

In A Nutshell

The Official Newsletter of the Australian Almond Industry

Autumn 2021

IN THIS ISSUE

[Murray to Moyne cycle relay](#)

[Onshore biosecurity levy](#)

[All-weather harvesting at Walker Flat Almonds](#)

[Monterey leafing failure](#)

[Hull rot in almonds - research update](#)



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

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ALMOND BOARD OF AUSTRALIA

Autumn 2021

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CONTENTS

From the Executive	5
Murray to Moyne cycle relay	6
All-weather harvesting at Walker Flat	8
ABA partner organisations	11
Onshore biosecurity levy	12
Importation of improved honeybee genetics	15
Marketing update	16
Hull rot of almond	20
Monterey leafing failure	23
Hort Innovation news	27
Calendar: March-May	29
Recipe: Beef, broccolini and almond stir-fry	30

Cover image: Zali Clarke and Lila Petersen inspecting the 2021 harvest at Cooltong, SA.

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From the *Executive*...



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

2020 was a year full of concern. Concern about COVID-19, trade tensions, global warming, and political angst. Business and personal concerns from lockdowns and travel restrictions have added to what are troubling times. Everyone is wanting life to return to normal, but it is likely it will never return to the way it was. Hopefully COVID-19 is on the way to being defeated but the attitudes of people will be influenced by what we have experienced over the past year and what still lies ahead.

However, there are many positives to go along with the negatives that can be observed everywhere. Many people have taken healthy lifestyle choices such as improved exercise regimes and healthier diets. For the almond industry, these choices bring added optimism. Almonds have many proven health benefits. Almond protein is great for recovery after physical exercise. Almonds provide an alternative to dairy products that are lactose free and free of any perception of animal welfare issues. Almonds are a key ingredient in many delicious recipes.

The world has become more conscious of not only personal health but also that of the environment. The focus on solar power, electric vehicles, zero carbon emissions bodes well for a more sustainable future. With trees being the lungs of the world, 17 million almond trees in Australia and 300 million globally

are working to clear the air of carbon dioxide whilst producing their valuable crop of nuts.

A recent study by consulting firm RMCG found the Australian almond industry delivered 0.1 percent of Australia's GVP and importantly provides nearly 10,000 jobs, many of which are located in the producing regions of Sunraysia, Riverland and Riverina. The study based on 2019/20 figures calculated the contribution to the nation's gross domestic product (GDP) to be \$1.633 billion or 1/1000 of Australia's GDP.

The industry's future contribution will be much greater than this as the 2021 crop is forecast to be nearly 16 percent larger than that of 2019 and the industry's future crop modelling predicts a crop significantly larger by 2025. The almond industry contribution to jobs in Sunraysia and the Riverland is around 5 percent of total regional employment and the Riverina figure will approach if not surpass this once the recently planted almond orchards mature given there is more than a third of Australia's total almond acreage in the area.

With the 2021 harvest concluding and the efforts of the 2020/21 growing season coming to fruition, the quality of our 2021 crop is very important. The kernel size of all varieties appears to be excellent and this will be a key point of differentiation from the global

supply available to buyers from 2020 harvested crops. After early concerns that La Nina impacted weather patterns may bring a wet harvest period, the summer/ spring weather allowed much of the harvest to proceed with above average temperatures.

The shipment figures for Australian almonds have seen record monthly figures for September 2020 to January 2021. During this period exports were up by nearly 17,000 tonnes on the previous year or 87 percent. These strong shipments are making up for the comparatively slow start to the marketing year where figures from March to August were well behind. Indications are that the annual sales this marketing year will be similar to last year leaving the industry in a satisfactory position for the start of the new 2021/22 year.

It would be remiss not to acknowledge the efforts of not only our Australian industry members during the difficult past year but also the endeavours of the Californian industry in building consumer demand and achieving many months of record shipments to go a long way to clearing their large record crop.



Murray to Moyne cycling event - *a heartening* exercise





THE Almond Board of Australia continued its support of the Murray to Moyne bicycle relay event with the Almonds for Heart Health team completing the 530 kilometre trip from Mildura to Port Fairy over the weekend of the 27-28 March. The 23 person team, comprising of 18 riders and five support crew, completed the 34th running of the event to raise awareness of the cardiac health benefits of regularly eating a handful of almonds and to raise funds for Heartbeat, a charity which donates equipment to hospitals.

The 2019 team's fundraising enabled a paediatric ultra sound probe to be purchased for the Mildura Base Hospital and this year the funds are allocated to buy a probe for the Riverland General Hospital in Berri.

The ride was challenging with the four groups of riders each completing four legs totaling 110 kilometres on the Saturday. The first two legs for the groups were pushing into a strong southerly wind before the wind eased for the dusk and night legs.

The team's strongest riders completed the 90 kilometre second day from Hamilton to Port Fairy with most of the team doing the 50 kilometre ride from Macarthur to the coast. The weather conditions on the Sunday were perfect and the whole team rode into Port Fairy together to the acknowledgement of the crowd that turned out to support the riders. The Almonds for Heart Health team enjoyed a barbeque lunch before the bus provided by Select Harvests and the support vehicle provided by Sunrise Ag returned riders to Mildura.

The ABA wishes to thank the major team sponsors of CMV Farms for their \$4,000 donation to Heartbeat and Select Harvests for their \$500 donation and in-kind contributions to facilitate the ride. Other \$500 sponsors were: Sunrise Ag Growers Services; Peter Cavallaro; Legacy Industries; Thomas Manufacturing and Weiss McNair.

David Crawford, Managing Director of CMV Farms, along with wife Nicole rode the event and enjoyed the experience noting the camaraderie

not only within the almond team, but also the support provided by participants of the other teams as riders passed by during the journey was great.

Peter Ross from Select Harvests who was joined by other staff members, Tim Kennedy, Upal Gunawardena and Stuart and Alex Voutier on the ride, believes the event, that brings a wide cross section of the industry together, is a tremendous initiative that promotes the industry and benefits the participants and the nominated medical charities of each team. Former ABA Director Grant Birrell and current Director Nigel Carey, from Nut Producers Australia, agreed the event was well worth the effort involved and are keen to continue being part of it in future years.

Team captain Joseph Ebbage, riding for the first time, praised the M2M organisers and volunteer route marshals, the riders, and the Almonds for Heart Health support crew of his wife Penne (who captured the photos in this article), Louise Skinner, Lyndal Workman, Ray Pickering and Steve Patridge.



Pictured: Stockpile in storage shed.
Photo credit: Melina Mueller, Walker Flat Almonds.

HARVEST

All-weather harvesting at Walker Flat Almonds

RAIN and cool weather at harvest time affects a grower's ability to dry their almonds down to the correct moisture levels on the orchard floor. Walker Flat Almonds have an east-west row configuration due the naturally occurring swales on the property, which adds another difficulty in the dry down process. To combat these issues, Walker Flat Almonds have put processes in place to get the almonds out of the orchard and into a drying area as quickly and efficiently as possible. Walker Flat Almond's Assistant Manager, Melina Mueller, explains the dry-down process used.



Windrows in paddock.



Trailer unloading.



Elevator loading trailer.

A designated paddock is prepared before harvest every year that is used exclusively for putting almonds out in the open to dry down.

We shake on day one, then once the green leaves have semi-dried, we can bring the sweepers in, either in the afternoon of day one if they are shaken in the morning, or on day two if shaken later in the day. As soon as the almonds have been swept into windrows, our harvesters are sent in, and then the runners will take the loads out into the drying paddock instead of the storage shed.

In the paddock on a pad we have an elevator waiting which empties into a purpose-built trailer pulled by a tractor. Our trailer has been specially designed with a conveyor floor and a hydraulically driven trapdoor at the back, which allows the tractor driver to unload on the run, leaving a windrow in the paddock at the correct width for the harvesters to pick up. The tractor driver will take predicted weather into account and will vary the depth of these rows to suit. The harvesters have sweeps on the front to bring in any almonds that may fall to the sides of the rows as well, which helps to eliminate lost

nuts; this also means that the rows in the paddock do not have to be re-swept. Whilst these paddock rows are thicker than the typical windrows in the orchard, they are open to sun and wind without the shade of the trees, allowing them to dry much faster. In the orchards, we have a normal dry time of up to ten days; in our paddock that can be brought back to as little as two to four days, depending on weather conditions. If we do encounter damp weather, the rows in the paddock dry down faster than they would on the orchard floor.

Another advantage of the almonds being brought out into the paddock is there tends to be less leaves and sticks in the windrows, as the elevator at the pad has a stickjack to remove the bigger sticks and branches. The finished product we bring into our sheds are then much cleaner and have less unwanted debris in the stockpiles.

Getting the almonds out of the orchards promptly after shaking also means that we are able to continue our normal irrigation routine, resulting in the trees being under less stress and being in optimum health to best utilise the post-harvest

fertilisers. Setting our trees up efficiently for winter means that they are able to produce a higher quality almond in the following season.

As we are bringing the almonds out of the orchards at a greener stage than under normal conditions, this minimises the possible damage that is often typical with double handling, especially with Nonpareil.

Once the almonds have reached the required moisture level to be brought into the shed, the harvest process in the paddock is much faster as there are no trees, branches, driplines etc to deal with.

In ideal circumstances, we would have our conditioner go through the orchard windrows before the harvester, taking out leaves, sticks, branches etc. However, time often runs short, but we have found that we can reduce the side-effects of not conditioning by using the above-described all-weather harvest process".



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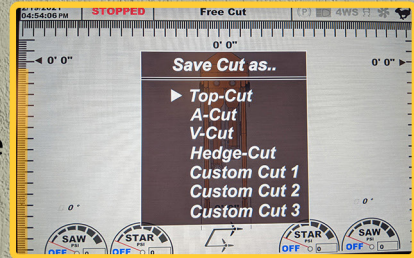


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ABA Partner organisations

THE Almond Board of Australia (ABA) actively works with a broad range of partner organisations to maximise the opportunities for producers and ensuring a sustainable Australian almond industry. The ABA represents the interests of growers, processors and marketers and collectively responds to industry-wide issues, invests in market development and research, shares knowledge and interacts with government and other stakeholders. A number of key partner organisations are listed below recognising their specialised services that aid the development of the Australian almond industry. Hort Innovation are also an important partner, acknowledged with their own segment in each edition of *In A Nutshell*.



Australian Nut Industry Council

The Australian Nut Industry Council (ANIC) is the organisation representing the seven commercial tree nut industries in Australia. ANIC works to deliver efficiencies to the industry in areas of commonality and shared action throughout the supply chain. Through ANIC, the multiple nut industries work together, sharing experiences and resources to advance the industries and promote the benefits of Australian-grown nuts.



International Nut Council

The International Nut Council (INC) facilitates the sustainable growth in the global nut and dried fruit industry. INC provides information and advice on health, nutrition, food safety, statistics, government standards and government regulations regarding trade barriers and trade quality standards. Their annual congress provides a forum for the global nut industries to meet.



Frucom is the official body representing the interests of European importers of dried fruit and nuts, processed seafood and processed fruit and vegetables. Frucom facilitates the trade of safe and quality products and ensures that its members are aware of the legal requirements. Frucom provides valuable information and advocacy on chemical approval for use withdrawals and was of assistance in dealing with Aflatoxin breaches in Europe.



National Farmers' Federation

The National Farmers' Federation (NFF) is the peak national body for Australian farmers and the agriculture sector. The NFF serves the industry by working through national and foreign policy issues including workplace relations, trade and natural resource management. The NFF Horticulture Council was recently established. ABA has representation on the Trade, Water, Biosecurity and Chemical working groups.



Australian Government
Australian Trade and Investment Commission

Austrade

The Australian Trade and Investment Commission (Austrade) is Australia's leading trade and investment agency. Austrade helps Australian businesses grow by linking them to global export opportunities whilst helping them understand the risks involved. Austrade develops market information and insights, promotes Australian capabilities and builds a strong network globally to benefit Australian organisations. They assist with organising trade events in India and elsewhere.



Food South Australia

Food South Australia is the peak body for the food and beverage manufacturing industry in South Australia. Food South Australia supports and sustains the industry by helping businesses grow their markets and industry connections. They assist with organising ABA participation at trade events in Asia.



Australian Honey Bee Industry Council

The Australian Honey Bee Industry Council (AHBIC) is the peak body for beekeeping in Australia. AHBIC represents the interests of the Australian beekeeping industry through advocacy and the facilitation of research, development and education. AHBIC's role is to enhance the industry by encouraging the implementation of best practice in production and quality assurance. The ABA works with AHBIC to develop the pollination aspect of the honey bee industry.



National Irrigators' Council

National Irrigators Council

The National Irrigators' Council (NIC) is the peak body representing irrigators in Australia. The NIC's objective is to develop projects and policies to ensure the efficiency, viability and sustainability of Australian irrigated agriculture.



Sports Dietitians Australia

Sports Dietitians Australia are Australia's peak professional body for dietitians specialising in sports nutrition. They aim to help active Australians maximise their exercise goals with credible evidence-based sports nutrition. They provide information about the value of almonds for sports nutrition to their members which is widely available to then use in the broader fitness community.



Onshore biosecurity levy

THE Almond Board of Australia has written a letter on behalf of 20 horticultural industry representative bodies to the federal Minister for Agriculture Drought and Emergency Management the Hon. David Littleproud to express deep concern about the decision not to proceed with the Onshore Biosecurity Levy, leaving it up to Australian plant industries to meet the costs of remediating incursions of exotic pests and diseases which they have had no part in introducing. These incursions can mainly be traced to imported goods in shipping containers.





The current system is costing Australian farmers tens of millions of dollars annually and there is an upward trend that is set to continue. The CSIRO report titled *Australia's Biosecurity Future: unlocking the next decade of resilience (2020-2030)* states that 'biosecurity outbreaks are continuing to rise in volume and complexity due to growing levels of trade and travel, urbanisation, climate change and biodiversity loss' and that the 'burden of biosecurity threats will continue to escalate'.

This increasing trend has industries questioning their continuing support to the current biosecurity cost recovery framework that has farmers contributing to the clean-up of exotic incursions that others have caused.

The CSIRO report also states that the biosecurity system will continue to face significant resourcing challenges that will be compounded with the frequency of pest and disease incursions. A Biosecurity Levy on containers could, in addition to funding the incursion management plans, provide extra resources to enhance the detection process at the border which in turn should reduce the number of biosecurity breaches needing eradication.

The letter questions why farmers should have to pay for the careless or negligent actions of those who are shipping products to Australia without appropriate biosecurity processes.

The reason provided for not pursuing the onshore biosecurity levy was due to ..."significant regulatory impacts on industry and proposed levy payers. The department also considered the ongoing impacts of drought, bushfires and COVID-19 on the Australian economy and the rapidly changing trade environment. The levy may have resulted in increased costs of agricultural inputs such as fertiliser, chemicals and machinery as levy payers may have chosen to pass the costs on."

These considerations overlook the key point that the 'risk creators' are

containers and their cargos that include machinery, equipment, door handles, baby furniture, household appliances and other products that have had no direct linkage to the agriculture sector.

A prime example is the increase in Khapra beetle (*Trogoderma granarium*) incursions seen in Australia with 16 detections in 2020. Khapra beetle is a serious pest of stored grains, rice, oilseeds, nuts and dried foodstuffs that can destroy stored product and threaten market access for Australian produce. In 2020 there were two separate events where Khapra beetle escaped into the general public in the packaging of imported refrigerators and baby highchairs. These events are now being managed under the Emergency Plant Pests Response (EPPR) Deed where the almond industry, along with other affected industries and State and Federal governments, share the cost of eradicating such exotic pest and disease incursions.

As a result of the incursion, the almond industry has extended the existing EPPR levy which was established to repay the cost of *Varroa jacobsoni* eradications in 2016 and 2019 with debts due to be cleared in 2021. This new incursion has meant the EPPR levy will remain in place to refund the Federal government's loan to industry to cover the eradication cost associated with the new Khapra beetle incursions allocated to it.

A biosecurity levy on containers would provide a fairer, more reasonable and sustainable arrangement as it passes the cost of remediation to the risk creators and acknowledges the direct link between the impact of infested or contaminated containers or commodities on the cost of incursion eradication and management.

In late 2020 the Federal Government allocated further funding to strengthen Australia's border inspection processes aimed at reducing future incursions in shipping containers. In response to the recent and increasing hitchhiker

risk of Khapra beetle in shipping containers, the Federal Government has changed the management of containers. Recognising that inspections are not adequate in detecting Khapra beetle, new treatment measures for containers will be implemented on the 12 April 2021 (urgent actions to protect against Khapra beetle) that will require "high risk" sea containers to be treated offshore with one of three options (methyl bromide, heat treatment or contact insecticide) by a registered treatment provider and be accompanied by a valid treatment certificate. High risk containers are those carrying a high-risk plant product (grains, seeds etc.) and loaded in a Khapra beetle target risk country, or shipped from a Khapra beetle target risk country and destined to a rural grain growing area of Australia. These measures will be reviewed and additional measures may be introduced later in 2021.

While these measures, together with the increased cost recovery charges on importers back in January 2020 (which included contributions towards the cost of import pest and disease risk mitigation planning and increased analytics and intelligence activities, in addition to the cost of managing biosecurity inspections) are a step in the right direction, the ABA believes this is recognition of who is responsible for the incursions. Agricultural industries should not be required to carry an unfair burden when border biosecurity fails. The Onshore Biosecurity Levy was a means of ensuring that those benefitting from the movement of cargo containers and creating the risk of incursions pay for the cost of the activities required to return the biosecurity status to that which existed before their shipment arrived.

Photo credit: Chris Pagan

AN ALMOND ORCHARD MANAGEMENT TOOL

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- Assist alignment of pollinators
- Help reinvigorate older trees
- Increase flowering uniformity
- Increase uniformity of growth stages
- Enable better harvest date management



Importation of improved honey bee genetics to Australia



Above left: Australian queen bee (blue mark) that has been artificially inseminated with imported semen having Varroa resistance genetics. Above right: A frame of brood she has laid. Photo credit: Jody Gerdtts.

THIS project (MT18019: Development and implementation of protocols to enable importation of improved honey bee genetics to Australia) aims to develop a framework that helps industry to import desirable honey bee stock into Australia but mitigates the risk of unwanted pests such as Varroa mite and deformed wing virus. Having safe access to Varroa-resistant stock is a priority strategy for Australia's Varroa preparedness and safeguard pollination services. The project is led by Dr John Roberts (CSIRO) in partnership with Victorian queen breeders Dr Jody Gerdtts and Mr David Briggs, and is working with Arista Bee Research in the Netherlands who are providing Varroa resistant queen bees and bee semen. The project is funded through Hort Innovation with contribution from the Almond, Avocado and Melon levy funds.

Despite the challenges of 2020, the project team successfully imported bee semen with Varroa Sensitive Hygiene (VSH) genetics in August 2020 and inseminated

Australian queens bred for general hygienic behaviour against disease. Bee semen is collected by fatally squashing the body of the male bee (drones) to cause ejaculation. Semen from 8 to 20 drones is needed for each queen insemination.

Three 'Arista-semen' queens are now being maintained and monitored and show good productivity. To further secure the imported genetics, we are currently rearing daughter queens and will assess their general hygienic behaviour by testing how well they remove dead/diseased brood.

The semen importation faced many logistical challenges, particularly the negotiations between Australian and Dutch authorities (via the project team) to meet permit requirements. Dutch source colonies were also tested before semen collection to reduce the risk of introducing unwanted bee viruses and Africanised (aggressive) bee genetics. Timing the collection of semen in the Netherlands with queen production in Australia also added seasonal complexity. Semen

from mature drones becomes available in the Dutch spring and summer (February – May), but Australian colonies are winding down in preparation for winter.

From this importation, we have shown that virus testing and DNA testing can be carried out effectively to reduce the risk of unwanted viruses and Africanised genetics being introduced with imported drone semen. Monitoring and testing of the Arista-semen queen's offspring has continued to show there is no evidence of exotic viruses, supporting the results of the donor colony testing.

We are now planning to import queen bees with Varroa Sensitive Hygiene in early 2021, which will be the first queen imports to come through Victoria's Post Entry Quarantine facility. We have already carried out a trial import at the facility using Australian queens to identify potential issues with the import process and strengthen capability at the facility.



Marketing update



Joseph Ebbage | Industry Market Development Manager

Lou Martin | ABA Marketing Officer



Australian Almonds recommence international trade fairs

AUSTRALIAN Almonds have recommenced its export trade fair program since the COVID-19 restrictions cancelled most of the events planned for 2020. We had a 6 metre by 3 metre booth at this year's Gulfoods exhibition which ran from February 21 to 25. It was held at the Dubai World Trade Centre. This year's Gulfoods Fair was the first 'in-person' food and beverage sourcing event of the year. Exhibitors from 85 countries met with buyers and attendees from 156 countries within a COVID-19 safe environment.

We engaged a Dubai-based Communications Agency called Ymakan to manage our trade stand

at Dubai. Our exhibition had two key features: a video highlighting the major elements of our industry covering our orchards and processing facilities and a video encouraging the visitors to our booth to register and enjoy our Virtual Trade Exhibition.

This virtual trade exhibition is hosted on our AustralianAlmonds website. Go to www.australianalmonds.com.au/expo to register for our virtual exhibitions. These platforms are being continually developed and enriched with new content. With international travel restrictions likely for most of this year, we will look to maximise the effectiveness of our digital engagement strategies.

The photos highlight some of the changes made due to COVID-19. We had segmented clear screens on each table to keep visitors and staff safe. Also, the Gulfoods organisers

did not allow full distribution of printed promotional material. As a result, we had individual QR codes for each of our promotional resources for visitors to download. We featured another QR code on the backwall to assist visitors to register for our virtual trade exhibition.

The analytical data from the Gulfoods trade stand and its accompanying virtual trade exhibition are still being analysed and will be reported in our next *In A Nutshell* edition.

We are planning a calendar of digital engagement programs to promote Australian almonds in our key export markets. These include a special promotion around the Festival of Holi in India held in March and also a healthy snacking promotion at Ramadan incorporating our Middle East and South-East Asian markets in April.



Fitness and Sports Nutrition program

As part of our Fitness and Sports Nutrition Program, work with Sports Dietitians Australia (SDA) has been undertaken to develop a nutrition course for fitness professionals. This course is accredited through Fitness Australia which will allow fitness professionals to earn Professional Development Points. Access to this course will be available through the Professional Development section in our new Health Professionals website.

The theme of this education module is around "the value of including plant foods within your diet". The objective is to educate participating fitness professionals about the inclusion of plant food within the context of the whole diet in active individuals.



Diabetes Online Expo

ON 27 March 2021, Australian Almonds exhibited at the Diabetes Online Expo organised by Diabetes Victoria. This event is important for anyone living with or affected by diabetes as it helps people stay connected and up to date with the latest in diabetes management and research and technology. Diabetes continues to be a core focus within our health programs as it is evident almonds play a positive contribution in maintaining and controlling diabetes.

ReFuel Magazine- Sports Dietitians Australia (SDA)

This month Australian Almonds are featured in the ReFuel Magazine through Sports Dietitians Australia (SDA). Refuel is a digital magazine packed full of case studies with real life examples, hot topics, recipes for success and expert advice from their members around sports and nutrition. The theme of this issue is based around pre competition and how to prepare for an event.

PREPARING FOR AN EVENT?

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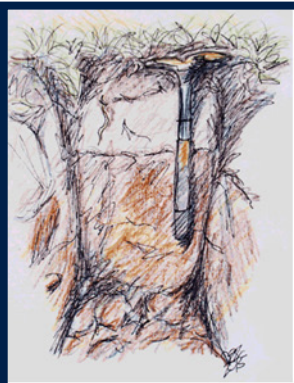
"Nutrition is key. Start by seeing if you are spreading your protein intake out over the day.

Almonds add protein. Grab a handful as a pre or post training snack, with breakfast cereal, on top of a stirfry or blended in a smoothie."

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



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Educating Health Professionals (AL16007)

WITHIN the scope of the Educating Health Professionals program, one of the key activities was to investigate any emerging research around the consumption of almonds and the effect this has on gut health and brain health. A literature review investigating these topics was conducted by Nutrition Research Australia (NRAUS).

Our main objectives were to explore any emerging research and develop evidenced-based key messages in education collaterals, including fact sheets for healthcare professionals and consumers. Although there were encouraging research findings, these fields of study are in their early stages.

Opposite is an excerpt from Nutrition Research Australia's research findings.



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.

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- ✓ 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 percent 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,

5 reasons why almonds are good for gut health

Almonds are one of only a few foods that contain fibre, phytochemicals, unsaturated 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, preferably 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 percent 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.



Hull rot of almond

Simone Kreidl¹ Tonya Wiechel¹, Peta Faulkner², Len Tesoriero³ and Jacky Edwards^{1,4} |

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HULL rot is a major disease affecting almond productivity. A recent industry-wide disease survey conducted across two seasons determined that approximately 70 per cent of Nonpareil is affected by hull rot in Australian orchards (Wiechel et al. 2020).

Hull rot causes direct loss of yield due to infected rotten nuts and downgrading of in-shell nuts, but it also reduces future yield due to twig dieback and loss of fruiting wood. In California, hull rot is mainly caused by two common fungi, *Rhizopus stolonifer* and *Aspergillus niger*, with *A. niger* more prevalent in the hotter regions (Michailides, pers. comm). These fungi look similar, i.e. fluffy and black, and a hand lens or a microscope is required to tell them apart. In Australia, hull rot is primarily caused by *Rhizopus stolonifer*. While *M. fructicola* and *A. niger* have been occasionally observed on almond hulls in Australian orchards they are not a major cause of hull rot.

Identification and symptoms

Hulls become susceptible to infection shortly after hull split with



Figure 1: Early hull split, when nuts are reported to be most susceptible to infection.

the early stages of split, B2-B3 (deep V stage), being most vulnerable (Figure 1). *Rhizopus stolonifer* is unable to penetrate the sealed hull but once hull split occurs, it can gain access to the moist inner surface which is an ideal environment for it to grow.

Once inside the hull, the fungus grows on the inside surface of the hull resulting in a slight shriveling of the hull around the split.

If the weather is wet the fungus produces masses of dark black/grey spores which becomes visible within a few days (Figure 2).

Infection is usually accompanied by spur death and twig dieback known as hull rot “strikes”. The first noticeable sign may be bunches of dried leaves. These usually remain pale green and may initially be quite hard to spot if infection levels are low. Severe infection can cause dieback of the whole stem with each spur along it infected.

Spur death and twig dieback is caused by acid by-products of the fungus which are translocated through the vascular traces and kill the plant tissues (Mirocha et al. 1961). Infection of older nuts, where the hull has begun to abscise, is less likely to lead to twig death due to the weakened connection between the nut and the twig, reducing translocation of the acid (Teviotdale et al. 1996). The recent industry-wide disease surveys found that 63% of hull rot in Nonpareil was associated with strikes.

Where it comes from

Rhizopus stolonifer is one of the most common fungi worldwide. It is found in all environments, in soil and on decomposing organic

Download Hull rot of almond Fact Sheet (with reference list) from ABA website.



Figure 2: Shriveling of hull and black sporulation of *Rhizopus stolonifer* infection beginning inside the split hull. In humid conditions all surfaces of the nut may be covered with sporulating fungus.

matter such as leaf litter. When the environment is conducive to fungal growth (i.e. mild to warm temperatures plus moisture), spore production in the orchard is prolific, the spores become airborne and are spread easily. Mummies (shrivelled nuts left in the tree from the previous season) have been assumed to be a major source of inoculum, but the data from our field trials does not support this. Less than 30 percent of mummies produced inoculum when placed in ideal laboratory conditions, and there has been no correlation between mummies per tree and subsequent hull rot development. Similarly, there has been an assumption that hull rot leads to the formation of mummies or “stick tights”, but again, the data from our field trials does not support this, with poor correlation between hull rot strikes and subsequent numbers of mummies (Figure 3).

Spores are dispersed by wind and rain splash into the canopy and onto split fruit. Insect pests may also carry spores into the split fruit. Carpophilus beetles are known to vector spores of the brown rot fungus within Australian stone fruit orchards (Holmes et al. 2011), and it is possible that they may spread *Rhizopus* spores in almond orchards.



Favourable conditions

Rhizopus stolonifer requires high humidity and warm temperatures for growth and spore production. The optimum temperature range is 15-30°C, with poor growth below 10°C and above 30°C (Amiri et al. 2011; Pierson 1966).

Hull rot is strongly associated with rain events post-hull split. Statistical analysis of the industry-wide disease survey results found a highly significant correlation between hull rot incidence in an orchard with the amount and timing of regional rainfall in mid-late January.

Hull rot is often referred to as a good grower disease, being more prevalent where trees are well supplied with water and nutrients. While rainfall is out of our control, there has been much work done on irrigation practices and how they can be used to improve outcomes. Irrigation that promotes long periods of high humidity within the canopy is more favourable to hull rot development. Current trials in this project are investigating whether the use of imaging to identify areas of low, medium and high water stress in the orchard can predict hull rot incidence and severity.

Cultivar susceptibility

Susceptibility to hull rot varies among popular commercial almond varieties. The industry standard Nonpareil is among the most susceptible; common pollinisers such as Price and Wood Colony are moderately susceptible; while Carmel and Monterey are more resistant (Lightle et al. 2019). There is considerable effort put into the

production of new breeding lines for Australian almonds (AL12015) with many new varieties in the pipeline. Recent assessments have identified that most of these new lines are less susceptible to hull rot than Nonpareil (Edwards 2020).

Control measures

Commonly reported methods of hull rot control include restrictions in water and nitrogen application and fungicides.

Californian research has demonstrated that imposing moisture stress during hull split reduced hull rot severity (Teviotdale et al. 2001). Additionally, restricting nitrogen leading up to hull split also reduced hull rot (Saa et al. 2016). Recent recommendations from California are -14 to -18 bars stem water potential (SWP) for two weeks, beginning just prior to hull split (Niederholzer et al. 2020) and sap nitrogen levels to be in the moderate range (2.2-2.5% N) at summer sampling (Doll 2020), with no further nitrogen applications after kernel development has completed.

Our trial investigating restricted water and nitrogen as a practical control measure in Australia demonstrated that when conditions prior to harvest were wet, restricted irrigation resulted in significantly fewer hull rot strikes. When conditions were dry hull rot severity was low anyway and any additional effect was not significant. We did not show that restricting nitrogen reduced hull rot severity (Faulkner et al 2020).

Fungicides are an important part of a control program. Spraying at the right time is critical for good hull rot control with nuts most susceptible at

early hull split but nut growth stage will vary across the orchard and may take two to three weeks for all nuts to reach this stage. It is recommended to start application before or as soon as the first nuts begin splitting. Good spray coverage is very important to reach the vulnerable split surfaces.

Typical spray volumes in Australian orchards vary but higher volumes and slower speeds give better coverage. Fungicide FRAC groups 3 (DMI) and 11 (QoL) and combinations of 11 with 3 and 7 (SDHI) are reported to give control in Californian orchards (Adaskaveg et al. 2017, University of California 2017). In Australia only two products from FRAC groups 3+11 are registered for hull rot suppression (APVMA Pubcris database). Alternative products such as alkali- and microbial-based products have also been suggested to provide hull rot control, but data on their efficacy has not been published.

Conclusion

Rhizopus stolonifer is the key pathogen causing hull rot in Australian almond orchards. It is a very common fungus and is favoured by high humidity, warm temperatures and January rainfall. Contrary to popular opinion, we did not find a correlation between hull rot and mummies. Early hull split is the most susceptible stage for pathogen infection. Once inside, the fungus colonises the inner surface of the hull and produces acid by-products which cause spur death.

Effective control measures are still under development. Protective sprays should be applied at early hull split to prevent the fungus colonising the fruit. Targeted application of water stress reduces disease severity when conditions are favourable. If rain events occur in January after hull split, consider whether early harvest is a practical option.

Future work will continue to investigate the effect of water stress on hull rot development, as well as gaining more insight into microclimatic effects on the infection process, assessing the susceptibility of root stocks and new varieties, and assessing alternative treatments.

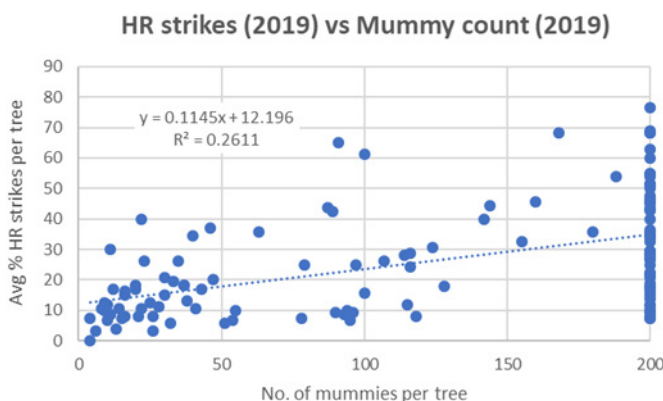


Figure 3. Relationship between hull rot strikes and mummy numbers.

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Monterey leafing failure



ABA Industry Development Team |

THE Almond Board of Australia (ABA) has received reports of significant leaf bud failure in the variety Monterey and is working with researchers and growers to explore potential causes including biological agents and physiological stresses. In this article we outline what activities have been done to better understand this phenomenon and the Australian almond grower experience.

Symptoms have been described as significant leaf bud failure, or delayed leaf out, followed by shoot dieback, which may progress to affect the whole limb or tree. Symptoms appear after 5th or 6th leaf but have been reported to appear as early as 2nd and 3rd leaf. The level of impact experienced by Australian growers has also differed where some have observed symptoms in one year without any further progression and negligible economic impact while others have experienced significant shoot and limb death over a two-three year period and some have chosen to replace the variety.

Monterey is a relatively new variety for Australia, first planted in the Riverland in 2002 as an early flowering pollinator variety, with high and consistent yields and late maturity to extend the harvest period. Early plantings were relatively small until its popularity grew and larger plantings made in 2015. In 2020 the total area planted to Monterey was 6,637 hectares representing 11% of the total Australian almond plantings. 90% of the Monterey is less than six years old and the majority of plantings (55%) are located in New South Wales.

The earliest known report of the leaf bud failure in Australia was in 2017 with subsequent reports being sporadic and variable. Individual growers have undertaken their own diagnostic investigations with no clear definitive causal agent identified from samples of the roots, stems, trunks or leaves.(Cont...)



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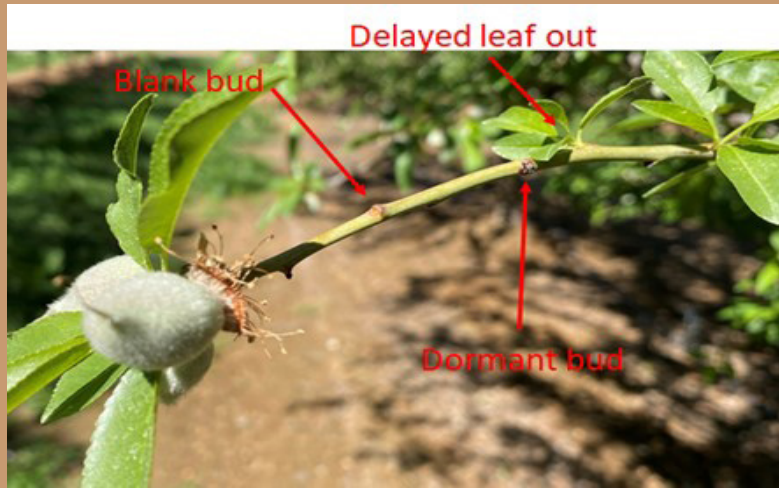


Figure 1. Monterey shoot with normal proximal (tip) and basal (base) leaf out and delayed leaf out or blank buds in-between (Luke Milliron (April 2020) Monterey and the leafing failure 2020: What we are seeing?).

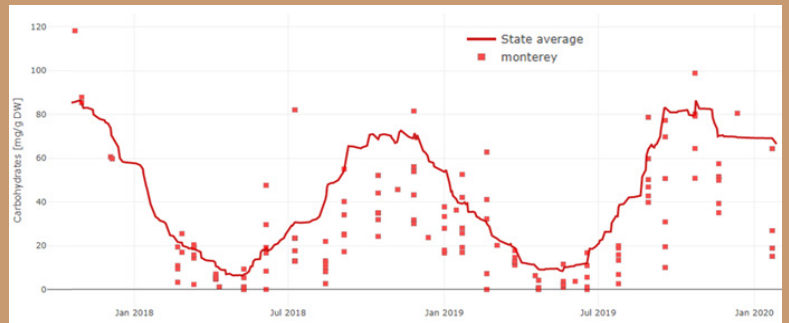


Figure 2. The UC Davis Carbohydrate Observatory data for starch (mg/g dry weight) in the wood of Monterey compared to the state average (Milliron et al. 2020).

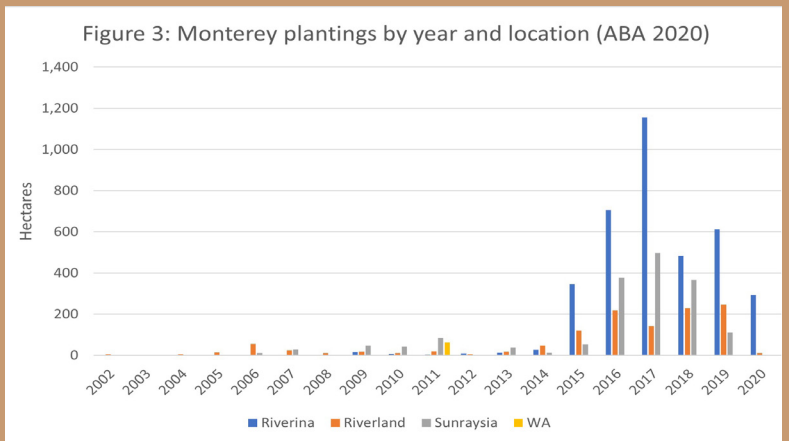


Figure 3: Monterey plantings by year and location (ABA, 2020).



In October 2020 the Integrated Disease Management team (AL16005) assessed Monterey trees showing decline in four orchards around Griffith, NSW. Observations concluded that there were no external trunk symptoms (cankers, gumming) but the core tissue of the trunk had a brown and black necrosis that extended above to the lower scaffold limbs and below to the crown. Some gumming was observed on shoots near the junctions between symptomless and necrosis in tips or side shoots. Although larger secondary roots were symptomless the fine feeder roots were necrotic and withered. Trees showing symptoms were observed to be growing alongside rows of other varieties which generally look healthy and vigorous.

Subsequent diagnostic analysis at the NSW DPI Central Coast Primary Industries Centre at Ourimbah did not yield any significant fungal species from the necrotic trunk tissue sampled suggesting an abiotic cause. However, candidate plant pathogenic fungi were recovered from affected tissue which require further investigation. These investigations will continue into the next spring to identify potential plant pathogens at bud break and flowering.

Similar symptoms are being seen in California where farm advisors and specialists think there may be an association with warm winters and stress events such as water stress during the previous harvest, wet conditions the previous year, acute disease, defoliation from mites or trunk bark cankers ([Luke Milliron et al. 2020. Monterey and the Leafing Failure: What could be causing it?](#)).

Carbohydrate data (mg starch per gram dry weight) collected by UC Davis suggests that Monterey has lower non-structural carbohydrates at the beginning of winter (Figure 2) which may mean fewer spare reserves if autumn and winter conditions are mild and trees continue to respire.

Other work done at UC Davis connected wet conditions with leafing failure in Monterey. It is thought that wet conditions in spring may lead to poor root development and subsequent water stress during summer.

The situation in Australia

To better understand the extent of this issue in Australia the ABA undertook a survey of all Monterey growers in January 2021. Forty three growers participated in the survey representing 93% of the area planted to Monterey of which 13 growers (19% of area planted to Monterey or 2% of total industry) believed they have seen leaf dieback symptoms to some extent ranging from less than 10% randomly scattered across the property to more than 30% consistently spread across all trees. Two properties had removed their plantings.

Some of the stress events observed by these growers in the years leading up to seeing the symptoms included: extreme heat; poor chill hours; disease infection (rust leading to early defoliation); high crop loads; and aging trees.

Growers have reported symptoms look similar to non-infectious bud failure (NBF) mostly seen in Carmel but also Nonpareil. [Milliron \(2020\)](#) describes the difference with Monterey leafing failure is that vegetative buds are late to push or push on some parts of the branch but not others. In the case of NBF there are whole shoots where no buds have broken. NBF is a chronic genetic disorder that can be linked back to the original budwood source and is a problem exacerbated by the environmental component of hot spells in December. With classic NBF vegetative buds completely fail to go into dormancy and have likely already died in the previous autumn.

Grower experience

Surveyed growers consistently said Monterey trees are sensitive to stress be it over or under watering, shading out, nutrient stress etc. While they yield well, they are not the best-looking tree. Some of the specific management strategies to avoid these stresses are summarised below.

The weeping and willowing habit of Monterey trees are more likely to experience limb breakage or cracking especially with: heavy crop loads; machinery damage especially in young or overgrown trees.

The variety requires regular pruning or hedging to avoid issues associated with shading out. Therefore wound protection will be important with Monterey to prevent infection by trunk disease pathogens.

The Integrated Disease Management team (AL16005) are currently evaluating wound protection products with the aim of gaining label registrations and hope to develop practical methods of application following pruning and hedging in the future.

Monterey appears to be sensitive to both excess water and also sensitive to water stress. Irrigation scheduling technologies that measure tree water demand/use together with irrigation systems that enable alternative watering regimes to other varieties help to get the right balance for irrigation as well as nutritional requirements.

Pests and disease that cause premature leaf drop including mites and rust need to be managed to avoid contributing to tree stress.

In summary

The variability seen by growers between seasons and between orchards makes it difficult to work out a definitive cause and provide a straightforward solution. Orchard stress appears to exacerbate the expression of symptoms, so these are best avoided. Investigations are ongoing to better understand what is causing this problem.

Growers are encouraged to flag trees with symptoms to track recovery and let the ABA know if you are seeing these leafing failure symptoms.

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The 2019/20 Hort Stats Handbook is here

THE latest Australian Horticulture Statistics Handbook is now available. It offers the most comprehensive and contemporary data available on all sectors of the Australian horticulture industry in one easy-to-read guide.

The Handbook features more than 470 pages of information drawn from several supply chain sources, including international trade statistics and industry peak bodies, including the ABA. The Handbook includes data on more than 70 horticultural products including fruit, nuts, vegetables, nursery, turf, and cut flowers. View the 2019/20 Hort Statistics Handbook.

[View 2019/20 Hort Statistics Handbook](#)

Impact assessment work

DURING 2019/20, Hort Innovation engaged independent consultants to evaluate the impact of our R&D investments. This included looking across a random sample of all Hort Innovation R&D projects completed in the 2018/19 financial year, plus a specific look at the impact of work within the Hort Innovation almond funds with a focus on projects completed within the five years to 30 June 2019, aligned to the current industry Strategic Investment Plans.

The assessments revealed a range of economic, social and environmental impacts being generated for horticulture growers, supply chain participants, and the community at large. Where suitable data was available, the impacts were valued in monetary terms as well – this demonstrated that an average

benefit-cost ratio of 3.4 to 1 was achieved across the sample projects, generating a total net present value of some \$40.5 million over 30 years. It should be noted that projects were chosen at random and does not include others that have delivered much greater returns.

Further information can be found on the [Hort Innovation website](#).

The industry-specific impact assessments for almonds can be [found here](#).

Annual Investment Plans available on Hort Innovation website

ANNUAL Investment Plans (AIPs) detail how levy funds will be spent over a 12-month period. Investment decisions are guided by industry Strategic Investment Plans (SIPs) and prioritised based on potential industry impact, as well as availability of levy funds.

Each AIP was developed by Hort Innovation, informed by the SIP and industry consultation, and then discussed with the industry Strategic Investment Advisory Panel (SIAP) for feedback and prioritisation.

The majority of AIPs are now available on our industry-specific Fund Management pages on the Hort Innovation website, with just a few remaining AIPs currently with their relevant SIAP for final feedback.

You can find these pages at www.horticulture.com.au/growers.

Meet our Regional Extension Team

DO you know which Hort Innovation Regional Extension Manager is working to enhance the coordination, communication and application of R&D outcomes in your region? To support growth in the horticulture

sector, Hort Innovation launched an Extension initiative that involves staff based in the regions, who will play a linking role within industry.

We have developed a series of written and video profiles of the team so that you can get to know your Regional Extension Manager and hear about their background in Extension and what skills they bring to the role.

Over the past year, the Extension Team have been working hard on a regional level to:

- Identify cross-industry issues with growers and other supply chain stakeholders
- Investigate approaches to whole-of-horticulture concerns such as farm waste, biosecurity and water efficiency
- Initiate Hort Frontiers investments in collaboration with the private sector in the areas of leadership and extension
- Conduct grower consultations to renew industry Strategic Investment Plans
- Manage the industry development portfolio and facilitate networking with industry development delivery partners to create peer-to-peer learning opportunities.

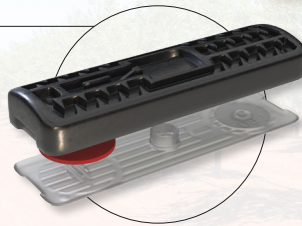
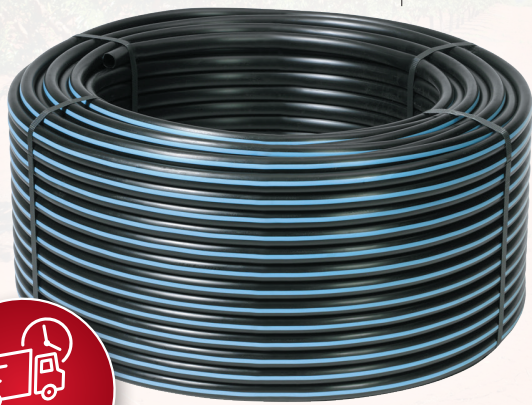
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[Read more about the Hort Innovation Extension initiative](#)

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Calendar

*March

17 Almond Centre of Excellence Committee Meeting, Loxton..

27/28 Murray to Moyne Cycle Relay, Mildura to Port Fairy, Victoria.

*April

22 Pollination Committee Meeting, via Zoom.

*May

3 Plant Improvement Committee Meeting, Production Committee Meeting, Loxton and Zoom hybrid.

5 Market Development Committee Meeting, ABA Board Meeting, Adelaide;

6 ABA Strategic Planning Day, Adelaide.

7 ABA Board Meeting, Adelaide.

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



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ALMOND BOARD OF AUSTRALIA

ABA MEMBERSHIP: JOIN TODAY

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

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

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

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

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

Join the ABA by [visiting our website](#), phoning **08 8584 7053**

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BEEF, BROCCOLINI AND ALMOND STIR-FRY

Stir-frying is a healthy and quick way to cook food. This stir-fry combines melt-in-the-mouth steak with tender broccoli and almonds for a tasty and satisfying dish.

Serves 4

INGREDIENTS

- 400g scotch fillet beef
- 1 tablespoon Shaoxing wine
- 1 tablespoon light soy sauce
- 1 teaspoon sugar
- ¼ teaspoon sesame oil.
- 1 teaspoon corn flour
- 1 tablespoon vegetable oil
- 1 large onion, peeled and diced
- 1 large clove garlic, finely chopped
- 1 bunch broccolini, washed and chopped into pieces
- 70g raw almonds
- Cooked rice

METHOD

1. Wash and pat dry meat, then cut into ½ cm slices, cutting diagonally across the grain.
2. Place into a bowl and then pour over Shaoxing wine, soy sauce, sugar, sesame oil, and cornflour.
3. Stir to combine and then cover and refrigerate for one hour to marinate.
4. Heat up a wok or large frypan until smoking and then add oil.
5. Add onion and cook over medium heat for a minute, stirring all the time. Add garlic and continue cooking and stirring for another minute.
6. Turn the heat back up to high and then add beef, cooking and stirring it for a minute so it browns on all sides.
7. When the beef is browned but not fully cooked, turn off the heat and remove beef to a plate and set aside.
8. Turn the heat back on and add almonds and broccolini. Stir to combine and then cover with a lid and turn the heat down to low-medium.
9. Let cool, covered for two minutes.
10. Remove lid and stir. Return beef to the pan and then mix to combine thoroughly.
11. Serve immediately with steamed rice.

