations Manager of the Sumich Olive Oil Division in Western Australia for 10 years. Stephen is a past Chairman, Treasurer and Director of two local Community Banks. Stephen is a member of the ABA Production Committee, Conference Committee, a member of the Audit Committee and Chairs the ABA Chemical Committee. Stephen has a Bachelor of Business Degree.

**Ross Skinner is the former ABA CEO.** Ross has a comprehensive understanding of the needs and expectations of the Australian almond industry. Ross continues to assist the ABA in areas of his expertise and extensive network. He will assist in organising the study tour program to ensure relevance to the needs of the industry stakeholders to build on Australia's productive sustainability and international competitiveness. He has 39 years' experience in horticulture with involvement in research project management, extension, and market development during most of this period. He will assist in identifying knowledge and technologies that may be valuable to Australian producers, processors, and marketers.

Ross developed the advanced production system concept for the industry and continues to be involved with its implementation and remains involved with the ABA's Experimental and Demonstration Orchard. Aspects of the California visit will cover key areas of the advanced production system.

Ross is a member of Hort Innovation's Almond SIAP. Ross will manage the key learnings sessions during the study tour and assist with the preparation the project's reports.

The trip was originally planned with the intention of introducing Tim Jackson as the new ABA CEO to many of Ross' contacts in the US almond industry, including researchers and commercial entities, and the Almond Board of California but the Murray River flood meant he was unable to undertake the trip.

### **3. Project management and general services**

Tim Jackson provided the point of contact with HIA for the contracted project. Tim ensured all contractual requirements were met and provides support to HIA in achieving organisational and industry goals. Tim's participation on the study was curtailed by the threat posed by the Murray River flooding.

### **4. Monitoring and evaluation plan, risk register, stakeholder engagement/communications plan**

On commencement a program logic and monitoring and evaluation plan with linkage to Hort Innovation and industry objectives was developed in consultation and clearly identifies the causal linkages between project resources, activities, outputs, target audience (knowledge, aspirations, skills, attitude towards adopting the outputs), project objectives and long and short-term outcomes.

From these discussions a monitoring and evaluation (M&E) plan was developed considering learnings from the previous study tour projects. As part of these discussions potential risks to project delivery were identified and suitable mitigation strategies developed and documented. Key messaging for each stakeholder was considered and used to formulate a Stakeholder Engagement and Communications Plan (national and regional). The M&E Plan, Stakeholder Engagement and Communications Plan and Risk Register were provided to Hort Innovation at Milestone 102.

Due to the wide-ranging nature of the knowledge and technologies across the supply chain gained from this project the reporting to the Market Development, Processing, and Production Committees, and the sub committees is a key deliverable.

The ABA will also continue to liaise with other horticultural bodies where the findings of the study tour are relevant to their industries. This is facilitated by the ABA's membership of the Australian Nut Industry Council and the close working relationship with the peak industry bodies located in the Murray Valley.

## **5. Research Services**

The ABA developed the tour itinerary to explore the latest R&D and technological development that are suitable for application to the Australian Almond industry and which reflects industry's innovation needs, both short and long term.

The ABA is facilitating the communication of the project findings to the research community and broader industry to ensure the project benefits extend beyond the tour participants. This is being achieved by way of project reporting, including to Hort Innovation, and through forums and the wide range of the ABA's communication platforms.

## **6. Reporting**

A report for each tour element form the basis for reporting to the ABA Committees that the participating directors Chair in the areas of: Market Development; Production; Sustainability; Plant Improvement; Chemicals; Water; Conference; and the Experimental and Demonstration Orchard. These Committees have representation from the vast majority of production and provide input to HIA's Almond SIAP and act as project reference groups for most almond research projects.

The directors at ABA Board meetings have a key role in determining the best strategies to utilise the knowledge and technologies identified during the study tour in taking the industry forward. The ABA Board has a whole of industry focus with Production, Processing and Marketing director representation.

The reporting to the wider industry of information and insights is being undertaken through the Communications and Industry extension / development projects (AL18001 / AL19001) utilising the ABA's communication platforms including the magazine, electronic mediums, field days, one to one discussions, and presentations to regional forums. The participating directors on the study tour represent all producing regions in New South Wales, Victoria, South Australia, and Western Australia. This facilitates ongoing formal and informal reporting to industry members.

Relevant knowledge and technologies ascertained during the study tour are being incorporated into industry best practice guidance materials. Market research, human nutrition, and supply information are being utilised by the industry's marketers. The ABA Market Development Committee manages the industry's marketing program funded from the voluntary marketing levy that 98% of production contributes to.

The reporting process also comprises two milestone reports, including the final report. Reports continue to be produced for each tour element to facilitate information sharing with the industry committees and others and these provide the basis for the following Results and Discussion section of the Final Report.

Once approved by Hort Innovation the Final Report will be uploaded to the ABA website.

## Results and Discussion



***The diagram above shows the sites visited during the study tour, mainly located in the Central Valley.***

For the implementation of the Australian Almond Industry’s Strategic Plan developed by the ABA there is a need for new knowledge and technologies to be developed not only by Hort Innovation’s R&D program but identified from the work being undertaken overseas by researchers and commercial companies.

The knowledge and technologies identified are categorized into the following areas:

1. Plant Improvement
2. Pollination
3. Sustainability
4. Chemicals
5. Orchard Redevelopment
6. Harvesting Technologies
7. Processing Technologies
8. Human Nutrition
9. Market Analysis and Trade Issues
10. Other General Observations of US Almond Industry
  - Production 2022
  - Orchard Planting trends
  - Water Resources
11. Network Development
  - Almond Board of California
  - Davis University
  - Commercial Companies
12. California Almond Conference 2022



***James Callipari, Ella Hansen, Brendan Sidhu, Darren Minter, and Neale Bennett at the Sacramento Conference Centre, the venue for the 2022 California Almond Conference, the 50<sup>th</sup> conducted by the Almond Board of California. James, Brendan, Darren, and Neale are ABA Directors representing the almond producing regions of the Riverina (NSW), Riverland (SA) and Sunraysia (Vic).***

## 1. Plant Improvement

Significant research has been completed on rootstocks (19 types) including field and greenhouse studies performed by the University of California funded by the ABC.

All rootstocks have been documented in an ABC rootstock publication for growers, detailing each rootstock on:

- Genetic background
- Horticultural Characteristics
- Abiotic Conditions
- Disease and Nematode susceptibility

Research has been conducted on the uptake of sodium and chloride, and water use, given the drought conditions and lowering water quality trends, along with rootstock selection to mitigate stress in the long term.

In terms of new rootstocks that are available, Hansen 536 continues to be the main rootstock being planted in California. Most nursery production is now done in pots rather than field grown bare rooted trees. Potted trees provide more versatility in the time of planting and are significantly less susceptible to planting diseases such as crown gall.

The Almond Board of California is funding five regional rootstocks trials. These sites combine to inform decisions based on the best rootstocks for various situations. The information collected is like that of Australian rootstock trials with the overarching findings being the same so far. This being that Peach-almond hybrids are the most productive, peach rootstocks having a mid-range productivity and plum-almond hybrids are the least productive.

When comparing all peach-almond hybrids, statistically there is not much variation. Therefore, decisions on which to use are based on inherited traits such as nematode resistance, disease tolerance and nutritional vulnerability characteristics.

The University of California is working on developing new rootstocks and are emphasizing the importance of nematode resistance within this.

The learnings in California on nematodes will be beneficial when it comes to replanting Australian orchards. The rootknot nematode is the easiest species of nematode to breed resistance to, as it wants to live within the roots. The nematode can only live in the roots if a gall is formed. Therefore, rootstocks that do not swell and form a gall are resistant to rootknot nematodes. Other types of nematodes can live both inside and outside of the roots which then creates difficulties in breeding resistance.

Sierra Gold nursery has developed a rootstock known as SG5 that it was reported tolerates waterlogging like a plum rootstock, despite having a peach-almond parentage. The performance of this new rootstock will be monitored as it may be valuable to growers in Australia with heavy soils and trees planted at the base of sloping rows.

The study group visited Duarte's Nursery and were given a tour the tissue culture and nursery facilities. The group was provided with a description of the varietal trials being conducted by Duartes. It was noted that possible new rootstocks were Yorizanne (Florida guard x Alnem), and DT15 a drought tolerant (Brights Variety)

The following are recommendations based on the learnings from the study tour's insight into Californian plant improvement work:

- Investigate the importation of Sierra Gold's SG5 rootstock for evaluation in heavy soils
- Utilise the University of California's almond rootstock's characteristic table to further enhance the Australian rootstock trial technical document
- Review the methodology used for nematode sampling in the Californian rootstock trial to

incorporate into the Australian trial work

- Determine if potted trees would be a better option to bare rooted trees in Australia
- Maintain ongoing contact with University of California’s rootstock almond breeding program
- Maintain contact with Duarte Nursery’s new almond varieties trial.



*The study group visited Duarte’s Nursery and were able to inspect the potted nursery trees.*

## 2. Pollination

The study group visited the offices of Antles Pollen Inc. in Modesto that has been supplying pollen to farmers since 1929. They provide pollen for the nut, pome, and prunus crops.



*Pictured (L to R) are David Kee, Antles Pollen Supplies, Josh Fielke, Brendan Sidhu, Darren Minter, and Stephen Beckwith.*

The group was advised that between 7-12% of Californian almond growers use controlled (mechanical) pollination annually to improve pollination efficiency and nut set. This number has grown in recent years with the increased strain on the bee keeping industry to supply sufficient hives.

While it is difficult to quantify the benefits, the best return on investment is seen in years when there is a flash flowering, poor synchronization, or poor pollination conditions. Controlled pollination is not replacing bees, but fewer bees are able to do the same job with more pollen in the canopy increasing the chances of cross-pollination.

The value proposition for controlled pollination is better pollen quality; increased pollen density; and improved pollen compatibility in the orchard together with improved control of pollination timing.

Fresh pollen is collected from donor sites at pop-corn stage (matured pollen) to 15% flowering, milled and dehydrated separating out the anther sacs and other debris to produce pure pollen (100% active ingredient) of known genetics. The almond varieties Fritz and Padre are 'universal donors' targeted for pollen collection as they are 100% compatible with Nonpareil. Ambient pollen is viable for 2-5 days and can be stored at sub-zero temperatures (less than -9°C) and retain 80-100% viability within the first season.

There are two main methods used to apply pollen being blown on application and beehive dispenser application. The blown on application gives more control in the specific areas where pollen is applied, and more controlled timing of the application. The beehive dispenser is a more 'efficient' use of product given it is applied directly to the foraging bee's body hairs and while it is less expensive it relies on the bees to forage and spread the pollen. This method is time limited, less direct and may end up in neighboring orchards.

The best results are achieved using the two methods in combination so that the same material is introduced into the hive as well as spread throughout the tree. Application using the beehive dispenser is most effective when there is earlier flowering and bees are actively visiting flowers increasing the probability of successful pollination.

When blown on application is used, the pollen doesn't have to land directly on the flower stigma. It just needs enough pollen throughout the canopy to increase the chance of cross-pollination by foraging bees. Best results are seen for blown on applications when flowers are open increasing the surface area for pollen to land. The group noted that there are losses of pollen that lands on branches, limbs, and the ground. A minimum of two applications and ideally three applications are required each season at intervals during favorable weather in peak bloom, for example at 30-40% flowering; 50-60% flowering; and 75-90% flowering.

Donor pollen blocks are sourced from producing commercial orchards. It is thought there would be a small impact on crop but when there are around 300,000 plus flowers on each tree to start with and only a small percentage actually sets nuts, with 90% of the flowers lost so any impact is considered negligible and difficult to quantify. Donor growers are paid on a basis of grams of pollen collected. The return is different for each variety as each has their own characteristics. It was noted that Fritz shakes well releasing lots of flowers, but Padre shakes poorly at less than half the Fritz rate. NePlus is a prolific bloomer and Senoras are an early flowering variety.

A carrier or filler called Vericet, an inert calibration powder, is used in each application to help calibrate equipment and get a more even spread. It is a bioactive that provides nutrients and carbohydrates that supplies energy for bees. It was noted that it is not marketed as a bee attractant, but bees are seen to get excited when it is used.

Vericet Gold group of pollens are claimed to improve the accuracy and rate of pollen tube growth, improve receptivity of the receiving flower, and overcome low temperature effects on pollen tube growth.

The group was advised Vericet was currently exported to Chile as a calibrating agent.



The cost for 240 grams of pollen material plus Vericet was reported as being \$150/acre per annum. The blower application equipment can be either bought or rented from Antles. For comparison purposes beehives cost around \$105/acre.

It was noted that there was a positive public reception to the method as a natural, organic solution that increased long term average crop yields by manipulating timing of natural processes.

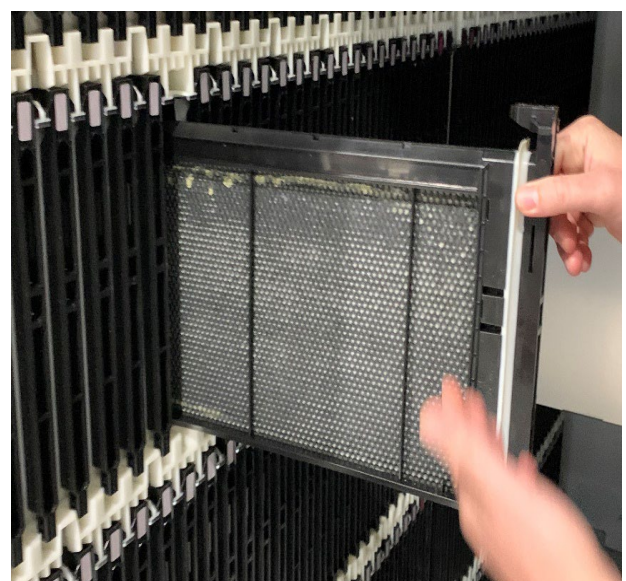
The Antles pollen application unit is a pollen application system using constant air flow and auger metering to disperse pollen into the canopy of orchard trees. It is mounted to the rack of a quad bike, or in the bed of a side-by-side vehicle with the delivery tubes oriented to use with most tree heights and training styles.

Historically, the Australian almond industry has relied 100 percent on European honeybees to cross-fertilize and set nuts. A rapid expansion of almond orchards as well as other pollination dependent crops has increased demand for beehives in Australia. The growth rate of the honeybee industry supplying pollination services is not keeping pace with demand leading to pollination deficits and increased hive prices.

The Australian almond industry is also facing the additional issues of: State border closures during the biosecurity response to Varroa detections; adverse weather events and bushfires destroying hives as well as limiting floral resources important to maintaining hive health out of season. These risk factors have led the ABA to investigating risk management strategies involving new approaches to pollination services to supplement honeybees when there are not enough hives available to meet growing demand.

Generally, the uptake of controlled pollination in Australia has been limited with a few hand-held technologies and vehicle-mounted blowers trialed in almond orchards with variable results and questionable improvement in yield or quality. A high quality pollen source is required and although small-scale pollen collection methodologies exist, a pollen harvesting, and supply infrastructure is lacking in Australia. There is an upward trend worldwide in the number of patents regarding artificial pollination devices.

The Australian market is of much interest to Antles. The group noted it was not feasible for Australia to be the off season pollen source for Antles given Chile is so close and their cost structure was much less.



***Beewise exhibitor stand at the Conference.***

The Beewise exhibitor stand at the Conference was of great interest to the study group as the Beehome (pictured) is a device that houses 24 colonies, allowing beekeepers to remotely care and treat their hives.

The Beehome has cameras inside of it, robotic arms, sensors, and other systems, that allow it to execute what a Beekeeper would normally do. The robotic arms within Beehome treat pests, feed, prevent swarming from happening and more, similar to what a Beekeeper does. Beekeepers can also remote control the Beehome over the web, so they have full flexibility with the upkeep of their colonies. An automated climate control system ensures a comfortable environment for the bees all year long, both in terms of climate and humidity.

The following are recommendations based on the learnings from the study tour's insight into controlled pollination on Californian almond orchards:

- Investigate the potential for Australian joint venture with Antles Pollen Supplies Inc.
- Investigate phytosanitary requirements and cost to import pollen
- Investigate import requirements for the pollen carrier Vericet
- Review the outcomes of Hort Innovation funded project feasibility of artificial pollination project
- Monitor the uptake and costs associated with the Beehome.

### **3. Sustainability**

The study tour to inspect the Californian almond industry and attend the Annual California Almond Conference provided the opportunity to learn from an industry that faces similar challenges and opportunities to the Australian almond industry. Under the guidance, and with their significant resources, the Almond Board of California (ABC) has been addressing their sustainability journey for some years. The Australian almond industry has been monitoring the path the Californian almond industry has and is currently taking to assess the best way forward for our own sustainability program.

#### ***California Almond Stewardship Program (CASP)***

The California Almond Stewardship Program has had elements that have worked, and parts that have needed change. The insights from CASP's implementation have provided useful knowledge for the development of the Almond Board of Australia's grower self-assessment benchmarking portal, Almond Hort360.

The ABC's initial sustainability benchmarking program consisted of 9 modules. This was seen as being overly complicated and often misinterpreted as a certification scheme. With the aim of eliminating confusion and removing the burden from growers as much as possible, the ABC adapted their benchmarking program into a simpler, single assessment stewardship program. Although Hort360 will consist of multiple modules there is a need to consider whether each question adds value and to be conscious of repeating questions across the modules.

#### ***Reputation Management Program***

The key objective of the ABC's Reputation Management Program is summarised as "proactive storytelling to build trust". The program is a combination of public relations, advertising, and social media, linking sustainability and marketing. The ABC's substantial financial resources allows them to partner with major media and influencers on social media. Although the Australian industry does not have access to the same level of funding, there are valuable lessons on how to engage with consumers about sustainability.

The Californian almond industry is facing similar issues to the Australian industry, including criticism about water use. They have focused on shifting consumer attention from the reactive "How much water is used?" to a proactive program of "What is done with water?".

#### ***Carbon Emission Research at University of California Davis***

The Californian almond industry has conducted a great deal of research in partnership with University of California Davis.

The study tour group met with Professor Alissa Kendall of the Department of Civil and Environmental Engineering to discuss their Carbon emission work in California. Prof. Kendall's research applies and advances the methods and perspectives of Industrial Ecology to understand and reduce the environmental effects of transport, civil infrastructure, energy, and agricultural systems. Specific research and teaching interests include life cycle assessment and other structured environmental assessment methods, and the development of new methods for carbon accounting.



**Tour group with Prof. Alissa Kendall 4<sup>th</sup> from the left.**

It was reported that UC Davis conducted their first life cycle assessment in 2012 and the Australian industry is now following suit.

In California, many growers are switching to solar power or making use of cheap or low carbon electricity. Just like Australian growers, Californian growers are thinking about when they're using energy to make the most of it or investing in energy storage. However, there are limitations regarding renewable energy. California is even more limited by their energy infrastructure than we are in Australia and the grid is not able to store and distribute the amount of energy that is being produced.

At present, in both Australia and California current carbon storage and carbon credit methodology is not applicable to horticulture. Researchers at UC Davis are looking at a method for carbon stored in trees, producing an equivalent time frame (25-30 years) based on 100-year value.

#### ***Challenges in California to Sustainable Farming***

The group met with Professor Daniel Sumner, Director Agriculture Issues Center, to discuss Californian agriculture challenges. Professor Sumner listed the following issues impacting farming sustainability:

- Over drafting of water from aquifers at an unsustainable rate
- Immigration and farm labour supply
- Rising farm labour wages
- Increased interest rates
- Increased energy costs including electricity where California has the highest prices
- Transport costs and shipping logistics
- Increasing regulation in food safety, environment, labour, water use
- Manufacturing support has reduced with companies leaving the State.

It was noted that there was serious conflict between local governments based on California's coast and agriculture in the Central Valley.

### ***Management and Benefits of Cover Crops***

The Group met with Associate Professor Amelie Gaudin to discuss cover cropping in California. She is the new Endowed Chair in the Department of Plant Sciences aiming to develop a fellowship program to support undergraduate research in agroecology and regenerative agriculture. The program will provide undergraduates across disciplines with mentoring opportunities and financial resources to study impacts and promote implementation of regenerative agriculture. Throughout the fellowship, students will engage with diverse communities of educators, growers, advisors, and advocates to gain practical experience in research and outreach to best prepare them for career paths.

Associate Professor Gaudin has is driving an Agroecology Working Group to serve as a connection between commodity boards such as the Almond Board, policy experts, food producers and UC researchers and advisors who share the goal of advancing agricultural systems that are grounded in ecological principles. The group's aim is to leverage collective expertise for greater research impacts in the field of agroecology to address local and global challenges.

It was explained to the study group that Agroecology is deeply rooted in diversity and will engage in participatory action research, embracing the breadth of California farms, farmers, practices, and landscapes to achieve change to ensure future resilience.

Amelie advised that less than 3% of almond orchards in California are under covercrops.

In both the Australian and Californian industries, the benefits of cover crops have been observed in practice but there has been little formal research.

In California, there is a government incentive for soil health improvement achieved through Covercrops however, it is complicated to apply for resulting in most agricultural funding going to compost impacts because it is more readily quantified.

It was noted that covercrops had benefits in addressing compacted soils found in both California and Australia and in modifying orchard temperatures during heatwaves. It was also noted that grazing benefited soil ecology, but this may lead to food safety issues given current ground harvesting practices. The benefit of covercrops providing a diverse diet for bees during almond pollination was recognised but the difficulty to synchronise flowering of the trees and covercrop was noted acknowledging that the planting time for many covercrop varieties coincided with the almond harvest occurring in late Summer and Spring.

The connecting of Australian and Californian growers to facilitate conversations about their experiences with and concerns about cover cropping is a positive outcome of the study tour.

It was noted that a cover cropping extension booklet had been produced in California, which the Australian Industry's Development Officers will use to incorporate relevant knowledge into best practice advice.

### ***Utilising Almond Co-products***

Capturing and utilising co-products of almonds is priority area for both the Australian and Californian industries. Currently in California, there is a growing surplus of almond hull and shell due to a decrease in demand from the shrinking dairy industry. Similarly, in Australia the value of hull and shell has decreased considerably given the better weather conditions for silage and grain production. The large increases in planted orchard area in both countries means far greater volumes of hull and shell will be produced in the near future.

Alternate avenues for utilising shell and hull not yet explored in Australia include almond shell and hull for biosolarisation, almond cellulose from wood for clothing, carbon black (from biochar) for production of rubber and plastics, powdered almond hulls as an ingredient for human consumption, and hull and shell for chicken feed.

The group received a presentation from Professor Christopher Simmons on soil biosolarisation that is a soil disinfestation technology that combines passive solar heating and organic amendments to generate multiple soil pest inactivating stressors. It has the benefits of replacing fumigants and herbicides and adding organic matter to the soil.

University of California (UC) Davis researchers are seeking to use almond hull and shell with the goal of developing new ways to recycle these materials in orchards close to where they were produced.

While traditional solarisation has been used as a pest management tool for decades, it is often ineffective in orchards as soil heating only reaches a shallow depth. The addition of almond hulls and shells can potentially solve this problem. Returning hull and shell to the soil may provide additional benefits to soil health including providing valuable soil amendments due to their high organic carbon content. Laboratory studies found that even before solarisation, the addition of hulls and shells to the soil increased the level of organic acid biopesticides in the soil.

The field trials are being conducted in Chico. The process involves the broadcasting of hull and shell material milled to two millimetres or less that was smoothed with a float. A clear film is used to cover the soil which is irrigated. The soil can reach a temperature of 65 degrees Celsius leading to anaerobic activity producing potent pesticides in acetic acid, propionic acid, and butyric acid. The research showed nitrogen levels increased for two years following the six week trial. Potassium and soil carbon also increased. It was also reported the solarization also killed weeds. In the trial, Nonpareil performed better than the pollinator varieties.

The group was advised that the amount of material added was important as adding more led to less than optimal results in terms of yield. The best rate was nine tonnes to the acre.

Additional studies are being completed to explore the use of hulls and shells for bio solarisation to manage soil pests in other crops to maximise opportunities for the use of California's supply of hulls and shells.

The group visited a commercial user of the almond shell Corigin Solutions. The business started out making Biochar from almond hull but now have developed a pyrolysis process that creates “a plant growth enhancer” which has Biochar, Bio oil and Lignin Acid which is a Lignin Chlorophyll. It is claimed to have good success in heat stress management, and post-harvest situations. More information is being pursued by an Australian processor seeking to add value to the almond shell biomass.



#### 4. Chemicals

The study group received a presentation from Professor Brad Hanson on herbicide weed control during the visit to UC Davis campus. Developing methods to manage weeds in tree and vine crops is the focus of his research. He is a faculty member in the Department of Plant Sciences at UC Davis, but he is also a statewide Cooperative Extension specialist for the UC Division of Agriculture and Natural Resources working on chemical-based weed control.

In addition to his role as CE specialist, he is the Vice Chair for Outreach and Extension in the Department of Plant Sciences and has field trials in a 600-kilometer stretch of the Central Valley and oversees his lab group that includes several graduate and undergraduate students, postdoctoral researchers, and research staff.

Brad shared his concerns on the chemical Basta that he believed was transferring from the soil to being mobile within almond trees causing issues with the short withholding period. He also noted that Paraquat and Diquat posed a risk of contamination to nuts.

The group was advised that preemergent chemicals were unlikely to pose an MRL issue in almonds, but crop injury was an area of interest.

It was noted that spray drift of 2,4-D was not an issue for California horticulture as there was very limited broadacre farming occurring near orchards.

His mantra for weed control was “the right rate at the right time.”

Brad provided a brief overview of some alternate weed control technologies including:

- Electrozapper from Brazil that is slow at less than 1mph, dependent on soil moisture, and requires large energy input
- Propane Flamers that can cause fires in dry weed material and melt irrigation tubing
- Hot air is less efficient than flamers but without the incidental damage concerns
- Stream has an issue with towing heavy water tanks through orchards
- Microwave is not yet practical given energy requirement to cover a large width
- Robotics is progressing rapidly but is an expensive technology to apply to large scale orchards
- Organic herbicides are very expensive at 8 to 10 times the cost and on a cost basis it is better to manually weed.

The conclusion was that chemical weed control was the most viable technology for large scale horticulture at this point of time.

The Californian industry has access to many more chemicals registered for use on almonds than in Australia due to the size of their industry. The study group considered the chemicals they have access to and agreed the registered products in the US that are worth investigating for registering in Australia are:

- Velum by Bayer. Nematicide/Fungicide, Fluropyram Group 7. Registered for ground applications or dripline applications for the suppression on Lesion, Ring and Root-Knott Nematodes.
- Matrix SG by Corteva. Rimusulfuron Group 2. Pre and early post-emergence herbicide for broadleaves and grasses.
- Orondis by Syngenta. Azoxystrobin Group 11 and Oxathiapiprolin Group 49. New reduced risk fungicide with extremely high activity against all Phytophthora species. Recently registered in the US.
- Cevya Fungicide by BASF. Mefentrifluconazole Group 3, Registered in US 2022 (Registered as Belanty in Australia but restrictions with EU MRL's).
- Miravis Duo by Syngenta. Difenconazole Group 3 and Pydiflumetofen Group 7, registered in US 2022

Other new modes of action that are in development are:

- Fluopicolide Fungicide; New Group 43 (Bayer)
- Ethaboxam Fungicide; New Group 22 (possibly Nufarm)

It was noted that there is a movement to biofungicide and biorational-conventional fungicides such as:

- Regev Fungicide by Sumitomo. Difenconazole Group 3 and Tea Tree Oil Group BM-01, registered in US 2022

Chemicals in development and in the process of being registered are:

- Miravis Prime Fungicide by Syngenta. Pydiflumetofen Group 7 and Fludioxonil Group 12
- Parade Pre-Emergent Herbicide by BASF. Pendimethalin and Picolinafen

The ABA's Chemical Committee will review and pursue the registration of the chemicals listed above it considers warranted. This may involve an investment via the Almond SIAP by Hort Innovation.

## 5. Orchard Redevelopment

The visit to Fowler Brothers Farming, who are a large scale practitioner of orchard tree removal and mulching for incorporating back into soils, was cancelled on the day of the visit because of the unavailability of their staff due to illness. The initial contact established in planning the study tour can be followed up in future.

## 6. Harvesting Technologies

The Australian, US, and Spanish almond industries are all interested in shake and catch harvesting due to efficiency gains and reducing food safety risks. The Spanish industry have much smaller trees due to their reliance on rainfall whereas the Californian and Australian trees are irrigated and are much larger. The similarities between the Australian and Californian production systems have seen Australian producers rely on imported harvesting equipment from Californian manufacturers. The study group visited both the Flory and Orchard Machinery Corporation (OMC) manufacturing facilities.

The grower directors enthusiastically inspected the range of equipment of both companies, noting new developments to the machinery.

A highlight of the visit was the inspection of OMCs over the tree shake and catch harvester in their Yuba facility. The prototype machine is nearing completion before trials during the Californian harvest in mid-2023.

The Orchard Machinery Corporation was formed in 1961 and began producing hydraulic tree shakers to enable a more efficient prune harvest, but their shakers and other harvesting equipment are now used in many orchard crops.

The study group recommended that the Californian trials of the OMC shake and catch harvester be monitored and contact with Brian Johnson of OMC be maintained.

## 7. Processing Technologies

The study group visited Blue Diamond's processing and sales facility in Sacramento. Due to Covid protocols it was a restricted visit, and the technologies that were viewed were for the most part the same as used by Australian processors.

What is unique to Blue Diamond, the largest processor / marketer of almonds in the world, is their flavored almond range.

Several efforts to achieve the product quality and sales success of the Blue Diamond product have failed.



## 8. Human Nutrition

The Almond Board of California advised that it had funded 130 research studies on human nutrition with 27 currently active. It was noted that human nutrition was a major R&D investment area with work being done on the benefits of eating almonds on:

- Cognition
- Skin
- Weight management
- Gut health
- Cardiac health
- Diabetes
- Sleep

The ABA has had access to the updates on the research studies and was recently invited to participate in a review of the ABC funded research at the University of South Australia in October. The investment in human nutrition research projects by the ABC is more than \$25 million.

The ABC carefully uses the learnings from the projects to build demand in markets most attuned to the particular benefit derived from consuming almonds for instance skin care in Korea and Japan, cognition in India, and weight management and cardiac health in their domestic market. This marketing strategy has been very successful, and one Australia has replicated on a more limited scale.

## 9. Market Analysis and Trade Issues

The Almond Board of California reported on the profound trade and marketing challenges they faced as an industry during 2022. The ongoing multiyear drought, global logistic challenges, and inflationary impacts.

The strategies undertaken to overcome these challenges are:

*Short term:*

- Maintaining strong shipments
- Continuing to improve logistics

*Medium to Long term:*

- Expand into new markets
- Resolve market access issues - particularly into India and China (Reduce the contact with markets that use barriers just because of government issues)
- Evolve almond relevance with younger consumers
- Maximise new product development
- Add value to biomass
- Drive down production costs
- Innovation is key
- Maximise industry efficiency

The themes around growing global demand were prominent on the Conference program. The ABC underlined their key pillars and what they see is important in driving demand. Their evolving drivers highlighted were taste, health and wellness, social impact, and environment. Their traditional drivers are trade, place, and convenience.

In correlation with the demand drivers, they're investing in online advertising through paid partnerships with reputable ecommerce businesses that reach millions of people all around the globe. For example, a marketing campaign was commissioned with the Chinese ecommerce company Tmall, which reportedly has 500 million active users each month and represents 58% of ecommerce in China. To accompany these investments, they work with influencers to drive relevancy and desire for almonds directly to the point of sale. This is something as an industry we should explore, given that shopping habits continue to evolve.

Also, leveraging the health and wellness space allows consumers to learn about the certain health attribute's almonds have to offer. With the ABC's extensive research portfolio, this is an area our industry



can leverage from, by collaborating more closely with the ABC to build content we can post to our social media platforms and website.

Learning what the ABC have done to establish their Almond Stewardship Platform was valuable. In terms of driving demand, the ABC invest heavily in building influencer partnerships who specialise in healthy, sustainable living who share the almond nutrition and stewardship story. These influencers help bolster the reputation of almonds. Essentially, they act as a conduit between growers and consumers. They not only make the story easier to interpret but they help build trust amongst the consumers, which can influence purchasing behaviour.

The presentations at the Almond Conference conveyed a sense the uncertainty of what lies ahead for the California almond industry. Many of the challenges faced in 2022, were very similar to those of the Australian almond industry except on a much larger scale. The ABC focus is on implementing strategies that will grow demand for almonds so monitoring these efforts will be highly beneficial.

The recommendations for the Australian industry are:

- Continue diversification into new markets
- Evolve almond relevance with younger consumers
- Establish strategic ways to engage with the retailers
- Outline clear measures/objectives for certain marketing campaigns
- Continue to invest in market research to better understand our emerging and established markets
- Continue to leverage the tariffs imposed by India and China on US almonds

## **10. Other General Observations of US Almond Industry**

### ***US Production***

The subjective forecast for the 2022 California almond production is 2.80 billion pounds (pounds is the traditional measure). This production forecast is 4% below the 2021 production of 2.92 billion pounds. Forecasted yield is 2,040 pounds per acre, 8% lower than the 2021 yield of 2,210 pounds per acre.

The subjective production forecast is based on a survey conducted from April 19 to May 6 from a sample of 500 almond growers.

Like last year, the 2022 almond crop experienced a mostly dry winter. The almond bloom began in early February with favorable weather for pollination. Warm temperatures encouraged a shorter bloom period than has occurred in recent years. The North Region, with an earlier bloom than the Central and South Regions, was hit the hardest by frosts that occurred during late February. Frost damage was severe in some cases with some acres left unharvested due to inadequate nut set.

In addition to variability in expected yields across regions, the impact of the frosts differed by variety, as late-blooming varieties were reported to have fared better than the early flowering varieties. Excellent weather in April helped the crop develop.

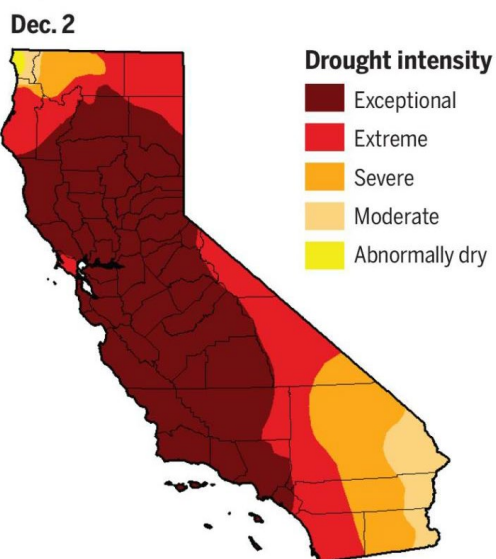
It was reported that despite record-high bearing acreage, the 2022 crop is not expected to be as large as the past two years.

### ***Orchard Planting Trend***

Forecasted bearing acreage for 2022 is a record high of 1,370,000 acres or 554, 419 hectares. Australian planted area is 65,000 hectares. The nurseries visited all reported a slowing of future sales of trees. The growers confirmed there is a definite slowdown in expansion if not a grinding halt to it. They hold severe concerns over what crop to turn to if almond prices do not rebound. It was noted that there is a move towards row crops such as tomatoes given their current high returns. Conversations with growers confirmed many were looking at instigating cost cutting measures with inputs but were trying to get as much “bang for buck” on their production inputs as they can.

### **Water Resources**

At the time the Almond Conference was held from December 6 California was in deep drought and the lack of water was a top concern for almond growers. The map below shows the extent and severity of the drought in early December 2022.



However, record precipitation since Conference has increased the snowpack, dam levels and ground water storages reducing the relevance of the information collected on the study tour. The extremely wet winter has lifted much of California out of drought with the deluges of rain and snowfall wiping out exceptional and extreme drought in California for the first time since 2020.

The storms have caused flooding in the Central Valley with areas that have been drained and used for almond production and other crops over past decades returning to lake and swamp conditions.

The study group noted that despite concerns about overdrawing the aquifers during the drought groundwater metering and reporting was still only undertaken on a voluntary basis. It was further noted that the 2014 Sustainable Groundwater Management Act (SGMA) to bring annual water use in line with aquifer recharge will not be fully implemented until 2040.

### **11. Network Development**

A major output of the study tour was to continue to develop the network with members of the broader Californian almond industry.

#### ***Almond Board of California***

The strong relationship between the Almond Boards of California and Australia has developed to one of trust based on frequent contact and support for initiatives of mutual benefit over many years. The study tours during the past decade have facilitated the relationship and the 2022 visit and attendance at the California Almond Conference further enhanced the connection. This was particularly important after the lull in face to face contact during the pandemic.

The ABC generously arranged presentations in their head office in Modesto on the California groundwater management regulations being implemented, their stewardship program, trade issues, and their research program. The information from these presentations is covered elsewhere in this report.



***The Almond Board of California hosted a meeting of the study group with their staff at their head office in Modesto. The ABA liaises with many of the ABC staff and the gathering provided an opportunity to build relationships with new staff on a face to face basis.***

### ***University of California***

The group spent a day at the Davis campus of the University of California and received presentations from:

- Prof. Alissa Kendall to discuss Carbon emission work in California
- Prof. Daniel Sumner to discuss Californian agriculture challenges
- Prof. Chris Simmons to discuss Work on the assessment of almond orchard performance and soil health following biosolarization using almond residue amendments
- Prof. Bradley Hanson to discuss Herbicide performance and crop safety evaluations in the conventional almond production system
- Assoc. Prof. Amelie Gaudin to discuss Management and benefits of covercrops, and managing soil health targets and potential in almond orchards
- Prof. Maciej Zwieniecki to discuss Interaction of non-structural carbohydrates (NSC) with biotic and abiotic stresses, management practices, and varieties in assessing its impact on yield
- Assoc. Prof. Brian Bailey to discuss Three dimensional modelling of almond orchards, and the Assessment of almond water status using inexpensive thermal imagery

The discussions with the University of California staff have been incorporated into the sections above apart from the presentations by Prof. Zwieniecki and Prof. Bailey.

Prof. Zwieniecki explained that successful yield in orchards is the culmination of a series of events that start with plants entering dormancy with adequate energy reserves known as non-structural carbohydrates (NSC). These NSC are responsible for the maintenance of activities during dormancy and extending onto the period of activeness.

Using multi-year yield information and monthly NSC content in twigs, it was shown that high levels of

carbohydrate in almonds during the winter months are indeed associated with high yield, while high levels of the NSC in late summer often correlate with low yield. An evaluation of monthly NSC level importance on yield revealed that for almonds high levels in February (August in Australia) were a good predictor of yield and that low levels throughout summer were associated with high yield.

The Professor advised that results suggest that NSC levels can serve as good predictors of orchard yield potential and should be monitored to inform orchard management.

The study group noted that this research could explain the issues the Australian industry was having with the Monterey, that was a late crop maturing variety that continued to be active well beyond when other varieties had entered dormancy thereby running down NSC levels going into Winter.

Prof. Brian Bailey's research is interdisciplinary, combining expertise in engineering, computer science, atmospheric science, and biology to study plant systems. His focus is on developing the next generation of plant simulation tools to better understand and represent heterogeneity in plant systems across scales. The work is developing high-resolution, 3D models and measurement techniques that can explicitly represent scales ranging from leaves to canopies.

Prof. Bailey explained with orchard based trials there was an inability to rapidly vary environmental, geographical, and architectural conditions also limits the utility of field experimentation. These challenges can potentially lead to widely used management practices that are primarily based on anecdotal rather than sound observational evidence. The purpose of his project modelling almonds is to develop the next generation of simulation tools based on highly accurate and efficient three-dimensional crop models that can be used to rapidly evaluate proposed orchard design or management strategies in a simulated environment.

It is not expected that the tool will entirely replace field trials, but rather will provide a tool for rapidly evaluating many proposed designs or practices in a simulated environment before investing in a field experiment. The modelling system used is based on the Cronus crop modelling that is unique from other crop modeling system in that it uses detailed, physically based models that can represent individual leaves through whole-canopy-scales. The ABC funded project focuses on extending the system for use in almond crop systems and using the tool to examine interactions between canopy architecture and trade-offs between water use and photosynthetic production.

Additional development of the system is anticipated beyond the scope of the current project is anticipated to add functionality such as sub-models for growth, yield, and disease spread. This would allow the simulation system to be used to address a wide range of questions to support decision-making in almond orchards, ranging from spray application to placement of pollinators.

Prof. Bailey believes that although the results of the project will provide an immediate benefit to growers, but it will also be a starting point for further model development that will have a wide range of future benefits.

### ***Commercial Contacts***

The study tour enabled interaction with many businesses supporting the Californian almond industry during the itinerary visits and at the Conference where over 200 firms had exhibition stands.



**12. California Almond Conference 2022 [Final Printed Program - Digital.pdf \(almonds.com\)](#)**

The Conference was attended by more than 3,500 participants in the almond industry and was held at the Sacramento Convention Centre. 2022 was the 50th consecutive year, almond growers and industry members had gathered to learn the latest research, marketing efforts and regulatory updates.

The Conference was conducted over three days with general sessions focused on grower’s return on investment and driving global demand as well as other sessions reporting on R&D being invested in.

The study tour group planned attendance at the sessions to achieve optimal coverage of the Conference proceedings that ran for more than 15 hours.



### **Day One: Tuesday, December 6**

- *International Horticultural and Global Tree Nut Production Insights*  
In this session, attendees were provided with insights on the way almonds are grown in Australia, Spain, and Portugal, and how growers are tackling challenges. Information was provided on current and future global production as well as what the future may look like for the global industry. The speakers included David Doll of Rota Unica, ABC's Richard Waycott, Brian Ezell of Wonderful, and Damien Houlahan an ABA Director.
- *What's New in Almond Pollination?*  
Growers heard the latest research aimed at keeping the cost and supply of bees stable, such as cold storage of bees. Talks provided the latest information on how growers can protect this investment and get the most out of this input to lay the groundwork for a good harvest. Speakers included Brandon Hopkins from Washington State University, Elina Niño from UC Davis, Rory Crowley of Project Apis m., Miles Daikin of Pollinator Partnership, and Wynter Vaughn of Monarch Joint Venture.
- *Creative Approaches to Managing Limited Water*  
The western U.S. is in another multi-year drought, requiring new creative approaches to secure reliable agricultural water supplies and address business risks. In this session, attendees heard from leaders who have developed ground-breaking approaches to managing water shortages while maintaining economic productivity. Methods included forging difficult agreements, developing regional strategies and incentivizing groundwater recharge. Speakers included David Guy of Northern California Water Association, Stephanie Anagnoson of Madera County, grower Mark Huston, and Daniel Mountjoy of Sustainable Conservation.
- *Almond Food Quality and Safety Resources*  
This session provided an understanding of the food safety and quality resources available to help navigate the complexities across the supply chain. It highlighted both new and existing resources, showcased where and how to access the tools, and provided a preview of the new "Almond University." Speakers included ABC's Tim Birmingham and Guangwei Huang.
- *State of the Industry*  
Due to the ongoing multi-year drought, global logistical challenges and increasing production from other growing regions, the California almond industry is facing unprecedented challenges. During the annual State of the Industry address, the ABC Chair Alexi Rodriguez and CEO Richard Waycott discussed ways the Almond Board of California is working to drive global demand, ensure a favorable trade and regulatory environment, and maximize industry efficiency.

### **Day Two: Wednesday, December 7**

- *Driving Global Demand*  
The building of long-term global demand for California almonds is the top strategic priority for the Almond Board of California. In this session attendees heard how the ABC leverages the nutritional profile of almonds, the "health halo" to drive consumer demand while educating consumers about their responsible farming practices to protect that demand, both now and in the future. Attendees heard from the people representing California almonds around the world.
- *Fertigation When Times Are Tight*  
California and Australian producers face skyrocketing fertiliser prices. In California grower are under continuing regulatory pressures on nitrogen use that has them needing to evaluate their fertilisation plan. This session discussed practical recommendations to equip growers with the knowledge they need to make strategic decisions to maximize profitability. Speakers included Patrick Brown from UC Davis and grower Tommy Bottoms.
- *Irrigation in Stressful Times*  
Increasing water use efficiency is a core tenet of the Californian and Australian almond industries.

Drought and regulatory pressures emphasize the need for continuous improvement with irrigation. At this session, attendees learnt from irrigation experts how sensing technologies and irrigation evaluations can benefit them in getting the most out of every drop. The session concluded with a three industry member panel that shared their experiences and lessons learned from managing limited water supply. Speakers and industry members included Mallika Nocco from UC Davis, ABC's Tom Devol, Kevin Greer of Tehama County RCD, Zac Ellis from Ofi, pomology consultant Wes Asai, and Jeffrey Inigue from Wonderful.

### **Day Three: Thursday, December 8**

- *Managing Input Costs to Increase Return on Investment*

The session noted that with input costs at an all-time high, decisions needed to be made regarding orchard operations to increase the return on investment. This was a breakfast session that reviewed industry experiences on how to manage labour, pesticides, and other input costs. Panel members included ABC's Josette Lewis, Chris Gallo from YARA, Justin Nay from Integral Ag Inc., Lucas Avila from Farmland Management Trust, and Brittney Goodrich of UC ANR.

- *Rootstock Selection to Mitigate Stress in the Long Run*

This session has been included in past Conferences and was included again due to grower requests. The session highlighted that appropriate rootstock selection is an efficient tool to mitigate soil challenges, and replant issues with pests and diseases. The R&D program has supported the evaluation of multiple rootstocks in different California conditions for decades. The latest research results clearly illustrate how rootstock selection impacts yields over the lifespan of an almond orchard and how chemical control can be reduced and made more efficient. Speakers include Katherine Jarvis-Shean, Roger Duncan, Andreas Westphal, Greg Browne, and Cameron Zuber, all of University of California's Division of Agriculture and Natural Resources.

- *Almond Stewardship*

In this session, the ABC introduced CASP 2.0, now called the California Almond Stewardship Platform following its refresh after more than 10 years and 3,000 grower self-assessments. The session advised how the data of participants is protected and leveraged, and what additional stewardship opportunities through incentive funding is available including the role of pollinator habitat in stewardship. Speakers included ABC's Tom Devol and Jesse Roseman, Eric Harris from SureHarvest and Miles Daikin from Pollinator Partnership.

- *Whither Pest Management?*

This session acknowledged that controlling pests keeps getting more complicated as new regulations, pests and techniques all seem to be on the rise. The session explored both the ideas for "Sustainable Pest Management" with current regulatory issues and covered the ABC's research efforts to develop or assess newer technologies for managing key pests. Speakers included Julie Henderson from California DPR, ABC's Jesse Roseman and Jim Adaskaveg and Jocelyn Millar, both of University of California Riverside.

On top of the Conference sessions, the study group had the opportunity to ask one-on-one questions to researchers at the two dedicated poster sessions.

The study tour participants noted that the resources for growers at the ABC stand in the exhibition hall were very impressive with several publications available on a free to grower basis. These publications included:

- Almond Disease and Nutrient Deficiency Identifications cards
- Weed Identification manual
- Pests Identification manual
- General Almond Growing manual
- Almond Rootstocks

The information is valuable to the Australian industry with relevant aspect to be incorporated into the extension program run by the ABA through its grower network and communication platforms.

The study group noted a difference in industry mood from Conferences attended in the past. Sessions were aimed at a “defensive” stance to be taken by growers as a means of surviving the price downturn. Also, noted was the strong push towards identifying “Californian Almonds” in the marketplace over other countries of production, and the fewer sessions on R&D project reporting.

## Outputs

Table 1. Output summary

<p>A monitoring and evaluation plan linked for Hort Innovation objectives.</p>	<p>Ongoing internal by project leader and monitoring by the ABA Board and Committees.</p>	<p>As per Milestone 102, an M and E plan was developed and is being executed.</p>
<p>Study tour delivered to benefit almond industry members in areas of production efficiency, sustainability, pollination, human nutrition, technology developments, market analysis, productive capacity challenges, research co-investment and networking.</p>	<p>Ongoing internal by project leader and monitoring by the ABA Board and Committees.</p>	<p>The above section details the knowledge gained across the broad scope of the study tour. This knowledge has been categorized as per the stated output for dissemination to the industry’s decision makers and broader industry stakeholder community.</p>
<p>Stakeholder engagement/communication plan.</p>	<p>Ongoing internal by project leader and monitoring by the Production Committee that guides the industry’s extension program. Hort Innovation staff also provide project management oversight and guidance.</p>	<p>As per Milestone 102, a stakeholder engagement and communication plan was developed and is being executed.</p>
<p>An evaluation linked to Hort Innovation and industry/fund objectives (Outcome 3. Strategies 1,2, and 3) incorporated into final report.</p>	<p>Ongoing internal by project leader and monitoring by the ABA Board and Committees.</p>	<p>See outcome section below.</p>
<p>A project risk register and how risks will be managed.</p>	<p>Ongoing internal by project leader.</p>	<p>As per Milestone 102, a risk analysis was developed and was executed. The risk of Covid was identified and two members of the study group were impacted on the trip and a further two fell ill following the completion of the itinerary. Their care was well managed, and their recovery has been good. There was little impact on the information gathering and networking aspect of the study tour given the infections</p>



		occurred later in the itinerary.
A final report.	Ongoing internal by project leader. Hort Innovation staff also provide project management oversight and guidance.	This final report completes the project output commitments.

## Outcomes

The Almond Board of Australia study tour of California, including attendance at the 2022 California Almond Conference .

**Table 2. Outcome summary**

Outcomes	Alignment to fund outcome, strategy and KPI	Description	Evidence
<ol style="list-style-type: none"> <li>1. An enhanced Australian almond industry as a result of accessing research findings and knowledge and technologies held by the Californian industry</li> <li>2. An effective Australian almond representation at a key international conference</li> <li>3. Establishment and/or improvement of relationships between Australian delegates and those of the Californian industry</li> <li>4. Enhanced industry awareness of issues and opportunities faced by the international industry and how these are impacting or could impact the Australian almond industry</li> </ol>	<p>Outcome 3, Improved capability, and an innovative culture in the Australian almond industry. Strategy 1: Deliver extension and communication capabilities and business insights to support positive change in the areas of productivity and demand.</p> <p>Strategy 2, Provide opportunities for the required levels of engagement across the almond industry to innovate through trusted relationships.</p> <p>Strategy 3, Strengthen industry skills and leadership through targeted training, leadership development and a career pathway program for the almond industry</p>	<p>The study tour itinerary was fully implemented apart from the visit to Fowler Brother Farming that was cancelled due to their staff being ill.</p>	<p>The Results and Discussion section documents the knowledge gained and recommendations for its use going forward to deliver on these outcomes. Apart from the direct knowledge gained, the insight into the focus areas for their marketing, R&amp;D, and grower return on investment efforts provides value for the Australian industry. The further building of the relationship with the ABC, Californian researchers and commercial contacts will enable further knowledge to be learnt in future. The attendance at the three day Conference facilitated this as did the preconference visits, particularly to the ABC head office in Modesto. The information on the environment confronting the Californian industry is very pertinent to the Australian industry given both the dominance of US product in the global market and the similarity in production systems. The recommendations noted in the Reporting and Discussion section</p>

			<p>reflect how the enhanced awareness can have a positive impact for the Australian industry. The ABA’s grower directors chair the ABA Committees and have played a strong role in preparing the report on the knowledge gained and the action recommendations. They either have or will in future take the reports to their committees and lead the discussions and actions to be taken. In their role on the ABA Board, they will also direct the investment of resources towards utilising the learnings from the study tour.</p>
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## Monitoring and evaluation

Key evaluation questions	Project-specific questions
<b>Effectiveness</b>	
<p>To what extent has the project achieved its expected outcomes?</p>	<p>Has new knowledge been identified and adopted to further develop the Australian almond industry?                      Yes. The knowledge identified in the areas of chemical control of weeds, new plant material, the recycling of orchard trees and other biomass utilization, enhanced pollination with fewer bees, and the learnings from the ABC approach to their sustainability program as one of stewardship are all valuable to the Australian industry and can start to be implemented in the short term. Longer term knowledge will be gained from monitoring the R&amp;D at Davis campus of the University of California and the success of the new marketing strategies of the ABC.</p>
	<p>Has the network of contacts that can assist the Australian almond industry been maintained or expanded?                      Yes. The visit to UC Davis expanded the linkage to researchers undertaking relevant projects to the Australian industry and the opportunity to meet other researchers at the poster sessions at Conference were also beneficial. The meeting with the ABC staff at Modesto was also a valuable opportunity to establish new links and renew established relationships. Similarly, the study tour enabled linkages with those in commercial businesses that support the almond industry in California. Antles and Corigin companies have both expressed an interest in the Australian market that would benefit the industry in the areas of pollination and biomass use.</p>
<b>Relevance</b>	

<p>How relevant was the project to the needs of intended beneficiaries?</p>	<p>The dominance of the Californian industry and their investment in R&amp;D and Market development means collaborative competition is beneficial?</p> <p>The study tour was very relevant as the reports categorized across the main areas dealt with by the ABA Committees and Board attests.</p> <p>Did the study tour identify new knowledge and technologies to further develop the Australian almond industry?</p> <p>Yes, refer to the Results and Discussion section for extensive detail regarding the knowledge and technologies identified.</p>
<p><b>Process Appropriateness</b></p>	
<p>Were engagement processes appropriate to the target audience/s of the project?</p>	<p>How well did the extension activities convey to the broader industry the knowledge and technologies derived from the study tour?</p> <p>This is an ongoing process as per the communication plan, but reports have gone to the Board and Committee meetings of the ABA. The Committees and Board are key groups in the guidance of the almond research program through Hort Innovation under the new Deed arrangement.</p>
<p><b>Efficiency</b></p>	
<p>What efforts were made to improve efficiency?</p>	<p>Were there aspects of the broad extension program undertaken in the project an appropriate use of resources for stakeholder engagement?</p> <p>Yes. The Industry Development staff are fully briefed and are incorporating the knowledge into their best practice advice. The report to the SIAP was planned but cancelled due to illness.</p> <p>How were other ABA initiatives utilised during delivery e.g., AL19001 Liaison with growers, AL19000 ACE orchard; AL18001 Communications; AL16700 Conferences and R&amp;D Forums?</p> <p>As noted above, the Industry Development staff (AL19001) are using the knowledge obtained during the study tour to incorporate into their best practice advice. The communication project (AL18001) has many platforms to disseminate information and already the magazine and regional forums have been used and the final report will be placed on the website once approved. The trialing of new Californian rootstocks and varieties will occur on the ACE orchard (AL19000) if importation into Australia is deemed warranted. Best practices will also be adopted and showcased during field days and visits conducted at the orchard. The OMC shake and catch harvester would be a valuable addition to the orchard’s equipment to suit the research trials aimed at developing an advanced production system. The identification of strong presenters for the Australian Almond Conference (AL16700) was facilitated by the visit to UC Davis, the ABC office, and the Californian Conference.</p>

## Appendices

**Appendix 1 – The Californian Almond Conference 2022 Program**

**Appendix 2 – The “In a Nutshell” article**

## Journey to California invaluable for ABA directors and staff

Ella Hanson  
ABA Sustainability Officer

THE Californian almond industry provides us with a unique opportunity to learn from an industry that faces similar challenges and threats. As a considerably newer and smaller industry, there is a great deal we can learn from our counterparts in California. To gain a better understanding of recent developments in the Californian almond industry, ABA staff and board members travelled to Sacramento to attend the 52nd Annual California Almond Conference in December last year. The last time ABA staff and board members travelled to California was in 2019, before the pandemic. Before heading to Sacramento, the group embarked on a study tour to gain additional insights into new and evolving developments.



ABA staff and board members visited a nursery to learn about new almond varieties during their trip to California.

Continued next page



The group covered a lot of ground in the four days before the conference, from visiting nurseries to machinery companies, meeting with researchers and networking with the Almond Board of California.

On the first day of the tour, the Almond Board of California (ABC) hosted the group for lunch at their office in Madesto and gave presentations on a diverse range of topics including water regulation, sustainability, and nutrition. The ABC's hospitality, generosity, and willingness to work together was greatly appreciated. Learning about new developments that have the potential to benefit growers is a priority for the ABA. The group visited orchard machinery companies, GMC and Flory to inspect orchard equipment and discuss developments in machinery, including GMC's shake and catch machine.

The group also visited Duarte Nursery to learn about new varieties. Vice President of OMC, Brian Anderson kindly arranged for the group to meet with Californian almond grower Sam Nevils. The group gained a lot from hearing

about the issues currently being faced by the Californian almond industry from a grower's perspective. On the final day of the tour, the group visited UC Davis and met with researchers to discuss a range of topics.

Highlights from the day at the University of California included learning about Professor Alissa Kendall's carbon research, discussing cover crops and integrated pest management with Associate Professor Anelise Gaudin and hearing Dr Maciek Zeleniecki's insights on the impact of non-structural carbohydrate concentrations and its potential relationship with dieback observed in Monterey. Another huge benefit of the tour was giving board members and staff a chance to reconnect, after the pandemic. Opportunities to catch up in person have been few and far between in recent years due to covid restrictions.

The study tour was an excellent lead up to the conference and provided ample opportunity to learn about new research and development and to network and make connections.

**The Almond Industry Californian Study Tour 2022 (AL22006)** is a Hort Innovation funded project and enables the Australian almond industry to continue to build on the international network established in recent years with the Californian almond industry that combined with Australia represent 87% of global production. The US industry is the dominant world producer and invests annually \$80 million on research and market development programs. The funding of travel to allow the interaction of Australian industry members with counterparts in the US and with researchers developing knowledge and technologies of interest has been the key to this network development. A final report will be developed to illustrate the benefits to the participants on the trip to the wider Australian almond industry and members.



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This project has been funded by Hort Innovation using the Almond research and development levy and funds from the Australian Government. For more information on the fund and strategic levy, visit [hortinnovation.com.au](http://hortinnovation.com.au)

RESEARCH & EVENTS



## Almond Board of California Conference highlights

**Lou Martin**  
ABA Marketing Officer

The 50th Annual California Almond Conference highlighted the opportunities and challenges faced by the industry in 2022.

While some of the industry's challenges are external - water shortages, supply chain issues, increases in input costs, inflation - some are self-imposed, namely an imbalance in domestic supply and demand.

The Almond Board of California have commissioned a series of initiatives to boost demand, including media and digital advertising campaigns, leveraging influencer partnerships to educate consumers within the e-commerce and gaming world and the sponsorship of events such as Italy's Music Festival San Marino.

In addition to the various sessions, the three-day conference also featured a trade show. This offered an opportunity for people to learn about the different innovations and programs certain agricultural organisations are doing in California and around the globe.

As an industry grows, we thoroughly enjoyed the experience and look forward to capitalising on the many warnings that were taken away.



Leveraging influencer partnerships was one of the topics at the California Almond Conference.



Board member Darren Minter pictured during the trip.



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Board member Neale Bennett



Industry Development Manager Deshae Jaenisch during the conference.



ABA staff and board members visited a number of locations to learn more about the Californian almond industry.

## Media coverage

### In A Nutshell

## Intellectual property

No project IP or commercialisation to report' if there are none to report.