

In A Nutshell

The Official Newsletter of the Australian Almond Industry

Spring 2021



From dust to bustling orchard

Story page 8

IN THIS ISSUE

- Ross wraps up
- SARDI's orchard experiment
- Marketing update
- Nuts for Life 2030 vision
- Plus much more...

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COVER PHOTO: CMV Farms orchard manager Jeremy Miatke pictured at the company's Loxton-based almond orchard, which was established in 2016. Photo: Jane Kuerschner

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From the Executive...



Peter Hayes, ABA Chairperson and Tim Jackson, ABA CEO |

“ The Almond Board of Australia recognised the importance of the issue by creating a Sustainability Manager role to ensure the industry was sufficiently resourced to establish a credible framework for all our stakeholders...”

Tackling sustainability collaboratively

Resources devoted to tackling the sustainability of agriculture have increased dramatically over the past year.

Consumers are demanding a greater level of accountability on how and where their food is produced.

Farmers across the world are now being asked to present their credentials on sustainable food production via manufacturers who are setting carbon neutral targets for all levels of their organisation, including suppliers.

The Almond Board of Australia recognised the importance of the issue by creating a Sustainability Manager role to ensure the industry was sufficiently resourced to establish a credible framework for all our stakeholders.

Whilst it is early days in formalising our sustainability framework, the process now has a dedicated resource with the appointment of Megan Coles as Sustainability Manager. Megan comes with a wealth of experience in this field, having driven sustainability programs in a range of industries, including wine.

She will be working with growers, marketers and processors, suppliers and end users in co-ordinating a process that we believe will ensure the Australian almond industry is

best placed to grow sustainably long into the future.

The International Nut Congress announced this month that it has established a high ranking Global Sustainability Working Group that features the leaders of some of the biggest suppliers and manufacturers in the nut industry.

In Australia, the “all of supply chain” approach to striving for sustainable outcomes is showcased in a project known as the Cool Soil Initiative. This project has linked grain growers, manufacturers and researchers in discovering linkages between variables such as soil, landscape, crop growth, production and management, and greenhouse gas emissions.

Multi-nationals Mars and Kellogg’s are both partners of this project along with Charles Sturt University.

Kellogg’s Global Agribusiness Manager Chris Stevens, who is based in Sydney, told the ABA that more than 50% of the company’s total carbon footprint was created by agricultural suppliers.

“Kellogg’s is more than happy to emphasise the importance of all stakeholders in the supply chain operating in a more sustainable way,” he said.

“Tackling this at an industry level is by far the best approach, so learning

that the ABA has a Sustainability Manager coming on board is music to our ears at Kellogg’s. “We buy a lot of almonds and the industry is on our radar in regard to addressing sustainability issues in a collaborative manner.

“The ramifications of being more sustainable is going to hit us all. It is not going away.”

Kellogg’s and many other companies like it are setting carbon neutral targets that will be handed down through the supply chain. The ABA looks forward to working with all stakeholders in order to promote and protect the industry through this journey to a sustainable future.

Market update

The global market appears to be entering a period of volatility due to several key influences.

Californian yields have improved since they first started harvest, but water and drought remain the main topics of conversation, according to ABA director Damien Houlahan was in the US in October.

Damien has seen many “very sick orchards that have been abandoned and trees now coming out”.

“Many (Californian growers) feel that even if rain and snow return to normal levels this winter it will not be enough,” he said.

It is estimated that California needs a

“140% wet winter” which is unlikely. Despite the prevailing drought, the global market softened in September-October and inshell pricing has especially eased on the back of reduced demand.

After experiencing the quickest bounce back from low pricing in the past 20 years, the price drop has created uncertainty. The Californian shipping numbers for September were down on last year and were the first non-record month since August 2020.

There is speculation that October shipments will also be down. The reduced shipments had to occur at some point, given that the volume to sell is thought to be significantly down on last year’s record crop, but it has come sooner than most expected.

All eyes will be on pricing trends in the coming weeks as prompt shipments at good prices get delayed due to ongoing shipping issues. Large kernel is in short supply and holding value, but the gap to smaller kernel prices has increased.

The industry is being seriously impacted by the shipping chaos. The cost of freight has sky-rocketed, but the damage of the continuing delays is yet to be properly assessed. Californian and Australian exporters are experiencing huge price increases for containers (upwards of 400%) but with no certainty on shipping timeframes and booking commitments. It is not unusual in Australia for product to be waiting 10 weeks before leaving port.

There is no end in sight for the shipping problems and some within the logistics industry are predicting it could be a three to five year problem. The issue is obviously not isolated to almonds and a myriad of Australian industries have supported calls for government intervention where possible.

The problem for the almond industry will be accentuated by the increased volume of product that will need to be exported in the coming years due to increased production. The industry was one of the signatories to a detailed freight briefing presented to the Federal Trade Minister Dan Tehan and his department this month.

Making news...

Hailstorm hits our almond-growing regions

Many growers throughout our almond-growing regions are assessing the damage from a hailstorm which hit on Friday, October 28.

The storm, which also brought flash flooding and extreme winds, was widespread.

Growers with concerns or queries regarding the impact of the storm are urged to contact the Almond

Board of Australia CEO Tim Jackson on 0438 871 312 or email tjackson@australianalmonds.com.au, or ABA Industry Development Manager Deidre Jaensch on 0429 007 200 or email djaensch@australianalmonds.com.au. More information on the storm’s fallout will be outlined in the summer In A Nutshell, available in December.

Almond Board’s AGM goes online

Two new directors were among the seven elected to the Almond Board of Australia (ABA) at the annual general meeting (AGM) on Monday, October 18.

The virtual AGM was attended by more than 30 people.

Young Murtho-based almond grower Luke Stoeckel was elected as a Riverland grower director, while Select Harvests managing director Paul Thompson has replaced Laurence van Driel as a marketing director.

Peter Cavallaro, Neale Bennett and James Callipari were re-elected grower directors while Olam’s Damien Houlahan continues as a marketing director and Almondco managing director Brenton Woolston returns to the Board.

Chairman Peter Hayes paid tribute to the work of retiring CEO Ross Skinner over his 11 years in the



To read the ABA’s 2020/21 Annual Report click on the cover. role and thanked him for his tireless efforts in establishing the ABA as a widely regarded peak industry body within the horticultural community in Australia and overseas.

Australian Almond Breeding Program ACE Orchard’s new trees

This month the ABA and The University of Adelaide planted over 2,200 primary evaluation trees at the Almond Centre of Excellence Orchard at Loxton. These trees will be grown out at one-metre tree spacings with minimal inputs to generate approximately 30 almonds. The kernels will then be evaluated for their appearance, shell type and taste before either progressing into a secondary trial or being removed.

The Australian Almond Breeding and Evaluation Program (AL17005) is currently funded to develop new high yielding self-fertile varieties through parental selections created in the previous breeding project (AL12015). The program has targeted self-fertility, improved tree architecture, closed shell, and bacterial spot resistance. To read more on the Australian Almond Breeding Program click [here](#).



Ross *reflects* on 11 years

After 11 years leading the way at the Almond Board of Australia as CEO, Ross Skinner will step away from the role. He has reflected on his time with the ABA...



With a background in economics and accounting, Ross decided to move into the world of agriculture when he took up the position of Project Officer with the Australian Dried Fruits Association in the early eighties.

Before long this led to a role as Assistant General Manager of the ADFA, and then as General Manager of the Dried Fruits Research and Development Council. The role of General Manager of the Australian Dried Fruits Board (a statutory export marketing body) was added when their office was relocated from Melbourne to Mildura as the industry transitioned away from strong government

support mechanisms.

He then joined Horticulture Australia to manage the statutory research and marketing levy programs for many of the major horticulture industries in the Southern Basin, including almonds.

After some coaxing by the then ABA Chair, Brendan Sidhu, Ross decided to take up the CEO role in 2010 to focus on one industry's development and one that he believed had enormous potential.

Ross says the almond industry has come a long way during the past decade.

"When I joined the ABA, the

industry's first planting boom had subsided with plantings plateauing at around 27,000 hectares, but many orchards were still maturing, and the production was setting records year on year from 39,000 tonnes in 2010 to now 124,000 tonnes," he said.

"A second planting boom commenced in 2016 that has seen the orchard area develop to 60,000 hectares including plantings this past winter.

"This will continue to drive production increases well into this decade along with ever improving yields per hectare that our growers are achieving."

Ross says the Almond Board itself has also grown over the past decade.

“As the production base has grown, the ABA’s programs have grown in the areas of market access and development, identification and extension of best practices, biosecurity, food safety, sustainable production systems, along with efforts to achieve input surety for water, bees, chemicals, labour and quality planting material,” he said.

“These are all elements of the industry’s strategic plan, the implementation of which has become better resourced with funding and skilled staff as revenue from levies, grant funding and commercial activities have increased.”

Ross says a notable change during his time has been the growers’ appetite to innovate and change their practices, and a continued commitment to grow a high-quality product sustainably.

“The size of the industry is an obvious change but the ever-hungry attitude of industry members for knowledge and improved technologies to apply to their production systems has been evolving and is due to the quality of growers’ management and the staff of businesses within the industry, whether they be large corporations or smaller family enterprises,” he said.

“A further change over the past decade is the strengthening relationship with the Almond Board of California that has led to a free exchange of research and knowledge between our organisations based from our perspective on great respect for their efforts across many areas that advance the global almond industry.”

“ Early in careers, we often don’t appreciate the influence good people have on you when you are learning skills and gaining life lessons but as careers come closer to ending you become more thankful to those that have given generously of their time and knowledge to educate and guide... ”

Ross says the support from the almond industry had been exceptional during his time with the Board.

“The ABA has been fortunate to have the strong support of industry members, and this has provided a basis for whole of industry decision making on key issues and the investment of resources in research and market development,” he said.

“One of the challenges for an industry expanding and with new entrants is the maintenance of cohesion amongst industry participants and the building of trust that enables greater productivity in addressing matters that can have a positive impact.”

Ross says he believes there are many reasons the almond industry is going from strength to strength.

“We have a wonderful product, suited to mechanised production systems, with few pest or disease issues compared to many other industries, and few phytosanitary issues in accessing export markets,” he said.

“Almonds enjoy strong demand growth due to their health benefits, versatility of use, durability, and cultural acceptance in countries with burgeoning economies.

“An important element in the success of the Australian industry is the enormous skill and effort that industry members, from producers and their staff to those working to process and market our almonds, bring to their businesses and jobs.

“All of the above underpins an industry that is both viable and sustainable in a relatively stable operating environment.”

Ross says he has gained a significant amount of enjoyment on a personal level from the role.

“The CEO’s role at the ABA has provided the opportunity to return to working for an agricultural peak industry body where there is great job satisfaction in seeing the industry and its members progress,” he said.

“The interaction with committed, skilled, and sincere people brings enjoyment to every day no matter what the challenges or issues that are being faced.”

Ross says he has many people to thank for their guidance and support throughout his career.

“Early in careers, we often don’t fully appreciate the influence good people have on you when you are learning skills and gaining life lessons, but as careers come closer to ending you become more thankful to those that have given generously of their time and knowledge to educate and guide,” he said.

“The list of those that have helped me is long and now contains many from the almond and other nut industries to whom I am most grateful.”



Outgoing ABA CEO Ross Skinner (sixth from left) pictured during the 2019 R&D Forum Review.



From dust to *bustling* almond farm

WORDS AND PHOTOGRAPHY
JANE KUERSCHNER

With 340,000 almond trees planted over 615 hectares, CMV Farms orchard manager Jeremy Miatke (pictured) and his team have plenty to keep them busy all year round.

And it was only five years ago in 2016 when the property along Stanitzki Road near Loxton, South Australia, was completely bare. Jeremy took up the job in 2016 alongside one other employee to help establish the revolutionary development.

Fast forward to now and the site boasts 17 fulltime staff.

“Going from a bare paddock to 340,000 trees that are now coming into full production is just massive,” Jeremy said.

“The first plantings were probably as thick as your little finger and going from the trellis system we had, and plastic guards to what we have now is just a massive change. “Plus going from just a couple of workers to a full workforce and a developed orchard has just

been fantastic. It’s fantastic for the region and especially Loxton where our workers pay rates or rent, and spend their money there.”

While the property near Loxton is in its infancy, CMV Farms is well versed in almond production, with its Lindsay Point site established since 1981.

The initial plantings across 6.5 hectares at Lindsay Point is now a 488-hectare property.

Speaking to In A Nutshell at the end of September, Jeremy said the season was shaping up to be “excellent”.

“For us we’ve gone through the fruit set stage after the pollination stage... we had a slight nut drop after four weeks, which is usually unpollinated nuts,” he said.

“We had a bit come off because of some 50km/h winds but not a huge amount.”

Jeremy said the focus has now turned to fertigation and watering.

“We’re also chasing a bit of extension growth through the trees and setting up for next year’s crop just trying to find the right balance between crop load and extension growth, which can mean adjusting fertiliser budgets if needed” he said.

“Leading up to pit hardening, obviously that’s when the trees will turn and use more water, the shells start to solidify and the nut begins to harden.

“Really monitoring a few things like that on the trees are very important for us this time of year.” Jeremy said there was also no shortage of things happening on the operations side.

“We have a hygiene pass going on, so we’re blowing and flailing,” he said.

“We’ll do the whole property so that should be done in the next week and we’ll do another one pass when we’ve had a bit more rain and wind leading up to harvest.

Continued page 10



CMV FARMS



CMV goes medium density

“Obviously with the reasonable amount of rain we had a few weeks ago now, we had to go and put a fungicide spray on.

“So, it’s really waiting for the rain, but if we don’t get the rain, we’re in with the folio nutrients.

“That’s pretty well it... probably the biggest one for us is the irrigation and fertigation at the moment.”

The property’s plantings are still in their initial stages, with the trees building up to full production.

“This property will be coming onto its fourth harvest so it’s heading towards full production within the next few years,” Jeremy said.

“It’s starting to level out and we can get some data to follow on from, but this year pollination was fantastic.

“We couldn’t have got better weather so far... the season looks really promising and it’s warming up now. “Soil temp is getting up to about 16C, which is probably a degree warmer than what is has been the last few years (at this time).”

The team out at CMV aim to harvest at the beginning of February each year.

“We start early February because we always shake a little bit green and we do have some younger trees,” Jeremy said.

CMV Farms has delved into the world of medium-density plantings at its new orchard, near Loxton, where 340,000 almond trees have been planted over 615 hectares.

CMV Farms director Ryan Norton said the new orchard – which was established in 2016 and is known as Fielke’s Orchard – was planted as medium density following promising replant trials at their Lindsay Point orchard after observing what was happening with many other tree crops.

“We trialled several planting densities during the replant process and considered the one chosen for the Fielke orchard to be a good compromise,” he said. “For CMV, the key advantages of denser plantings were the lure of achieving higher yields and associated cash flow in the early development stage.

“There are some additional costs such as actual nursery tree costs, planting and training costs compared to traditional spaced orchards but in our experience the early yields and returns outweigh these and any additional input costs.

“Other capital costs and development expenses remain almost identical.”

Ryan said medium-density plantings do require a different management approach compared to traditional spaced plantings. “We accept there will be management problems especially around sunlight and in orchard drying of almonds as the orchard ages and we are yet to fully understand how to best manage these issues,” he said.

“We are commencing strict canopy management from a much earlier stage in the orchard age than normal and aiming for a smaller tree but with more leaf area to capture sunlight.

“We are not anticipating major yield advantages as the orchard matures compared to traditional spacings.”

Ryan said the new approach was an opportunity for CMV staff to experiment with new practices and see what works.

“CMV Farms managers have always been encouraged to think outside the square and challenge convention,” he said.

“The Fielke’s orchard is an example of putting into play learnings from our Lindsay Point orchard and looking at other forms of horticulture. So far, so good.”

Continued page 12



“Our harvesting system involves removing all product from the orchard and drying it in the open. This reduces the drying time and allows us to shake a little bit greener.”

Jeremy said sustainability and water consciousness were emerging factors in growing and producing almonds. “How we use our water is a big thing on the radar at the moment,” he said. “We all have, including myself, dig sticks, so I probably do 10 to 20 up to 50 digs a week, depending on what we have on and the irrigation guys will do double that.

“Then we correlate all that data for a weekly meeting to see where we’re at with moistures and see where we can back off and not push any past the root zones and we just monitor that daily.

“That’s the biggest thing is to make sure we’re not wasting any water and giving the trees what they need. “And same with fertiliser, we don’t want to be throwing fertiliser out for no reason so we’re constantly doing leaf and soil (analysis) to see if we are on target for fertiliser inputs for the year.

Jeremy said other almond producers

in the industry were also prioritising sustainable practices.

“I think going back through the drought in the early 2000s, people probably woke up a bit to water usage and got a bit smarter when it comes to water,” he said.

“We’re all drip irrigation too, so we monitor our water usage very closely “At the moment our hulls get used for

cattle feed, which is pretty sustainable and going back into the environment in a different way.

“I think we will look at ways we can bring them back into the orchard in some sort of mulch way.

“So, I think we are looking into things like that and it will become part of the future.”



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- Soil health

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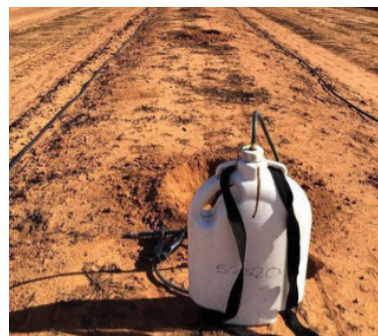
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Application



Mycorrhizae (like in EndoPrime) provide the greatest benefit to new almond transplants when applied early at the planting stage. The correct dose of inoculum can easily be applied into the planting hole during the planting operation

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Almond transplant trial at Carrathool, NSW

EndoPrime treated trees showed 100% transplant survival vs 4% loss in the untreated trees (6 months post-planting). The value of EndoPrime in this trial is demonstrated through removing the labour requirement for replanting and through negating any lost productivity in replaced trees.



EndoPrime treated almond trees at Carrathool, NSW, showed 100% transplant survival and excellent growth.

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High density, *high* reward

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

Season 2021 saw SARDI's Almond Research Team complete its first commercial-scale harvest of field trials at the Almond Centre of Excellence (ACE). Across a two-month period, SARDI, with support from the Almond Board of Australia (ABA), assessed four fully replicated experimental orchards covering 600 trial plots and

more than 3000 individual experimental trees. These large-scale trials used commercial shaking, sweeping and pickup machines to demonstrate the practicalities of working with unique varieties, rootstocks, planting densities and production systems. While the experimental yield assessments significantly





slowed the pickup operation, the data from this third leaf harvest was valuable. The following subset of results offers an early insight into the value of the ACE experimental orchards which aim to inform industry wide orchard development decisions for years to come.

Optimising density in traditional H1-H2 orchards

While interest is growing for the development of super-high density, Horizon 3 (H3) production systems, an easier step for many producers remains the progression from low density, Horizon 1 (H1) to medium/high density, Horizon 2 (H2) plantings. H2 plantings offer improved production efficiencies

without departing too far from traditional operational practices or diminishing the value of existing orchard machinery. However, the planting density sweet spot, that maximises production efficiencies between H1 and H2, is yet to be defined for industry relevant varieties grown under Australian conditions.

One of SARDI's ACE trials addresses this question using four varieties (Shasta, Carina, Nonpareil and Vela) grafted to Garnem, planted at six densities between H1 (308 trees/ha) and H2 (615 trees/ha). In the first three years of their life, trees received minimal training or pruning which allowed canopies

“ These large-scale trials used commercial shaking, sweeping and pickup machines to demonstrate the practicalities of working with unique varieties, rootstocks, planting densities and production systems...”

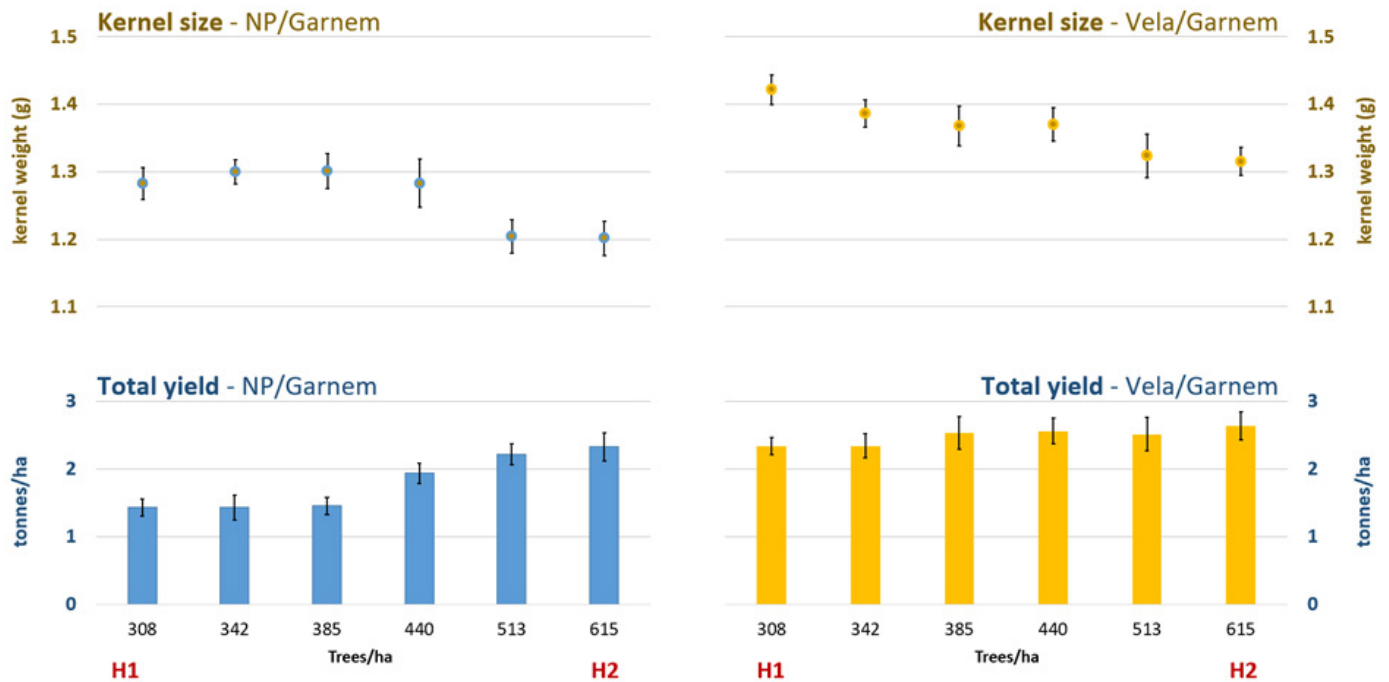


Figure 2. Effect of six planting densities, ranging from H1 (308 trees/ha) to H2 (615 trees/ha), on kernel size (g) and total yield (tonnes kernel/ha) for third leaf Nonpareil and Vela grafted to Garnem. Almond Centre of Excellence, SARDI Loxton (2021).



to naturally fill their space and express their untrained form. The more precocious varieties of Vela, Shasta and Carina showed signs of being constrained by resource availability at the higher densities. For these varieties, individual tree yields reduced from more than 6 kg kernel/tree at H1 to 4 kg kernel/tree at H2. Conversely, Nonpareil varied little across the density range at 4 kg kernel/tree. The per hectare yield response for Nonpareil and Vela represent the lowest and highest yields recorded in the first commercial harvest of this third leaf trial (Figure 2). On average, Vela out-yielded Nonpareil by 0.7 tonnes per hectare. Yields increased

with density, particularly for Nonpareil whose individual tree yield was less constrained by competition at the higher density. Nonpareil produced less than 1.5 tonnes kernel/ha at 308 trees/ha but more than 2.3 tonnes kernel/ha for trees planted at 615 trees/ha. Vela yielded 2.3 to 2.6 tonnes kernel/ha for the same density range. Average crack-out exceeded 28% for Nonpareil and 30% for Vela with the largest kernels tending to be associated with the lower yields on the low-density treatments.

Rootstock compatibility screens complement density investigations

SARDI also manages genotype compatibility screens at the



ACE experimental orchard. One of these is duplicated across medium, H2 (513 trees/ha) and high, H3 (1111 trees/ha) densities and examines the compatibility of 14 rootstocks with Nonpareil and four self-fertile 'Nonpareil-like' varieties. The screen is being used to identify genotype incompatibilities, canopy architecture and varietal susceptibilities to pest, disease and nutrient disorders. Yield assessments also offer insights into potential production efficiencies for the 70 different genotype combinations being grown at higher planting densities.

In 2021, the more productive combinations produced exceptional yields for third leaf trees. In particular, Vela grafted to either Barrier-1, Atlas or Garnem rootstock, each of which exceeded 3.3 tonnes kernel/ha at H2 and 5.7 tonnes kernel/ha at H3. Almond-21 also performed well on these rootstocks. The best yielding Nonpareil trees were those grafted to Barrier-1 and these averaged 2.8 tonnes kernel/ha at H2 and 4 tonnes kernel/ha at H3. The industry standard combination of Nonpareil on Nemaguard produced 1.7 tonnes kernel/ha at H2 and 3.4 tonnes

kernel/ha at H3.

The effect of density on the third leaf yield is summarised in Figure 3 where the varietal performance reflects average yield across multiple rootstocks. Individual tree yields at H2 and H3 were 3.8 and 3.2 kg/tree on average. The high-density planting of the H3 trees (1111 trees/ha) resulted in significantly greater early returns on investment. The obvious questions then become, 'how long can the yield benefits last and what is the trade-off in establishment and management costs'?

Harvest assessments across future seasons will better characterise the longevity of the early production gain and also highlight any increased inputs or compromises required to ensure practical management of the higher density plantings. Suitability of various variety and rootstock combinations must consider the practicalities of orchard management and resource use, not just the yield/quality metrics.

Next steps

SARDI's involvement with the establishment phase of the ACE experimental orchards will end

in October 2021. Interpretation of datasets is underway and will deliver a range of production metrics on orchard development and resource use efficiency. Continued monitoring of these commercial scale experimental orchards (beyond 2021) would provide important learnings around the longevity of production, genotype compatibility and resource use efficiency during the orchard's most productive years.

Acknowledgements

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For more information, please contact the SARDI Almond Research Team at Loxton (08 8595 9149) or Adelaide (08 8429 2299)

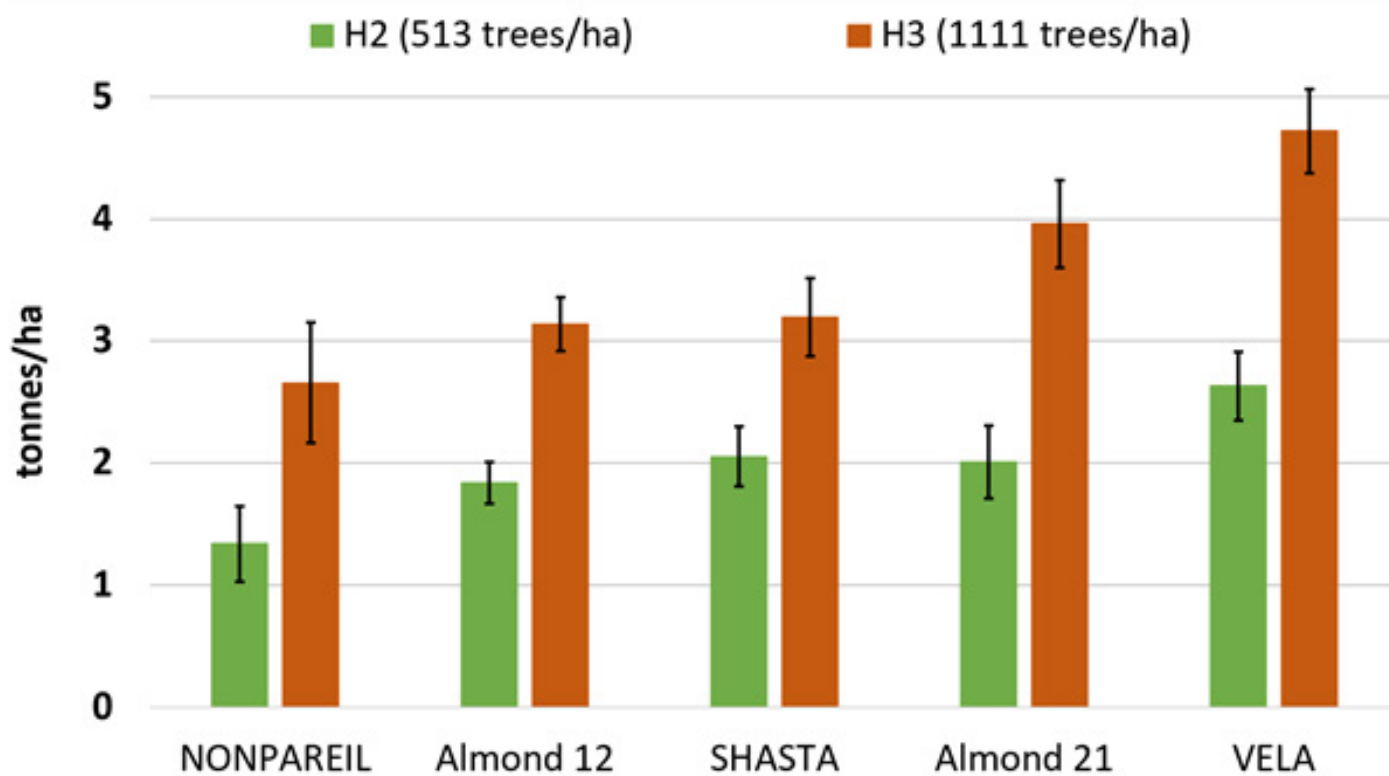


Figure 3. Effect of density on yield response of third leaf varieties planted in SARDI's genotype compatibility trials. Data are average yields across multiple rootstocks. Almond Centre of Excellence, SARDI Loxton (2021).

MINDFUL EATING

"With warmer weather comes the pleasure of being more active outdoors. This might mean your body needs extra fuel. You could eat larger nourishing meals or snacks. Mixing some fresh Spring fruit with a healthy handful of almonds would work well as a before or after exercise snack. The almonds, paired with fruit, combines the carbohydrate from the natural sugars in the fruit to refuel muscles, with the protein in the almonds to help support muscle growth and repair." ¹

Simone Austin is an advanced sports dietitian, keynote speaker and author. She is also our nutrition program ambassador.

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5852756>



australian
almonds

fitness & sports
nutrition

Marketing update



Joseph Ebbage | Industry Market Development Manager



Lou Martin | ABA Marketing Officer

World Heart Day

On September 29 we celebrated World Heart Day. Cardiovascular Disease (CVD) remains the world's number one killer, resulting in 18.6 million deaths a year. Dietary intervention is key to managing the risk factors and there is compelling evidence that consuming nuts, including almonds, offers protection against CVD. Almonds are a convenient and portable snack that can be eaten anywhere and any time of day. Look after your heart and eat 30 grams of almonds every day!

Simone Austin, our fitness and sports nutrition program ambassador, has great advice on how you can include more almonds in your diet for a healthy heart. To find out more click here.

Our promotional activities included a feature within the consumer section of our website and a number of posts across our social media channels.



Exciting new growth opportunities for Australian almonds in India



Almond paste for Non-Dairy Alternatives

Almond flour for biscuits, cakes and pastries

Almond butter for spreads and energy bars



AIBX webinar

On September 30, the Almond Board of Australia (ABA) participated in the Australian India Business Exchange (AIBX) webinar. This online event provided Indian food manufacturers with an insight into the Australian Almond Industry. Peter Hayes (ABA Chairman) provided a background to the role the Almond Board of Australia plays and the long-term strategic plan for the industry. ABA staff members Joseph Ebbage and Lou Martin focused on giving a snapshot of the new almond product development in India in addition to providing an overview of consumer behaviour towards snacking. We also had an informative Q & A session from our five Australian marketers and exporters involving Nigel Carey, NPA, Ben Fessey, Olam International, Ekrem Omer, Select Harvests, Brendan Sidhu, Century Orchards and Nick Spanos from Almondco Australia. We were able to clearly communicate our industry's capacity to help meet India's growing demand for almonds with a focus on innovation.



Marketing update

Promotions



How you can
Bee Friendly

Blossom season 2021

To help communicate the natural goodness of Australian almond orchards in bloom this year we sent almond gift packs to different social media influencers around Australia. The main objective was to promote the Bee-Friendly Farming practices of Australian almond pollination to an audience interested in sustainability and bee health. The almond packs included almond honey, an almond recipe, blanched almonds, and bee seed bombs. This year's promotion was a huge success, with our message being amplified across more than 20 influencers' social media channels and reaching a whopping 1.35 million people on Instagram.



Can't wait to whip up a recipe with
Australian honey & almonds!!

Almond Cheers

To help celebrate the versatility of almonds we wanted to find a light-hearted way to communicate the uniqueness of the Almond Porter Beer produced by Almondco Australia and the Woolshed Brewery. We organised an almond gift pack to be sent out to social media influencers in addition to hosting a competition on our Facebook and Instagram platforms for the chance to win a gift pack.

The overall response was excellent, with the audience overwhelmed by the innovation and versatility of Australian almonds.

We reached a total of 32,000 people on Facebook, 116 shares across Facebook and Instagram and 230 comments on the competition post.



CHECK OUT HOW WE'RE PROMOTING
ALMONDS BY CLICKING ON THE
PHONE...

Introducing Meshu

Meshu Shah recently joined the team at the Almond Board of Australia (ABA) as Administration and Finance officer.

Originally from India, Meshu moved to Australia in 2018, and relocated to the Riverland from Melbourne earlier this year.

She began the role in August 2021, and quickly showcased her hard work and impressive skill set.

Meshu was relocating to the Riverland to be close to family in Renmark and chose the role at the ABA as she was trained in finance and looking to grow further within her field.

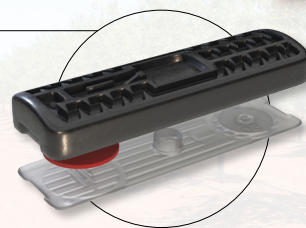
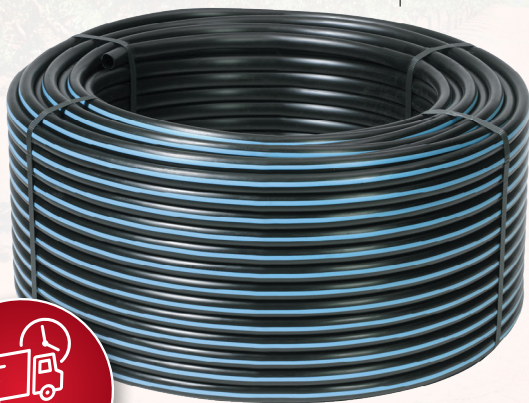
She said she has already learnt a significant amount about the almond industry, and was looking forward to discovering more about it.

Meshu said she has enjoyed living in the Riverland so far and was busy exploring all it has to offer.



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TORO

Bee-lieve it or not

By Jo Martin, Queensland Beekeepers' Association Inc State Secretary

It was early June, 2021 and I was sitting on my deck soaking up the warmth of the morning sun, enjoying a coffee and some downtime after co-ordinating the 2021 Queensland Beekeepers' Association Annual Conference, when a notification popped up on my phone. The NSW Premier was about to hold an important COVID-19 update.

It was 11am and I was tuning in to stay abreast of the COVID-19 situation across a relatively COVID-free Australia. This is the same regime I had followed for much of the past 12 months. Watching other state COVID-19 updates had come the new normal for me.

I followed the link to the live press conference and began to listen in. Gladys mentioned that simple but short phrase that sent memories of the past 12 months flooding back. "We have one new case of COVID-19 in the community, and we've confirmed it is the delta variant". Although they may not be Gladys' specific words at the time, that is my recollection of the day.

I remember, taking my last mouthful of coffee knowing that the day I had already planned out was about to change dramatically, I knew that 2021 would indeed be different to 2020. After seeing the scenes in India only a few short weeks earlier, I understood that there was no time to waste.

The relatively simple exercise of migrating honey bees to almond growing regions would again prove challenging, as 2021 would be an entirely different operation to what we'd all experienced in 2020, as we all reflected on how 'easy' the mass migration was in 2019 and in the previous years.

For me, it felt like 'ground-hog day', just a little different to Bill Murray (in the movie), I wasn't hearing that same old tune on the alarm clock, instead I found myself putting a detailed email together to senior representatives in Queensland Health, Agriculture, Police and Transport to commence consultation on the movements of our important livestock and the future movements of the Queensland honey bee



colonies in the months ahead.

Interestingly, the work and efforts we'd employed last year delivered a sound, solid understanding of our industry's needs to migrate borders freely ensuring that Queensland's fat, healthy and strong honey bee colonies could be delivered on time and in great shape to our southern farming friends.

To be honest, getting the Queensland border arrangements secured for industry was a walk in the park. Queensland's Chief Health Officer and department, already had a solid understanding of the nature of work carried out by industry and evidence of the high level of compliance demonstrated by the beekeeping sector during the 2020 border closures.

In order for anyone reading this article to understand, you must appreciate the challenges of COVID-19, and closed borders. Most would naturally assume beekeepers migrating honey bees through states would be an essential activity under an agricultural operation and would 'fit in' to subsequent existing border framework for the agricultural industry. Some even suggested that the industry would be given the green light as agricultural had been deemed 'essential' by the Federal Government. Well, let's say they were wrong, really wrong.

The options for most state jurisdictional entry permits under the agriculture framework are, and continue to be incompatible with the operations of our industry. Essentially the job of the QBA over the past two years was to draw to the attention of respective state health departments that our beekeepers are technically primary producers, operating heavy-vehicles over long distances, regularly providing consigned goods to clients under contract.

Fundamentally we are a specialised industry that cannot be outsourced or imported into the country to fill a void. That pretty much sums up the basis of our initial efforts to see commercial beekeeping operations recognised under the National Heavy Vehicle Protocol for interstate movement across all eastern seaboard jurisdictions.

It must be said, this was a serious challenge for the industry. If we'd been left to operate under the agricultural permits for each state,

“ It must be said, this was a serious challenge for industry. If we'd been left to operate under the agricultural permits for each state, most orchards would have only seen a single delivery of honey bees... ”

most orchards would have only seen a single delivery of honey bees. Getting back to the 2021 migration. Although much of our work needed to centre around the closure of the New South Wales border with Victoria during 2020, the situation was reversed in 2021.

After working with our close network of Queensland Government contacts to establish the requirements for the movement of bees and beekeepers into NSW, it was then onto securing access provisions for entry into Victoria. On initial investigation, Victoria had a strict set of permit arrangements for the entry of essential workers into the state.

After contacting representatives from the Victorian health department, it became clear that the permit arrangements for the movement of agricultural workers would not meet the needs or the mechanism that is Australia's largest movement of livestock each year.

After constant consultation with representatives from Victoria Health and Agriculture Victoria, advocating for a more appropriate permit arrangement, we were successful in confirming an arrangement to allow commercial beekeepers to be recognised under the essential worker freight permit. Although some may believe that this may have been an insignificant win however, it secured entry provisions under the freight permit allowing apiarists to re-enter Victoria multiple times on the one permit over a 14-day period, thus minimising the large volume of paperwork and testing requirements.

After securing provisions for beekeeping industry to enter Victoria relatively freely, we were then faced with changes introduced to the Victoria entry requirements as well as challenges with the South Australian border. Again, after multiple

conversations and emails, it became clear that in order to migrate bees into Victoria, all drivers and support staff would need to meet a strict PCR COVID-19 seven-day testing regime. With the outbreak of the virus across NSW and the issues obtaining a test result in a timely manner we recognised we had a serious issue on our hands.

Obtaining a test in NSW was out of the question for many apiarists, and after careful investigation of the availability of covid testing sites, and their location with respect to the delivery of hives to orchards, we again faced another mountain to climb in order to ensure bees made it to orchards in time.

If the mandate on testing requirements wasn't enough to do, I then began to receive phone calls from concerned apiarists with regards to the delivery of hives into South Australian orchards. It was at this point in time I contacted Ross Skinner from the Almond Board of Australia for assistance (well it was more like an SOS).

Ross and I immediately pooled resources and got to work solving the issues advocating on two fronts. Firstly, with the support from Ross we were able to secure an agreement with Robinvale Hospital and Victoria health which would allow beekeepers and support workers to be easily tested onsite at the hospital across a range of working hours.

This was a huge relief for many apiarists contracted to supply bees to property owners. As it would effectively and efficiently allow them to migrate colonies into the orchard, point the truck for Robinvale to meet the requirements for testing, and begin the long journey back to base to commence the second run south to the orchards.

Entry access into South Australia

Continued page 24



was also a significant problem. From my work diary entries, it was with less than 10 calendar days before the scheduled arrival date of honey bee colonies, that multiple Queensland-based beekeepers had contacted me in a panic as they'd been advised of a lengthy process (then at play) to have an application to enter South Australia considered.

After discussions with the PIRSA Apiary Officer, it was clear that we'd need a small miracle on our side to secure access for our beekeepers and their critical livestock. Again, Ross Skinner was worth his weight in gold. Ross was in a position to liaise with key decision makers in South Australia to see our industry recognised under the freight and logistics permit pass to enter the 'Festival State'.

It was with less than seven days before bees were required onsite that the QBA executive and I finally felt that the 2021 migration to almonds would be a successful operation.

I believe it is important to emphasise, that although the QBA played a major role in securing provisions for permit access to the relevant almond growing states, the work of the stakeholder engagement group (which bought together the Almond Board, AHBIC, QBA, QLD Govt, NSWAA, NSW Govt, VAA, VIC Govt, SAA and PIRSA) was instrumental in ensuring open lines of communication across all jurisdictions to ensure migration in and out of orchards delivered another successful outcome for all involved.

Over the past 18 months I've been interviewed many times about the mass migration events in 2020 and 2021. The main question which continues to be asked is why did the Queensland Beekeepers' Association tackle the job of securing provisions for border access?

My answer. Our teams of apiarists travel the furthest, that's it. I'm thankful that the work our organisation has undertaken has benefited every apiarist who's supplied honey bees to almond growers and in turn, the growers are reporting another successful pollination event.

Although the COVID-19 pandemic has been a monumental headache/migraine, juggling the constant and evolving border changes, health requirements and being on call 24 hours a day to support apiarists who have been delayed at border check points, its all been worth it.

For those who are unaware, we've had, and continue to have a battle on our hands in Queensland, lobbying Government to secure a secure pathway to the continuation of access to floral resources through Queensland's National Park Apiary sites. Ultimately we need access to apiary sites without a legislated exclusion date.

The introduction of the pandemic, as crippling as it has been for many, has been a blessing of sorts for our industry. It has raised the profile and the importance of a healthy, productive and somewhat thriving honey bee industry in Australia, whilst highlighting the critical role and economic contributions of strong agricultural/horticultural sector amidst the chaos and uncertainty of lockdowns, uncertainty and economic instability.

I believe that through our constant engagement with the Queensland Department of Agriculture, Health, Transport, Police, the understanding, appreciation and the 'mood' about the importance of a strong honey bee sector has dramatically shifted.

Over the past 12 months, and on first impression, it's like the future of the Queensland beekeeping industry was being played out in the eyesight of policy/decision makers and senior ministers within the Queensland Cabinet. Very quickly, issues that we had been lobbying about over decades, were being escalated through the corridors and doorways into the 'in trays' of people who could enact change.

COVID has indeed opened multiple new doors for our organisation more recently. Doors that will remain open to encourage and facilitate clear and concise communication, ensuring the Government is well informed when it comes to making any decision that may impact our future and the future of our farming friends.

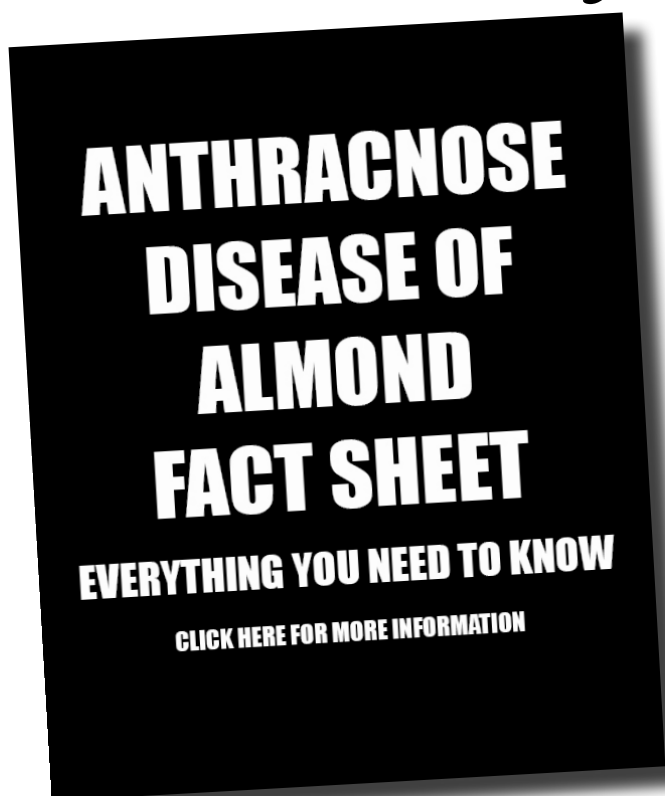
Although the constant nature of daily briefings and multiple daily meetings to 'stay on top' of the evolving changes was a 24 hour a day, seven-day a week beast, that seemed to last months, it was all worth it. Every single minute.

As I've been writing this piece for your reading pleasure, I've been snacking on the Almonds sent to me by my friends at the Almond Board. As I nibble on the nuts in the heart-shaped tin, it gives me a great 'buzz' to think I played a small but unique role behind the scenes from my home office in Boonah Queensland, in making it happen in 2021 for our beekeepers and almond growing mates.

In 2022, I hope to tick off a personal bucket list item. A matter that has been prioritised to the top of my list in recent years in light of the work I've been involved in. For those curious, it relates to a visit to one or more of the almond-growing regions (whilst pollination is underway) to experience the sights, smells and sounds for myself.

I wish everyone within the Almond industry sector all the very best for the season ahead. May your 2022 harvest be the most successful yet.

Get your *facts* straight



Suzanne McKay, Brittany Oswald, Len Tesoriero, Jacky Edwards and Mark Sosnowski have prepared a comprehensive fact sheet on anthracnose disease.

Anthracnose disease of almond in Australia is caused by several species of the fungus *Colletotrichum*.

The pathogen mainly affects young almond hulls but leaves, blossom and woody tissue can also be affected. *Colletotrichum* spp. also cause anthracnose on a wide range of other perennial crops, e.g. pistachio, orange, olive, avocado and grape, with serious yield losses reported.

KEY POINTS

- Anthracnose is a fungal disease that mainly affects young nuts and leaves
- All cultivars are likely susceptible
- disease development is favoured by mild to warm and wet conditions
- Infection mainly occurs in late winter and early spring
- Fungicides should be applied early in the season prior to the onset of symptoms.

Acknowledgement

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 investment, visit horticulture.com.au



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Nut industry 2030 vision launched

Nuts for Life has recently launched an exciting initiative – a 2030 Vision for the nut industry.

The 2030 Vision aims to get more Australians eating a handful of nuts daily, and provides a road map to help our industry get there, together. The goals within this are novel, bold and large-scale – real game changers for the nut industry.

Consistent research tells us of the well-established link between nut consumption and improved health. Despite this, Australians are still not consuming enough nuts, with just two per cent eating the recommended 30g of nuts a day.

The 2030 Vision will elevate the prominence of nuts within healthy and environmentally-sustainable diets to, ultimately, get more Australians eating a handful of nuts daily.

And importantly, the Vision will help all sectors of the nut industry to prosper into the future.

How will we reach our 2030 Vision?

1. First up, by boosting the prominence of nuts in the Australian Dietary Guidelines. Nuts are essential for good health – similar to fruit and vegetables. They've earned a greater 'piece of the pie' – and this should be reflected in the next Dietary Guidelines.
2. Secondly, by working to gain a high-level health claim for nuts, for use on packaging. This would really cement, in the minds of health professionals and the Australian public, just how crucial nuts are for heart health.
3. And lastly, by changing labelling policies to reduce the energy (or kilojoule) values on pack, for nuts. Nuts provide our bodies with up to 30% less kilojoules than what's currently listed on nutrition labels. The existing labelling system is outdated, and we want that to change.

To support this bold advocacy, Nuts for Life will continue to connect with health professionals – sharing the nutrition and health benefits of nuts.

To learn more, access the 2030 Vision Blueprint and Supporting Document from the 'About' page of the Nuts for Life website: <https://www.nutsforlife.com.au/about/>



A glass of white milk stands on the left side of the image. To its right is a white ceramic bowl filled with almonds, garnished with two green leaves. Several almonds are scattered on the dark, textured surface around the bowl. The background is a dark, textured surface.

**“ By 2030,
10 million
Australians
will be eating
nuts daily,
generating
an additional
\$350 million
for the
Australian nut
industry...**

- Nuts for Life

About Nuts for Life

Nuts for Life is Australia's credible voice for the crucial role tree nuts play in good health and nutrition. On behalf of the nut industry, Nuts for Life works closely with health professionals, government, and other bodies to improve the nutritional reputation of nuts.

US almond findings lead to successful trials in Australia

Research in California, showing activity on the adult stage of a species similar to the Carob moth led to grower trials in Australian orchards last season.

The trials were facilitated by Graeme Judd, Senior Agronomist with E E Muir at Mildura.

Graeme said the United States research had been conducted with the active ingredient Spinetoram on the Navel Orange Worm.

"Physiologically, Navel Orange Worm is closely related to Carob moth so I was interested to see if we could replicate it with Delegate® insecticide in Australian almond orchards."

High-pressure orchards in Hillston, NSW and Sunraysia, Victoria were chosen for the trials with Delegate applied at night in January when the almonds were between one and five per cent hull-split.

"We compared Delegate to



Graeme Judd, of E. E. Muir and Sons, Mildura, VIC, said trials had shown the effectiveness of Delegate insecticide in reducing adult Carob moth numbers as well as the larvae.

is the most susceptible to damage from Carob Moth and Carpophilus Beetle due to being a 'softshell' variety. Hard shell varieties such as Carmel, Monterey and others are far less susceptible."

He said the trials demonstrated the ability of Delegate to control adult moth populations as well as larvae at a critical time of the season. "Carob moths fly at night and if you can spray to reduce moth numbers and break the breeding cycle it will provide better control."

"Delegate is definitely having an effect on moth numbers. It is reducing the numbers that are able to breed as well as getting control of the Carob moth larvae themselves."

The Carob moth lays its eggs along the suture line on the almond kernel and there is a small window of opportunity to spray with an insecticide before the larvae make their way into the nut.

Delegate has ovicidal and larvicidal activity on the juvenile pest and is an excellent option to reduce the amount of damage.

Graeme said Carob moths were a challenge for Australian almond growers and often started in the off-season with the expensive process of poling mummy nuts out of the trees.

"We monitor flight numbers with in-orchard traps and will occasionally conduct an insecticide application in the late-September to mid-October period if the pressure is high."

He said Prodigy, from Corteva was an ideal option to control the first generation of Carob moth larvae, followed by Delegate for the second generation at hull split.

"Prodigy is a Group 18 and Delegate is a Group 5 insecticide, so they work well in rotation."

"Both options can also be rotated with other modes of action to help prevent resistance."

the industry standards for the control of Carob moth and also looked at activity on Carpophilus beetle," Graeme said.

"In a comparison with another Carob moth insecticide Delegate had 6 per cent damage and the comparison product had 16.3 per cent damage.

"A separate trial had Delegate

against an alternative comparison product with just one per cent damage compared to 4 to 6 per cent damage from the other.

"In general, Delegate did an exceptionally good job.

"It produced a better result than the other products on the pests based on this year's trials."

He said one interesting finding in the trials was the activity of Delegate on Carpophilus beetle.

"We sampled 300 nuts from one of the trials to see the effectiveness of both products on Carob moth and Carpophilus beetle.

"In the Delegate sample there was one mummy nut but no live pests. In the other product sample, there were five live Carob moth grubs and two live beetles."

Carpophilus beetle is currently not on the Delegate label, however work is being conducted by Corteva to determine its efficacy on this pest.

Early results from the Corteva work have been very encouraging and a decision on whether to add it to the label will be made soon.

Indications are that both Carob moth and Carpophilus beetle can be controlled with a Delegate insecticide application at the early hull-split stage.

Graeme said the trials were conducted on the Nonpareil almond variety which was widely grown in Australia and throughout the world because of its demand by processors. "Nonpareil Almond variety

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Almond *research* update

Clear traps may be the best for catching Carob Moths

Fazila Yousuf and David Madge
Agriculture Victoria

Almond producers generally use white delta traps to monitor Carob Moth activity in their orchards, but Agriculture Victoria Research scientists have found clear traps may be more effective.

Trapping carob moths in almonds

Carob Moth is a major pest of almonds in Australia. To monitor this pest, almond growers use traps baited with artificial sex pheromone. The pheromone mimics that of female Carob Moths and specifically attracts males, which are then caught on the sticky trap liner. In Australia, white tent-like delta traps are used for carob moth monitoring, but is white the most effective colour?

Plant-feeding insects use a combination of visual cues and odours to locate host plants. Colour vision is not only used by day-flying insects, but also those that are active at dusk or at night, such as Carob Moth. Moths have been shown to discriminate between different colours in extremely low light conditions where humans are almost colour-blind, and they use visual cues to identify different coloured hosts at night. In moths, colour also plays a role in male orientation and landing near sources of sex pheromone.

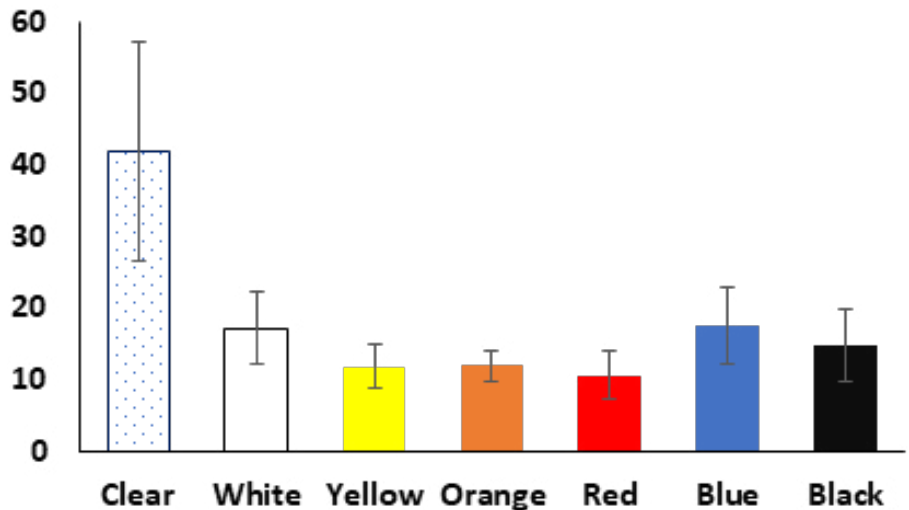
Male Codling Moth, for instance, is more attracted to orange traps baited with sex pheromone than to white ones; and in some studies, visual cues have been found to be even more important than odours. Surprisingly little is known about how colour influences Carob Moth behaviour, so as part of the Almond IPM project (Hort Innovation Project AL16009), we are conducting field trials to evaluate the attractiveness of different coloured traps to this pest, to help improve trapping efficiency.

Last season's field trial

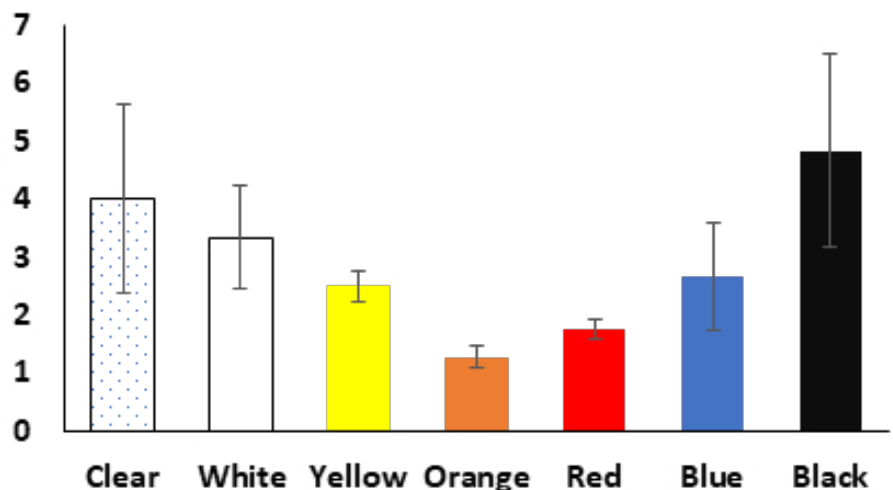
Our first trial was conducted from late January to mid-March 2021 in a

Continued page 32

Mean number of male Carob Moth



Mean number of female Carob Moth



Mean number of other insects

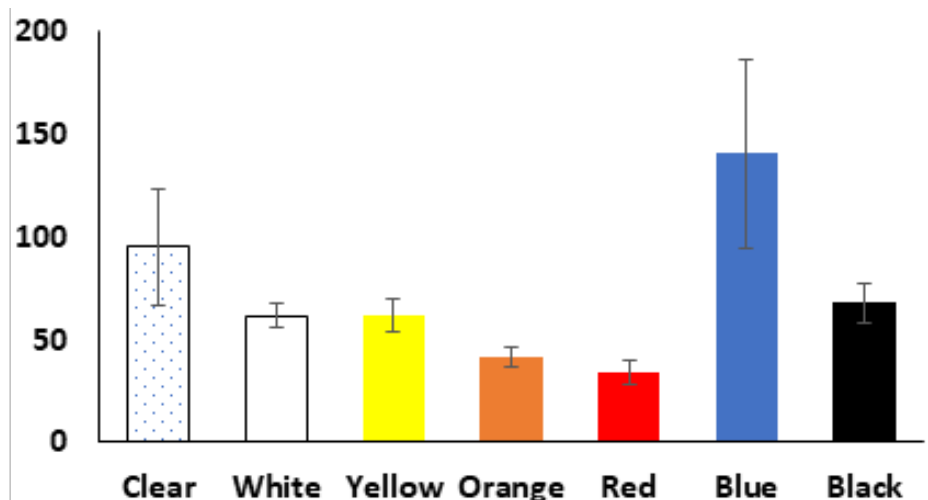


Figure 2: Insects caught in sex pheromone-baited colour traps in the almond orchard: (a) male Carob Moth, (b) female Carob Moth, and (c) all other insects. Results are shown mean (\pm standard error) catch per trap over the eight-week experiment period.

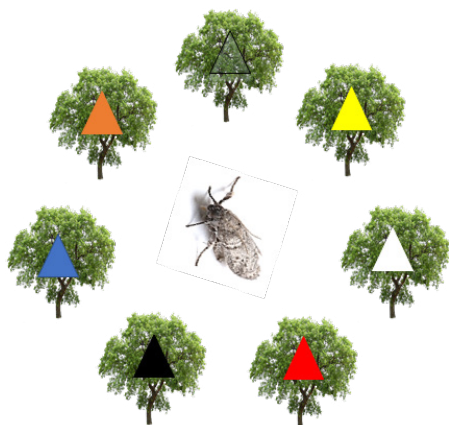


Figure 1: Different trap colours affect the flight behaviour of Carob Moth.

commercial almond orchard in the Robinvale district of Victoria, using seven different coloured delta traps: white, yellow, red, orange, blue, black, and clear (Figure 1).

The clear traps were made of shiny plastic, while the other coloured traps had a matte finish. All traps were lined with standard white sticky cards and were baited with an odour lure (rubber septum impregnated with synthetic female sex pheromone). Traps were hung on wire hooks from branches of almond trees at a height of around two metres and spaced twenty metres apart. All insects caught on the sticky liners were counted at weekly intervals.

Clear traps appear to be better!

Our early results indicate that clear traps are more effective in catching male Carob Moths than the standard trap (white) or other colours (Figure 2a). Female Carob Moths were also caught, but in low numbers (Figure 2b). Non-target insects such as flies, wasps, and bugs preferred blue traps over other colours (Figure 2c). Overall, yellow, red, and orange were the least preferred colours for Carob Moth as well as for non-target insects.

Why might clear traps catch more Carob Moths?

One explanation could be that the smooth, shiny surface of clear traps reflects polarized light, which the male moths detect as an attractive cue. Some insects, including moths, are known to detect polarized light and can distinguish matt from shiny surfaces by perceiving them as different colours. Alternatively, the



Fazila Yousuf of Agriculture Victoria Research checks a trap in her colour trapping trial.

colour of almond foliage and nuts as perceived through the clear traps may be more attractive to Carob Moths than opaque, coloured traps. It is also possible that the actual colour of the coloured traps repels the moths to some degree.

Another explanation could be that the male moths are attracted to other Carob Moths (or other insects) that are caught on the sticky liners, visible through the clear traps but not through the opaque coloured traps. We are hoping to explore some of these possible explanations in follow-up trials.

What next?

Our experiment covered the third-generation flight of Carob Moth (late January to mid-March). More experiments will be conducted next season during the spring flight (September to November) and first summer flight (early December to late January). As well as trapping males, we will also test the response of female carob moths to different colour traps baited with food lures. Other properties of colour, such as shade, reflectance, and texture (shine/matt) can also influence insect attraction and make significant differences to the effectiveness of traps. In this season's trials, we plan to investigate the role of texture by using shiny coloured traps. In addition, laboratory studies will be conducted to better understand the visual response and behaviour of Carob Moth.

How might this knowledge benefit growers?

If our findings are confirmed in further trials, the adoption of clear delta traps baited with female sex pheromone could improve the efficacy of Carob Moth monitoring in almonds. Transparency and/or texture may be an important factor in the design of a mass trapping system for Carob Moth.

Acknowledgements

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Hort
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Strategic levy investment

ALMOND
FUND

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 investment visit horticulture.com.au

New genetic technologies power the Australian Almond Breeding Program

Wilkinson, Hardner, Wirthensohn
Varieties with superior performance for commercially important traits, such as kernel size, support sustained industry growth and development. The levy-funded Australian Almond Breeding Program utilises traditional breeding, which typically involves the transfer of pollen from one variety to the flower of another variety (refer to Figure 1).

Using this technique, the program has produced thousands of unique individuals. Only the best performing individuals, selected after extensive field evaluations, go on to become varieties. The breeding program has produced six new varieties for Australian growers to support the expanding Australian almond industry (<https://australianalmonds.com.au/topic/varieties-and-rootstocks>).

Because genes are inherited from the parents, the selection of parents that can produce high-performing individuals is extremely important. In traditional breeding, the performance of these parents is recorded as a breeding value. This breeding value is often calculated using a combination of measurements of the parent's own

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Parent	BV	Highest and lowest BVs
155	6.56	Highest 5%
Ferraduel	5.42	Highest 5%
Mandaline	4.99	Highest 5%
Marta	4.86	Highest 5%
Ferralise	4.49	Highest 5%
A98031>R30T45	1.39	Lowest 5%
LeGrand	1.46	Lowest 5%
Price	1.51	Lowest 5%
R29T105	1.54	Lowest 5%
Peerless	1.60	Lowest 5%

Table 1. The five parents with highest, and lowest, predicted breeding value (BV) for in-shell weight (g) based on a pedigree analysis of offspring data.

field performance for various economic traits including yield, disease resistance, and self-fertility.

However, the observed performance of an individual is the result of both the genetics of the variety and other environmental effects which cannot be inherited. Breeding values predicted using its own performance therefore may not accurately reflect true breeding value as the impact of the environmental effect cannot be separated from its genetics.

To better understand the true performance of these parents, researchers from the National Tree Genomics Program (a new Hort Frontiers initiative funded by Hort Innovation with co-investment from research partners and funds from the Australian Government) have used the wealth of historic data collected by the Australian Almond Breeding Program to predict more accurate breeding values of parents.

Applying methods long used in cattle breeding, breeding values have been predicted (in-shell weight example - Table 1) using the historical knowl-

edge of pedigrees of parents (Figure 1) and the average performance of their offspring. These breeding values have successfully been used by researchers in the breeding program to select high-performing parents with increased confidence, increasing the chances of producing superior varieties for industry.

Researchers from the National Tree Genomics Program are also investigating new genomics technology where the breeding value of a parent can solely be predicted from its DNA. These genomic prediction models are built by combining unique information on the parent's genetic code with existing field performance data. Our research will test if these models can accurately predict breeding values and accelerate the efficiency of the Australian Almond Breeding Program.

For more information regarding the National Tree Genomics Program - <https://www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/as17000/>

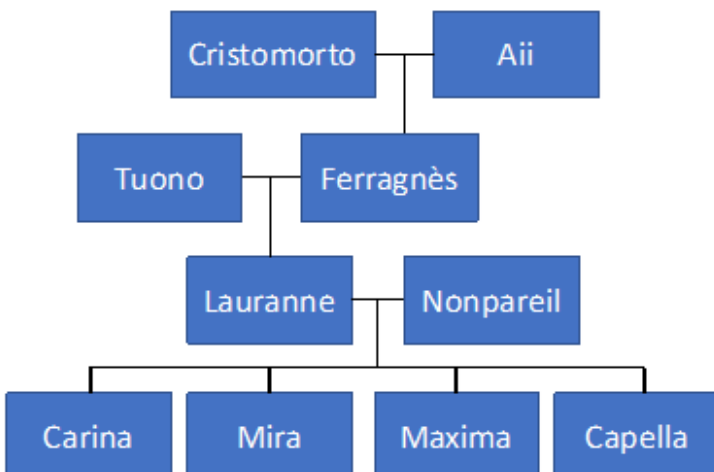


Figure 1. Pedigree showing the lineage of four new varieties from the Australian Almond Breeding Program.



Pictured in the ACE orchard are (from left) Jana Kolesik, Ethan Dight, Michelle Wirthensohn, all from the University of Adelaide.

Almond Farms of the Future – new Hort Innovation program on intensified orchard systems

Grant Thorp Plant & Food Research

The almond industry is one of five tree crop industries in Australia, along with avocado, citrus, macadamia and mango, set to benefit from new research into the possibilities and practicalities of more intensified growing systems. The projects are part of the National Tree Crop Intensification in Horticulture Program (AS18000), funded by the Hort Frontiers Advanced Production Systems Fund, part of the Hort Frontiers strategic partnership developed by Hort Innovation (refer separate article on page 36).

The cross-sector, multi-organisational research and development effort will provide the step-change needed to progress the understanding of physiology, agronomy, genetic, economic and management practice implications of increased orchard intensification. This will allow orchard owners, managers and researchers to make more informed decisions on orchard systems.

The five-year research program is comprised of several components located at the ABA Almond Centre of Excellence in Loxton North, SA, and at private grower sites across SE Australia. Plant & Food Research (PFR) is

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leading the research on almonds in partnership with the South Australian Research and Development Institute (SARDI), the research division of the Department of Primary Industries and Regions. Here, Dr Grant Thorp, Project Leader for PFR, provides an overview of the breadth of research and development that industry stakeholders will have an opportunity to engage with over the next four and a half years of the program. Data presented here are preliminary summaries from the 2021 harvest.

ABA Almond Centre of Excellence

Field trials at the ABA Almond Centre of Excellence, established by PFR and SARDI scientists, are at the heart of almond research in the new AS18000 program. The purpose of the research is to take a fresh look at almond orchard design with new, more intensive planting systems, cultivars with architectural traits better suited to high-density orchards, rootstocks to help manage vigour, and pruning/training systems to produce trees with the desired narrow canopies.

Large-scale experimental plantings, established in 2018, were designed to demonstrate the effects of intensification of orchard systems in replicated trials, including pruning responses, rootstock/scion combinations, and the associated impacts on resource requirements across a continuum of planting densities.

The first substantial yields from these trials were harvested during this 2021 season, with some impressive results from 3rd-leaf trees.

While no cultivar is perfect, and with further seasonal data needed to build confidence in the results, there is certainly optimism with the new cultivars released from the Australian almond breeding program.

PFR High Density Trial

PFR is testing a model high-density

Cultivar (3rd-leaf trees)	Kernel yield (kg/tree)	Crackout (t/ha)	Crackout (%)
Vela	3.33	2.47	29
Shasta®	2.72	2.02	29

Table 1. Kernel yield per tree and per hectare (based on 741 trees/ha) and crackout of 3rd-leaf Vela and Shasta® almond trees at ABA Loxton, harvested in 2021. Trees were spring-budded on Nemaguard rootstock and planted in 2018.

Cultivar (3rd-leaf trees)	Kernel yield (kg/tree)	Kernel yield (t/ha)	Crackout (%)
Carina	2.86	2.12	17
Maxima	4.72	3.50	22
Nonpareil	3.10	2.30	24
Shasta®	2.17	1.61	21
Vela	3.23	2.39	26

Table 2. Kernel yield per tree and per hectare and crackout of 3rd-leaf Carina, Maxima, Nonpareil, Shasta® and Vela almond trees at ABA Loxton, harvested in 2021. Trees were budded on Garnem rootstock and planted in 2018 with 741 trees per ha.



Figure 1. Vela (left) and Shasta® (right) trees on Nemaguard rootstock planted in 2018 in 4.5m wide rows (images taken July 2020). Trees were side-trimmed in winter 2019 to encourage a tall, narrow canopy.

growing system with 4.5m wide rows against a more traditional spacing with 6.5m rows. Using the new self-fertile cultivars Vela and Shasta® on Nemaguard rootstock, the project is comparing planting densities with 513 (6.5 x 3 m), 769 (6.5 x 2 m), 741 (4.5 x 3 m) and 1111 trees per ha (4.5 x 2 m).

All trees were spring-budded in December 2017 and selected in the nursery in winter 2018 to have a single dominant trunk (central leader) with multiple side branches. Trees were then planted in the orchard with no pruning of lateral shoots with the objective to grow a tall, narrow "slender pyramid" shaped tree with minimal pruning (Figure 1).

Trees were machine harvested onto nets in 2021 and the crop collected from these nets for weighing (Figures 2 and 3). Average yields on 3rd-leaf trees across all planting densities in 2021 were 3.33 and 2.72 kg/tree, which is the equivalent of 2.47 and



Figure 2. Harvesting crops from 4.5m rows. The crops are shaken onto nets then picked up by hand and weighed.

2.02 t/ha of kernel, for Vela and Shasta®, respectively (Table 1). Further analysis, taking into account water and fertiliser usage is required before we can make detailed comment on the effects of planting density. SARDI Super-High Density Trial Planted in May 2019, this trial is assessing the effect of intensification, ranging from high density through to super-high density.

This fully replicated trial covers 1.6 ha and includes the self-fertile varieties (Vela and Shasta®) grafted on each of three size-controlling rootstocks (Controller™ 6, Controller™ 7 and Rootpac® 40). Each grafted combination is being assessed across three planting densities: 635 trees/ha (4.5 x 3.5 m); 889 trees/ha (4.5 x 2.5 m) and 1481

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Genotype (3rd-leaf trees)	Kernel weight (kg/tree)	Yield efficiency (g/m ³)	Genotype (3rd-leaf trees)	Kernel weight (kg/tree)	Yield efficiency (g/m ³)
Nonpareil	3.11	175	UA24	1.76	102
Capella	3.31	211	UA25	1.93	106
Carina	2.27	141	UA33	3.48	256
Maxima	5.36	314	UA101	4.33	266
Mira	4.14	244	UA102	2.66	270
Rhea	2.41	203	UA103	1.45	139
Vela	2.84	179	UA104	4.39	343
			UA18	5.65	319

Table 3. Kernel yield per tree and yield efficiency in 2021 of 15 genotypes of almond trees at ABA Loxton. Trees were budded on Garnem rootstock and planted in 2018 as unpruned central leader trees. Yield efficiency is the weight of kernel per m³ of canopy.



Figure 3. The PFR team picking up the crop from nets for weighing and taking a subsample for hulling and cracking to determine kernel yield per tree

trees/ha (4.5 x 1.5 m). The large scale of this randomised complete block design ensures that quantification of production efficiencies will be biometrically robust. The first crops will be harvested in 2022.

SARDI's automated orchard assessment platform will be critical in this research (Figure 4). Designed and built

by the SARDI research team, this is a new piece of equipment to describe canopy responses to higher density planting systems across large areas of field trials. The platform includes LiDAR scanners to estimate tree size and pyranometers to record light interception. Output data, georeferenced by irrigation valve unit, experimental plot or individual trees, will



Figure 4. Members of the Crop Reference Group examining the SARDI Mobile Orchard Phenotyping Platform (MOPP) used to collect light interception and tree dimension data from trees in the Super High Density trial block at the ABA orchard in Loxton North. Image supplied by Ben Wiblin.

provide estimates of yield efficiency across the different planting densities and scion/rootstock combinations, thus linking light interception and canopy structure with kernel yields.

PFR Pruning Responses Trial

This study is looking at various young tree management systems with five varieties (Nonpareil, Maxima, Carina, Vela and Shasta®) budded on Garnem rootstock and planted in July 2018 at 4.5 x 3 m spacing (741 trees per ha). Starting in the nursery, trees were selected to have a single dominant trunk with multiple side branches. They were then grown in the orchard with different training/pruning methods to produce the desired narrow tree shape.

An additional “low cost” option was to plant trees that were dormant budded in May 2018, planted in the orchard in July 2018 with a “sleeping eye” bud. These trees were then trained during spring and summer to produce the desired tree shape (Figure 5). Garnem rootstocks are well known as a vigorous rootstock. Hence maintaining trees on this rootstock within their allocated space in 4.5m wide rows, with minimal pruning, has been a challenge. None-the-less average yields from 3rd-leaf trees in 2021 ranged from 1.61 to 3.50 t/ha for Shasta® and Maxima, respectively (Table 2). Yields were similar across all treatments so even the “low cost” dormant budded trees produced good yields for 3rd-leaf trees.

PFR Architectural Studies

This research aims to identify and work within the architectural features

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\$28 million program to improve farm productivity

A new research and development program launched by Hort Innovation aims to arm growers with the tools they need to produce more fruit and nuts per hectare.

The five-year \$28 million National Tree Crop Intensification in Horticulture Program will develop the needed systems to increase the intensity of orchards whilst improving production, quality and profitability outcomes for growers. Initially, the program's focus is on almonds, avocados, citrus, macadamias and mangos.

Hort Innovation Research and Development Manager Dr Adrian Hunt said: "The program will optimise the orchard system to help produce more fruit or nuts per hectare. The program will investigate scion rootstock combinations, orchard design, vigour and canopy management strategies for optimal light interception. Orchard automation is also a key industry goal and the program will provide insights from a tree physiology perspective to facilitate this transformation."

The program involves an international collaboration of leading research providers from Australia, New Zealand, USA and Spain — creating a transformational international research program.

The program is being led by the Queensland Department of Agriculture and Fisheries, New South Wales Department of Primary Industries and Plant & Food Research, in Australia and New Zealand. Collaborators include South Australian Research and Development Institute (SARDI), Queensland Alliance for Agriculture and Food Innovation, Western Australia Department of Primary Industries and Regional Development and Food Innovation, the University of Adelaide, the University of California Davis, and the Centro de Investigación y Tecnología Agroalimentaria de Aragón (CITA) and Institut de Recerca i Tecnologia Agroalimentàries (IRTA) from Spain. NSW Minister for Agriculture, Adam Marshall, said citrus was one of most important horticultural industries in NSW, worth \$242.6 million per year. "NSW produces around 250,000 tonnes of citrus annually, representing 40 per cent of Australia's production and 36 per cent of citrus exports," Mr Marshall said.

"The NSW Department of Primary Industries has the largest citrus research and extension team in Australia and plays a leading role in supporting the NSW and Australian citrus industry with its substantial research, extension and information capacity."

These improved and intensive cropping systems will contribute to the strategic priorities of industries included in the program. The projects include on-farm demonstrations that will provide critical insight in the adoption and extension of intensive cropping. Each of the five crops also have crop advisory groups to provide ongoing insight and feedback from growers and researchers. NSW Department of Primary Industries Director Horticulture Dr Shane Hetherington said, "Our research program will address citrus tree canopies modified using dwarfing viroids, dwarfing rootstocks, planting densities, pruning and cultural practices, and plant growth regulators to understand their effect on the relationships between fruit density, canopy volume and saleable fruit. "Our work will also include surveys of a wide range of citrus varieties in an attempt to better understand the physical traits that promote fruit density and, in turn, suitability to production intensification."

Plant & Food Research Australia Scientist Dr Grant Thorp said: "Plant and Food Research has provided global leadership in increasing the yield per hectare of apple and other high-value crops through the intensification of tree crop production systems over the years. We're glad to be collaborating with SARDI and researchers and growers in Australia, California and Spain to intensify the production systems of almond and macadamia. We'll do so through increasing understanding of the underlying physiology and genetics of key orchard systems components and through the development of systems to better manage these components."

The program is closely linked to the National Tree Genomics program also underway in the Hort Innovation Advanced Production Systems Fund. By working together, the programs are collectively gaining new knowledge in areas of shared interest and increasing the efficiency of delivery outcomes.



Figure 5. Nonpareil almond trees on Garnem rootstock, either spring-budded in December 2017 (left) or dormant budded in March 2018 (right) and planted in the orchard July 2018. Similar yields of 3.09 kg/tree were harvested from both sets of trees in 2021. Images were taken in November 2020 (arrow indicates position of original dormant "sleeping eye" bud).

limiting orchard intensification in almonds and to develop advanced production systems specific to each cultivar. The research will help identify cultivars that are inherently more amenable to intensive production systems and naturally form the desired tall "slender pyramid" tree shape. Research will also assist breeders to select for higher productivity genotypes at an earlier stage in the breeding pipeline than at present.

There are 15 genotypes in the current project, including six new cultivars recently released from the University

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of Adelaide breeding program, eight novel genotypes with contrasting tree architectures from the same program, and Nonpareil as the control variety.

Trees were budded on Garnem root-stock and planted in July 2018 at 4.5 x 3m spacing (741 trees per ha). Apart from removing lower branches, up to 60 cm on the trunk, the trees were left to grow with no pruning so we could observe the natural growth habit of each genotype. In 2021, average yields ranged from 1.45 to 5.65 kg/tree of kernel (Table 3).

To give some context to these results, if the trees were planted in a more standard orchard with 513 trees per ha (6.5 x 3m) producing 5.65 kg per tree, yield would have been the equivalent of 2.9 t/ha on 3rd-leaf trees with no pruning.

However, the main objective of this part of the program was to identify trees with interesting growth habits suitable for high density plantings and with high yield efficiency or quantity of kernel per canopy volume (g/m³). In that regard, while UA18 and Maxima had the highest yield the genotypes UA104 and UA102 were of interest as they had high yields on relatively compact trees (Table 3 and Figure 6).

PFR Regional Trials

In addition to the established research underway at Loxton North, a national network of demonstration trials has been established across the main almond growing regions of SE Australia to explore intensification strategies and practicalities under localised scenarios. The projects are already providing good baseline data on the performance of the new ABA cultivars growing under commercial management across a range of soil types and growing conditions.

A Crop Reference Group comprised of growers, industry advisors and research team members is providing feedback on research activities and findings to guide interpretation and relevance for industry. Frequent field and training events are also planned, to give industry stakeholders the opportunity to engage in the research and experience these innovative management systems for themselves. For more information, contact Grant Thorp, Senior Scientist (PFR) on 0422 610 748 or grant.thorp@plantandfood.com.au.

UA18



'Vela'



UA104



UA102



Figure 6. Examples of contrasting growth habits from the architectural study. Trees were planted in 2018 and images were taken in winter 2020 (left) and before harvest in summer 2021 (right).



This is a project of the National Tree Crop Intensification in Horticulture Program, funded by the Hort Frontiers Advanced Production Systems Fund, part of the Hort Frontiers strategic partnership initiative developed by Hort Innovation, with co-investment from Plant & Food Research, South Australian Research and Development Institute, Hort Innovation using the Almond research and development levy, and contributions from the Australian Government.





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ALMOND BOARD OF AUSTRALIA

ABA MEMBERSHIP: JOIN TODAY

The Almond Board of Australia (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

