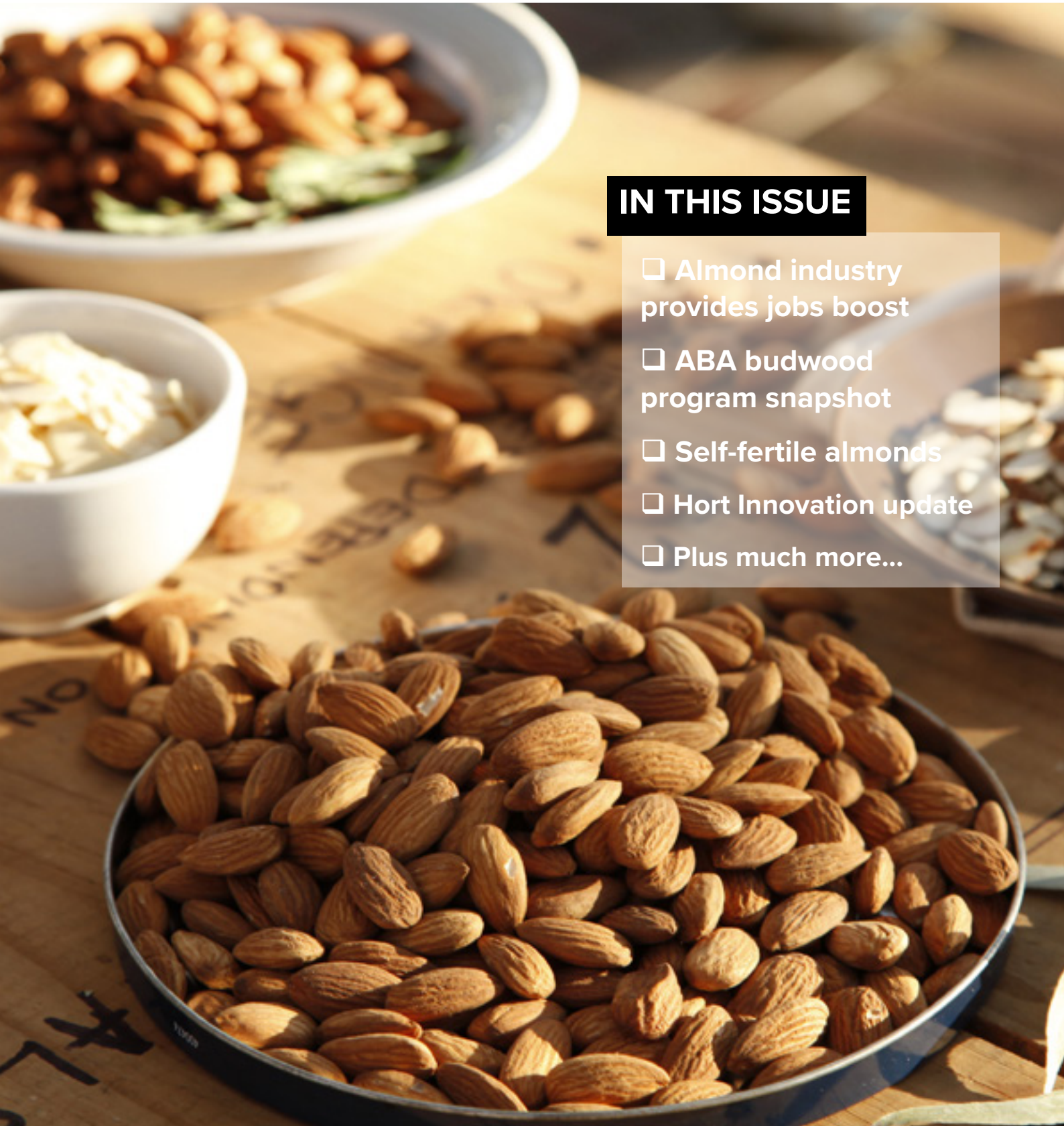
australian almonds

In A Nutshell

The Official Newsletter of the Australian Almond Industry Winter 2021



IN THIS ISSUE

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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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In A Nutshell

The Official Newsletter of the Australian Almond Industry

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For more industry updates, news, recipes and grower resources head to our website and social media pages

From the *Executive...*

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

The global almond industry has been expanding at a rapid rate in California, Australia, Spain, and Portugal. The young orchards planted since 2015 are reaching full maturity, and those planted more recently are also contributing to the rising productive capacity of the global industry.

Booms in viable horticultural industries are nothing new and are usually accompanied by falling returns. 2020/21 was such a year for almonds with large crop increases in the US, Australia and Europe leading to substantive falls in prices for almonds in world markets.

The pandemic and shipping logistical issues added challenges to the already confronting situation. The fall in price has seen demand respond strongly with record monthly shipments set by the Californian and Australian industries. Consumers love almonds.

They are a nutritious, versatile nut with proven health benefits. For those uneasy with the treatment of farmed animals, almonds provide an important alternate source of protein needed for a balanced diet. Plant based diets are growing in popularity for many reasons and this has contributed to the almond industry being well placed to benefit from a steady demand growth trajectory.

Strong economic growth in countries with established consumption of almonds has further contributed to the positive outlook for almonds over the past two decades. However, in 2020-21 supply in California jumped dramatically, and the price point at which supply and demand found equilibrium was around 30 per cent lower than the previous year.

In the past, it has taken quite a period for the price of almonds to recover, but this has not been the case this time as global supply has been impacted by the drought being experienced in California.

The objective crop tonnage estimate was a 10 percent reduction on the subjective estimate derived from grower opinion of their crops early in the growing season. Now with the Californian harvest underway, the actual yields are indicating a crop size in line with or slightly smaller than the objective estimate.

The drought impacting much of California's wonderfully fertile central valley is classified as extreme and exceptional. Similar harsh droughts have been experienced in Australia twice in the past twenty years and recovery of orchards that have been severely stressed from lack of water or poor quality water takes time.

Ideally, a steady growth in supply matched by consumer demand provides market and price stability. Drought is becoming a significant and more regular influence on the global almond market. It is hoped that the rain and snowpack in California's Autumn and Winter returns to normal so a steady rather than bumpy movement in supply can be restored.

If it is harvest time in the US, it must be the pollination season in Australia and the start of our growing season.

"Almonds are a nutritious, versatile nut with proven health benefits. For those uneasy with the treatment of farmed animals, almonds provide an important alternate source of protein needed for a balanced diet. Plant based diets are growing in popularity for many reasons and this has contributed to the almond industry being well placed to benefit from a steady demand growth trajectory.

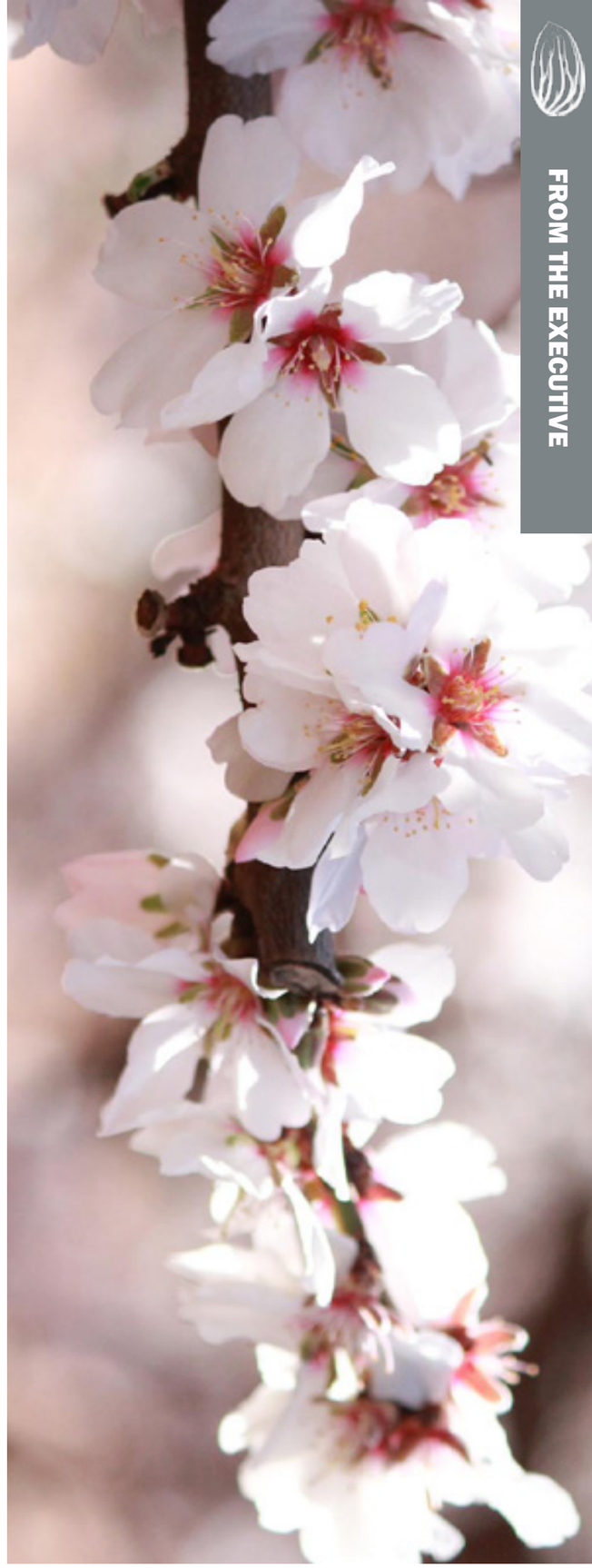
This year has again seen state border closures and covid-19 testing regimes create challenges for those freighting beehives.

With government co-operation and the resilience of beekeepers, these issues have been overcome and growers have been able to secure sufficient hives. The weather has allowed very good bee flight hours, and a strong synchronicity of varietal bloom has meant the pollination period has progressed well.

We have passed the first hurdle towards having a good 2022 crop. With regards to the 2021 crop, the first quarter of the marketing year has seen an increase in export sales of 43 per cent over the same period last year, but it must be remembered the early sales in 2020 were slower than in the past.

The marketers report that demand for Australian almonds is strong at the improved prices.

In concluding this report, we are pleased to report that Tim Jackson will be joining the ABA in October to take up the CEO Role. We will get to know Tim and our other new staff members in our spring edition of In A Nutshell.



Almond industry provides *major* jobs boost

A recent study has revealed a whopping one in every twenty jobs is being generated from the almond industry in the Sunraysia and Riverland regions...

The Australian almond industry is generating one in every twenty jobs in Sunraysia and the Riverland producing regions.

This significant number is according to a recent economic study completed by Bendigo based consulting firm RMCG in a project funded by Horticulture Innovation Australia (AL19004).

RMCG, who routinely submit business cases to Departments of Treasury and Finance at state and commonwealth levels, also found that the almond industry contributes one dollar to every thousand dollars of Australia gross domestic product.

The study showed the highest contributions come from the Sunraysia and Riverland regions, contributing $482 million and $213 million, respectively, to gross regional product (GRP). In these regions, the almond industry is a significant driver of the economy, accounting for 8.3 per cent and 9.2 per cent of Sunraysia and Riverland GRP, respectively. The industry directly and indirectly employs 2,206 people in the Sunraysia region, and 946 in the Riverland.

While the industry made up 3 per cent of the Riverina economy, its contribution to the local economy in that region is likely to grow rapidly as new plantings commence bearing and older trees reach full maturity. The study was undertaken on the 2019 crop of 107,000 tonnes, marketed during 2019-20.

The growth of the almond industry should continue to contribute strongly to the economic wellbeing in the producing regions as the industry's tonnage is forecast to reach more than 180,000 tonnes by 2025, a 70 percent increase over the study's tonnage.

The report is important in illuminating the contribution almonds is making to the growing regions, that also benefit from other horticultural crops such as grapes and citrus. These are all high value crops, generating a strong return on key inputs such as water and labour, and deliver benefits to the growing communities and nation through direct employment or the purchase of supplies and services that provide further jobs in the growing areas and beyond.

JOBS BOOST

"The growth of the almond industry should continue to contribute strongly to the economic wellbeing in the producing regions as the industry's tonnage is forecast to reach more than 180,000 tonnes by 2025...

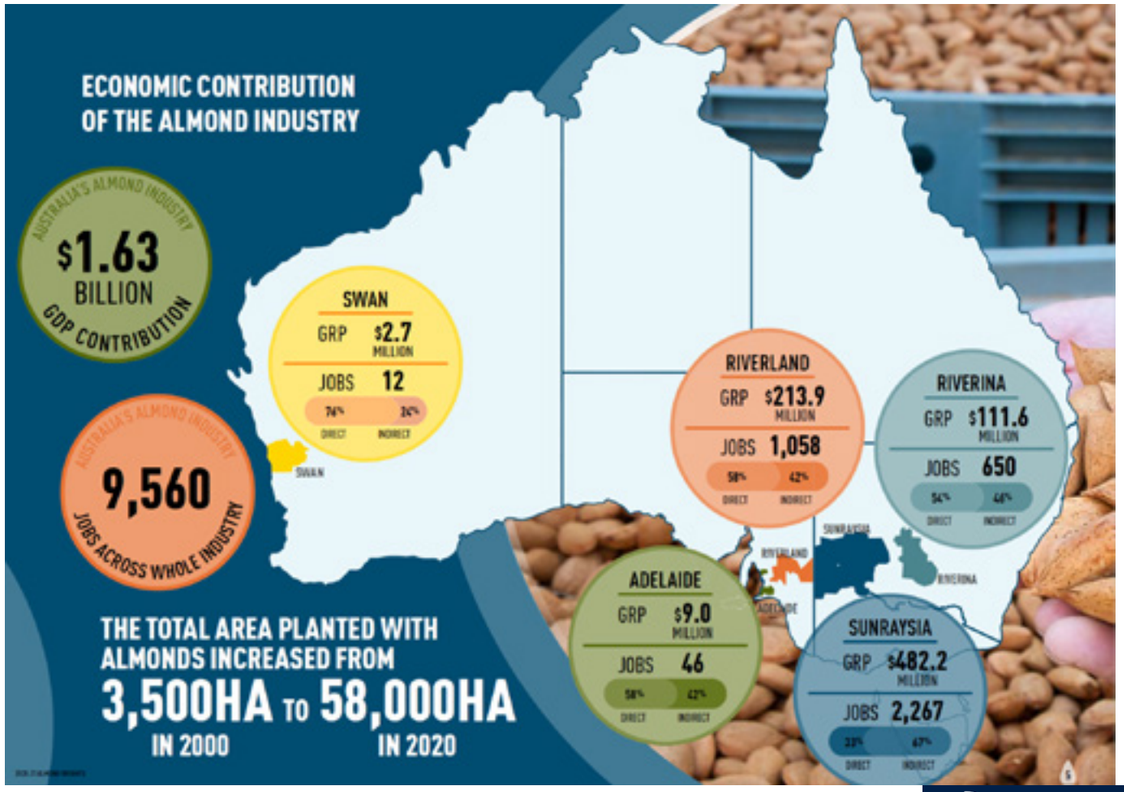
The study highlights the benefits that viable agricultural industries can contribute to their growing regions and also the wider population.

The industry has increased its plantings since 2016, and these new trees will deliver increased crops year on year for the next few years to help meet a growing demand for almonds driven by the health benefits of eating nuts and an increase in consumers preferring plant-based protein.

The industry's statistical booklet "Almond Insights" was recently completed for the 2020-21 year and is available to download from the ABA's website. It shows domestic sales of Australian grown almonds grew nine per cent in the 2020-21 marketing year. This resulted from an increase in home use and hundreds of new products using almonds as an ingredient making their way onto retail shelves.

The export tonnage was also a record with a slight increase to the prior year's figure despite logistical issues with shipping containers for much of the year and delays in overseas ports due to the pandemic.
The start to the new almond marketing year commencing March, has seen an improvement in early season shipments with a 45 per cent gain over last year's figures.

The RMCG study provides valuable information as to the economic benefit of the Australian almond industry now and provides a baseline figure to measure the likely substantial economic gains in future for the communities where almonds are grown and for Australia.



Introducing ABA's Communications Manager... Jane Kuerschner

The Almond Board of Australia recently welcomed Jane Kuerschner to the team. Jane began her role as Communications and Conference Manager in August and is based at the ABA's Loxton office.

Jane is originally from Orroroo in the Mid North, (SA), before her family moved to Adelaide where she completed high school and a Bachelor of Journalism at UniSA.

"I always knew I wanted to be a journalist and have always loved the written word and communications," she said.

"I got my first job as a journalist at the Murray Pioneer in Renmark in 2015, and spent six years in a range of roles including a stint as editor in 2020."

Jane has well and truly entrenched herself in the Riverland, meeting her partner and starting a family.

"I had no intentions of being here this long, but plans change and now I wouldn't have it any other way," she said.

"I've really fallen in love with the Riverland and have found a new passion for the agriculture sector through my work at the Pioneer and as editor of the newspaper's Farmer magazine.

"It's been very clear to me how much the almond industry has grown and thrived over the past few years and I am extremely excited to be working at the Almond Board.

"I think there is an incredible upside to the almond industry and I can only see it getting bigger and better from here."

Jane will oversee the ABA's publications, including In A Nutshell and Almond Bytes, plus will be at the forefront of organising the Board's conference in 2022.

Jane's appointment is part of the Hort Innovation-funded project AL18001 almond industry communications project.

Bacterial spot of *almond* snapshot

Growers have been warned to watch out for bacterial spot among their almond trees. The bacteria, which appears as brown lesions on fruit, can be caused by extended periods of wet weather...

Simone Kreidl[1] Tonya Wiechel [1], Peta Faulkner[2], Len Tesoriero[3] and Jacky Edwards[1,4] |

[1] Agriculture Victoria Research, Department of Jobs, Precincts and Regions, Victoria |

[2] Crop Doc, NSW Department of Primary Industries, Ourimbah, New South Wales

What to look out for

Infected fruits have sunken lesions that often ooze amber coloured gum; these brown corky lesions extend into the hull. Once the hull begins to dry, the lesions become raised. Severe infections penetrate through to the shell and sometimes the kernel, leaving dark marks resulting in downgraded quality. Some infected fruit may fall prematurely, others remain attached to the tree as mummies, these are the main causes of yield reduction (Figure 1) (Haake et al. 2020, Lamichhane 2014).

Figure 1. Bacterial spot fruit symptoms a. and b. amber gumming, c. lesion extending into the hull, d. raised lesion on drying hull.

Leaf symptoms first appear as pale green or yellow spots, becoming purplish brown angular lesions over time, often joining up to form larger necrotic patches. Sometimes the leaf spots may drop out, giving a shot-hole effect. Symptoms are most often found at the leaf tip and margins or along the rib where moisture accumulates (Lamichhane 2014) (Figure 3).

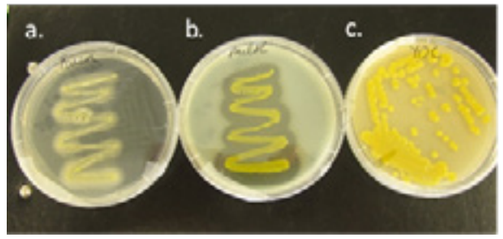


Figure 2. Xanthomonas arboricola pv pruni on different diagnostic media, a. Tween agar, b. Milk agar and c. YDC agar.

Where it comes from

The bacteria are spread by rain splash and wind-driven rain, contaminated pruning tools and machinery or by mites and insects. Mummified fruit and associated peduncles are the main source of overwintering inoculum in almonds (Haake et al. 2020). The bacteria can also survive on dormant buds, leaf scars, twig cankers and fallen leaves. From the overwintering sites, the bacteria spread to new leaves in spring where they multiply on the leaf surface without causing infection. From there, they can spread to susceptible tissue entering through natural openings such as stomata, leaf scars and lenticels or through wounds (Lamichhane 2014).

How can it be managed?

Disease control starts with good orchard hygiene. Symptomatic plant material including mummies should be removed. Pruning tools should be regularly disinfected especially after working in disease-affected areas. Disease is promoted by free water, so irrigation methods that wet the foliage should be avoided. Lush young growth is susceptible, so excessive nitrogen that promotes this should also be avoided.

There are no chemical controls registered in Australia specifically for bacterial spot of almonds (APVMA). In California, the application of copper-based products is recommended during dormancy or in-season (University of California, 2017). Copper is only effective on direct contact with the so needs to be applied before they get inside the plant tissue. This relies on accurate timing and good spray coverage. Copper or copper/mancozeb sprays during dormancy, full bloom or petal fall were found to give good protection during wet years (Haake et al. 2020). Copper sprays applied early in the season have been reported to have moderate efficacy (Morales et al. 2017). However copper resistance has developed in some situations (Haake et al. 2020, Garita-Cambronero et al. 2018).

For further information about the "Integrated disease management program for the Australian almond industry (AL16005)" project led by Agriculture Victoria please visit the ABA website or Hort Innovation's online fact sheet.

Figure 3. Bacterial spot leaf symptoms.

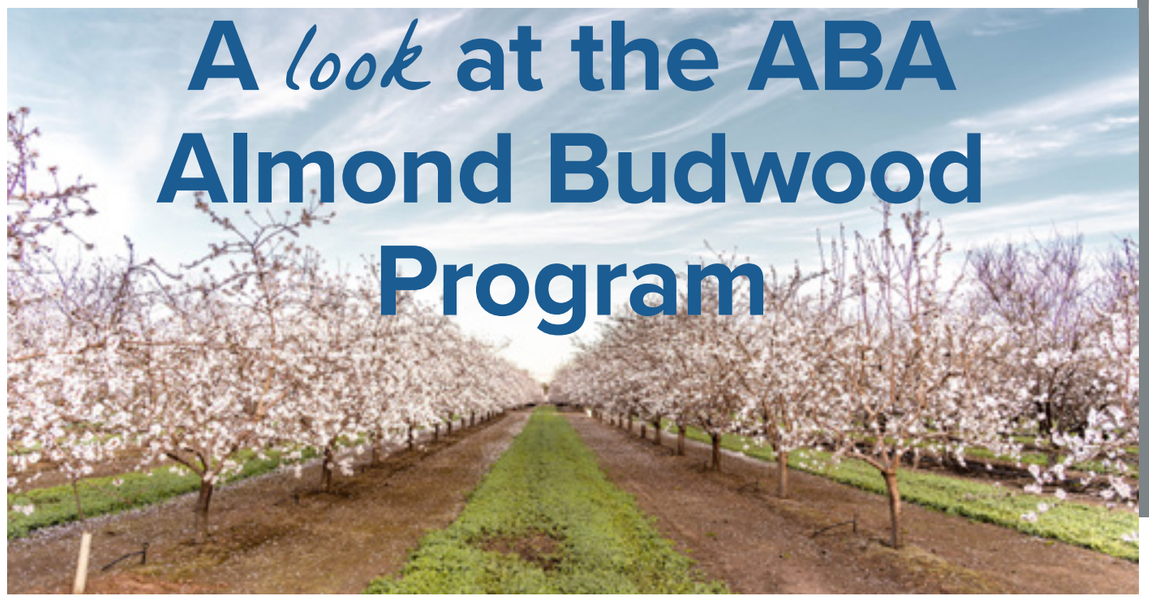
Bacterial snapshot

- ❑ **Caused by the bacterium Xanthomonas arboricola pv. pruni**
- ❑ **Symptoms include sunken brown corky lesions on fruit, often oozing amber coloured gum, and small brown angular spots along the midrib, tip and margins of leaves, sometimes coalescing into larger patches**
- ❑ **Wet weather with extended periods of leaf wetness is needed for infection. Optimum temperature is 25-30C**
- ❑ **Spread by wind-driven rain, rain splash, pruning tools and insects**
- ❑ **Survives on mummies, peduncles, dormant buds, leaf scars, cankers and fallen leaves**
- ❑ **Control is through orchard hygiene and minimising in-canopy wetness**
- ❑ **No chemical products are registered for bacterial spot in almonds in Australia. However, copper products are recommended in California.**

Hort Innovation 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

A *look* at the ABA Almond Budwood Program



Almond Board of Australia Industry Development Officer Ben Wiblin takes a look at the Australian Almond Budwood Program, from humble beginnings to its major presence in today's almond industry. He also delves into the current risks facing almond production when it comes to viruses and how healthy young trees establish better as in the photo above...

Ben Wiblin
Industry Development Officer

The Australian Almond Plant Improvement Committee established in 1960 was responsible for the implementation of the Australian Almond Budwood Program in 1990.
At the time, there were less than 3,000 hectares of almonds planted and it was an ambition of the industry to be self-sufficient in domestic almond supply and not rely on imported nuts. Steady industry growth and high variability in budwood quality and nursery trees drove the decision to implement the budwood program.

The key objective of this program is to create a high health budwood site that would supply nurseries with virus tested, true to type budwood that would assist in the prosperity of the industry's expansion.
In November 1993, 500 budwood trees planted by the ABA at Monash, South Australia came into production.

Figure 1. Monash (South Australia) budwood site – post pruning.

All trees had been through rigorous testing to ensure they were true to type and virus .

The propagation material used to develop this site was sourced from the original varieties that were imported into Australia ensuring they were as close to the 'mother' tree as possible. The Australian Almond Budwood Program continues today and consists of 1,179 trees across three sites including two in the Riverland (Monash and Loxton) and one in Colbinabbin, Victoria.

The varieties planted in the sites are chosen based on industry demand. As older varieties, such as Price and Peerless, move out of favour, they do not reserve the same amount of space in the repository as they once did but are still retained should they be sought in the future.

Today's plantings are largely made up of a mix of Nonpareil, Carmel, Monterey, and the newly commercialised varieties from The University of Adelaide.
While some of the management techniques may have changed over time, the original objectives established for the budwood program in 1990 remain the same.

The key purpose of the sites is still to provide industry with high health, virus tested and true to type budwood material that growers can rely on to provide the healthiest trees and best yielding orchards.

Virus impacts on almonds

There are seven viruses that are found in Australia that can cause disease in almonds. Visual symptoms vary and may include bud failure, calico and chlorotic mottling, in severe cases they may cause stunting and yield losses of up to 60 per cent.

However not all almond cultivars show symptoms and if untested propagation material is used the full cost of this decision will only be realised years after planting when expected commercial yields are not realised. Once trees are infected with viruses there are no cures or control methods. Prevention is the only way to protect against viruses.

By establishing the ABA budwood program it has enabled growers the confidence that material supplied is of high health having been tested for viruses known to effect almonds.

How do viruses spread?

In almonds, viruses can spread in a number of ways. Prunus Necrotic Ringspot Virus (PNRSV) and Prunus Dwarf Virus (PDV) are spread by pollen, seed and propagation material whereas Apple Moasiac Ringspot Virus (ApMV) is transmitted vegetatively.

There is some evidence for spread of Ilarviruses, particularly PNRSV and PDV, by vectors including mite (Aculus fockeui), nematode (Longidorus macrosoma) and thrips (Frankliniella occidentailis). To read more on the effects of viruses in Australian almonds click here.

Budwood production

The ABA budwood production process employs a number of strategies to ensure only high health material is produced by preventing new infection from outside sources.

Sanitation and hygiene practices

Strict sanitation and hygiene practices are the most important factors when managing a high health mother planting. This includes maintenance of an animal-proof fence around the site so feral animals cannot chew on tree bark which could potentially introduce disease or viruses from external flora. The following protocols are used to mitigate the risks of disease or virus transfer through plant tissue or vectors from one tree to another:

- ❑ All cutting equipment (secateurs, saws, loppers) is sanitised with methylated spirits before cutting from another tree.
- ❑ All large pruning wounds are sealed immediately.
- ❑ All flower buds are removed prior to bloom to stop insects and birds moving between trees and potentially vectoring disease or viruses through pollen transfer.

Pruning and flower bud removal

Each year in June, all repository trees are heavily pruned back to their main scaffolds (see Figure 1 and 2). The tree height is also maintained at an appropriate chest height to reduce the requirement for ladders during the cutting season. Branches growing into the canopy are completely removed to encourage light penetration and wood on the outer scaffold is spur pruned to approximately two to three buds.

During late July to August, all flower buds are manually removed by hand before any of them open removing the potential for infected pollen to be transferred by insects.

Budwood cutting

Budwood cutting begins when the buds mature, generally late November. However, continuous efforts in management are being made in order to bring the maturity date forward to provide nurseries as much time as possible to bud and grow a tree that meets industry standards for planting the following year. For example, Exenday® floor matting is used to reflect light into the canopy, fertiliser inputs are significantly reduced, water inputs are managed closely and selected growing tips are removed.

Each budwood stick passes through an inspection phase prior to being packaged. The inspector will look to ensure there is an average of eight viable leaf buds present, the diameter of the stick is within the nursery's requirements e.g., 4 – 6mm and it is free of any physical damage.

The cutting process follows strict protocols to ensure the highest quality material is being collected while upholding all sanitation and hygiene requirements. This is achieved through:

- ❑ Cutting budwood when the temperature is below 32^{C}.
- ❑ Sanitation and hygiene protocols such as sterilising secateurs when moving between trees.
- ❑ Removing all leaves within ten minutes of wood being cut and retaining the leaf petiole to protect the bud.

Figure 3. A de-leafed Nonpareil bundle of 500 buds ready to be wrapped. Each label states the variety, number of buds, size, date and time of packaging.

- ❑ Collecting budwood into bundles of 500 buds for packaging (see Figure 3) and is identified with an ABA budwood label.
- ❑ Wrapping bundles in wet 'Rag-On-A-Roll' paper towel and newspaper and placed in a cooled esky in the field.
- ❑ Transferring field-packaged budwood into styrene boxes placed in a cool room at 2-4^{C} within two hours of being cut.
- ❑ Storing budwood in the cool room overnight for next-day delivery in labelled styrene boxes with an icepack to keep the material cool during transit.

A *look* at the Almond Budwood Program

BUDWOOD PROGRAM

Virus testing

To be confident that ABA budwood material is virus tested the ABA conducts a rigorous virus screening program every year where each tree is individually tested for the following: Apple Chlorotic Ringspot Virus, Apple Mosaic Virus, Ilarvirus, Plum Bark Necrosis Stem Pitting Associated Virus, Prune Dwarf Virus and Prunus Necrotic Ringspot Virus.

If a positive result is found, the tree is immediately removed from the repository and destroyed.

Budwood distribution

The Budwood distributed through the ABA program since 2013/14 alone have exceeded 7.8 million which has played a pivotal role in supporting the industry's most recent expansion.

The body of work undertaken by the ABA that maintains and distributes high health material has significantly benefited the Australian almond industry and growers providing the best planting material possible. Therefore, in order to remove the risk of planting virus infected trees, and expedite tree establishment growers should ask nurseries for proof they are using ABA high health budwood material. This small upfront investment will return strong dividends for many years.

Figure 2. Colbinabbin (Victoria) budwood site - pruned and unpruned trees.

7 reasons why almonds are good for brain health

Almonds contain a unique package of nutrients that can support brain structure and function. One daily serve (1 handful or 30g) may help to prevent cognitive decline, while up to two handfuls each day (60g) may positively impact shorter-term outcomes of mood and memory.

❑ Source of protein and rich in the amino acid, arginine, which helps keep blood vessels healthy.

❑ Rich in vitamin E which provides antioxidant and anti-inflammatory protection. One serve (30g) of almonds provides 90 per cent of vitamin E requirements.

❑ Contains riboflavin and magnesium, brain specific nutrients that have been linked to mood and depression.

❑ Rich in unsaturated fatty acids to support healthy gut flora and circulatory health.

❑ Source of fibre (3g/ serve), with almond skin containing approx. 50 per cent of the fibre. The fibre has a high insoluble to soluble fibre ratio (7:1) and contains prebiotic fructans to support gut health.

❑ Contains polyphenols in the skin to support gut health and are anti-inflammatory.

❑ Almonds contain higher levels of vitamin E, riboflavin, niacin and fibre compared to other nuts.

Marketing update

Joseph Ebbage | Industry Market Development Manager

Lou Martin | ABA Marketing Officer

Ramadan

Ramadan is considered the holiest month in the religion of Islam. Fasting is considered an integral part of their lifestyle because it is one of the five pillars of Islam.
The Almond Board of Australia saw an opportunity in communicating a message to those fasting during Ramadan with tips of how to consume more Australian almonds as part of a healthy diet. The base of the content was developed by a senior sports dietitian, Kylie Andrew, who works at the Richmond Football Club.
Kylie worked specifically with Bachar Houli, a committed Muslim and observer of Ramadan, around managing his daily fasting and the rigors of playing AFL football.
Please click the image below to hear the full interview.

We are already working on our 2022 'Healthy almond snacking for Ramadan' promotion which will include extending our reach to Indonesia and Malaysia. We will be taking the key nutrition insights and applying them to consumer interests in these two emerging export markets.

Mother's Day

As a way to celebrate Mother's Day on Sunday, May 9, the Almond Board of Australia produced a promotion to communicate the good taste and versatility of almonds. Our key message was to spoil all mums on Mother's Day, whether that be breakfast in bed, brunch, afternoon tea or dessert made with Australian almonds and support local growers and producers in the process.

One key piece of creative used for this campaign was a 3D animation of the lifecycle of an almond that moves from blossom to harvest. The animation concludes with the almond being ground into meal and being used in a pink macaron. Almond products can be used in a wide variety of savoury and sweet dishes and baked treats, including decadent macarons whose 'secret' ingredient is almond meal which helps create a perfectly smooth, fine texture.

Please see below for the 3D animation of the lifecycle of an almond.

The advantages of self-*fertile* almonds

Wiebke Kämper[1], Grant Thorp[2], Michelle Wirthensohn[3] and Stephen Trueman[1]

[1]Griffith University, Brisbane, Queensland
[2]Plant & Food Research Australia, Melbourne, Victoria
[3]University of Adelaide, Waite Campus, South Australia

A team of almond experts explored the world of self-fertile almond varieties compared to traditional varieties which require bees to transfer pollen from one variety to another.

They say new self-fertile varieties only require pollen transfer within the same variety and confirmed that most nuts from self-sterile varieties resulted from cross-pollination, while most nuts from the new self-fertile varieties in almond orchards resulted from self-pollination.

Introduction

Almond varieties such as Nonpareil, Carmel, Monterey, Peerless and Price are considered self-sterile, which is why orchards are established with trees of different varieties in alternate rows. Large numbers of honey bee hives are introduced into orchards to transport pollen from the flowers of one variety to another; i.e. cross-pollination. The Australian almond breeding program has developed new varieties selected for self-fertility. The flowers of these varieties only need to receive pollen from the same variety; i.e. self-pollination.

We hypothesised that most nuts from self-sterile varieties would result from cross-pollination whereas many nuts from the new self-fertile varieties in almond orchards would result from self-pollination. We also hypothesised, based on results from macadamia, that self-pollinated almond nuts would be smaller than cross-pollinated almond nuts of the same variety.

Nut sampling and analysis

We sampled nuts from an orchard at Renmark (SA) and an orchard at Lindsay Point (Vic) in February and March 2020. The Renmark orchard (Figure 1) was established with Nonpareil, Carmel, Monterey, Peerless and Price trees. Row spacing was 6.5 m, the trees were 13 years old, and there were five honey bee hives per hectare spread out across the orchard during flowering.

The Lindsay Point orchard was established with trees of Nonpareil, Carmel, Peerless and 57 novel genotypes, including six new Australian varieties selected for kernel size (Maxima), taste (Rhea) or self-fertility (Capella, Carina, Mira and Vela). Row spacing was 7.3 m, the trees were 7 or 10 years old, and there were seven honey bee hives per hectare spread out across the orchard during flowering. Trees of each variety were planted in single rows in both orchards, with Nonpareil

Continued page 21

Figure 1. Dr Wiebke Kämper in the Renmark orchard.

SELF-FERTILE ALMONDS

trees planted in every second row.

We collected mature fruit from Nonpareil, Carmel, Monterey and 'Price' trees at Renmark, and Nonpareil, Peerless, Maxima, Rhea, Capella, Carina, Mira and Vela trees at Lindsay Point. Fruit were collected from six trees along a single row of each variety, sampling every fifth or tenth tree depending on row length. We measured in-shell mass and kernel mass of ten nuts per tree (60 nuts per variety) and calculated their shelling percentage. We analysed DNA from each kernel to determine whether the nut had arisen from cross-pollination or self-pollination.

Amount of self-pollinated nuts

At least 83 to 98 per cent of Nonpareil, Carmel, Monterey and Peerless nuts resulted from cross-pollination (Figure 2). At least 92 to 94 per cent of Maxima and Rhea nuts also arose from cross-pollination. Maxima and Rhea had been selected for kernel size or taste, rather than self-fertility. Therefore, it was not surprising that most of their nuts arose from cross-pollination, as they do in the traditional self-sterile varieties.

At least 70 to 91 per cent of Capella, Carina and Vela nuts resulted from self-pollination (Figure 2). This confirms that these new self-fertile varieties produce mostly self-pollinated nuts in a commercial orchard situation. In fact, they produced these high percentages of self-pollinated nuts even when they had a different variety planted only 7.3m away in the next row. We could expect that the percentages of self-pollinated nuts would be even higher if these self-fertile varieties were planted in wide blocks rather than in single rows alternating with another variety.

Mira nuts were unusual in that while at least 40 per cent of the nuts arose from self-pollination, as expected with a self-fertile variety, there were similar numbers of Mira nuts produced from cross-pollination. This shows that self-fertile varieties can also set nuts from cross-pollination if their flowers are receiving a mixture of self-pollen and cross-pollen.

Also, at least 76 per cent of Price nuts arose from cross-pollination, but at least 21 per cent arose from self-pollination (Figure 2). Price appears to have some degree of self-fertility, although the rate of self-pollination was not nearly as high as with the new self-fertile varieties.

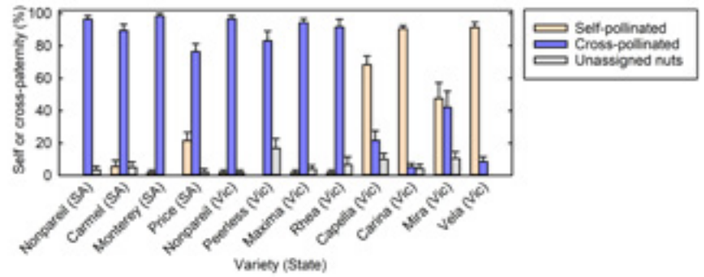


Figure 2. The percentage (mean + SE) of self-pollinated and cross-pollinated nuts from almond varieties in an orchard in South Australia (SA) and an orchard in Victoria (Vic). "Unassigned nuts" could not be distinguished as self-pollinated or cross-pollinated at a 95% level of confidence.

Variety:	'Capella'		'Mira'	
Pollen parent:	Self	Cross	Self	Cross
In-shell mass (g)	4.13 ± 0.30	4.53 ± 0.60	3.66 ± 0.30a	3.98 ± 0.30b
Kernel mass (g)	1.28 ± 0.03	1.38 ± 0.06	1.47 ± 0.02	1.57 ± 0.04
Shelling (%)	31.3 ± 1.0	30.8 ± 1.0	40.5 ± 0.6	39.6 ± 0.9

Means ± SE with different letters within a variety are significantly different (mixed model; n=6 trees; n=13-41 nuts)

Table 1. In-shell mass, kernel mass and shelling percentage of self- and cross-pollinated almond kernels of two varieties.

Nut and kernel mass

We assessed in-shell mass, kernel mass and shelling percentage for two self-fertile varieties (Capella and Mira) that had a sufficient mixture of self-pollinated and cross-pollinated nuts (Table 1). Self-pollinated Mira nuts had lower in-shell mass than cross-pollinated Mira nuts. However, kernel mass and shelling percentage did not differ significantly between self-pollinated and cross-pollinated nuts in either Capella or Mira.

Conclusions

Our DNA results confirmed that Nonpareil, Carmel, Monterey, Peerless and, to a lesser extent, Price, produce nuts mainly by cross-pollination. Maxima and Rhea also produced nuts mainly by cross-pollination. The DNA results also demonstrated that the new Australian bred self-fertile varieties developed using the almond R&D levy, Capella, Carina, Vela and, to a lesser extent, Mira, produced nuts mainly by self-pollination in commercial orchards, even when another variety was planted in the next row.

Kernel mass did not differ significantly between self-pollinated and cross-pollinated nuts. These results suggest that single-variety blocks of self-fertile varieties could be established successfully without the need for pollinizer rows.

It will be important to monitor the yield and quality of nuts from the new self-fertile varieties and compare these with the traditional self-sterile varieties. It will also be important to determine the optimum number of hives required to get full production from these new self-fertile varieties when planted in single-variety orchard blocks.

Acknowledgements

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Nuts about *healthy* qualities

The body of evidence about nuts and health continues to grow. A number of recently published local and international papers, outline new nut research and corroborate decades of research about the importance of a regular handful of nuts in a healthy diet.

Small targeted dietary changes can yield substantial gains for human and environmental health. (2021)
US-based researchers evaluated 5853 foods to identify environmentally sustainable foods that promote health. They quantified whether the foods either added or took minutes away from a 'healthy life'. Results suggested that substituting just 10 per cent of daily calorie intake from beef or processed meat in favour of fruit, vegetables, nuts, legumes and 'selected seafood' adds 48 minutes of healthy life every day and cuts our carbon footprint by a third (33 per cent).
Eating a 30g serve of nuts and seeds provides a gain of 25 minutes of healthy life per day.
Prevalence and early-life risk factors for tree nut sensitization and allergy in young adults. (2021)
This population-based cohort study (the Swedish birth cohort BAMSE) gauged the prevalence of tree nut sensitisation and reported symptoms at age 24 years, and also assessed early-life factors linked with the development of tree nut allergy.
In this Swedish cohort, prevalence of tree nut sensitisation was found to be common (21.2 per cent), but usually asymptomatic.
Egg allergy, eczema and asthma at pre-school age were linked with future development of tree nut symptoms and storage protein sensitization.

Adherence to the Mediterranean diet, five-year weight change, and risk of overweight and obesity: A systematic review and dose–response meta-analysis of prospective cohort studies. (2021)
This research combined the outcomes of six prospective cohorts, together involving more than 244,000 adults.
It revealed that greater adherence to the Mediterranean diet was associated with a 9 per cent decreased risk of overweight and/or obesity. It also found less weight gain over five years in those adhering to a Mediterranean dietary pattern.
In conclusion, the researchers suggest their findings have practical importance for public health.

The relationship between adherence to the Mediterranean diet, intake of specific foods and depression in an adult population (45–75 Years) in primary health care. A cross-sectional descriptive study. (2021)
This study looked at the link between adherence to the Mediterranean diet, and the intake of specific foods, in people aged 45 to 75 with depression.
It found being female, younger, with a higher BMI, consuming more than 1 serving of red meat a day and drinking >1 carbonated or sugary drink daily, not consuming 3 servings of nuts a week and not eating 2 vegetables cooked in olive oil a week to be predictors of having higher depressive symptoms.
The study authors point out that the relationship between nutrition and depression must be further examined.

- Source - Nuts For Life

Check out Nuts For Life's podcast on sustainabilty in the almond industry with Almond Board of Australia Market Development Manager Joseph Ebbage. Click here to listen...

About this episode:
The latest podcast discusses sustainability in the almond industry. This episode is the second in our two-part series on nuts and sustainability. We speak with Joseph Ebbage, an expert from one of the largest nut industries in Australia – the Almond Board of Australia. Find out about the Australian Sustainable Almonds Program, which has been progressing work on a broad range of sustainability issues for more than two decades. From water use to waste management, learn more about what the almond industry is doing to ensure quality almonds are produced without compromising the health of our environment.

Hort Innovation NEWS

Aussie horticulture shines spotlight on responsible farming

Limiting food waste, packaging, and boosting water and energy efficiency are just some of the opportunities captured in a new Australian-Grown Horticulture Sustainability Framework that has been developed with input from industry.

Created with input from more than 600 industry participants, the Framework details 17 focus areas that align with existing business measures and initiatives, as well as the United Nations' Sustainable Development Goals.

Hort Innovation chief executive Matt Brand said the Framework has been developed for Australian horticulture industry participants at a time when consumers and investors are increasingly asking for evidence of ethical and sustainable practices from their food producers.

"The aim of this Sustainability Framework is to acknowledge the significant contribution Aussie fresh produce growers make to the nation's families and environment through the provision of fresh and nutritious food," he said.

"It also promotes sustainable and responsible care for our natural environment and provides a vital roadmap for a stronger Australian farming future."

Mr Brand said the initiative aligns with a range of research efforts being delivered by Hort Innovation, in line with the target to grow agriculture to $100 billion by 2030.

Shane Quinn, from vegetable producer Mulgowie Farming Company, said the Framework is a useful resource for industry.

"The Mulgowie Farming team is proud to use ethical sustainable practices when producing nutritious produce from our healthy soils," he said. "We look forward to the Sustainability Framework providing the means to

demonstrate positive environmental impacts and industry issues of concern to a wide range of stakeholders."

Joseph Ebbage, Market Development Manager at the Almond Board of Australia, said sustainability is important to customers both domestically and internationally.

"Our trade partners in Europe and in the UK are looking for suppliers that can meet sustainability metrics. Our ability to communicate sustainability credentials is vital to maintaining and growing these relationships," said Mr Ebbage.

"The framework provides an invaluable foundation document for our industry. The Australian almond industry is looking to leverage this rich body of insights to create a program specific to growing and processing almonds in Australia."

The Horticulture Sustainability Framework was developed over more than 12 months and involved input from producers, employees, industry peak bodies, service and input suppliers, and researchers. Financers and investors, marketers and exporters, retailers, governments and consumers also had input.

Mr Brand said all groups shared very similar sustainability priorities with topics such as limiting produce waste, food safety and energy use being some of the most important issues.

"The next step is to measure the sectors current performance against each indicator identified in the Framework".

For more information, click on the Horticulture Sustainability Framework.

Scientists probe bee recovery after fires

The aftermath of the Black Summer Bushfires will give researchers a rare standpoint to study the recovery of wild honey bees and other pollinators, providing important insight for growers facing future catastrophic events.

More than 15 million hectares of native forest were destroyed nationwide after the 2019-2020 bushfires, with NSW losing 68 per cent of its national parks and other floral resources. These resources are critical for maintaining healthy honey bees that support pollination in 65 per cent of agricultural crops.

Hort Innovation is funding a new research project based in the major apple growing region of Bilpin, NSW, looking at how the recent bushfires affected crop pollination and how long these effects will be felt.

Hort Innovation Research and Development Manager Ashley Zamek said that while the devastating bushfires are gone, they will not be forgotten, and growers remain under threat of an increasing number of extreme weather events.

"The project we're launching today will provide a detailed case study of the impact left by a major bushfire on wild pollinator communities by looking at the services they provide to the apple crops of Bilpin," Zamek said.

"This project provides a rare opportunity for scientists, who had already been studying the pollinator popu-

lations and floral resources in Bilpin for three years prior to the bushfires. That piece of research provides excellent pre-fire data to launch this project.

"Over the next few years, the new study will help growers better understand how pollinators and the landscape recover after a disaster, and hopefully lead to recommendations and mitigation measures that will help protect crops and pollinators from future fires."

Project lead Professor James Cook, from Western Sydney University's Hawkesbury Institute for the Environment, said the project will look into how fires impact wild pollinators and the flora they rely upon, and how these change or recover after fires.

It will also study the relative contributions of managed honey bees, wild honey bees, and wild native insects in crop pollination, and how changes in non-crop floral resources affects pollination services.

"The Black Summer fires were awful, but they have provided our team with a unique opportunity to study the impacts of extreme events on pollination services," Professor Cook said.

"Fires burnt right up to apple orchards that we had been studying for the previous three years, so we had already quantified the abundance and diversity of pollinators there. Now we can find out how the fires have affected the pollinators and the floral resources they rely upon outside apple flowering season, and how these things recover or change over the next few years."

Findings from this study will also be useful for the horticulture industry's understanding of the potential impact of Varroa Mite on honey bee pollination of crops, and what may happen if the pest takes hold in Australia and the free pollination received from wild honey bees is dramatically reduced.

While this project focusses on apple crops in Bilpin, the case study is expected to benefit growers of many pollination-dependent, horticultural crops such as almonds, avocados, lychees and others.

This project, funded by the Hort Frontiers Pollination Fund, is part of the Hort Frontiers strategic partnership initiative developed by Hort Innovation, with co-investment from Western Sydney University and contributions from the Australian Government.

Hort Innovation is the grower-owned not-for-profit research and development corporation for Australian Horticulture.

Efforts to combat small but 'ravenous' worm ramp up

The nation's top scientists and biosecurity experts have joined forces with growers around the country to fight one of the nation's newest and most prolific pests.

Fall armyworm larvae can be less than half a centimetre in size with an appetite for more than 350 plant species. Since it was first spotted on mainland Australia in January last year, the pest has travelled to every state except South Australia.

The nation's horticulture research and development corporation, Hort Innovation, is delivering a suite of targeted defence measures against the pest. Research to identify natural predators, deliver rapid diagnostic tools, and education measures are just some of the projects in the RDC's armory.

Hort Innovation General Manager of Research and Development Dr Alison Anderson said the pest has caused significant damage in parts of the country where some sweetcorn growers have lost entire crops.

"Fall armyworm moves fast. It's good at developing resistance to insecticides, and it's ravenous — it completely devours crops," Dr Anderson said. "The pest was only recently detected in Australia early last year and immediately affected grain crops. We're working with growers and the nation's leading researchers to give the horticulture industry the tools it needs to help manage this prolific pest."

Funded through Hort Innovation, projects are being delivered with the expertise of researchers around the country. Led by Queensland's Department of Agriculture and Fisheries (DAF), Agriculture Victoria and the Cotton Research and Development Corporation (CDRC), this work is already seeing results.

Dr Anderson said one of the research projects has provided early insights into the Bowen area of Queensland.

"We've seen that fall armyworm has spread beyond sweetcorn in northern Australia and into other horticultural crops, such as capsicum, leaving between 10 to 30 per cent loss of saleable product for some growers there," she said.

"Collaboration with growers has been critical. They have provided access to their properties and have shared information on growing practices and many photos with the researchers, and this really helps us understand fall armyworm more."

Initiatives include a fall armyworm podcast series available online now (CDRC), the development of a rapid field-based test for fall armyworm (Agriculture Victoria); the identification of potential fall armyworm predators and the risk to Australian horticulture (DAF), and the development of extension programs to effectively fight fall armyworm (DAF).

DAF senior entomologist Siva Subramaniam said, "Hort Innovation's investment has made possible a national research and development effort into fall armyworm, including horticultural crop risk analysis and crop surveys to identify parasitoids and predators.

5 reasons why *almonds* are good for gut health

Almonds are one of only a few foods that contain fibre, phytochemicals, unsaturdated fat and nutrients that can positively affect bacterial abundance and microbiota composition, and support gut health. Eating at least 1 large handful (>42g) of almonds daily, perferably whole or chopped, has been shown to have a positive impact on gut microbiota.

✓ Source of fibre (3g/ serve) including prebiotic fructans that feed the gut microbiota.

✓ High insoluble to soluble fibre ratio (7:1) with the skin containing approx. 50 per cent of the fibre.

✓ Rich in unsaturated fatty acids.

✓ Contains phytochemicals (flavonoids, flavonones and polyphenols) - again, these are particularly rich in the skin.

✓ Compared to other nuts, almonds have the highest content of fibre and one of the highest amounts of phytochemicals.

Almond and Honey Cake

PREP TIME: 25 MINS | COOK TIME: 45 MINS | SERVES: 1

Ingredients

Cake

- ❑ ½ cup polenta
- ❑ 1 cup milk
- ❑ 1 2/3 cups plain flour
- ❑ 2 tsp baking powder
- ❑ 1 tsp bicarbonate of soda
- ❑ ½ cup almond meal
- ❑ ¼ tsp ground cardamom
- ❑ 150g butter, softened
- ❑ ½ cup caster sugar
- ❑ Finely grated zest of 1 orange
- ❑ 3 eggs, separated
- ❑ 1/3 cup Beechworth Almond Blossom Honey
- ❑ 1/2 tsp salt
- ❑ ¼ cup finely chopped blanched almonds

Almond Honey Syrup

- ❑ ¼ cup water
- ❑ Juice of 2 oranges
- ❑ 1/3 cup Beechworth Almond Blossom Honey
- ❑ 4 cardamom pods, bruised with the back of a knife
- ❑ ¼ tsp almond essence

Garnish

- ❑ Zest of 1 orange, zested into fine long strips using a mandoline or zester
- ❑ ¼ cup toasted flaked almonds

Method

1. Preheat oven to 180C or 160C fan forced. Grease and flour a 23cm bundt pan or ring tin.
2. Place the milk in a small bowl and microwave until just warm, about 30 seconds.
3. Add the polenta to the warm milk. Stir and set aside until needed.
4. Place the flour, baking powder, bi-carb soda, almond meal and cardamom into a bowl and stir well with a spoon or whisk to combine the ingredients thoroughly. Set aside until needed.
5. In the bowl of a stand mixer place the butter, caster sugar and zest. Beat until pale and creamy. Add the egg yolks and the honey and beat to combine.
6. Using a spatula, mix in the milk and polenta mixture until well combined.
7. Fold in the flour mixture until just combined. Add the chopped nuts and fold in to combine.
8. Using a clean bowl and whisk, place the egg whites and the salt in the bowl. Whisk until firm peaks form.
9. Fold the egg whites into the cake mixture, 1/3 at a time, folding gently to combine and ensuring no white lumps or streaks of egg white.
10. Gently spoon the cake batter into the prepared tin and smooth the top with a spatula.
11. Place in the preheated oven and bake until a skewer comes out clean, about 45 minutes.
12. Meanwhile, to make the Syrup, place all the syrup ingredients in to a small saucepan over medium to high heat. Stir to combine the ingredients and bring the mixture to the boil.
13. Continue to boil until the syrup in reduced by half, about 3 minutes. Remove from heat, strain through a fine strainer and set aside until needed.
14. Stand the baked cake in the tin for about 10m minutes before turning out on to a wire rack. Whilst still warm, spoon over the syrup to cover the cake. Sprinkle the fine strips of zest and the flaked almonds over the top to crown your cake.