australian almonds

In A Nutshell

The Official Newsletter of the Australian Almond Industry Summer 2020/21

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The Almond Board of Australia is the peak industry body representing the interest of almond growers, processors and marketers in Australia. In a Nutshell is published by the ABA to bring news to all industry contacts and members.

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ALMOND BOARD OF AUSTRALIA

Summer 2020/21

In A Nutshell

The Official Newsletter of the Australian Almond Industry

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From the *Executive*...

Peter Hayes, ABA Chairperson and Ross Skinner, ABA CEO |

At he November Board meeting, the ABA Directors agreed to form a Committee to help develop the Australian Sustainable Almond Program (ASAP) with our Riverina Director, James Callipari, as Chair of the Committee. Such an initiative is important given the increasing interest from customers, consumers and the community regarding good farming practices and use of natural resources.

The ASAP acronym conjures the thought that this is an urgent situation but it is more a case of documenting the practices that already exist in an industry that uses very little chemicals, manages water application with advanced technologies to optimise yield (value) achieved for every litre applied, and produces a crop where there is practically no waste with even visually imperfect almonds being used for almond meal and pastes.

These added value products are being used increasingly in foodstuffs found in supermarket aisles and the alternate dairy product cabinets. The movement away from animal farmed products continues to gain strength and the opportunity for plant-based products in the cheese, yoghurt and icecream categories is gathering momentum. If the uptake is like that for plant-based milks this will be an area of rapid expansion.

The no-waste claim also extends to the use of the hull and shell which is a valuable product for cattle food, compost, and power generation. Other value-added products from this biomass are being researched.

The community is rightly concerned about honeybees and the wonderful job they do pollinating flora, almond trees included. With the increasing acreage of almonds planted in recent years, the demand for well-paid pollination services is also on the up with beekeepers developing more hives and thereby expanding bee populations in Australia. The high quality protein of almond blossom pollen is very good for bees and sets the hive up for their movement into honey production.

The concern about a lack of bees for the 2020 pollination season in almonds, following the terrible bush fires in summer, did not come to pass with mostly strong hives doing their job to produce good potential crops of average to slightly above yields in most producing regions. The growing conditions have been good for both this season's crop and for producing next season's fruiting buds.

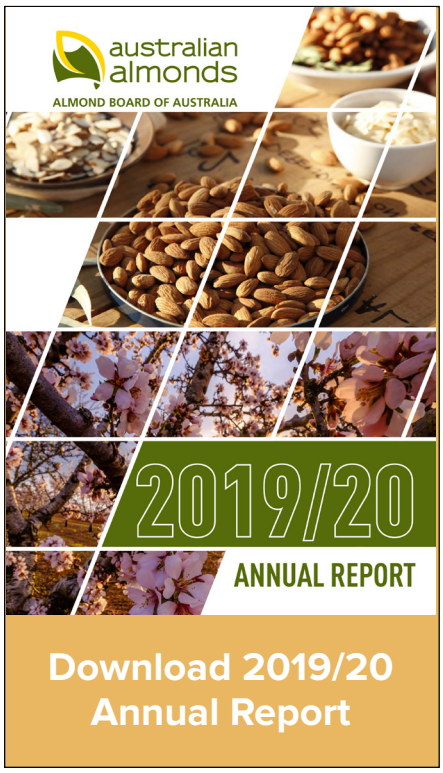
With a good crop developing, many producers are putting in place systems to manage any poor conditions that may be faced before or during harvest. Such management bodes well for the 2021 crop. The large 2020 Californian crop, thought to be around 20 percent larger than that grown in 2019, is selling very well with record shipments month on month helping to clear the crop at an astonishing pace with shipments up 25 percent in their marketing year to date. After a slow start, Australian sales have also picked up and September and October were record shipment months. This is likely to continue with an uplift in inquiries from around the world for our almonds.

The marketer directors on the ABA Board reported that the last time the global prices for almonds were at comparable levels the Australian dollar was at parity or above against the US dollar. Fortunately, the current exchange rate is much weaker providing a better grower return than would be the case if it was at stronger levels.

It was also reported that the lower price structure was creating strong interest from food manufacturers seeking to include almonds as an ingredient in their new products. With around 50 percent of almonds sold into the Australian market used in manufacturing this will further assist domestic sales that are up nearly 7 percent in the marketing year to date compared to 2019.

With Christmas fast approaching, after a year of great disruption to our normal lives, the ABA directors and staff wish everyone a wonderful Christmas and a safe and prosperous 2021.

ABA Annual General Meeting



The ABA held its Annual General Meeting as a virtual event on October 7. The election of directors resulted in Brendan Sidhu (Riverland), Darren Minter (Sunraysia) and Stephen Beckwith (Swan Region) appointed as grower directors and Laurence Van Driel appointed as a marketing director. Nigel Carey was also appointed as a marketing director, to fill the position vacated by Grant Birrell, who retired from the Board after ten years. Grant served as Chair of the Audit Committee and was a member of the Market Development and Almond Centre of Excellence Committees. His contribution to the ABA board and industry is gratefully acknowledged. (Check out page 7 for our "5 minutes with..." article).

The ABA directors and senior staff have undertaken the Australian Institute of Company Directors foundation course delivered over six half day sessions covering governance, finance for directors, and strategy and risk topics. The program was funded in part from a Commonwealth Department of Agriculture grant secured by the Australian Nut Industry Council.

The course, delivered in interesting fashion by highly qualified presenters with strong real world experience to draw upon, was a valuable learning experience that will assist with the aim of continuous improvement of the ABA as the peak industry body representing Australian almonds.

2020/21 ABA Board of Directors

Peter Hayes - Independent Chair
Brendan Sidhu (Riverland Rep)
Darren Minter (Sunraysia Rep)
Nigel Carey (Marketing Rep)
Laurence Van Driel (Marketing Rep)
Stephen Beckwith (Swan Rep)
Tim Jackson (Marketing Rep)
Robert Wheatley (Riverland Rep)
Neale Bennett (Sunraysia Rep)
Damien Houlahan (Marketing Rep)
James Callipari (Riverina Rep)
Peter Cavallaro (Adelaide Rep)

Appointments for 2020/21

ABA appointments for 2020/21 (top L-R): Laurence Van Driel, Darren Minter, Stephen Beckwith. (Bottom L-R) Nigel Carey and Brendan Sidhu.

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5 minutes with... Grant Birrell

IT's been a little while since we've featured a "5 minutes with..." article, so we thought it fitting to catch up with outgoing Board member Grant Birrell, and get some of his insights into his time as a Director of the ABA.

How long have you been a Director for the Almond Board of Australia?

I was afforded 12 enjoyable years with the ABA after being appointed as a marketing member in October 2008. At the time, there were three major processing/marketing organisations for three marketer positions so it wasn't too difficult to get a gig! In my time, I sat on the industry advisory and marketing development committees and chaired the audit committee. I bade farewell to the ABA in October this year.

How did you get in to the almond industry?

After 20 prior years in the seafood industry, I commenced in the role of CEO with Nut Producers Australia (NPA) in January 2007, encompassing sister companies, Riverland Almonds and Australian Pioneer Pistachio Company. This move proved to be a very fortuitous and rewarding decision for me, however, all good things come to an end and I handed over the CEO reins to the very capable Nigel Carey in May 2020. (Nigel was appointed as an ABA marketing director at the AGM in October 2020).

What have been some of the highlights during your time on the Board?

The growth of the almond industry in Australia has been, and still is, amazing with the industry now nearly five times larger than when I started. Underlying this, the industry has a cohesive and collective strength of purpose which I believe is unparalleled. The ABA has played no small part in this resolve, catering for small and large stakeholders for the common good of all. The ABA administers a successful strategic R&D portfolio, and programs such as the CT trials and commercialisation of Australian almond varieties come to mind. The market development of Australian almonds by the ABA, via a voluntary levy basis, has generated successful programs with key aspects of health messaging, educating health professionals, trade shows, export market development and market research to support the production growth. The current pinnacle for the ABA however has to be the development of the Almond Centre for Excellence and Experimental Orchard. For this I congratulate Ross Skinner and Brendan Sidhu for their foresight and endeavours.

On a more personal level, the Murray to Moyne bike ride with the ABA in 2019 was an absolute hoot, raised funds for a paediatric ultrasound probe and promoted eating almonds for heart health.

What have been some of the challenges you (and the Board) have faced? What was the key to overcoming these?

Food safety issues caused by wet harvests in 2010 and more particularly, 2011, led to the introduction of almond pasteurising in Australia with the ABA actively providing industry support through this process.

Challenges with chemical limitations, pollination and water security have been and continue to be at the forefront of ABA dealings at a policy, regulatory and/or political level.

So, what's next?

Fortunately, I have been retained by NPA in a part time project management role to oversee some key developments for the business. Outside of this, I have many personal endeavours underway or in train (suspect the list is bigger than my ability to deliver) when I'm not bike riding or catching up with mates for coffee.

Overview: ABA webinar series

Deidre Jaensch |

Industry Development Manager |

With the disruptions caused by COVID-19, and border closures preventing face-to-face meetings and field days, the ABA has adopted new ways to deliver information to our grower members and stakeholders. A series of webinars were developed to cover a range of topics each with a focus on preparing to deliver a quality product regardless of weather conditions. Webinars featured the latest research, grower experience, commercial and marketing perspectives as well as new technologies.

The five webinar topics delivered in 2020 were:

1. integrated disease management
2. irrigation management
3. integrated pest management
4. sustainable chemical use
5. food quality and safety.

Missed the webinars?

Catch up here.

1 | Integrated Disease Management

Delivered 5 November 2020

TRUNK diseases can be complex and often made up of more than one pathogen. It is important to know what disease you are dealing with to make sure the treatment is appropriate. This webinar provided an update on what diseases are commonly found in almond orchards; how to identify disease-causing pathogens that may be more prevalent in wet seasons; managing the orchard environment to reduce multiplication and spread of diseases; and how chemical control fits into an integrated disease management approach.

Webinar overview:

- **Research update**

Jacky Edwards (Agriculture Victoria): Industry-wide survey findings

Suzanne McKay (SARDI): Anthracnose, an adverse weather disease.

Brittany Oswald (SARDI): Lower Limb Dieback and Phytophthora.

- **Grower perspective**

James Callipari (Wilga Lane Produce): Observations and experiences.

- **Commercial perspective**

Graeme Judd (EE Muir) and Peter Reynolds (Yenda Producers): Crop Protection.

- **Practical solutions**

Brittany Oswald (SARDI): Trunk diseases - what do we know?

Peter Magarey (Magarey Plant Pathology): Almond rust modelling tool.

2 | Irrigation Management

Delivered 12 November 2020

WHILE irrigation management has evolved over time and sophisticated probes and software assists with scheduling, irrigation efficiency still goes back to how well the system is performing. This webinar demonstrates the new online drip irrigation tool for growers to enter their data and compare their performance against industry average; provides tips on maintaining system performance; ideas for retrofitting irrigation systems; and redevelopment consideration to improve system performance.

Webinar overview:

- **Research update**

Mark Skewes (SARDI): Optimisation of your irrigation through system maintenance.

- **Grower perspective**

Paul Martin (Nutwood orchards) and Rob Cox (Amaretto Almonds): Observations and experiences.

- **Practical solutions**

Trevor Sluggett (Nutrien Water) and Peter Henry (Netafim): Taking irrigation design to the next level.

Read more about irrigation management and the NEW online drip irrigation tool on pages 10-11.

3 | Integrated Pest Management

Delivered 19 November 2020

AS an industry we promote an IPM approach and encourage good hygiene practices. But instead of doing more activity this webinar challenges growers to think about what management practices are causing the build-up in mummy nuts and resultant pests numbers in the first place. Also covered is where to look to find pests with new ag tech that helps to find hot spots; some strategies used to prevent the build-up and spread of pests; and how chemical control fits into an integrated pest management approach.

Webinar overview:

- **Research update**

David Madge (Agriculture Victoria): Carob Moth and Carpophilus Beetle identification.

- **Grower perspective**

Jason Robinson and Michael Ward (Select Harvest): Observations and experiences.

- **Commercial perspective**

Greg Davis (Bayer): The functions and requirements of insecticides.

- **Practical solutions**

David Madge (Agriculture Victoria): Risk management of potential pest populations.

- **Commercialisation of past research**

James Underwood (Green Atlas): Mummy nut mapping.

4 | Sustainable Chemical Use

Delivered 1 December 2020

CHEMICAL use is coming under enormous pressure with increased regulatory requirement in overseas markets. The removal of active constituents mean there are fewer chemicals available for use each year. This webinar talks about some of these broader issues surrounding sustainable chemical use; ABA initiatives in response to this situation; other chemical stewardship programs developed to assist growers avoid chemical resistance; making the most of the current toolkit; and making every spray count.

Webinar overview:

- **Global perspective**

Kevin Bodnaruk (AKC Consulting): The international regulatory environment.

- **ABA perspective**

Josh Fielke (Almond Board of Australia): Getting the most out of our chemical toolkit.

- **Market perspective**

Tim Jackson and Russell Wickstein (Almondco Australia): Chemical use and market considerations.

- **Practical solutions**

Katie Asplin (CropLife): CropLife stewardship program.

- **Past research**

Brett Rosenzweig (Rosey Ridge Farms): Revisiting spray efficacy research.

5 | Food Safety and Quality

Delivered 8 December 2020

SINCE the La Niña in 2010, the industry has nearly doubled in size and many of the new entrants have not experienced a wet season. This webinar shares some experiences and describes what to do to be prepared for such a harvest by focusing on reducing the inoculum and reducing moisture levels in the crop and during storage in order to minimise quality issues.

Webinar overview:

- **Market perspective**

Tim Jackson (Almondco Australia): Processing almonds in a wet season.

- **Grower perspective**

ABA Production Committee learnings from previous wet harvests

- **Past research**

Chin Gouk (Agriculture Victoria): Understanding food safety in an adverse season.

- **Practical solutions**

Michael Coates (Plant and Food Research Australia): Current research and moisture management options.

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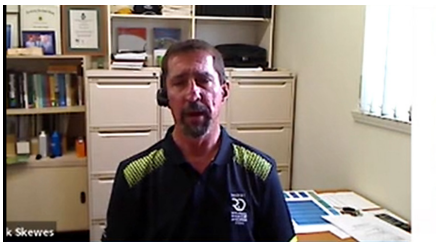
ALMOND BOARD OF AUSTRALIA

Irrigation management best practice

The ABA recently ran a series of webinars which covered a range of topics, each with a focus on preparing for a wet season under La Niña weather systems. Webinars featured the latest research, grower experience, commercial and marketing perspectives as well as new technologies. Below is a summary of the Irrigation Management webinar. A brief summary of all five webinars in the series can be found on pages 8-9.



Paul Martin (pictured top left) started life on the family farm in Willunga, South Australia moving to Lindsay Point in 1973 to establish an almond planting in partnership with his brother, Tom. His irrigation knowledge has evolved with the technologies-of-the-day: from overhead sprinklers, to under tree sprinklers, to buried drip, to the above ground drip systems in place today.

Still fresh in Paul's mind is the advice given to him by Donald Rough (previous Farm Advisor, University of California), during his visits to Australia in the late 1970s and early 80s, that "nothing can replace the shadow of the owner in the orchard". Paul says whether a corporate operation or a family farm, one of the most important things about irrigation management is to make sure that someone is doing daily checks from the start of spring to the end of harvest.

"Make sure that 'what should' be happening is actually 'what is' happening".

"We have technologies these days which makes it easier but you still need to get out and dig a hole every now and again, making sure lines are flushed and checking that repairs are keeping up with the damage caused by foxes, (kanga)roos and machinery."

Almond industry developments have led the way with state-of-the-art irrigation technologies. Now though, the opportunity to find additional on-farm water savings becomes increasingly challenging. The ABA Irrigation Management webinar highlighted that even with all the best technologies it comes back to the simple things, such as daily checks and regular maintenance, that makes sure the system is performing at its best.

Mark Skewes (South Australian Research and Development Institute, pictured bottom left) presented the results of an industry-wide irrigation audit (AL17004) measuring irrigation system performance of 50 properties across four almond growing regions. The audit identified that most systems are performing well (above 90 percent coefficient of uniformity) but there was a wide range in flow variation within valve units which may have been due to blockages in

Compare your irrigation system's performance against the industry average!

Use the online drip irrigation evaluation tool

Access a data collection sheet to work out where to look for problem areas.

individual emitters. Not surprisingly, system performance deteriorated with increasing age, but some older systems still performed within the design specifications (+/-5 percent) and in some cases performed better than new systems. By comparing maintenance schedules against system performance, Mark was able to demonstrate that flushing frequency was a key factor influencing drip system performance, regardless of age. Flushing frequency depended on water quality and in general, higher flushing frequencies had better results.

best options for each property. More information on system drainage can be found here.

Trevor Sluggett, an experienced irrigation agronomist (Nutrien), shared his advice for new and redevelopment situations, stressing that a lot of irrigation management issues can be avoided from the start with good land preparation and good irrigation design. Some of the essential things to consider during planning so that irrigation systems perform at their best include: design to the contours, separate soil types and depth,

FInally, Rob Cox (Amaretto Orchards) has been managing irrigated properties in Mallee sand dunes for over ten years and believes things have come a long way in that time. It wasn't until he did a systems check across the property, and fixed the problems, that he was able to achieve better irrigation efficiencies. Placing one bucket at every fourth tree and collecting drainage water for a two-hour period after the system was turned off helped to realise where the problem areas were and work out what needed to be done.

"Nothing can replace the shadow of the owner in the orchard"

System drainage was another key focus of the webinar, the cause of many wet patches in undulating landscapes. Peter Henry (Netafim) explained that at the end of a shift, water in the irrigation system can drain out and pool in low lying areas. Systems with large diameter submains hold more water than small diameter submains with volumes exceeding 1,000L for 50m of 150mm pipeline. It's not always easy to fix an existing system and while system drainage cannot be completely eliminated, Peter outlined a number of retro-fit options to help minimise drainage that can range from simple solutions to significant system re-design. Examples included: non-leakage drip tube and valves, sustaining (slave) valve on downhill submains, non-return valves on uphill submains and removing flush submains in high areas. However, the more equipment needed, the more costly the exercise will be requiring ongoing maintenance. Professional advice should be sought for the

leave out areas unsuitable for almonds and be generous with soil improvement especially deep ripping of compaction layers and soil ameliorants.

Trevor encouraged growers to tell the irrigation designer everything! By understanding how many varieties and how the orchard is going to be managed, a good irrigation designer can plan a wholistic system that fits in with what the grower wants to achieve. But beware, cheap irrigation design options are not always in the grower's best interest . Some irrigation designers, even certified ones, may not fully understand system drainage. Trevor recommended growers pay for their irrigation design separate to the installation, and always seek a second opinion. Simple design features such as smaller valve units, submains and run lengths and locating valves at the bottom of the hill will limit the amount of system drainage and reduce the need for expensive drainage equipment.

"Blocking off some emitters in the gullies has helped improve the evenness of maturity and efficiencies with harvesting across the whole block and achieving more production out of that orchard at the same time."

Robert's advice to fellow growers is that "system maintenance is king".

"We have a schedule of flushing every four to six weeks because we can see the benefits of consistency in doing this".

"As Paul mentioned earlier, the shadow of the manager out in the orchard continually looking at the real-time problems and coming up with solutions will benefit the system you are working with."

The ABA webinar recording also includes information and discussions about chemical treatments to remove organic and inorganic build-up in pipelines.

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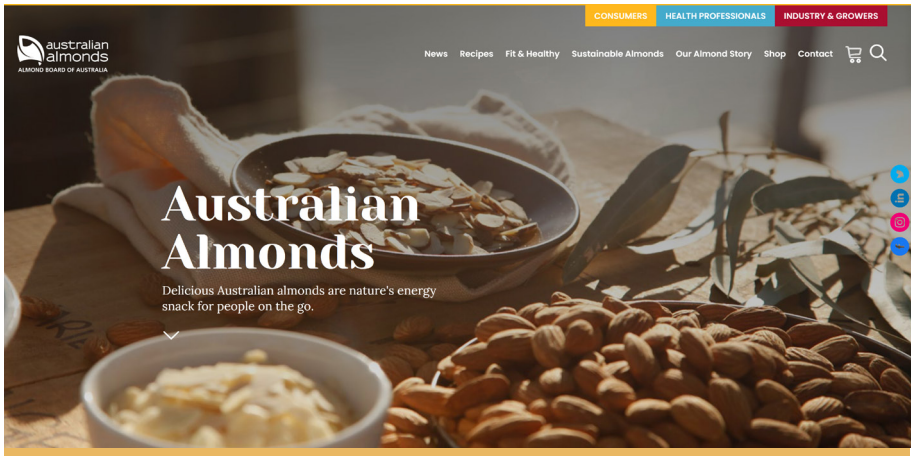
Marketing update

Joseph Ebbage | **Industry Market Development Manager**

Lou Martin | **ABA Marketing Officer**



NEW LOOK website

THE Almond Board of Australia (ABA) invites all industry members and growers, health professionals and consumers to explore the new Almond Board of Australia website, https://australianalmonds.com.au/

Over the last three months the ABA have developed a new structure, with the intent to produce a website for industry and growers, health professionals and consumers that is clean, sophisticated and provides timely information. This website redesign guides each user to the information they're seeking and entices them to dig deeper. We wanted to create an experience that engages all users whilst ensuring it is easy to navigate.

Our industry and grower webpage was a huge focus in the planning and redevelopment process of our website. We wanted to ensure the ABA best serves the industry by providing growers with insightful resources to produce almonds in better, safer, and healthier ways. It brings together knowledge and technologies from research and grower innovations and provides resources describing better production practices to enhance Australian almond production.

We have also included a section on the ASAP (Australian Sustainable Almond Program). As this continues to be a major focus within the almond industry, we understand the importance of communicating our framework and what we are doing as an industry to create a more sustainable future.

One of the core roles of the ABA is to provide a channel for communication and dissemination of information between members of the industry and other sectors of the horticultural community. We believe this new website will be a useful information hub and you can make good use of the various resources and tools that are available.

Australian Almonds Trade Seminar to India Webinar

ON 26 November 2020, the Almond Board of Australia and the Australian Trade and Investment Commission (Austrade) hosted an industry webinar for our Indian customers.

In 2019 the ABA Chair, Neale Bennett, and Australian almond marketers travelled to India for a networking function. However, due to travel restrictions this year the event was held online.

Highlights included presentations by the ABA and from Deputy Australian High Commissioner to India, Rod Hilton, Global Victoria Commissioner, Michelle Wade, and the Australian Test Cricket Captain, Tim Paine.

All the presentations were very insightful, and we even learnt that Tim Paine enjoys almond milk in his daily coffee. We all came together to celebrate the shared love for cricket and almonds. We look forward to travelling to India in the future to again hold this function face to face.

Preparing for adverse seasons

Contributors: Dr Michael Coates[1], Deidre Jaensch[2], Josh Fielke[2] |

[1]Plant and Food Research Australia
[2]Almond Board of Australia |

The last time Australia experienced a La Niña event was between 2010 and 2012 resulting in one of our wettest two-year periods on record according to the BOM. This was a challenging period for Australian almond growers who have adopted better ways to manage moisture content.

Developments include different land practices and adoption of mechanical drying technologies. Dedicated drying areas allow plenty of space to spread-out fruit for better air circulation and permanent structures are being used to store almonds on-farm. Methods of conditioning have been trialled in aerated stockpiles and sheds, along with drying tunnels used successfully in the dried fruit industry. Several huller and shelling companies have invested in continuous flow dryers. Growers must also play their part to manage moisture prior to delivery. Growers need their fruit to be at the recommended six percent moisture to avoid processing delays and possible quality downgrade penalties.

While a small amount of rain may be beneficial, providing weight to aid fruit shake, heavy rain, or rain at the wrong time, can increase the harvest effort and potentially extend the harvest period.

Rain at harvest can create pest and disease pressure. Fruit that remains moist may affect the texture and flavour of the kernel so it's paramount to remove moisture quickly. Ample air flow is the key to achieving this. After a rainstorm, orchards have high levels of relative humidity so there is very little moisture carrying capacity in the air. Ideally, Mother Nature will provide some wind to help move the moist air within the orchard and accelerate the drying process.

After a rain event, nuts on the tree will generally dry faster than anywhere else. If the four-day weather forecast indicates a lack of wind the following strategies may assist the drying process:

- utilising frost fans to displace moist air
- run spray unit blowers down rows at low speed to avoid dislodging fruit
- if the ground is dry enough consider shaking and finish-drying fruit.

Most growers avoid shaking too far ahead of pickup and only shake if they are confident the fruit can be picked up before predicted rain. If fruit is on the ground rotating with a ‘de-sticker’ or just picking it up and dropping it off the back of the ‘pickup’ may assist drying. Growers have manufactured simple carts to catch fruit coming out of the pickup so they can lay down a new orderly windrow. Ideally you want to get the fruit out of the orchard as quickly as possible.

Australian orchards generally have land reserved and maintained for local drying and stockpiling. This has led to different types of drying technologies being adopted including:

- Moving the windrows out of the orchard to an open field or along internal roadsides that have more exposure to wind and sun. Be aware that surface temperatures under constant sun can pass 60 degrees Celsius and while these high temperatures may lead to concealed damage if kernel moisture is high, the options are limited if fruit is wet.
- Continuous-flow dryers can dry the equivalent of a B-double truckload (about 18 tonnes) in 45 minutes bringing the hull moisture down by four percent. This has little to no immediate effect on kernel moisture but the hull will work as a desiccant drawing moisture away from the kernel.

Batch drying is still in its infancy and is the focus of current research by Plant and Food Australia.

- While not 'on farm', commercial silo drying had a successful trial in the Riverina drying multiple batches of up to 300 tonnes of fruit over five to seven days. There are limited facilities currently providing this service.
- Stockpile drying has had some success with the most promising results occurring this last season (2020) drying two B-double truck's worth of fruit under a 24-hour period.
- Batch conditioning uses smaller fans but can push the drying process out to more than 10 days as the reduced airflow slows down the drying process.

Airflow used to dry fruit (i.e. bring the moisture content of the kernel down by 10-15 percent to equilibrium) is much faster than airflow used to condition fruit (i.e. bring the moisture content of the kernel up or down by 2 percent from equilibrium). Faster airflow is necessary because the air temperature drops as air takes up the moisture. If the air lingers too long it cools the fruit and slows down the drying rate. This not only creates a cool humid environment ideal for mould development, but it can add weeks to the drying process. How much air is necessary is the subject of the current research projects, but if you are considering buying a fan, the industry trend is no smaller than 30kw.

Like an old sponge, dry hulls are partially hydrophobic and take a while to re-absorb water. This means rain falling on uncovered stockpiles will run through the fruit and pool at the bottom of the pile. Good site preparation and stockpile management will help to maintain optimum moisture levels during onsite storage:

- Cover stockpiles with a tarp to prevent rewetting.
- Level ground to avoid depressions that allows water to pool.
- Utilise sloped ground or build surface drains to direct surface water away from the stockpile.
- Clean up surface debris and weed growth.
- Position the long-side to run north-south for better light interception. However, some later season drying (April) may have better drying results with east-west stockpile.
- Maintain internal roads allowing all weather access to orchards, drying and stockpile areas.
- Ideally a covered shed would allow stockpile protection during harvest alternating as storage for equipment during the off season, but this is not always possible.

The industry has managed the challenges of previous adverse seasons and developed orchard practices, machinery to proactively cope with rain events during harvest and adopted mechanical drying technologies. These practices are now standard practice, especially in the Riverina where summer rain events are more common. With these new pratices and technology, growers are prepared for poor harvest conditions to occur.

Growth habits of new *Australian* almond cultivars in advanced production systems

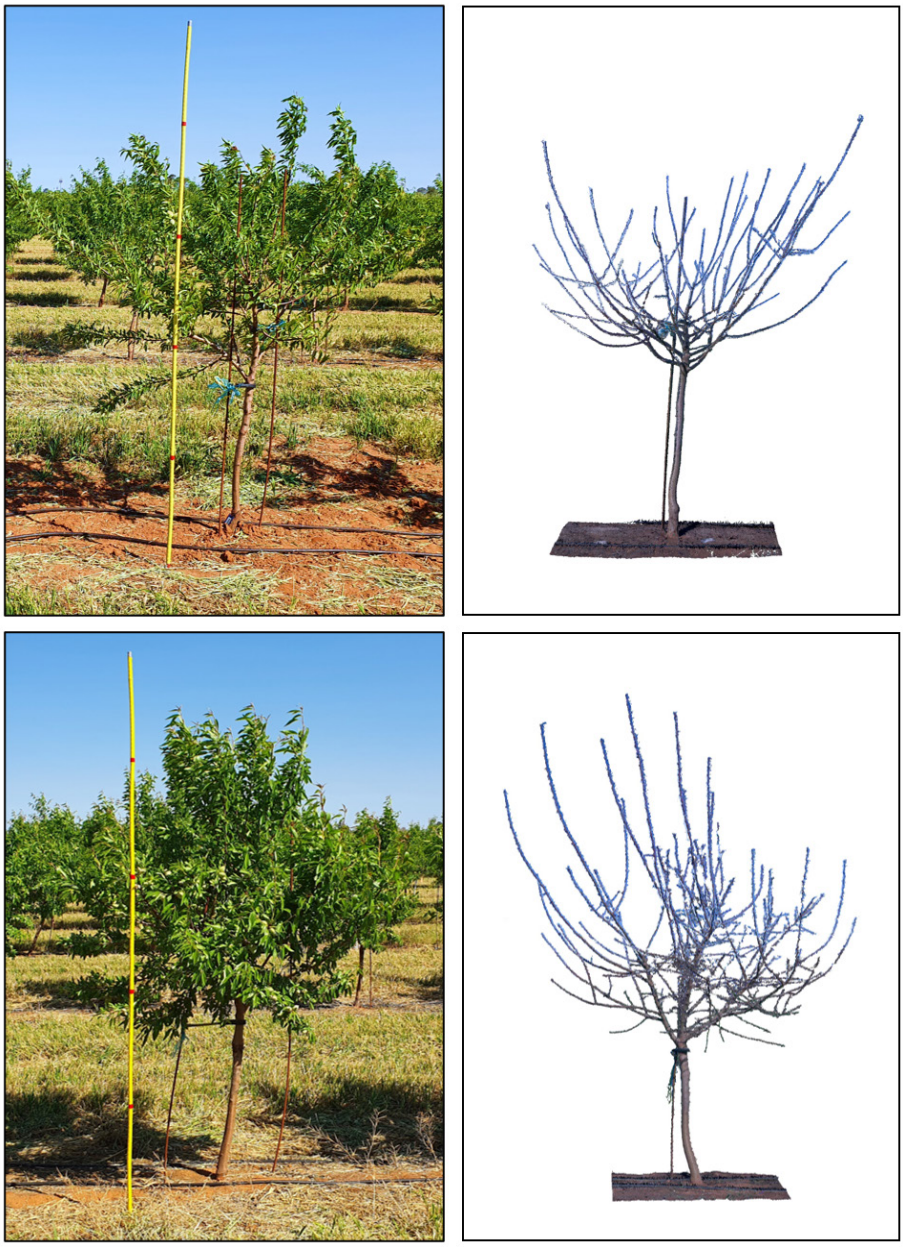


Figure 1: Images (left) of Carina trees on Rootpac20 (top) and Nemaguard (bottom) planted 2 m apart in spring. The yellow rod is marked at 0.5 m intervals and provides an indication of the trees' relative canopy dimensions. Creating 3D LiDAR point clouds of trees in winter without leaf cover (right) allows the characterisation of tree architecture.

Zelmari Coetzee and Michael Treeby |

Agriculture Victoria Research |

Agriculture Victoria Research (AVR) is investigating the growth habits of some of the new Australian almond cultivars developed by the University of Adelaide. The work is part of a program to develop more intensive production systems for Australian almond producers. The question being asked is: how do these cultivars selected for use in low density plantings fill out the tree row when planted closer together? How that space is filled out is important because productivity is closely related to how much light penetrates the canopy to promote spur fertility and longevity.

Tree architecture will determine the density of the canopy and the amount of light that will reach the lower and internal regions of the trees. The cultivars' natural tree architecture (the degree of branching and whether the branches grow upwards or weep), and the potential for different rootstocks to modulate that tendency subsequently becomes a critical issue. The situation becomes more complex as trees are planted closer together, e.g. 1 m, and other branch orientation patterns are included. For example, a weeping cultivar like Vela might be expected to increase the shading of limbs on adjacent trees, but depending on the leaf cover, light penetration into the middle of the canopy might be adequate. Currently a full understanding of the amount and type of light needed for spur longevity and floral bud initiation is still lacking, as well as the exact period when floral bud initiation occurs.

Describing tree architecture in anything other than qualitative terms (e.g. upright versus weeping etc.) is difficult, but technologies have been developed that make it easier than it was in the past. High-resolution terrestrial LiDAR (Light Detection and Ranging) can produce highly accurate 3D point clouds of objects by illuminating complex targets, such as trees, with timed bursts of laser light. The timing of the return signal is proportional to where in space, relative to the laser source and sensor, the surface that reflected that light is. By illuminating trees from multiple perspectives, point clouds are compiled that allow 3D representations of the target. The renderings of the architectural features of trees in winter (Figure 1) allow the characterisation of their natural branching habits, their tendency to throw lateral shoots and the orientation of branches or shoots, which in turn allows us to simulate how the tree will fill the space as trees mature. Preliminary work shows that LiDAR images collected in summer can further be used to model what the likely light receipts in the different parts of the canopy might be.

The planting being used was established in 2018 on AVR's Mildura SmartFarm in north west Victoria. The planting consists of Vela, Carina and Almond 12, which are all self-fertile, budded on industry standard rootstocks (Nemaguard or Garnem) and two size-reducing rootstocks (Rootpac20 or Rootpac40). Within-row tree spacings range from 4 m - more or less current industry standard - to 1 m, which is considered ultra-high density.

Figure 1 shows examples of the point clouds created with LiDAR in winter for Carina on two different rootstocks. The differences in canopy density between trees on Rootpac20 and Nemaguard is clear and is emphasised by the gaps in the trees' shadows. From the LiDAR images we can infer that the differences in density can be attributed to Rootpac20 limiting lateral branching in the scion compared to Nemaguard. LiDAR images collected this coming winter will allow us to determine the degree of branching over seasons and where new growth occurs, which in turn will allow us to predict what the trees will look like as they mature.

Acknowledgement

The plantings have been established as part of project ST16001; a co-investment between the Victorian Government and the Federal Department of Agriculture, Water and the Environment through the Rural Research and Development for Profit program. The Commonwealth funds are managed by Horticulture Innovation Limited. The initial light interception methodology development was conducted with support from the Victorian Government's Agriculture Infrastructure and Jobs Fund.

Influence of nitrogen and irrigation on *hull rot*

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Almond fruit is infected by the fungus *Rhizopus stolonifer* at hull split, causing the hull to rot. Spur death and twig dieback occur as a result of acid metabolites produced by the fungus, causing reduced yield in the following season.

Figure 1: Leaf, spur and twig dieback of hull rot infected shoots (hull strikes).

	% Irrigation (W)	
% N	70	100
56	-W-N	+W-N
100	-W+N	+W+N

Table 1: Irrigation and nitrogen fertiliser treatment combinations and codes.

Infected nuts with associated death of leaves and spur/s are known as hull rot strikes (Figure 1), and rain events close to harvest are known to induce strikes.

Hull rot has the reputation of being a 'good grower disease' as it is reportedly more severe when almonds are grown under optimum conditions. Restricting water and nitrogen has been demonstrated to reduce the incidence and severity of hull rot in trials conducted in California (Goldhamer and Viveros 2000, Teviotdale et al. 2001, Saa et al. 2016).

As part of project AL14005 "Identifying factors that influence spur productivity in almonds", an experimental trial site was set up to investigate the effects of sustained deficit irrigation and reduced nitrogen on spur productivity. With infrastructure and treatments already in place, the opportunity was taken to utilise the trial site to investigate hull rot disease development across two seasons under varying nitrogen and irrigation management practices in varieties Nonpareil and Carmel. Commercial practice for the major mineral elements N:P:K 320:40:400 with irrigation at 100 percent ETc was the control. Restricted nitrogen treatments received 56 percent of the standard amount of nitrogen (N:P:K 180:40:400), and restricted irrigation treatments received 70 percent ETc applied throughout the growing season as a sustained deficit (Table 1).

Hull rot disease assessment

Hull rot severity was assessed prior to harvest by a visual assessment of the number of hull rot strikes per tree for both Nonpareil and Carmel in 2019 and 2020. Timing was based on fruit maturation for each treatment and variety, with assessment for each taking place as close to commercial harvest as possible. During 2019 harvest, seasonal rain events occurred in late March which resulted in increased disease severity in Carmel (late ripening) compared to Nonpareil (early ripening). Sustained deficit irrigation (SDI) significantly reduced hull rot severity in Carmel while nitrogen had no apparent effect (Figure 2). Hull rot severity was significantly lower in Nonpareil ($p<0.001$) as it was harvested prior to the late March rain events, and neither SDI or nitrogen had an effect.

In 2020, Nonpareil showed a significant decrease ($p<0.001$) in disease severity in the SDI treatments compared to the control. In Carmel, the number of hull rot strikes followed a similar trend to 2019, with a decrease in disease severity under the SDI treatments. However, this year these differences were not significant.

Statistical analysis between years showed that there was a significant

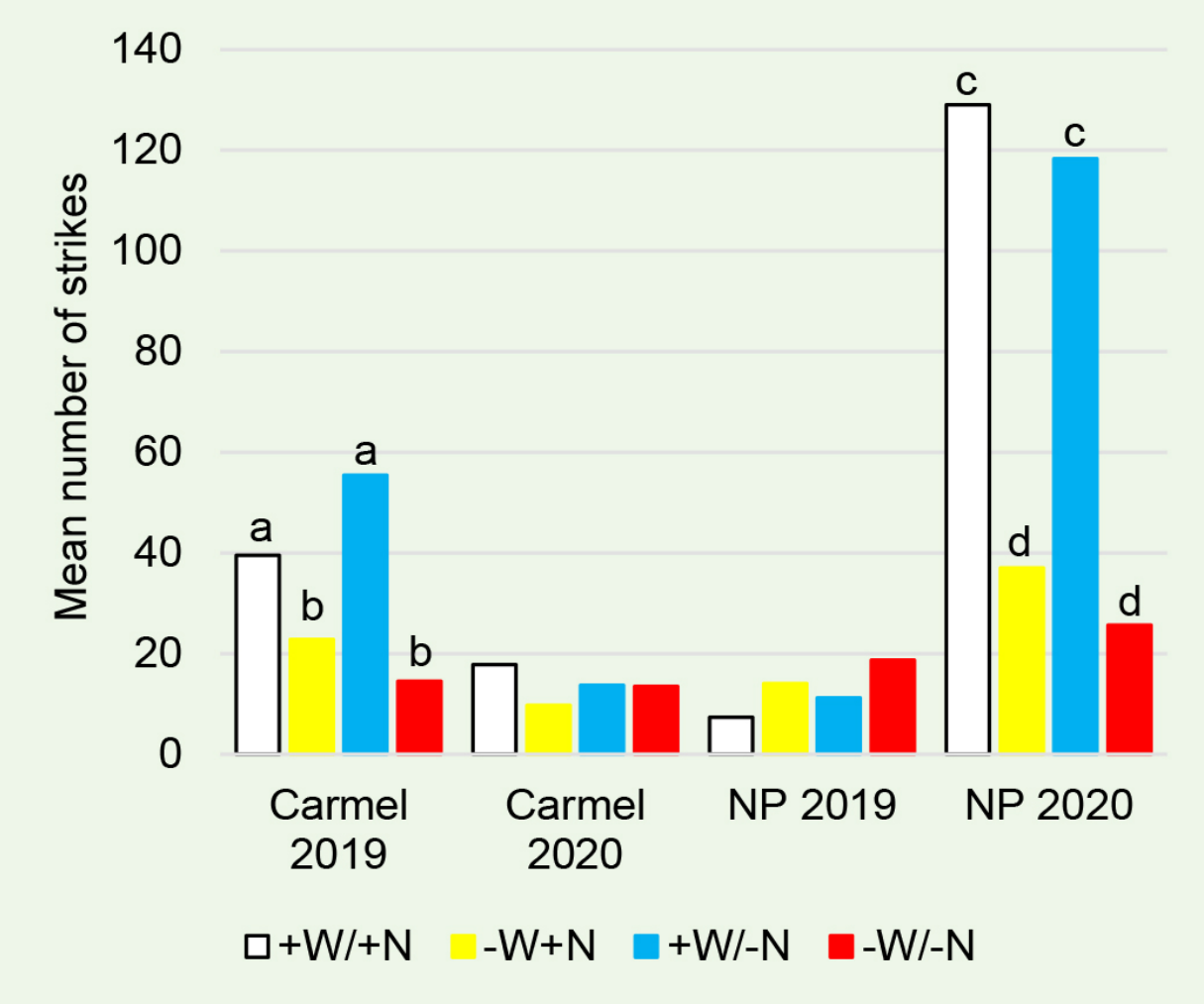

Figure 2 2019 and 2020 number of hull rot strikes/tree by variety under four treatments: control irrigation (+W), restricted irrigation (-W), control nitrogen (+N) and restricted nitrogen (-N). Letters above columns within each cultivar year indicate significant differences between mean number of strikes.

difference ($p<0.001$) between the degree of disease severity in 2019 compared to 2020. These results indicate that although irrigation management can influence disease expression, seasonal variation also plays a part. However, when disease severity was high in the control treatment (i.e. 2019 for Carmel and 2020 for Nonpareil), the sustained deficit treatments resulted in significantly less disease, indicating that when seasonal conditions are favourable for disease, restricted irrigation does reduce hull rot.
The effects of restricting nitrogen were less apparent. Under high disease conditions (Carmel 2019 and Nonpareil 2020), restricting nitrogen in combination with SDI further decreased disease severity, however, the reduction was not significant.

Hull rot twig dieback of infected shoots

In addition to disease severity assessments, infected shoots were monitored into the following growing season to determine whether nitrogen and/or irrigation affected the degree of dieback associated with infection. Infected shoots were tagged during hull split on both Nonpareil and Carmel across the four treatments and revisited during the following spring to determine the amount of shoot still alive.
Dieback per shoot was not found to be related to irrigation, nitrogen or cultivar, but did correlate with the diameter of the shoot at the point of attachment of the infected nut. Thicker shoots with diameters greater than 6 mm showed little to no dieback. Thinner shoots were affected by dieback, with many completely killed (Figure 3, following page). This suggests that thicker shoots have a higher tolerance for the acid metabolites produced by *Rhizopus*.

Outcomes

Trial results indicate that deficit irrigation has the potential to be an effective management strategy for hull rot during seasons of high disease pressure. However, the relationship between nitrogen and hull rot is not as clear. Extending on this current work, as part of the AL16005 project, a PhD study is examining in detail the effect of nitrogen and SDI on hull composition and how these changes influence *Rhizopus stolonifer* metabolite production.

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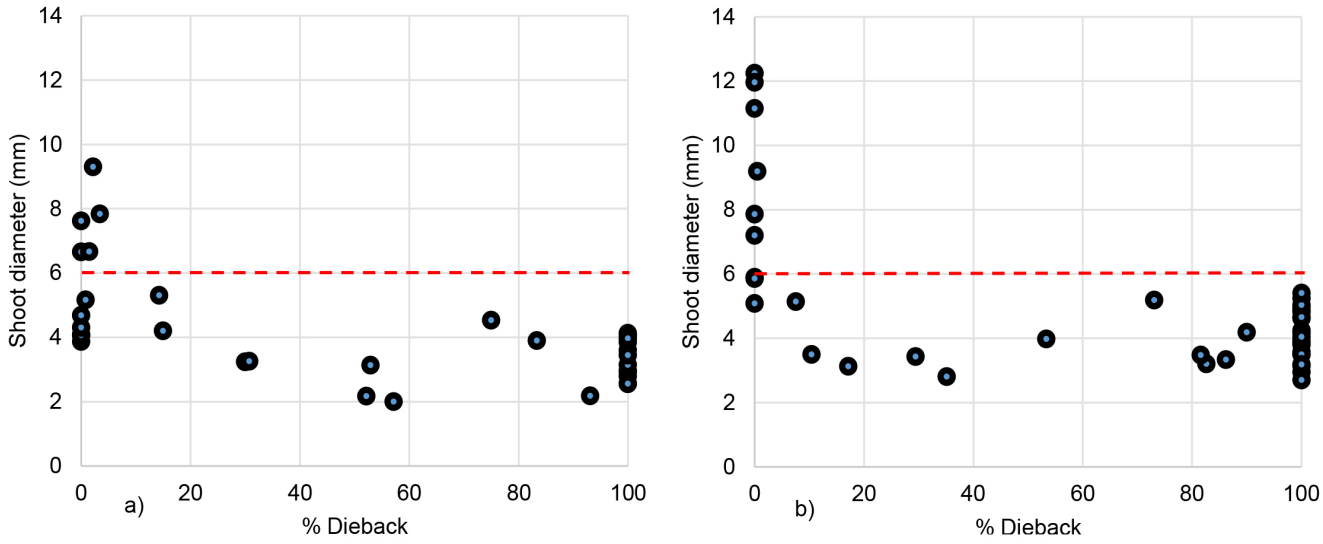

Figure 3: The relationship between % shoot dieback and shoot diameter at the point of infected nut attachment for a) Nonpareil and b) Carmel. Dotted line indicates shoot diameter threshold at which little to no dieback occurs.

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Click here for further information about the "Integrated disease management program for the Australian almond industry (AL16005)" project led by Agriculture Victoria or contact jacky.edwards@agriculture.vic.gov.

Acknowledgements

The team would like to thank CMV for providing and managing the trial site within one of their orchards.

Hort Innovation Strategic levy investment | ALMOND FUND

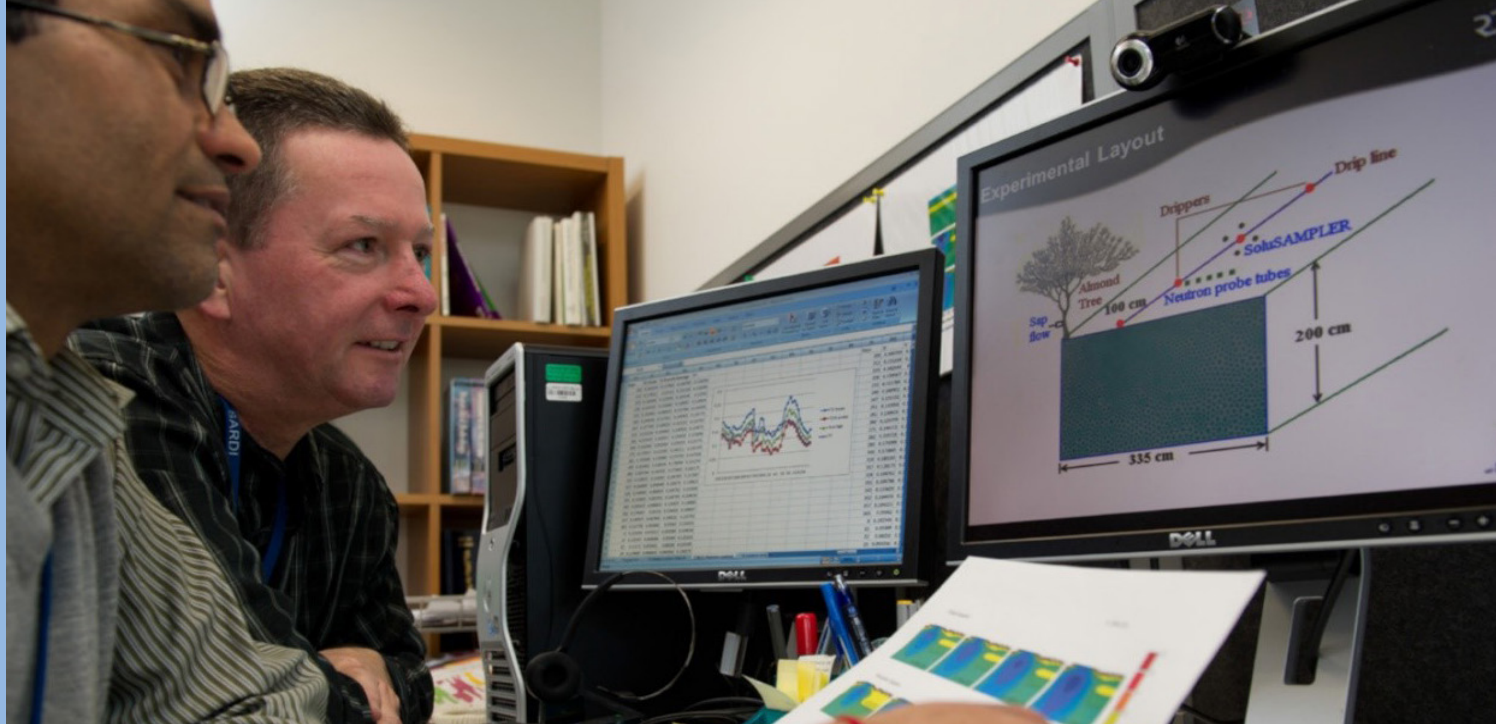

Figure 1. SARDI computer modelling for evaluating production systems.

Computer models add value to almond field trials

Vinod Phogat and Tim Pitt |

The Department of Primary Industries and Regions research division, South Australian Research and Development Institute (SARDI) |

SARDI have developed computer models that simulate irrigation, fertigation and climate scenarios suited to almond production systems. These models predict management impacts such as tree spacing or irrigation methods on plant water use, soil water movement and nutrient/salt dynamics. Validating models against the young, real world, plantings located at the Almond Centre of Excellence (ACE) orchard means that SARDI and the Australian almond industry are well placed to optimise learnings from their large-scale field trials.

To date, SARDI have applied the HYDRUS modelling platform to two of their field trials:

- Drip versus sprinkler Trial - planted in 2018 at traditional (H1) density
- Optimised density Trial - planted in 2018 at densities ranging from traditional (H1) to high (H2)

Models were calibrated during the 2019/20 (second leaf) season and are currently being validated through the 2020/21 (third leaf) season.
In the Drip versus Sprinkler Trial, second leaf water balance comparisons estimated that young almonds irrigated by drip transpired 60 percent of the water applied while those irrigated by sprinkler transpired less than 50

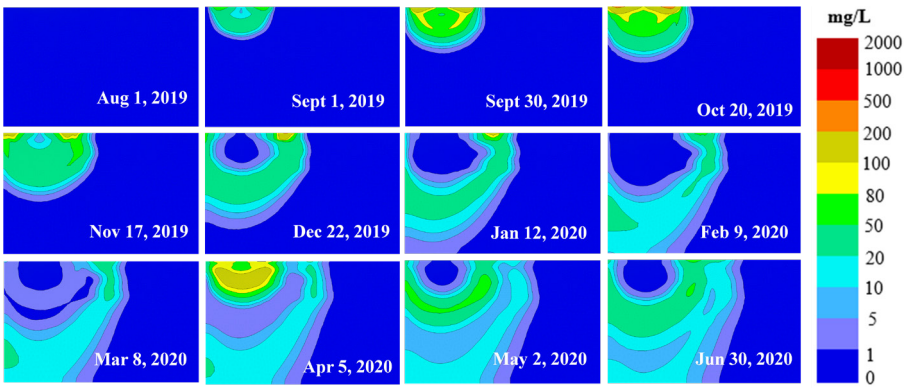

Figure 2. HYDRUS-2D simulated seasonal nitrate, NO3-N (mg/L) distribution in the soil under second leaf, drip fertigated almond planted at 6.5 x 5.0 m density (Horizon 1). Modelling domain = 3.25 x 2 m.

percent. A significant portion of the water applied by sprinkler was transpired by cover crop. In both the drip and sprinkler systems, evaporation losses accounted for more than 16 percent of water applied while drainage losses, exceeding 30 percent, accounted for the balance of water applied. These high drainage losses suggest an opportunity for improved irrigation scheduling for the young trees.

In the H1-H2 Optimised Density Trial, second leaf water balance components varied little between trees planted at different densities. This was because the second leaf trees were still small, and their canopy size and root distribution were not yet being constrained by the neighbouring trees, even at the higher planting densities. Transpiration ranged from 44-45 percent, evaporation ranged from 31-33 percent and drainage ranged from 28-36 percent of applied water. As trees continue to grow, and with continued plant, soil and water monitoring, the benefits and challenges of different planting densities are likely to become more apparent.

For both modelled systems, the predicted soil electrical conductivity (EC or salinity) remained below crop threshold values apart from some elevated readings in October 2020 associated with nutrient spikes. Early model simulations suggested that Nitrate leaching accounted for less than 9 percent of the applied nitrogen, but that more than a quarter of N application remained in the soil profile at the end of the growing season, leaving it susceptible to leaching through the following winter (Figure 2). The overabundance of nitrate (NO3-N) on the lateral margins of the drip-wetting front during critical growth stages may also increase the risk of pest and disease issues such as Carpophilus and Hull Rot. Continued monitoring of field samples through the 2020/21 season will assist in validating the model for rootzone salinity and nitrate dynamics to enable development of management strategies.

Once validated, against the current season's field trial metrics, the models will be able to run a wide range of hypothetical scenarios and predict the response for trees grown under ACE, or similar, production conditions. These tools will contribute to questions around resource use efficiency as influenced by alternate varieties and rootstocks, novel production systems and hypothetical climate scenarios.

For more information , please contact Vinod Phogat
vinod.phogat@sa.gov.au

Government of South Australia
Department of Primary Industries and Regions

SARDI
SOUTH AUSTRALIAN RESEARCH AND DEVELOPMENT INSTITUTE

Foamy canker update

Brittany Oswald[1], Suzanne McKay[1], Jacky Edwards[2] and Mark Sosnowski[1]

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Foamy canker has been reported in Californian almonds since 1974 (Strand and Ohlendorf, 2002) and has recently been observed in commercial almond orchards in the Riverland and Adelaide Plains of South Australia. Anecdotally, foamy canker has been present in Australia since at least 2015 (M. Ward 2020, pers. comm.). Some growers have voiced concerns over the past few years as the number of reported cases has increased. In 2018-19 there were two reports of foamy canker from properties in the Riverland and during 2019-20 there were five separate reports in the Adelaide Plains, Riverland and Riverina. Although it is theorised that foamy canker is caused by a bacterium, the specific causal agent(s) or factors are still unknown (Doll, 2009, Strand and Ohlendorf, 2002).

Figure 1. Foamy canker with watery orange sap exuding from cracks draining down the scaffolds and trunk of an affected almond tree.

Figure 2. Trees with foamy canker symptoms. A. Foamy canker on the scaffolds of a young tree. B. Foam and dripping sap on a scaffold. C. Bark peeled back to show staining and dead woody tissue.

Background information

Since the causal agent(s) are unknown, there is no information on how foamy canker spreads, whether there is an associated infectious agent or if it is a physiological condition (Doll, 2009, Strand and Ohlendorf, 2002). Foamy canker will most often affect only a few trees scattered throughout an orchard, and is more commonly observed in plants at second and third leaf. There is no particular pattern or cultural practice that appears associated with the condition, and foamy canker can occur in trees of any age (Strand and Ohlendorf, 2002). Researchers from California report that foamy canker is potentially linked to previous diseases or other stressors such as a high salinity or nutritional issues (Doll, 2009).

Foamy canker is active in the summer, and will not normally persist into the following year and some affected trees may recover (Strand and Ohlendorf, 2002). Losses from foamy canker are usually minimal, but significant losses in both California (Doll, 2009) and losses of up to 10 percent have been reported in one block of 2-year-old trees in the Riverland (M. Ward 2020, pers. comm.)

Symptoms

An active canker usually produces copious amounts of reddish/ orange gum (Figure 2A) that drips from cracks in the cambium, forming a puddle on the ground. White foam accompanies the red watery exudates (Figure 2B), and is associated with an alcoholic odour (Doll, 2009, Strand and Ohlendorf, 2002). Woody tissues under the bark of the trunk will sometimes appear white and “mushy” (Doll, 2009). Eventually the bark and wood dies, turns dark brown, and irregular shaped lesions sometimes become visible (Figure 2C) (Strand and Ohlendorf, 2002). Foamy cankers usually start at the tree crotch, before moving up into the scaffolds and down toward the graft union. The canker does not advance past the graft union and the roots remain unaffected (Strand and Ohlendorf, 2002, Teviotdale, 2002).

Management

Because there is so little known about the syndrome, management options are limited. Young trees not killed can be pruned and retained.

If only a portion of the tree has been affected, it is possible to excise the dead wood, cutting around dead tissue, into the healthy wood to retain the tree (Strand and Ohlendorf, 2002).

There has been very little research into foamy canker in California and no research has been conducted in Australia. If foamy canker is to be successfully managed, further research must be conducted to identify causal agents and/or factors in order to develop successful management strategies.

Next steps

To gain a better understanding of foamy canker, samples were taken from trees expressing symptoms in 2019 and 2020, with sampling continuing in 2020-2021. Several bacteria, yeast and fungal isolates were obtained, however, to date, none appear to be disease causing organisms. To determine if foamy canker is associated with disease causing organisms, substantial research efforts would be needed in the future.

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Contact us

If you notice any trees in your orchard expressing foamy canker symptoms, please contact the team and let us know the age and variety of the tree, as well as the general location of the property. We are hoping to gain more detailed information on the prevalence and significance of foamy canker to the Australian almond industry.

Send through any relevant information to Brittany Oswald at SARDI: brittany.oswald@sa.gov.au

Better tree performance and water use efficiency through *root system* resilience

Everard J. Edwards, Alex Lawlor, Adelle Semmler, Shuang-Xi Zhou, Nina Welti and Rob R. Walker |

CSIRO Agriculture and Food |

Back in 2014, CSIRO Agriculture and Food began work on a project to better understand almond root systems and use this knowledge to improve tree productivity and resource use efficiency. Co-funded through the almond levy, the project was part of the productivity program being developed by the Almond Board of Australia at the time and included collaboration with other research agencies at the CMV Farms Lindsay Point site. Originally intended to run for four years, staff changes led to project funds being stretched over five years to ensure the work was completed. The project concluded in November 2020 and a final report has been provided to Hort Innovation that will be available in due course.

The key components of the project were to:

- monitor fine root development and phenology in-situ at the shared CMV Farms Lindsay Point trial site, including the response to reduced water and nitrogen supply
- track sapflow of those trees and link back to both the root system and canopy size (the latter through collaboration with the Agriculture Victoria work at Lindsay Point)
- determine the influence of root type and age on nitrogen uptake and whether this is affected by rootstock genotype
- combine the root phenology and nitrogen uptake information to estimate the potential for tree nitrogen uptake throughout the season and suggest optimisations to nitrogen fertiliser application.

The project also had a component that was to develop a rapid pre-screen method that could be used by nurseries or others to assess rootstock resilience to abiotic stress, which will be reported on elsewhere. The staffing changes and timing of achieving different parts of the work prevented a trial to test new fertiliser management strategies based on the work, but the project team did collaborate with Select Harvests in their trials to examine the potential to combine compost applications with changes to fertiliser application, including impacts on nitrogen availability .

The root phenology study at Lindsay Point involved more than 60 field trips over four years to image roots as they grew, using 90 minirhizotrons (transparent tubes buried in the rooting zone), resulting in nearly 100,000 individual images. The appearance, duration of activity (based on root colour), length, disappearance and, therefore, lifespan of individual roots was

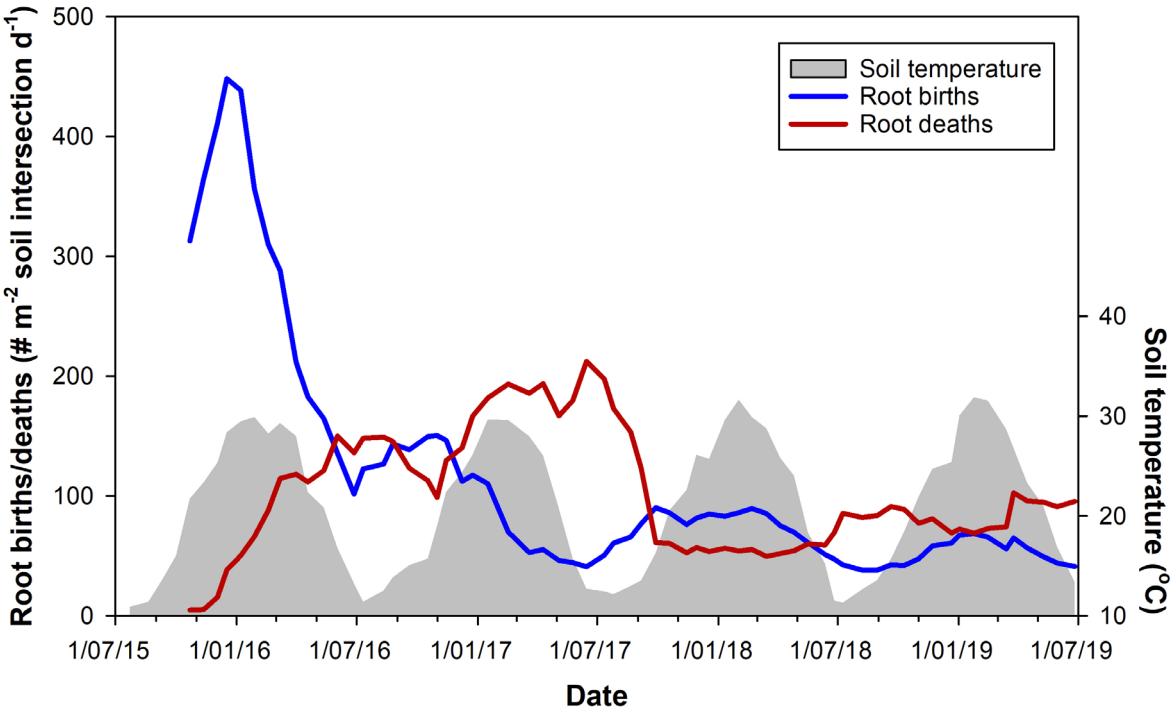

Figure 1: The seasonality of both new root production and root death can be seen in the root imaging data, overlaid on a high initial rate of root production (and subsequent root death) as a result of the installation of the minirhizotron tubes.

Opposite page: Root imaging at CMV Farms.

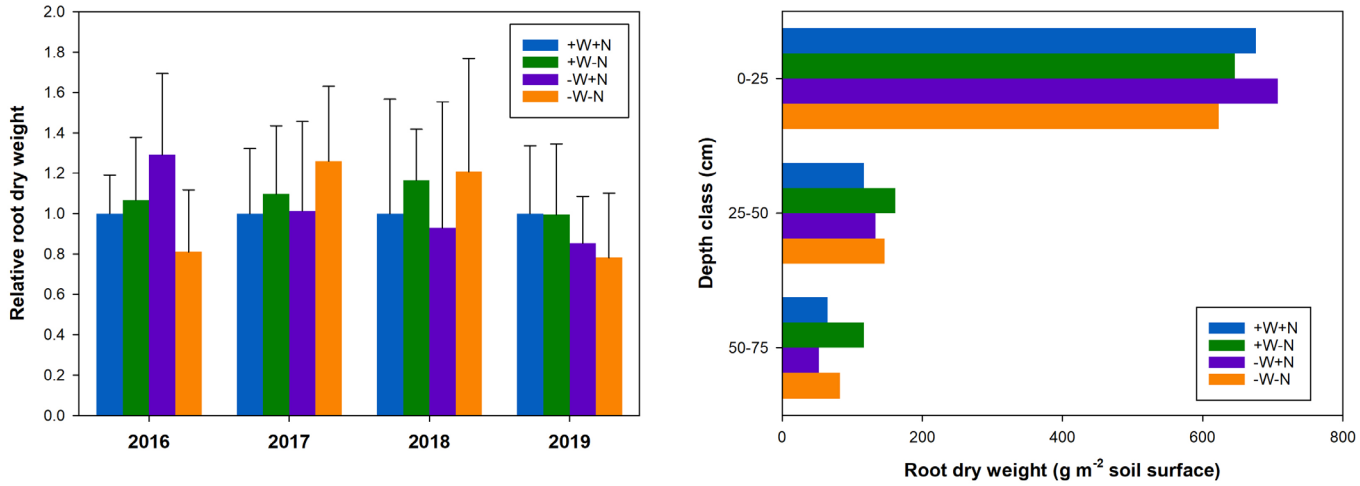

Figure 2: Reduced irrigation and nitrogen had a very limited impact on total fine root biomass (normalised to the control, left), but reduced nitrogen resulted in a small redistribution of roots to further down the soil profile (right).

Nitrogen uptake trial, Waite.

Soil coring at CMV Farms.

followed through the four seasons of data collection. Seasonality in the production, loss and the absolute amount of fine root present was clearly observed, but was less than expected, with some new roots appearing throughout the year and the majority of roots living for 2-3 seasons (Figure 1).

The root imaging was backed up by annual trips (pre-budburst) to determine over-wintering fine root length density and biomass by taking soil cores and extracting the roots. Overwintering fine root biomass was only marginally affected by the reduced water (-30 percent) and reduced nitrogen (-40 percent) treatments applied, although the reduced nitrogen treatments did cause a higher proportion of the root biomass to be located lower in the soil profile. Overall, two-thirds of the fine root biomass was located the top 25 cm of soil. (Figure 2).

Urea labelled with a stable isotope of nitrogen (15N), was used to determine the role of root age and time of season on nitrogen uptake by the root system. The cost of 15N labelled urea prevented this being used in a commercial orchard, but seasonality of nitrogen uptake potential was examined using potted trees outdoors and a separate glasshouse study looked at the interaction between rootstock and scion, with six rootstocks and three scions examined through eight individual combinations. These experiments demonstrated that fine root size class (diameter <1 mm or diameter 1-3 mm) made little difference to the nitrogen uptake and that whilst older, brown, roots were somewhat slower to take up nitrogen they still appeared to be able to do so at reasonable rates. Unfortunately, results on the effect of phenology were not available at the time of writing (Figure 3).

The final synthesis of the extensive results from this project will take more time and be communicated to growers in due course, but overall the work has demonstrated surprising resilience of almond root systems to water and nitrogen limitation, consistent with the lack of significant effects observed on yield by the Agriculture Victoria project (AL14005) that utilised the same CMV Farms trial.

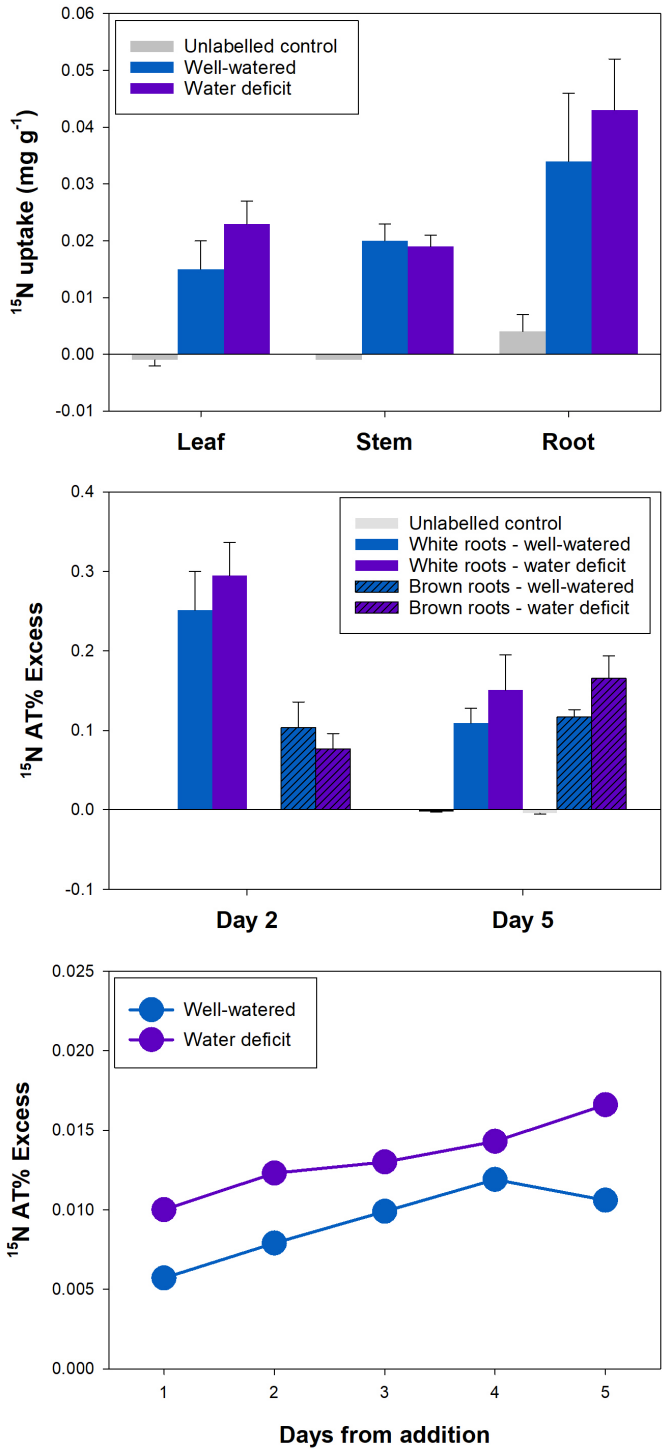

Figure 3: Labelling nitrogen fertiliser with a non-radioactive isotope demonstrated a significant distribution throughout the plant five days after application (top), a higher initial rate of uptake in young, white roots (middle) and a higher uptake, relative to existing plant nitrogen, in plants subjected to water deficit (bottom).

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Hort Innovation news

New directors, chair and deputy chair elected

AT the Hort Innovation 2020 AGM, voting members elected three new Directors to the Board and the newly constituted Board then met to appoint the positions of Chair and Deputy Chair. The new directors elected by members included Tony Kelly, Michael Nixon and Victoria Taylor, who you can read more about on the Hort Innovation website.

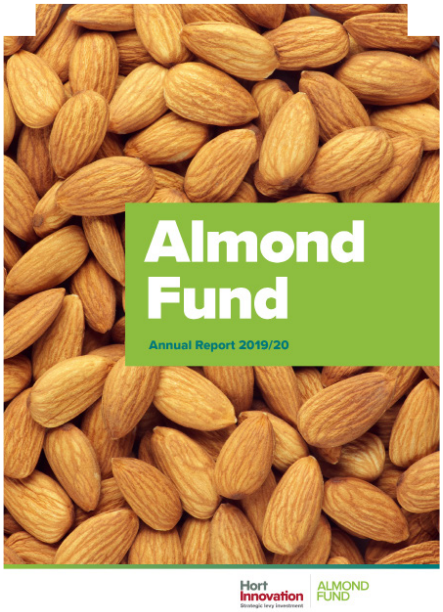
Taking over from former Chair Selwyn Snell, who announced his retirement earlier this year, will be new Chair Julie Bird who has been a Director of Hort Innovation since 2018. Hort Innovation's new Deputy Chair is Paul Harker, who has been a Director of the company since 2016, having been re-elected by members at last year's AGM.

Newly appointed Chair, Julie Bird.

Newly appointed Deputy Chair, Paul Harker.

Hort Innovation Almond Fund Annual Report

IN addition to the full company annual report for the 2019/20 financial year, Hort Innovation has released individual reports for each of the 37 industries it looks after. Head to www.horticulture.com.au/annual-report-portal to download the almond industry annual report and take a closer look at key levy investment and project information from the year.



Creating a sustainability framework for industry

YOU are invited to provide feedback on a framework to help the horticulture sector share its sustainable, ethical and safe farming practice stories. Hort Innovation has worked with a wide range of industry stakeholders this year to identify and understand the sustainability topics most important to decisions about Australian-grown horticulture. The result is a discussion paper that identifies sustainability goals that are linked to indicators that can be used as a way of measuring how the horticulture industry is tracking against each goal.

Read the discussion paper and provide your feedback

WE would like to wish all our members, levy payers, supply chain stakeholders and delivery partners a safe and happy break over the festive season. After a challenging year for the horticulture industry with the devastating bushfires followed by the global COVID-19 pandemic, we want to thank everyone who has contributed to investments across R&D, marketing and trade. We're looking forward to continuing our delivery of outcomes for growers in 2021.

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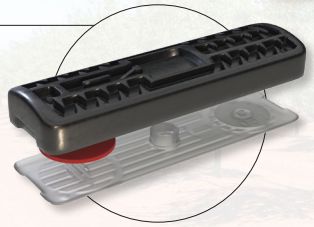

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Calendar

*January

*February

4	ABA Pollination Committee Meeting
11	ABA Production Commitee Meeting, ABA Plant Improvement Committee Meeting
17	ABA Audit & Risk Committee Meeting, Market Development Committee Meeting.
18	ABA Board Meeting

NOTE: Dates and meeting formats may change with COVID-19 restrictions in place.
At time of publication, all international events have been ommitted due to uncertainty of dates.

australian almonds
ALMOND BOARD OF AUSTRALIA

ABA MEMBERSHIP: JOIN TODAY

The ABA is the peak representative body for the Australian almond industry and as such addresses many issues that impact on all participants in the industry including growers, processors and marketers and those who supply inputs. These impacts can be positives such as free trade agreements or promotion to stimulate demand and hence prices or they can involve minimising negative situations such as food safety issues, market access problems, chemical registrations etc.

The ABA develops and drives the implementation of the Australian industry's strategic plan which is done to benefit all producers and other industry participants. The strategies involve building domestic and export markets, the key to strong grower returns and addressing a wide range of risks from the availability of production inputs to government policies that impact on costs and yields. These matters effect on the bottom lines of almond enterprises.

The ABA's whole of industry strategies have been successful and have worked to ensure the large increases in production have been cleared.

The ABA operates a number of activities that support industry and generate revenue to fund its operations and keep membership fees at a low and affordable cost. Being an ABA member provides crucial support for your industry body that we need and appreciate. A strong membership base provides added force in our representation of industry to government and in the wider community.

Join the ABA today, in the knowledge you are assisting the industry and yourself to move forward as Australia's most valuable horticultural industry.

Join the ABA by visiting our website, phoning 08 8584 7053
or email admin@australianalmonds.com.au

Berry Breakfast Smoothie

Serves 2

INGREDIENTS

- **2 cups fresh or frozen berries**
- **1.5 cups almond milk**
- **1 banana, peeled**
- **¼ cup slithered or flaked almonds**
- **2-4 dates, pitted or 1-2 tablespoons honey**
- **Ice (optional)**

METHOD

1. Blend all ingredients until well combined.
2. Divide into two glasses and serve immediately.

TIP: You can make your own almond milk for this smoothie or you can buy a pre-made almond milk from the supermarket. For a thicker smoothie, add a couple of tablespoons of natural or Greek style yoghurt. If you don't have fresh berries, frozen berries work extremely well in this recipe, too.