

TALKING AVOCADOS

A group of approximately 15 people, mostly men, are standing in a line outdoors in what appears to be an orchard or farm setting. They are dressed in casual attire like jackets, hats, and jeans. The background shows large trees and a clear sky. The text is overlaid on the lower half of the image.

Avocado strategic R&D overview

Supply volumes increasing

Indian market opportunities

Building biosecurity capacity

Avocados Australia Limited

Avocados Australia Limited ABN 87 105 853 807

Level 1, 8/63 Annerley Road, Woolloongabba, Qld 4102 Australia
PO Box 8005 Woolloongabba Qld 4102 Australia

Phone: +61 7 3846 6566 Fax: +61 7 3846 6577

Email: admin@avocado.org.au

Web: www.avocado.org.au

John Tyas Chief Executive Officer +61 7 3846 6566 j.tyas@avocado.org.au

Avocados Australia Directors

Jim Kochi Chairman, North Queensland	0422 133 890	j.kochi@avocado.org.au
Tom Silver Tamborine & Northern Rivers	0402 017 239	t.silver@avocado.org.au
Daryl Boardman South Queensland	0427 151 033	d.boardman@avocado.org.au
Kym Thiel Tristate	0437 939 119	k.thiel@avocado.org.au
Eric Carney Central Queensland	0403 917 769	e.carney@avocado.org.au
John Walsh Central Queensland	0428 268 200	j.walsh@avocado.org.au
Robert Price Sunshine Coast	0419 329 411	r.price@avocado.org.au
Ian Tolson Central New South Wales	0418 262 595	i.tolson@avocado.org.au
Dudley Mitchell Western Australia	0439 802 293	d.mitchell@avocado.org.au
Brad Rodgers Western Australia	0412 912 764	b.rodgers@avocado.org.au

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Editor in Chief: John Tyas

Managing Editor: Lisa Yorkson

PO Box 8005 Woolloongabba Qld 4102

Email: TalkingAvocados@avocado.org.au

Ph: +61 7 3846 6566 Fax: +61 7 3846 6577

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Designed and Printed by: Snap Brisbane Felix Street
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www.brisfelix.snap.com.au

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Advertising: Avocados Australia Limited
Ph: +61 7 3846 6566 Fax: +61 7 3846 6577

PO Box 8005 Woolloongabba Qld 4102
Email: TalkingAvocados@avocado.org.au

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Front cover Almost 100 industry members were present for the Pemberton regional forum.

Chairman's Perspective



In June this year a comment was made by David Goodfellow, Chief Executive Officer of AustOn Corporation that "Australia faces a 'tsunami' of avocados hitting the market in the next few years". He continues his comments based on "more than half the avocado trees planted in Australia are less than five years old, with market prices likely to fall substantially as they flood on to the market".

Avocados Australia CEO John Tyas said "the amount of avocados likely to come on the market in coming years would put pressure on the industry. Avocados Australia is expecting this season's crop to rise 9% to 95,000 tonnes by April next year". Source: *FreshPlaza* 26/6/19, bit.ly/TA302tsu.

For those of you who find this hard to believe I would direct you to read the report *Facts at a Glance, 2017/2018, for the Australian Avocado Industry*, as at August 2018 on the Avocados Australia website. This report gives the key statistics of our industry with a lot of the data compiled from the information contributed by growers to *OrchardInfo*, *Infocado* and ABS data.

The information we already have regarding future production of avocado in Australia is, in reality, our early warning system to the impending "tsunami" and we need to make sure we have the appropriate systems to monitor the advance of this wave and to have systems in place to mitigate or manage the damage. Your industry at Avocados Australia Board level and Hort Innovation level already accept and understand this situation and have R&D projects and Marketing strategies to make plans for the future that is coming our way.

My concern is that many growers do not know what we at Board level do know, and there are still many growers who do not contribute the information that our industry needs to have accurate data so future predictions and plans can be better constructed and managed. Quite simply, the basic information contributed to *OrchardInfo* and *Infocado* needs to be contributed by EVERY grower so we can understand the exact strength of the "tsunami". This then allows the Strategic Investment Advisory Panels for R&D and marketing (SIAPs) to evaluate projects using your R&D and Marketing levies to plan ahead.

We are all in this avocado industry together and we do need to work together and to contribute the information needed to allow our industry to plan ahead so that this impending "tsunami" does not smash our avocado industry, and that includes every grower and every other stakeholder.

Jim Kochi

Jim Kochi, Chairman, Avocados Australia Limited



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www.avocado.org.au/our-programs/anvas/

CEO's Report

Season outlook

The latest Quarterly *Infocado* Report published in July paints an unprecedented picture for the next 12 months. We have seen the rapid expansion of new plantings during the past few years, and now we are going to start seeing the rapid increase in supply volumes, as predicted.

The next 12 months will be a testing time for the industry with more than 100,000 tonnes forecast to be supplied to the Australian market (including from New Zealand). Records will continue to be broken. However, the good news is that this volume is likely to be spread fairly evenly across the 12 months and the traditional short supply period in late summer is not showing in the forecast. That is great for consumer confidence and the long term growth of the category.

Research underpinning our industry

We have a bumper edition for you this quarter, as we share the full range of research and development underway to help the Australian industry continue to improve and prosper.

In the R&D section, you will find a comprehensive summary of current research, both funded by your R&D levy or via other sources secured by Hort Innovation. There are projects from across the country, supporting everything from improved pollination to mitigating disease risks, from improving the supply chain to boosting fruit set.

This work is critical for our future, and even more critical is making the most of the results. I encourage everyone to take the time to connect with the researchers working on behalf of industry, to familiarise themselves with the results when we add them to the Best Practice Resource, to attend the various field days and workshops. This is how we will make changes that will help us remain sustainable and competitive, especially as production continues to grow. We are all going to need to work smarter, to produce a consistently good product, to open new



Avocados Australia's John Tyas and Daniel Martins with Western Australian industry member Jennie Franceschi (centre) during the regional forum in Wanerie in June 2019.

markets, to retain our existing consumers. Underpinning all of this is the research supported by your levy, your involvement in trial and field work, and your practice changes.



Indian market opportunities

Highly populated India is a real market opportunity for the Australian avocado industry. I recently had the chance to be part of a market study, organised via Hort Innovation and Austrade (more on page 15).

In India, fruit and vegetables are sold from street carts, roadside markets, all the way through to high-end retail outlets and on-line.

India, identified in our *Australian avocado export strategy 2019-2021*, has a young, growing population. As our domestic production continues to increase, it's one of the markets we are targeting to achieve market access as soon as possible.



Checking out the competition: Avocados Australia CEO John Tyas says there are real opportunities in India for the Australian industry.

Promoting Australian avocados in Malaysia

It's not only new markets where we are promoting great Australian avocados. Grower marketing funds are also being directed toward some of our existing markets, including Malaysia.

During July, a promotion of Australian avocados was launched in Malaysia, under the Taste Australia banner. At the launch, certified nutritionist and health advocate Alexandra Prabakaran, who worked with us on the PASE project last year, showcased a number of recipes using Australian avocados.

The launch, as part of a campaign to promote avocados' tasty and nutritious qualities, also involved Trade Commissioner Caitlin Noble and Jaya Grocer's Marc Francois, and a range of local media and online influencers.

This work will continue until September.



Malaysian health advocate and Australian avocado champion Alexandra Prabakaran helps launch the latest promotional campaign.



In-store displays are helping Malaysian consumers select the perfect Australian avocado for their needs, with information on ripeness stages.

Crossing the country

It's been an exciting few months, catching up with growers and industry members from Pemberton in Western Australia to Stuarts Point in Central New South Wales. The new industry development and extension project (more on page 11-14), is certainly off to a great start with excellent attendance figures and good feedback.

As our domestic production increases, it's up to us to make sure that we are delivering a consistently good quality product for all of our consumers, and that starts in the orchard. This project is helping bring the latest research and development, funded by your industry levies, and other expertise into your region.

I encourage everyone to keep an eye out for upcoming events in the fortnightly *Guacamole*, and also be sure to provide feedback on topics of interest.



Avocados Australia has relocated from Woolloongabba, to the Brisbane Markets. You can now find us at Unit 13, Level 1, in the Fresh Centre at 385 Sherwood Road, Rocklea Queensland 4106. Our new postal address is PO Box 134, Brisbane Markets Q 4106.

All other contact details remain the same, and you will still be able to reach the Avocados Australia team at 07 3846 6566. For valued team member Amanda Madden, pictured, it is her third office with the organisation, having started with Avocados Australia when it had an office at Stones Corner, helping to move to Woolloongabba, and now settling in at the Fresh Centre.

Do you know a new grower?

Do you know a new grower who isn't receiving industry communication? We encourage you to recommend they subscribe to the fortnightly *Guacamole* newsletter, for the monthly Avo Alerts, and for this magazine.

As we all know, new growers have joined the industry in every region in the last few years. It is important that new growers stay well informed about industry matters and we are very keen to engage with them.

Encourage new members of our industry to make contact via admin2@avocado.org.au or by calling 07 3846 6566 for more information about our various publications and activities.

John Tyas

John Tyas, CEO, Avocados Australia Limited



Around Australia

Central New South Wales Report

By Ian Tolson, Avocados Australia Director

Another very well attended Regional Forum was held at the Stuarts Point Hall in May. Even though the content of these forums is important, it seems the networking and orchard walk is the best part of the growers day. A big 'thank you' to Malcolm, Narelle & Isaac Heather who hosted the orchard walk, of special interest was their solar powered irrigation system. You can find photographs from the event on pages 13-14.

As spoken about in previous reports, the region's crop numbers will be down for this season. Harvest has begun in the local area. Comboyne and Bellingen will be looking to start within the next few weeks. Fortunately, no reports of hail damage to crops this year.

After quite a long dry spell, some very welcome rain was received during the last week of June. Some areas reporting 125mm, others were not as fortunate.

As always, just want to reinforce the importance of producing premium grade fruit.



In the orchard during the recent Regional Forum at Stuarts Point.

Western Australia Report

By Brad Rodgers, Avocados Australia Director

Once again in the Western Australian regions, weather, large fruit load, competition and new plantings are front of mind for most growers.

As I write this on the Queen's Birthday weekend, WA has just received its first significant winter weather event. This comes off the back of one of the driest Summer and Autumn periods for +50 years. With our largest fruit load on record growers will need to be right on their games during the remainder of Winter to get us to the start line for the coming 2019 harvest season.

I have fielded a few calls regarding the various potential South American imports and their implication to us in WA. There is a fair way to go on most of these and be assured Avocados



Australia is making sure key areas like biosecurity are addressed, and I as one of your directors will ensure I do what I can to represent WA growers' interests. I would encourage you to stay up-to-date by reading the latest editions of the *Avo Insider*, Avocados Australia's member-only publication.

New Zealand is here to stay so we need to continue our quality product point of difference and keep our fruit/tree data up to date with Avocados Australia so we can in turn help the marketers with their planning and push an "Aussie First" policy.

As our national fruit production races towards parity with consumption we need to look to new sale opportunities. Did I hear someone say "Avocchino please!?" It is pleasing to see the industry programs funded by your levies getting more focussed on the R&D and Marketing at both innovation and export levels. Hort Innovation are engaging with us well and your Avocados Australia members on these committees will ensure this continues.

In June, we had two Regional Forums in the west – Pemberton and Gingin. These were well attended and I'd like to thank the growers who volunteered their farms for these events. The content covered is constantly getting better and the speakers are always of top quality. Canopy management was a big hit and anyone wanting to catch up on this can have a look at the minutes of the Pemberton meeting on the BPR when they are available. Many thanks to Dudley Mitchell and Simon Newett, growers Shane & Joe Bendotti, David Morcombe and Gary Inkster.

As a new avocado grower myself, I don't profess to know much, however, the learning available in our network is amazing. I will try to get a coming regional event to have a specific focus on under five-year-old trees – I mentioned this to Simon Newett and he is keen...watch this space.

Good luck to all WA growers for our coming record season and feel free to contact me with any queries that I can help with.

Tristate Report

By Kym Thiel, Avocados Australia Director

Recent frost events in late June in the Tristate have put a dampener on the start of what was promising to be a huge season. Although losses are only minimal, any loss hurts, especially when we are only at the front end of the frost season. Some growers who have planted in low lying areas or areas that are considered susceptible to frost have learnt the hard way, as their losses are quite significant. Unfortunately, when temps hit -6°C there is not a lot any grower can do to overcome this.

Water allocations remain well below 100% which of course has exacerbated the frost issues. The dry Autumn set the region up for the frosts which have followed and have also now delivered low opening allocations. It's still hoped that recent rain activity



will increase allocations and provide more moisture in the atmosphere to help alleviate the frost situation.

With still such a large crop, growers are sitting just waiting to get market signals to begin harvest. I encourage all packers to make sure they are contributing to *Infocado* and *OrchardIndo* so industry has the best possible information from which it can make decisions.

The SAAGA (South Australian Avocado Growers Association) recently held our AGM, which in the past has coincided with an industry field day. This year we couldn't do that with the AGM, but with funds available we are calling for ideas about what this money could potentially be used for.

Sunshine Coast Report

By Robert Price, Avocados Australia Director



Well, the end of financial year and a fair percentage of the fruit for the area has been picked. The year has been a mixture of results with growers reaping a good average crop and at the same time for others harvest was down because of poor fruit set in 2018. It seemed to vary between varieties where some growers reported that Fuerte were down, but Hass was consistent with other years, while on the other hand I found that Hass were down but Pinkerton were up; it's difficult to arrive at a conclusive reason for the variance of the season.

As the new season approaches and trees start flowering, I will be following the weather closely. It has been a year with relatively low rainfall but at the same time the cooler temperatures have meant the ground hasn't been drying out as much. Monitoring the soil moisture levels I have found that the ground has been retaining good moisture to the extent that irrigation could be substantially reduced. Some growers closer to the coast reported that they hadn't watered in two months.

So what are the predictions for the coming months?

Looking at the Bureau of Meteorology (www.bom.gov.au/climate/outlooks/#/overview/summary/), it seems:

- the August to October climate outlook, issued 25 July 2019, suggests a drier than average three months is likely for large parts of Australia
- August to October daytime temperatures are likely to be warmer than average for much of Australia, with very high chances for the northern half of country
- nights are likely to be warmer than average for much of Australia. However, parts of southern Australia and north-east Queensland have roughly equal chances of warmer or cooler nights. With more cloud-free days and nights expected, there is an increased risk of frost in susceptible areas.

It seems prudent for the grower in South East Queensland to do a stocktake of current water supplies and plan for a potentially hard season.

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Around Australia continued

Central Queensland Report

By Eric Carney, Avocados Australia Director

At the time of writing this report, we are into the first week of July and by no means at the end of the season for the region, although there are growers who have well and truly finished.

This year we have seen some variability in orchard production for the region with some growers up on last year, while some others are down. This statement isn't really anything new, but the variance in production between farms has been more than just "a little"; some farms are down a considerable amount whilst others are having a bumper crop. In the end, the region as a whole is on track to be down on estimates by roughly 15%, perhaps more. One factor, as always, was weather. We had a fairly dry spring/summer with rain only coming very late into the season. Growers who had the ability and did pour on the water during the dry time typically did well in terms of production. Excellent early returns in March and April (and May) was a welcome surprise for many growers' bank accounts and made up for some of the variance in production.

Shifting gears slightly, within a couple of months the Queensland Government is expected to pass new legislation that will affect ALL horticulture crops in reef catchment areas of the state. The regulations are centred around protecting the Great Barrier Reef, and as Central Queensland avocado orchards fall in the Reef catchment area, avocado and other horticulture crops grown in Reef catchment areas *will be impacted*. You can find more about the Reef Bill, including a map, here: bit.ly/TA302REEF.

We do have to bear in mind that the Bill has not been passed yet, although no changes were made during the last review, and none are expected before it passes. It is expected the proposed legislation will affect all avocado growers (and other horticulture crops) in the Reef catchments by way of limiting how much nitrogen and phosphorus is allowed to be applied to your farm on an annual basis. In addition, sediment run-off targets will need to be met. There is also provision for the government to be given powers to collect fertiliser sale records from your fertiliser suppliers. The actual target amounts are yet to be established by the Queensland Department of Environment and Science (DES). It is expected there will be some consultation between the government and industry during the three years DES has to establish the rates (once the Bill passes), but details are lacking. There will also be a "no net decline to water quality" standard, and a permit requirement, for all new developments in Reef catchments.

The bottom line is, there will be a range of record-keeping requirements for all growers in the Reef regions, including fertiliser, chemical and soil condition records, and potential implications for on-farm practices and infrastructure requirements. Please keep an eye out for updates regarding the new Queensland Reef regulation from us. Avocados Australia



will be taking an active role when and where possible and we are likely to be seeking your feedback and input as we do so.

Tamborine and Northern Rivers Report

By Tom Silver, Avocados Australia Director

The Northern New South Wales/Tamborine harvest is in full swing; fruit size continues to be an issue for most growers undoubtedly a result of the prolonged dry summer. The eastern edge of the district has finally received good soaking rains throughout May and early June, however, the west of the growing area continues to be incredibly dry which is very concerning for effected producers.

Avocados Australia is currently in the process of redesigning the *Infocado* crop flow information program. It is intended that the new system will make it easier to input data and therefore



The eastern edge of the Tamborine/Northern Rivers has finally received good soaking rains throughout May and early June, however, the west of the growing area continues to be incredibly dry.

ensure more growers can contribute accurate production figures. This will in turn ensure that growers, packers and marketers are getting the most accurate information on which to base harvest, supply and marketing decisions. A program like this, is the envy of other industries. I am aware that *Infocado* in the past has been maligned due to criticisms that it is inaccurate or poorly taken up. Like any information system, *Infocado* is only as good as the data inputted. It is for this reason I implore all growers and handlers to take an interest in the roll out and implementation of the new system. It will undoubtedly be critical in helping the industry manage the large predicted volumes of avocados in the future.

Growers in the Northern New South Wales/Tamborine growing area will be able to attend our Regional Forum on 13 November 2019. It has been quite a while since the last industry field day, and I expect growers will be eager to attend. A venue and topics for the day are already being planned, please keep an ear out as info comes to hand. You will also have the opportunity



Harvest is underway in the Tamborine Northern Rivers.

to attend the Avocados Australia Annual General Meeting, an opportunity I encourage you to take up.

North Queensland Report

By Jim Kochi, Avocados Australia Director

The avocado industry in North Queensland is now the highest value horticultural industry in North Queensland surpassing blueberries, mango, and banana. NQ recorded 23,346 tonnes compared to Central Queensland (16,851t), South Queensland (3,470t), and Sunshine Coast (927t) in the 2017/18 year. The 2018/19 data is not yet complete but is likely to show an increasing supply trend for North Queensland because



this region has almost the same number of new trees in the ground (0-5 years) as there are older trees (6 years+). A similar situation exists in Western Australia where there are now more young trees (0-5 years) than old trees (6 years+).

As I continue with my comments from the Chairman's Perspective, it is imperative that I comment on the level of grower participation, and why I have made these comments.

Our records at Avocado Australia (AAL) now show AAL membership has increased 30% since 2013 but there are still around 330 growers who are registered growers but not financial members, as at June 2019. Even more concerning is that there is around another 300 growers (we believe) who are not registered with AAL.

To me, this means that the information we have on tree numbers and production may not be as accurate as it could be, and this inaccuracy does limit the planning for the movement of avocado through the supply chain in Australia and into the export markets.

North Queensland has had a miserable production year with a dry Spring up until January which caused sunburn and smaller fruit sizing, and then followed five months of constant rain and drizzle all through the harvest period. Mareeba area had

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Around Australia continued

more wet than usual and this has caused Phytophthora Root Rot problems for some and the Atherton area has had more wet days that impacted harvest schedules. In all, one grower reported to me that he had about 30 clear days in the last five months. At best, Tinaroo Dam is at capacity for Mareeba, and the Atherton aquifers have filled to lift water allocations back up to 100%. The Shepards are flowering and Hass are budding up, so on it goes into the next season.

South Queensland Report

By Daryl Boardman,
Avocados Australia Director



Harvest is well under way in South Queensland, with most orchards expecting to be done by the end of August. We are seeing yields down in some areas due to hailstorms that happened around flowering time last year.

However, quality has been good with dry conditions, even though fruit size is down a bit for growers who were struggling with water. Next season will also be interesting, as it's very cold at the moment with quite a few frosts this winter. Time will tell

the impact there.

On the industry front, it's a busy time with a number of South Queensland growers heading for the World Avocado Congress in September, as well as the Australian industry's Californian pre-tour. This is an important chance for us to see what is happening in the global avocado industry, and how we can apply that knowledge to improve the Australian industry. Knowledge of the international industry is particularly vital as our own domestic production increases, and we move more product into overseas markets.

A little closer to home, the Blackbutt Avocado Festival is coming up, on 14 September 2019. I understand Alvin the Avocado has already made his travel arrangements from the new Avocados Australia office in Rocklea to Blackbutt, and has his best green tights ready.



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Contact Us



40 Ralston Road, Ringbark
Western Australia 6258



+61 8 9771 1632



Joshua Franceschi +61 409 680 670
Sophie Cremasco +61 431 273 876



PO Box 901 Manjimup
Western Australia 6258



www.advancepackingandmarketing.com.au



josh@westnfresh.net.au
sophie@westnfresh.net.au

New extension events a success

Simon Newett, Queensland DAF

It's been a busy start to the new avocado industry development and extension project, with regional forums already held in Central New South Wales, Western Australia and North Queensland.

The *Avocado industry development and extension* project is led by the Department of Agriculture and Fisheries (DAF) Queensland and co-delivered with Avocados Australia with collaboration from the Western Australian Department of Primary Industries and Regional Development (DPIRD).

Positively for the team, the feedback at the initial events has been very encouraging.

There were 66 attendees at the Stuarts Point event on 15 May, and our evaluation activities on the day found 71% intended to make changes to their operation as a result of information provided on the day. The main changes were in the use of mulch and compost. Growers enjoyed the hands-on soil health assessment exercises and the farm walk with Malcolm Heather on his nearby orchard.

Speakers at this event included Dr Nerida Donovan from the NSW Department of Primary Industries (linking production and quality to soil health), DAF's Noel Ainsworth spoke about a new fruit management and handling project (AV18000), DAF's Bridie Carr (mulching), Avocados Australia's John Tyas provided an industry update and Liz Singh addressed farm safety. We then had a practical session on measuring different aspects of soil health, followed by the orchard walk.

The next events were in West Australia, with 97 attendees at the Pemberton event on 4 June and 46 at Gingin on 6 June.

At Pemberton, 88% of our evaluation respondents said they intended to make changes, mainly in the area of canopy management.

Dudley Mitchell's presentation on canopy management and the session with three growers on their experiences with canopy management were particularly popular, as was the farm walk with Joe and Shane Bendotti looking at canopy management. Dudley, an Avocados Australia director, has recently returned

from an overseas study tour as part of his Nuffield Scholarship, to study current trends in canopy management of avocado practices and how cultural practices need to adapt to higher density orchards.

We also heard from DPIRD's Declan McCauley on the new *Implementing best practice of avocado fruit management and handling practices from farm to ripening* (AV18000) led by DAF's Noel Ainsworth, CSIRO's Harley Smith scoped the need for a canopy management project and Avocados Australia CEO John Tyas provided an industry update.

At Gingin, we were hosted by David Morcombe and this included interesting farm walks on his orchard and on Gary Inkster's orchard nearby. From this event, 68% of respondents said they intended to make changes (mainly in the area of irrigation and nutrition) to their businesses as a result of attending. The most popular presentation was that of grower Alan Blight's presentation about nutrition on the sandy soils of the Perth region. Attendees again heard the latest on the industry from John Tyas, about the new fruit management project from Declan McCauley. The group also heard from Western Horticultural Consulting's Neil Lantzke on scheduling irrigation using soil moisture sensing on avocado sands, DAF's Bridie Carr on mulching and nutrition, and Simon Newett on highlights from the recent review of nutrition practices. The video 'Getting boron right in avocados' was also shown.

The meeting notes from these events will soon be available in the Event Proceedings section of the Best Practice Resource library (avocado.org.au/bpr/).

What's coming up

There are more regional forums planned for North Queensland and the Tamborine and Northern Rivers this year. Keep an eye on the events calendar on the Avocados Australia website for dates.

AvoSkills

By the time you read this, we will also have held the first of our AvoSkills workshops, also in North Queensland. The

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Avocados Australia Data Analyst Daniel Martins with the AV17005 project team, including Liz Singh (Avocados Australia), Simon Newett and Bridie Carr (Queensland DAF), and John Tyas (Avocados Australia) in Western Australia.

Acknowledgement

The *Avocado industry development and extension* (AV17005) project has been funded by Hort Innovation, using the avocado research and development levy, co-investment from the Queensland Department of Agriculture and Fisheries, and contributions from the Australian Government.

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Regional Development



AvoSkills workshops, covering the “A” to “O” of avocado orchard management, are tailored toward growers who have recently joined the avocado industry, re-sellers, farm supervisors and farm managers. More AvoSkills workshops are planned for Western Australia and Central Queensland in 2020, and in South Queensland and Central New South Wales in 2021.

Going international

We also have the upcoming tour of the Californian avocado industry in September, in the lead up to the World Avocado Congress in Colombia. This tour is fully booked, and participants will visit orchards, a nursery, packhouse and research sites.

DAF’s Bridie Carr will be presenting a paper at the conference, as will a host of other Australian researchers, including Dr Elizabeth Dann, Emily Lancaster, Louisa Parkinson and Neena Mitter from the University of Queensland, and CSIRO’s Dr Harley Smith.

More information

Check the fortnightly *Guacamole* newsletter and you can also find images from the recent Regional Forums on pages 13-14.

If you would like more information on the project, contact Avocados Australia Industry Development Manager Liz Singh, 0499 854 111 or idm@avocado.org.au (Mon-Thurs 9am-3pm), or at DAF, contact Simon Newett, simon.newett@daf.qld.gov.au or 07 5381 1326, or Bridie Carr, bridie.carr@daf.qld.gov.au or 07 5381 1327.

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Extension events underway across the country



Avocados Australia is pleased to announce the Order of Merit recipient for 2019, industry member Russell Delroy from Western Australia. The certificate was accepted by Jamie Collins, on behalf of Mr Delroy, at a presentation by Director Dudley Mitchell (left) at a recent Western Australian Regional Forum. Mr Delroy has played a major role in the development of the avocado industry, particularly in the area of market development. He has served on the Avocados Australia Board and participated on industry advisory committees. His efforts have certainly helped to develop the Australian avocado market to where it currently is today.



Growers at the Pemberton Regional Forum touring the Bendotti Orchards, in June 2019.



Avocados Australia Central New South Wales Director Ian Tolson, with Alison Tolson and Jake Binney at Stuarts Point.



QDAF's Simon Newett and Steve Rixson, Pretty Gully Avocados, at the Central New South Wales Regional Forum in May 2019. The day's practical sessions including measuring soil health.



Jeannette Ayala and Charlie Bell, Costa, with grower Peter Lindsay during the Stuarts Point Regional Forum.



Graeme Thomas with Josh McMillan, McMillan Avocados, Central New South Wales Regional Forum.



Jo Houghton, Hastings Organic, and Bridie Carr, QDAF, during the Central New South Wales Regional Forum.



Presenters Liz Singh, Avocados Australia, Dr Nerida Donovan from the NSW Department of Primary Industries and QDAF's Noel Ainsworth during the Stuarts Point event.



Robert Hampton and Tim Kemp in Malcolm & Narelle Heather's orchard during the Central New South Wales Regional Forum in May.



Frank Merenda, Wayne Franceschi and Glenn Mews at the Wanerie event at David Morcombe's orchard near Gingin.



Malcolm Heather talks mulch, during a tour of his Central New South Wales orchard during the May 2019 event.



Grower Michael Skivinis relating his experiences with canopy management during the Pemberton in June.



Avocados Australia Director Dudley Mitchell discusses his Nuffield Scholarship into canopy management and higher density plantings.



David Morcombe talks to visitors during a tour of his orchard, near Gingin in Western Australia, during a recent Regional Forum.



Craig Duncan, Tula Karjalainen, Helen Duncan and Stephanie Mews in Wanerie, Western Australia (June 2019).

Exploring the Indian market

John Tyas, Avocados Australia

In late July, I had the opportunity to travel to India, as part of a Hort Innovation market supply tour, arranged with the Australian Trade and Investment Commission.

The market study tour visits ranged from high end retailers, cash & carry businesses through to importers and wholesalers. The avocado, table grape, apple & pear, citrus and summerfruit industries were represented on the study tour.

What did I learn? There are definite opportunities for our Australian avocado industry in India.

The market study provided the Australian fruit industries with important in-country experiences. The Indian market has a lot of potential with a large population, and a high percentage of younger consumers looking for healthy options, including fresh fruit.

India has a population of about 1.3 billion people, and 65% of the population is under the age of 35. These younger generations tend to be earning more than their parents, and they're open to change and interested in international foods.

The market in India is very diverse, from street carts to high-end department stores. It is also very price sensitive, but avocados are a bit of an exception at the moment. We saw both Indian grown (green skin) and imported avocados (from Peru), on shelves during our visit.

Avocados are surprisingly prominent in the cities we visited, with upmarket stores displaying avocados at the front of the store, with very modern merchandising. For example, I saw 4kg trays of Peruvian avocados for \$50 per tray in wholesale markets and \$25 per kilogram at retail.



Avocados are prominent in upmarket Indian retailers, often displayed at the front of the store, with modern merchandising.

As we heard during Asia Fruit Logistica 2018 in a presentation from SS Associates Director Sumit Saran, India's total food market is US\$258 billion, projected to be US\$482 billion by 2020. And by 2025, he said it was projected that India would be the fifth largest food consumer market, as the food and grocery sector is growing at a rate higher than GDP.

Everyone we met with during the week confirmed that Australian avocados had a very good opportunity in India. We will continue to push even harder to get the Australian Government Department of Agriculture to negotiate market access as soon as possible. The opportunity is now.

More information

A comprehensive report will be prepared on this market visit, and will be available via the Best Practice Resource.

Acknowledgement

The *Avocado export readiness and market access* project (AV17000) has been funded by Hort Innovation, using the avocado industry research and development levy and contributions from the Australian Government.



The 2019 Australian fruit market tour group, visiting Lots Wholesale Solution, in Delhi.

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Bees: broken wing disorders

Parasitic Varroa mites magnify the damage from a common virus in honey bees that can cause deformities in the bees' wings, according to a review published in the *Annual Review of Virology*. The virus is not presently in Australia but overseas, the spread of Varroa mites has brought much higher levels of Deformed Wing Virus (DWV) to honey bee colonies. This means that keeping Australia free from Varroa mites is even more crucial.

Researcher Dr Laura Brettell from Western Sydney University's Hawkesbury Institute for the Environment (HIE), along with Prof Stephen Martin from the University of Salford, reviewed the current knowledge about Deformed Wing Virus (DWV) and its interactions with bees and the Varroa mite. Australia is currently one of the last remaining countries in the world still free of Varroa.

"Deformed Wing Virus is the most common virus found in bees and can result in mass deaths of bee colonies. It is estimated to be found in about half of all honey bee colonies internationally," Dr Brettell said.

"DWV was once a fairly minor honey bee virus but with the rise of Varroa infestation, it has spread across the world. Varroa mites are not only damaging to honey bees directly, but also exceptionally efficient transmitters of viruses like DWV," she said.

There is increasing evidence that viruses like DWV can also be carried by a much wider variety of invertebrates than just honey bees, with studies having shown detectable levels of DWV in 65 arthropod species including some arachnids (spiders and mites). How these organisms interact with, and maintain or transmit DWV back to honey bees, remains the subject of significant international research.

There is, however, a consistent relationship between DWV infections, Varroa mite damage and the characteristic deformed or shrunk wings that can cause the death of honey bees.

Part of this research is underway at Western Sydney University where the pollination science team is assessing virus prevalence in Australia's most common native bee species. These are widely believed to contribute significantly to pollination of our crops and wild plants, but very little is known about which species carry viruses and whether native bees can transmit viruses to honey bees or vice-versa.

"The Hort Frontiers-funded pollination research program underway at the Hawkesbury Institute aims to provide insights into the current state of native and exotic pollinators and prepare for a future where European honey bees might be adversely affected by viruses or pests," Professor James Cook, Lead Scientist of HIE's Pollination Science program, said.

"The best option for honey bees is to prevent pests and diseases like Varroa from entering Australia. However, we also need to better understand our native pollinators and use effective science to be ready for a future that may become more reliant



An example of a bee with deformed wing virus.

on pollinators other than European honey bees," Prof James said.

More information

You can read the paper *Deformed Wing Virus In Honeybees and Other Insects* at www.annualreviews.org/doi/abs/10.1146/annurev-virology-092818-015700.

Acknowledgement

Healthy bee populations for sustainable pollination in horticulture is funded by the Hort Frontiers Pollination Fund, part of the Hort Frontiers strategic partnership initiative developed by Hort Innovation, with co-investment from Western Sydney University, Bayer CropScience, Syngenta Asia-Pacific and Greening Australia, and contributions from the Australian Government.



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Second Varroa mite found in Queensland

It's believed a second incursion of *Varroa jacobsoni*, found at Queensland's Townsville Port in May 2019, can be eradicated.

An Asian honey bee nest was discovered as part of the ongoing exotic bee surveillance program, as a result of bee lining (tracking foraging bees back to their nests) activities, and mites were found after the nest was fumigated and collected on 17 May 2019.

Initial testing has identified suspect mites in the nest as *Varroa jacobsoni*, not the more concerning *Varroa destructor*. *V. destructor* is responsible for the collapse and death of European honey bee colonies wherever it is present (if untreated) around the world.

Genetic testing of Asian honey bee material collected near the port indicates that this Asian honey bee detection is not related to any previous incursion in Australia, including those present in Cairns, or those subject to the current national eradication program underway for *Varroa jacobsoni* in Townsville. They are most likely a recent arrival from Papua New Guinea (PNG) or the Solomon Islands, as evidence suggests they are genetically similar to bees collected from PNG between 1992 and 1995.

This detection of *Varroa jacobsoni* is therefore considered to be a new entry into Australia and is unrelated to the detection in 2016 that is subject to the current national eradication program.

We are currently still in the proof-of-freedom phase after the 2016 incursion. This means the avocado industry, (along with other affected industries, State and Australian governments) is now funding two separate eradication programs for this pest.

According to the Consultative Committee on Emergency Plant Pests (CCEPP), based on the evidence available to date, it is technically feasible to eradicate this pest. Avocados Australia's CEO is a member of this committee.

The committee is considering a response plan that has been put forward by the Queensland Department of Agriculture and Fisheries, which is the lead agency responding to this incident.

Brisbane Biosecurity Science Laboratory (BSL) confirmed that the comb also had a small hive beetle infestation and evidence of chalkbrood – both of which are considered to be present in Australia.

Asian honey bees

The Asian honey bee is about 10mm long with yellow and black stripes on the abdomen. It aggressively protects nesting sites and stings, has a tendency to abscond or 'move' from nests sites. These absconding colonies are believed to be able to travel up to, but no more than 10km.

Asian honey bees are the natural host for the *Varroa destructor* and *Varroa jacobsoni* and these mites do not kill colonies of this species of bee. They are species of parasitic mites that feed on the immature and adult bees.

There are a variety of strains and sub-species of Asian honey



A Varroa mite feeding on a European honey bee. The mites cause death and disease in bee colonies. Photo by Scott Bauer, USDA - ARS, Bugwood.org.

bee found throughout Asia, Papua New Guinea, Solomon Islands and Australia, but the Asian honey bee that is in Australia is *Apis cerana* - Java strain.

Varroa mites

The varroa mite (*Varroa destructor* and *Varroa jacobsoni*) is a well-adapted parasite of the Asian honey bee.

Varroa were mainly found in the northern regions of Asia before shifting hosts from Asian honey bees, to European honey bees when they were introduced to North East Asia.

Today the *Varroa destructor* mite is responsible for the collapse and death of European honey bee colonies wherever it is present (if untreated) around the world.

Varroa jacobsoni is currently being eradicated from Townsville. *Varroa destructor* is not present in Australia.

Spotted something unusual?

- If you find something unusual, phone the See. Secure. Report hotline on 1800 798 636. This will connect you with the Australian Government Department of Agriculture.
- The general public can report Asian honey bee detections to the national Exotic Plant Pest Hotline on 1800 084 881.
- All bee keepers in Australia should inspect their hives regularly for signs of varroa mite and other exotic pests. If you suspect your bees may have been affected, phone the Exotic Plant Pest Hotline on 1800 084 881.

Forecasted dispatches for the remainder of 2019

According to the July 2019 quarterly report, volumes for the coming year are expected to be fairly consistent from month to month with very large volumes expected from August to December 2019 (see *Figure 1*). Supply is expected to average 1.7 million trays per month and equating to more than 400,000 trays weekly.

We usually experience supply volumes drop off during the months of January and February, but in 2020 we are expecting 1.8 and 1.6 million trays will reach the market for January and February respectively, supplied mainly by Western Australia, New Zealand and North Queensland.

In the following months from March to June 2020, we are expecting slightly lower volumes, averaging 1.6 million trays per month, equalling around 370 thousand trays weekly.



Figure 1. July 2019-June 2020 forecasted dispatches

Those who contribute data regularly to the Infocado program receive detailed reports showing volumes previously dispatched and volumes forecast for the coming period. If you are interested in receiving regular and more detailed information, please contact us to become a data contributor - admin2@avocado.org.au or 07 3846 6566.

Shepard 2018-19 season summary

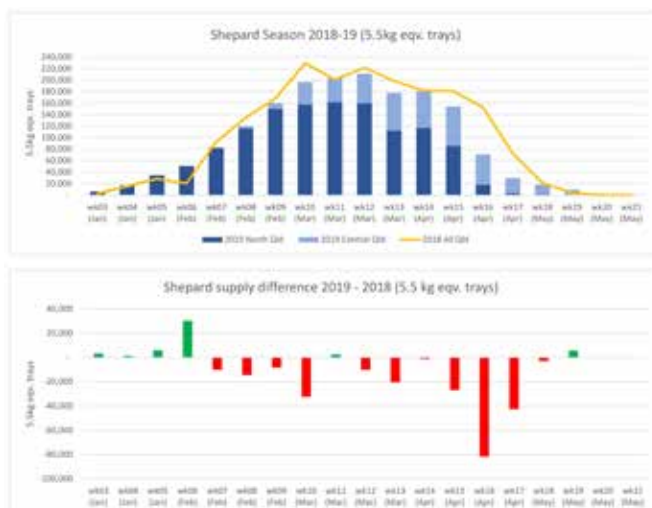


Figure 2. Weekly Shepard dispatches 2019 Vs 2018 (directly contributed data only)

Just like in 2018, the first Shepard avocados appeared on shelves in week 3 (the week ending 18/01/2019). The total supply for the whole season was 1.7 million 5.5kg trays (9,491 tonnes) a decrease of about 1,650 tonnes (-15%) relative to 2018 season, in which almost two million 5.5kg trays were dispatched. For most of the season (12 out of 17 weeks), the decrease hovered at about -5 to -10% respective to the previous year.

Despite this difference, supply followed a nearly identical pattern to last year (*Figure 2*), starting with dispatches under 10,000 trays, progressively increasing to surpass the 100,000 tray mark in week 8, peaking in week 12 at well above 200,000 trays, to start its decline and finalising into the early weeks of May.

Hort Innovation's avocado marketing team put a lot of effort into marketing of Shepard this past season, promoting the green skins' benefits and uses and helping mitigate user confusion regarding ripeness. Read more about marketing on page 28.

Direct and indirect data

The high levels of participation in *Infocado* give an indication of how valued the program is by its users. However, participation levels vary at different times of the year. We find that participation amongst the larger packhouses is very good, but some of the smaller packhouses don't contribute directly to the system.

The weekly *Infocado* report only reports on data contributed directly by packhouses each week. This is important to understand for those trying to compare weekly and quarterly reports.

For the quarterly (seasonal) Infocado report, we incorporate additional data which is not contributed directly to the system, so as to provide a rolling 12 month estimation as accurate as possible for seasonal planning. To capture this additional data, we contact packhouses to record their aggregate seasonal figures that are then apportioned throughout their region's season. In *Figure 3* below, "Indirect Contributions" relates to this portion of the data.



Figure 3: Percentage of dispatch and forecast data captured via direct and indirect contributions (April 2018 - March 2020)

The data in *Figure 3* is based on the data used to produce this year's April quarterly *Infocado* report. It gives us an idea of the relationship between these two subsets of data present in the quarterly report. As these graphs show the months with the highest rate of indirectly contributed data align with months in which North Queensland is the dominant supplier. However, there are other times of the year also where we would like to see higher levels of direct contribution.

We are keen to engage and bring on board current non-participants. The redevelopment of the *Infocado* software which is currently underway (check the breakout box) will play a key role by simplifying the data entry process. Once the software has been updated later this year, we will be very actively educating current users and new users through various means including workshops and one-on-one meetings. With increased numbers of direct contributors, we can provide an even more accurate picture of the supply dynamics on a weekly and quarterly basis.

Acknowledgement

The *Avocado industry and market data capture and analysis* project (AV16006), has been funded by Hort Innovation, using the avocado industry research and development levy and contributions from the Australian Government.

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Data system refresh update

As the Australian avocado industry continues its fast-paced growth, the industry's crop flow information system *Infocado* has played an instrumental role in assisting planning the industry's activities. *Infocado* is over 13 years old now, and an upgrade of the software and processes has been in the pipeline for some time.

Avocados Australia has now contracted software developers to commence building the new data system, which is scheduled to be completed by early 2020. This will represent a substantial investment for Avocados Australia, but well justified given the importance and value of good industry data.

The core data system has been redesigned to improve how *Infocado* data is captured and presented, to better reflect the dynamics of the current avocado supply chains in Australia. We are confident that the new system will provide even better data to support business decisions.

While there has been a lot of consultation over the years to determine what changes need to be made, we always welcome suggestions for improvement. As we build the new software, we will be testing it with users to ensure it is the best it can be. We want the data entry process to be quick and easy and we want the reports to be relevant and informative.

To contribute

If you would like to contribute to the development of this new data system, you are most welcome to call us on 07 3846 6566, or email Daniel on data@avocado.org.au or Amanda at admin2@avocado.org.au.



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New safety resources

Workplace health and safety is an important part of any business. The Avocados Australia Best Practice Resource has an entire section dedicated to helping growers manage WHS, and there are new resources available from relevant state bodies as well.

New South Wales

SafeWork NSW has released a video demonstrating how to safely use an elevated work platform when harvesting. You can view this YouTube video at: bit.ly/TA302safe the video will help you learn how to manage the risks involved when harvesting at heights in NSW.

A new A-Z Farm Safety Guide, designed to help farmers improve health and safety across their operations, has been launched in New South Wales.

The guide provides advice on how people can manage heat, the use of chemicals, as well as fall prevention techniques and tips for working in confined spaces.

Western Australia

WorkSafe WA has released an orchards safety and health checklist. You can find the file here: bit.ly/TA302wa. The

checklist is designed to help rate potential hazards and risks on your property and to help you control and prevent risks.

More information

The Best Practice Resource (avocado.org.au/bpr/) WHS module contains a range of avocado-specific resources, including guides, plans, registers and checklists.

We have also added links to the new resources in this story, in the BPR Library's WHS resources section, by state. These resources are from the country's various work safe departments. Please be aware that third party sites are not under the control of Avocados Australia Limited (AAL). Therefore, AAL can make no representation concerning the content of these sites to you, nor can the fact that AAL has referred you to these sites serve as an endorsement by AAL of any of these sites. AAL provides these references only as a convenience to you.

Acknowledgement

The content of the Best Practice Resource is maintained through the project *National avocado industry communications* (AV18003), which is a strategic levy investment under the Hort Innovation Avocado Fund.



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Accurate yield forecasting focus of new project

A grant worth more than \$5 million dollars has been awarded to Hort Innovation to continue work in optimising the management of Australian tree crop industries through innovative mapping and monitoring tools.

Awarded under Round 4 of the Federal Government's Rural R&D for Profit Program, the grant will fund Phase 2 of the project involving commercial avocado, banana, mango, macadamia, olive and citrus orchards.

Phase 1 of the project delivered a national map of all commercial avocado, macadamia and mango orchards across Australia, providing the industry with an accurate understanding of the extent and distribution of production, as well as supporting improved biosecurity and post-disaster response.

The grant will focus on achieving improved yield forecasting accuracy (pre-harvest), developing tools to improve orchard monitoring and mapping of tree health, fruit quality and maturity, and develop and deliver better detection and strategies to control future biosecurity threats.

Phase 1 also identified a range of emerging technologies that supported more accurate yield and fruit quality forecasting and mapping as well as the improved monitoring of abiotic and biotic stresses at the individual tree and orchard level.

Australian Government Minister for Agriculture Bridget McKenzie said Phase 2 would build on this work.

"Australian agriculture must innovate and develop smarter farming practices if it is to grow to a \$100 billion industry by 2030," she said.

"There is a strong link between R&D and agricultural productivity growth—the returns are consistently proven to be far greater than the investment."

Hort Innovation General Manager of Extension and Adoption Dr Anthony Kachenko said this project not only focussed on the commercialisation of outcomes produced in Phase 1 but also the introduction of the olive and citrus industries.

He said a number of commercially available remote sensing platforms including satellite, aerial and ground based sensing technologies, LiDAR (multispectral/ hyperspectral and thermal sensing technology) and associated analytics including machine learning and web and phone app development would be assessed with the intent to commercialise under the project.

"These tools will assist growers in better determining high, medium and low productivity areas within their orchards. This information supports targeted agronomy and the more judicious application of orchard inputs such as fertiliser, pesticides and improved irrigation management," he said.

"Additionally, accurate pre-harvest forecasts of yield, crop maturity and quality enable growers to make more informed decisions around harvesting logistics (labour, transport etc) as well as forward selling estimates."

"This technology benefits plant biosecurity by identifying the location and distribution of all commercial orchards. In the event of an incursion, this mapping layer supports the rapid deployment of surveillance staff and the establishment of exclusion zones to prevent further spread."



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Horticulture leads Australian agriculture in value and on-farm efficiency

A recent analysis of Australian agricultural industries has put horticulture at the forefront in sustainable practices.

A review of the latest data^[i] from the Australian Bureau of Statistics identified the Australian horticulture industry to have the highest water efficiency of all agricultural industries returning \$6,200 of value per megalitre used in Gross Value of Production (GVP) terms.

Horticulture generated the highest GVP per hectare of production land used at \$31,486, with the second highest (viticulture) trailing at \$7,720.

Avocados Australia CEO John Tyas said based on the organisation's figures, the avocado GVP generated per hectare was above \$50,000/ha.

"In 2017/18, the industry's GVP was \$557 million and according to *OrchardInfo*, the national area planted was 9,745ha in the same time period," he said.

"Our growers are continuing to improve on-farm efficiencies and production, contributing significantly to the Australian horticultural sector, and the economy generally."

Horticulture is now the second most valuable agricultural sector at \$10.2 billion.

And the horticulture industry also has the lowest total greenhouse gas emissions and lowest greenhouse gas emissions per dollar of GVP at 0.03 tonnes of CO₂-e.^[ii]

Hort Innovation Research and Development Lead Dr Anthony Kachenko said the changing climate, high energy costs and the emergence of water-related issues such as salinity, water contamination, reduced environmental flows and supply security had brought greater attention to the importance of on-farm efficiency.

"With the increasing cost of agricultural inputs, such as water and energy, increasing the efficiency of these inputs remains an important issue for the industry," he said.

"What this data has shown is that while horticulture is intensive in terms of resource use, such as capital, labour, energy and water, it is also a high value industry."

Dr Kachenko said horticulture had proved successful in its adoption of sustainable practices and moving forward, Hort Innovation would continue to support its industries to adopt greater sustainability approaches that avoid negatively impacting the environment.

"Initiatives which increase on-farm efficiency will be critical to ensuring the horticulture industry can not only become more

productive and profitable, but also improve environmental outcomes."

Hort Innovation is working to develop a Sustainability Framework for the horticulture sector to continue the momentum in this space.

Speaking at Hort Connections, Hort Innovation CEO Matt Brand said the framework would help "tick the economical, environmental and social boxes for horticulture".

"It's about creating long term stakeholder value," Mr Brand said.

References

[i] ABS efficiency data relating to water, land use, GVP and value is from the latest available report – 2017/2018.

[ii] Co2e references are based on the most recent available data – 2015/2016.

New generation Kangaroo Labels

Avocados Australia manages the Kangaroo Label for use on Australian avocados.

Kangaroo Labels can be ordered through our registered Kangaroo Label suppliers listed below. Packhouses need to apply for a Packhouse Registration (PRN) with Avocados Australia before can order can be placed. Please arrange your databar directly with GS1 Australia.



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J-Tech Systems:	ph: 02 6049 5001
Label Press:	ph: 07 3271 2111
Mildura Printing Services	ph: 03 5022 1441
Warehouse Design and Packaging:	ph: 02 9905 0963

www.avocado.org.au or call **07 3846 6566**



Industry profile:

Brad Rodgers

New Avocados Australia Director Brad Rodgers joined the Board almost a year ago now. Brad, who has a background in financial services, the plumbing trade and as an Army Engineer, has been an avocado producer for 2.5 years. He runs Karri Brook Estate, a two-hectare avocado orchard at Yanmah in Western Australia.

What prompted you to become an avocado farmer? What do you enjoy most about being an avocado farmer?

My wife, Jacinta, is from a farming background and we purchased a farm in 2015. After meeting neighbours, we quickly learned that avocados were a big deal in our area so we commenced our research into that field. We enjoy the health and vigour of our trees and love applying the practical and science side to our orchard.

What varieties of avocado do you grow? What other crops (if any) do you grow?

In our avocado orchard, we have the Hass variety but at Karri Brook, we also have white and red wine grapes, black truffles, pasture, marron and sheep.

Are there any growing practices you use that are different to standard growing practices (that you would like to share)?

We went with a relatively high planting design; the trees are only three metres apart.

Our region is quite cool so that is our challenge. The biggest



challenge other than the usual phytophthora is probably canopy management.

What's the best advice you would give to someone who has just started/entered growing avocados as a business?

Do your own research, use Avocados Australia's Best Practice Resource fully (www.avocado.org.au/bpr/), don't listen to too many people, make the decision and plant. Then the real learning begins...

You are also a new member of the Avocados Australia board. What

made you decide to step into the role?

There was a vacant position in Western Australia, and I thought, what better way to learn. I also hope to bring some experience from my past career in financial services to Avocados Australia and its members.

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New strategic plan: Hort Innovation

Launched on 1 July 2019, the Hort Innovation Strategy 2019-2023 represents a new way forward for your grower-owned research and development corporation – and for Australia's horticulture sector as a whole. It lays out Hort Innovation's focus, goals and key activities for the next four years, all of which are closely aligned to the industry's needs, now and into the future.

You can see the new strategy and what it means for you at www.horticulture.com.au/strategy-2019-2023/. Highlights include:

- a new focus on extension and adoption – one important change under the strategy is the development of a new Extension & Adoption function. This and other initiatives will be focused on getting practical investment outcomes, resources and knowledge directly to growers.
- a sustainability framework for horticulture – under the new strategy, Hort Innovation will be building a sustainability framework for Australian horticulture, to help the sector proactively manage emerging issues now and in the future.
- a sharpened focus on delivering consumer insights and improving the understanding

of domestic and international markets – this is all about helping industry influence consumers, and expand and strengthen presence in markets.

- more collaborative, across-horticulture investments – while this won't reduce the importance of investing in issues for single industries, Hort Innovation will work to deliver more multi-industry collaboration in RD&E, marketing and trade. This will support more effective and efficient outcomes for growers and the wider horticulture sector.

The Hort Innovation Strategy 2019-2023 was developed with vital input from growers and other horticulture participants, which was sought through consultation workshops in 20 locations across regional Australia, and via an online feedback mechanism. All up, more than 350 participants contributed to the thinking behind the strategy.









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Horticulture takes responsibility for workplace compliance

Fair Farms, the industry-developed workplace training and certification program for employers in the Australian horticulture industry was officially launched in Melbourne at the national horticulture convention, Hort Connections.

Developed by Growcom, the peak representative body for Queensland horticulture, Fair Farms is the industry's proactive response to identified problems around workplace compliance and exploitation within the Australian horticulture industry.

Fair Farms Manager Thomas Hertel said the program had been developed by industry, for industry.

"The program will support all members of the Australian horticultural supply chain with tools, information and training to implement employment practices that comply with existing labour laws and ethical standards," Mr Hertel said.

"As a Fair Farms certified employer, supply chain members will be able to demonstrate to their consumers, workers and customers a commitment to fair and responsible employment practices through an independent third-party audit.

"We want to work with the retailers and others fresh produce buyers on this, who can reward good practices through their buying decisions and create consumer awareness."

The Fair Farms program has already received support from supermarket chains Aldi and Woolworths, who accept suppliers choosing Fair Farms as their ethical audit program.

Woolworths Head of Produce Paul Turner said the supermarket was pleased to work closely with Growcom on the development of the Fair Farms program.

"We're committed to being a responsible retailer and a big part of this is working with industry to uphold the rights of workers in our horticultural supply chains," Mr Turner said.

"It's great to see industry take the lead."

A highlight of the Fair Farms launch was the announcement of the first Fair Farms certified grower, Mary-Jane and Cam Turner from Riverdale Herbs in Queensland.

"As an employer it was important for us to be able to distinguish our business from those that don't employ ethically," Ms Turner said.

"We chose Fair Farms as our ethical audit program because it was developed by Growcom. They have been supportive of us



Billy Bulmer, Chairman of the AUSVEG board (AUSVEG is a foundational supporter of Fair Farms), Australia's Federal Minister for Agriculture Bridget McKenzie with Growcom's Fair Farms Program Manager Thomas Hertel, and CEO David Thomson, at the launch of Fair Farms, at Hort Connections 2019.

as a grower and the wider horticulture industry for many years and we had faith that the Fair Farms Standard would be a true reflection on a grower's needs and requirements.

"Going through the assessment and audit process was a valuable exercise. It has allowed us to review our business documents, modernise our systems, and consolidate our records."

AUSVEG, the national peak industry body representing vegetable and potato growers, said the organisation was very pleased to support the Fair Farms initiative and work with Growcom and other industry partners to expand the program nationally.

"Our industry must take responsibility for ensuring that Australian workplace relations laws and industry standards are correctly implemented on-farm, and that growers are aware of their duties as fair and responsible employers," AUSVEG CEO James Whiteside said.

"Fair Farms is an industry-led initiative that allows growers to take ownership of their fair employment practices and access appropriate training and certification to demonstrate their compliance to customers and the wider industry."

For more information on the program visit the Fair Farms website, www.fairfarms.com.au.

Fair Farms is developed and delivered by Growcom with support from the Fair Work Ombudsman, the Federal Department of Agriculture and AUSVEG.

Workforce shortages cost money

By Andrea Martinello, NFF

New research from the National Farmers' Federation (NFF) has found that farms are losing as much as \$2 million each year due to workforce shortages.

Australia's farmers – particularly those in the horticulture industry – are being forced to leave their produce to rot on the vine or tree because they can't get workers to harvest it.

"The 2019 Farm Workforce Survey shines a light on the factors that influence Australia's labour supply challenges, as well as the consequences," NFF President Fiona Simson said.

"Agriculture's labour woes are felt most acutely by the horticulture sector, where farmers need high volumes of low-skilled workers for concentrated periods of time. These roles have been going unfilled.

"More than half of the survey respondents who were affected by labour shortages indicated direct and indirect costs to their business as a result."

According to the survey results, single-farm losses due to labour shortages were as high as \$2 million.

"\$2 million is a staggering cost for any business to bear. We can't continue to ignore this problem in the face of these findings," Ms Simson said.

Employment status

Typically, international workers take up farm work via a Working Holidaymaker Visa (often used by backpackers) or the Seasonal Worker Programme, which provides employment opportunities to citizens of Pacific countries and Timor Leste.

While both programmes are successful to an extent, they cannot adequately meet agriculture's labour needs, with only 12% of the survey respondents using the Seasonal Worker Programme.

"Most farmers choose the allegedly easier, cheaper and less fraught employment option of hiring workers directly and one fifth said they prefer to use labour-hire contractors," Ms Simson said.



The survey found 63% of respondents opted to instead employ non-residents on their farms. Many said it was necessary because permanent residents were either not available in sufficient numbers, or found farm work too difficult or not to their liking.

In fact, farmers found that non-residents were largely perceived as more reliable than permanent residents. This is mainly because farm work is labour intensive, not available all year around and therefore not suited to some Australian job seekers.

"Australian farmers are known to be fair employers and the stats show it, with almost all of the survey respondents paying their employees more than what's required by the applicable Award," Ms Simson said.

"Annual employment costs for most farmers range between \$100,000 and \$500,000 and in some cases almost \$2 million," Ms Simson said.

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Students learn about avocados

In Queensland, 55 students and their teachers embarked on a journey to a local avocado farm Touchwood at Mt Binga, owned by Andy and Judy Veal for a special occasion: their school photos. The day began with the photos being taken in the avocado orchard overlooking Kooralgin Valley to Upper Yarraman and Tarong Power Station.

Benarkin State School Principal Kerry Christie said the students had an enjoyable day walking the farm and listening to Andy's informative talk about growing avocado trees and the processing procedure.

"We enjoyed a lovely sausage sizzle and



After the school photos were taken, avocado growers Andy and Judy Veal (not pictured) talked to the Benarkin State School students about everything avocado, as part of the school's work to showcase opportunities and business in the region.

birthday cake to celebrate Fletcher Campbell's birthday who is one of our students and also a grandson of the Veals," she said.

"This day was organised to integrate student learning with local industries and showcase opportunities for primary production and successful business ownership.

"Thank you to Andy, Judy, Travis, Nicola, Ashley and Samantha for your hospitality and allowing us to visit your farm."

Avocados Australia provided a range of items produced for industry and the marketing program, including recipe cards for the school's Stephanie Alexander Kitchen Garden.



Students from the Benarkin State School in Queensland's Burnett region chose a different spot for their 2019 school photos: Andy and Judy Veal's avocado orchard.



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Hort Innovation Marketing Update

Welcome to the *Talking Avocados* Winter 2019 marketing update, where we give you a snapshot of the latest marketing activity that's helping Aussie consumers connect with Australian avocados. This activity is managed by Hort Innovation on behalf of the industry and is funded by the avocado marketing levy.

It has been a busy quarter for Australian Avocados with consumer-focused promotions across a variety of channels, including television, social media platforms such as Facebook and Instagram, as well as targeted partnerships with consumer-related publications and platforms. Read on for more detailed activities between March and June 2019.

Television

Television plays a key role in driving mass awareness of campaign communications and ensures key messages for Australian Avocados are delivered to consumers in both metro and regional Australia. The latest burst of television was staggered across eight weeks from March to May and was secured across a number of key metro and regional networks including Network 7, Network Nine, Network Ten, WIN, Southern Cross Austereo and Prime. The campaign took advantage of the strong opening programming schedule of 2019. This included programs such as *My Kitchen Rules*, *Married at First Sight*, *Masterchef*, and *Bachelor in Paradise*, as well as consistently rating news and current affairs programs.

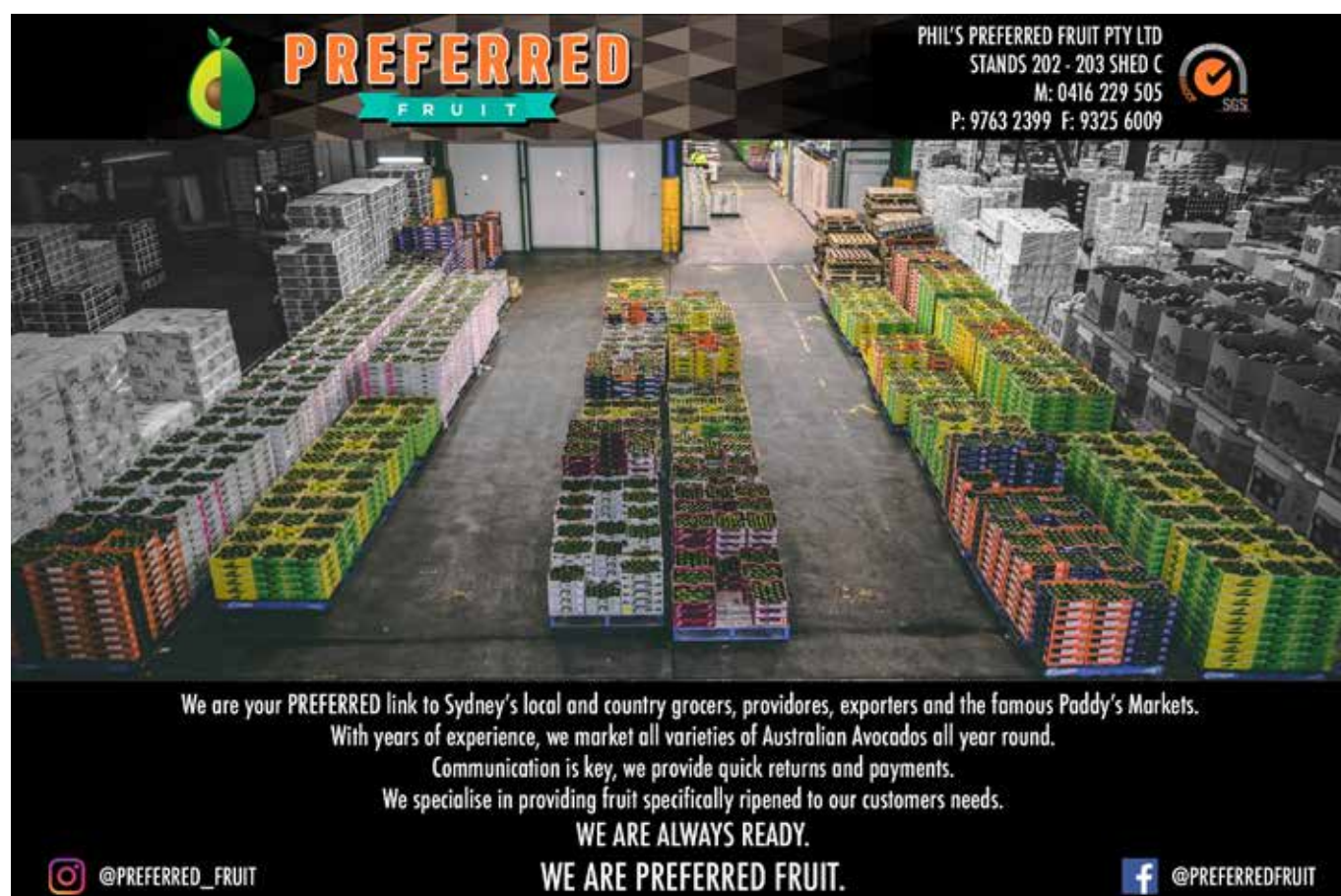
In every market the campaign successfully hit the goal of least 53% of the target audience seeing the ad at least two times; this is an estimated reach of 4.3 million. Regional New South Wales television exceeded this goal, where at least 54% of the target audience saw the ad two times.

The television activity will continue from the end of August and will be in market for six weeks in two bursts – between August and September and between October and November. In an attempt to reach more consumers, it will include an increased investment in regional markets with the addition of Victoria and Tasmania.

Digital

Supporting the television activity, Australian Avocados undertook digital activity during March to May. The activity included the Australian Avocados' 'smash an avo' ad across catch up television, Spotify and YouTube. All channels surpassed the key performance indicator (KPI) of a 70% completion rate and 70% viewability.

As of April, catch up television had a completion rate of 99% and a viewability rate of 94% while serving out over 517,000 impressions. Spotify had a completion rate of 70% and more than 247,000 impressions, and YouTube served over 905,000 impressions with an 84% completion rate.



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Definitions of some common digital terms are below.

Completion Rate - The percentage of all video ads that play through their entire duration to completion. It is calculated as complete video plays divided by ads served.

Viewability - An online advertising metric that aims to track only impressions that can actually be seen by users. For example, if an ad is loaded at the bottom of a webpage but a user doesn't scroll down far enough to see it, that impression would not be deemed viewable.

Impression - An impression is the presentation of an ad to a user while viewing a web page. If a single web page contains multiple advertisements from one advertiser, one impression is counted for each ad displayed.

Out Of Home retail, gyms and street furniture

From March until the end of June the campaign extended its reach and frequency across Australian Avocados' core audience with ads appearing on display panels in gyms, street furniture and shopping centers. This form of advertising reinforced the message of avocados making everything better and helped drive action before consumers entered a retail store - a critical step on the path to purchase journey. The campaign included 81 retail/shopping center panels (100% of which were in direct proximity to retail grocery stores), 44 street panels, a mix of content across 909 gyms, including a full-page print ad within *Fitness First Magazine*.



Social Media

Australian Avocados 'always on' approach to social media continues, ensuring avocados remain top of mind for Australian consumers. Demonstrating that engaging content can be super simple, a creative avocado toast recipe was the top performing post on Facebook with a higher than average engagement rate of 11% and reached over 72,000 people. The post also generated positive conversations in the comments section and had many people sharing the post to their own Facebook pages. On Instagram the top performing post featured the Shepard avocado along with the health benefits of avocados in general. This post generated over 6,600 likes!

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Hort Innovation Marketing Update continued

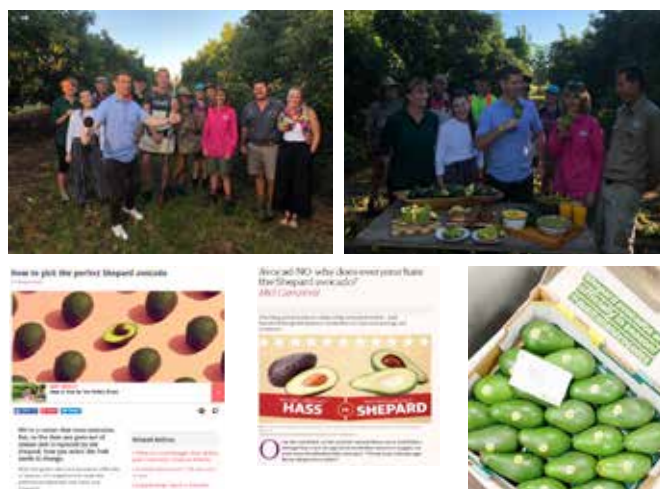
Australian Avocados also partnered with influencers Leah Itsines, 4ingredients and former Australian Bachelor Sam Wood. Both Sam and Leah created recipes and content which were pitched to media, shared on their own personal social media channels, as well as across Australian Avocados owned social media channels. Together both Sam and Leah have an Instagram following of more than 690,000 and provided a combined "opportunity to see" of more than nine million.



Public Relations

The PR element of the campaign was designed to educate Australians on the similarities and differences between Hass and Shepard avocados, during the Shepard season at the start of the year. The objective was to drive awareness of how to select and use the two varieties to ultimately turn Hass lovers into

Shepard lovers and Shepard lovers into Hass lovers. The rationale was to reduce the traditional dip in sales during the transition period between Shepard and Hass seasons. Between February and May, a total of 48 pieces of media and social coverage was achieved across a variety of platforms including television, radio, print, online and social media. Highlights included: a TV weather cross to an avocado farm on breakfast program *Sunrise*, features within *Lifestyle* and *The Guardian*, and on the mybody+soul Instagram page.



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Myfoodbook

Myfoodbook is an online recipe and cookbook network that allows users to create and collect their favourite recipes from chefs and cooking brands, to create their own personalised digital cookbook. Avocados continue to be extremely popular on Myfoodbook. In total, avocado recipes have been viewed more than 250,000 times. Avocados were also featured in two seasonal cookbooks, the *30 Minute Meals Foodbook* which has already been downloaded more than 5,500 times since its release in April, and *Winter Warmers* which was issued on 7 June 2019.

Taste.com.au

From March to May Australian Avocados partnered with *taste.com.au* to feature avocado recipe content. Avocados featured in three Taste TV videos which were viewed more than 114,000 times, had three recipe galleries which had more than 36,000 page views, and were featured in a variety of recipes which had combined page views of more than 36,000. Highlights included articles detailing how avocados can transform cooking and a panko-crusted avocado Japanese noodle salad recipe.



Website (www.australianavocados.com.au)

The new Australian Avocados website has continued to grow since its launch in February 2019. More than 50,000 new visitors have visited the website versus 33,000 in the previous quarter, and the website pages have been viewed over 89,000 times compared to 53,000 in the previous quarter. The most

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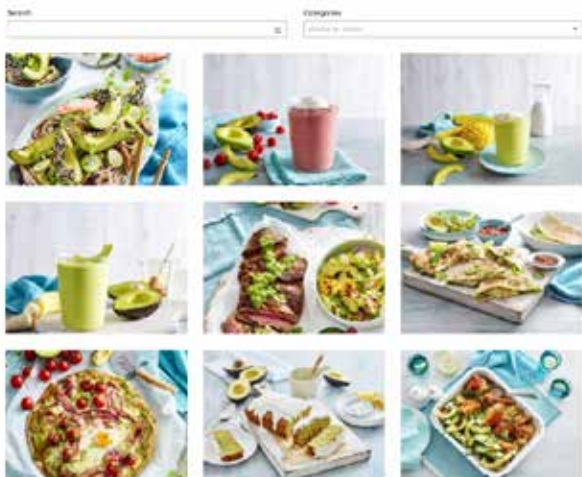
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Hort Innovation Marketing Update continued

visited pages on website included the 'about avocados' section, 'recipes' and 'guacamole recipe.'

avocado recipes



health professionals



healthy heart



mums & bubs



nutrition booster



diabetes



good fats



healthy boost



baby friendly



good mood food

Acknowledgement

This activity is managed by Hort Innovation on behalf of the industry, and is funded by the avocado marketing levy.



Corrine Jasper
Relationship Management Lead
Hort Innovation

Meet the avocado industry Relationship Manager and see how she can support you.

Corrine is keen to chat with you. She is your link to the latest R&D and marketing developments and how these can help your business grow. It's easy to request a phone call – just go to the 'Contact Me' form at horticulture.com.au/contact-me. Alternatively, call 02 8295 2300 or email membership@horticulture.com.au and let us know you would like Corrine to call you.

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New avocado marketing manager

A new marketing manager arrived at Australian Avocados in late May, with Matthew Dwyer now charged with continuing to drive demand for Australian avocados.

Matthew joins Hort Innovation from the red meat sector bringing with him extensive experience in both B2C (business to consumer) and B2B (business to business) marketing. Matthew has broad experience in marketing and communications across international and domestic markets and as a strategic and award-winning marketer, has a strong passion for all things food and has long been an avocado lover!



"What led me to this role was firstly the amazing natural product that is an avocado and the passionate growers that provide these for a nation that can't get enough of them," Matthew said.

"But also, I was drawn to addressing some of the challenges heading the industry's way such as record production, but also the opportunities that lie with export and new markets."

Matthew began his career at Meat & Livestock Australia and was nurtured in that organisation's high-performing marketing team, delivering impactful campaigns and programs, most notably the iconic Australia Day Lamb and Spring Lamb campaigns from 2015-2017.

He said the experience working on such an iconic Australian product in lamb had provided him with the expertise and knowledge to bring to life another emerging Australian icon, the avocado.

More recently Matthew led the marketing team at Bindaree Beef Group (BBG), a vertically integrated business operating out of Inverell and supplying Aldi as well as exporting premium beef to the world. Matthew delivered the global brand strategy and implementation for the expanding group, rationalising the brand portfolio and developing global brands to meet core consumer needs.

"My time at BBG allowed me to develop and implement a strong strategy that set the business up to drive demand for premium Australian beef both domestically and throughout Asia. It also gave me an understating of the importance of knowing the nuances of a globally connected audience and their individual needs, something that will become increasingly important for Australian Avocados as production grows and we look to new opportunities," he said.

Alongside Australian Avocados, Matthew will look after the marketing programs for the complimentary industries of Australian Sweet Potatoes and Australian Onions.



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Avocado Strategic R&D Levy Investment Program

Overview

The industry's research and development is funded by your grower levies, and contributions from the Australian Government.

The industry has long invested in research and development programs to support the sustainable development of the industry. Hort Innovation manages these funds, investing in projects addressing the industry's strategic priorities. The Australian Government also provides additional funding for avocado R&D through Hort Innovation.


Avocados Australia is the Prescribed Industry Body (PIB) that requested, on behalf of the industry, the Australian Government implement the R&D levy. This levy provides essential resources for ongoing avocado R&D and has helped to address various industry issues over many years.

Avocados Australia plays a key role in supporting Hort Innovation with its delivery of the avocado levy-funded R&D program, to ensure it continues to meet the needs of the industry.

This includes identifying R&D priorities, providing strategic advice through advisory panels, assisting with project planning and project reviews. With its extensive networks across the industry and R&D community, Avocados Australia assists Hort Innovation to deliver the best possible R&D outcomes from the levy.

Avocados Australia also collaborates with relevant agencies to undertake some R&D activities for industry that align with our capabilities and priorities. This may be as a service provider to Hort Innovation, or through other funding sources such as government grants.

Currently, Australian avocado growers pay a levy of 2.9c/kg for research and development. You can find out more about your levies here: www.avocado.org.au/industry-programs/levy-information/.

Investments are aimed at addressing levy payer priorities as set out in the Avocado Strategic Investment Plan 2017-2021. In the following pages, you will find summaries of projects undertaken in the last 12 months, funded through a variety of mechanisms, including funding secured by Hort Innovation through successful applications for Australian Government grants. Not all projects listed in this summary are funded by your avocado levy, but all are of interest. Projects that include an avocado levy component are marked with a .

AV projects funded through avocado levies only

MT multi industry projects to which avocado levies may have contributed, along with those of other industries

Hort Frontiers is Hort Innovation's strategic partnership initiative, where projects use funding from a range of co-investors - which sometimes includes levy industries. These projects are typically focused on big-picture and longer-term issues critical to the future of Australian horticulture as a whole. This includes the Pollination Fund (PH), Advanced Production System Fund (AS), and Asian Markets Fund (AM)

ST/AI projects funded by Australian Government grants, or across industry funding

HA across industry projects are funded through all horticultural industry R&D programs, including avocados.

The 2018/19 projects are reported on under the strategic investment plan objectives. Please note some projects meet more than one objective.

The Avocado Strategic Investment Plan 2017-2021 addresses the industry's major opportunities and challenges under four key outcomes:

- by 2021, increase domestic demand for Australian avocados by 20%
- by 2021, over 90% of avocados received by consumers will meet or exceed their expectations of quality
- by 2021, over 10% of production will be exported to markets where customers have a willingness and a capacity to pay a premium for Australian avocados
- by 2021, productivity (marketable yield per hectare) has improved by 15% on average, without increased production costs per kilogram.

You can find full details of the strategic investment plan online: www.avocado.org.au/industry-programs/about-industry-programs/.

Acknowledgement

The projects presented in this summary are investments under a variety of Hort Innovation funds. Not all projects are funded by the avocado levy, but all involve or are of interest to the industry. Information for this summary has been drawn from a variety of sources, including the Hort Innovation website (www.horticulture.com.au - search via the project code for the latest information), directly from researchers, from various editions of this magazine, and final reports.



Objective 1: By 2021, increase domestic demand for Australian avocados has increased by 20 percent

Avocado Industry and Market Data Capture and Analysis (AV16006)

Service Provider Avocados Australia Limited (AAL)

Project Leader John Tyas

Start Date 21/04/2017

End Date 31/07/2020

Funding Type Hort Innovation Avocado Fund

The objectives of this project are to:

- produce high quality industry and market data to assist both short and long-term industry planning and decision making
- support seasonal harvesting and marketing decisions by avocado growers and supply chain participants through the collection of robust, relevant and verifiable supply data
- help maintain a supply and demand balance.

Some of the activities this project is responsible for include: maintenance of *Infocado*, the industry's system for monitoring volumes of avocados dispatched and forecast to be supplied, with weekly and quarterly reporting; maintenance of *OrchardInfo*, which is used to monitor industry productive capacity and inform medium-long term production outlooks, with reports distributed to contributors; other relevant local data collection, analysis and reporting for the industry, including to identify and understand trends, supply, demand and price relationships; Global trade data analysis.

You can read more on Page 18.

Foodservice custom research reports (MT18002)

Service Provider Food Industry Foresight

Project Leader Sissel Rosengren

Start Date 01/10/2018

End Date 30/04/2019

Funding Type Hort Innovation Avocado Fund

This market research investment is delivering key insights around the foodservice industry for the avocado, mushroom and onion industries. It is producing information such as the total foodservice market sizes for these products, along with details on trends and opportunities. The information will be available for use in any future levy-funded projects and programs targeting the foodservice sector, from commercial businesses and staff to related training institutes and their students.

This project also involves contributions from the mushroom and onion funds.

Communicating the Nutrition and Health Benefits of Avocados (AV18004)

Service Provider Professional Nutrition Services

Project Leader Nicole Senior

Start Date 01/10/2018

End Date 30/11/2018

Funding Type Hort Innovation Avocado Fund

COMPLETED PROJECT

Running from late 2018 to early 2019, this investment brought together research relating to the key nutritional properties and health benefits of avocados. It has substantiated the health and nutrition claims that the avocado industry is able to make, for use in various forms of education.

Full details of all the claims that can be made about avocados – and, importantly, how and why they can be made – are detailed in the full final research report, which is available in the BPR Library, under the R&D Report heading. This information, and all of the related disclaimers, guidelines and legal information, is intended to be read together.

You can also see how the information has been used, at australianavocados.com.au/health-professionals/.

Potential impact of Chilean and Peruvian avocado imports for the Australian avocado industry (AV17004)

Service Provider Coriolis Australia

Project Leader Virginia Wilkinson

Start Date 07/05/2018

End Date 10/08/2018

Funding Type Hort Innovation Avocado Fund

COMPLETED PROJECT

This short project was tasked with delivering a fact-based assessment of the potential impact on the Australian avocado industry, should market access be granted for fresh Chilean and Peruvian avocados into Australia. The aim was to help Hort Innovation and Avocados Australia understand the potential effects of this access and to provide the insights needed to plan strategically for the future.

Australian avocado industry members can find the report from this project in the BPR Library, under the R&D Reports heading.

Avocado Strategic R&D Levy Investment Program Overview continued

Consumer Behavioural and Retail Data (MT17015)

Service Provider Nielsen

Project Leader Elisa King

Start Date 02/04/2018

End Date 31/03/2021

Funding Type Hort Innovation Avocado Fund



This multi-industry investment is tasked with providing regular consumer behaviour data and insight reporting to a range of industries, including the avocado industry. This information is intended to assist growers and supply chain partners in decision-making for their businesses and, for the wider industry, the data and insights are available to support strategic activities, as well as Hort Innovation Avocado Fund marketing plans.

The reports are accessible via a new online dashboard, www.harvesttohome.net.au/fruitmushroomnuts/latest-highlights/avocados.

Objective 2: By 2021, over 90% of Avocados received by consumers will meet or exceed their expectations of quality

Supply Chain Quality Improvement – Technologies & Practices to Reduce Bruising (AV15009)

Service Provider Department of Agriculture and Fisheries Queensland

Project Leader Daryl Joyce

Start Date 21/06/2016

End Date 31/10/2018

Funding Type Hort Innovation Avocado Fund



COMPLETED PROJECT

Avocado fruit quality in shops can be improved by identifying and adopting measures that lessen or, ideally, eliminate flesh bruising. This project, which ran from 2016 to 2018, set out to investigate if there are characteristics of the fruit that make them more or less likely to be damaged during handling. In addition, researchers tested tools that shoppers and retail staff could use to determine fruit ripeness without squeezing.

A key finding from the study was that fruit was found to be more resistant to bruising when it was cooled rapidly after harvest. Links were also found between greater bruising susceptibility and low dry matter content, advancing ripeness, post-harvest temperatures above 5°C and post-harvest storage durations of one week or more.

Pre-harvest factors leading to differences in fruit robustness were evidently important contributors to both bruise susceptibility and body rot upon ripening. For example, one of the studies found that a high ratio of nitrogen to calcium (N/Ca) in the fruit was linked to more body rots, although not bruise susceptibility. More work is needed to tease out the relationship between nutrition and poor quality at retail.

The study confirmed that shoppers are major contributors to avocado bruising as they apply compression forces typically ranging from three to 30 Newtons (N) to firm-ripe avocados when assessing ripeness. A 'slight' thumb compression of 10N applied to a firm-ripe fruit is enough to cause bruising, expressed within 48 hours at 20°C. It's here where the use of in-store decision-aid technologies can come into play. The team reviewed 16 tools for assessing avocado ripeness with four evaluated for reliability, ease of operation and maintenance. All were able to discriminate between different avocado stages of ripeness for both Hass and Shepard fruit. The devices included a handheld FruitFirm meter, a bench top Sinclair IQä Firmness Tester, a Digital Firmness Meter, and a prototype decision aid tool dubbed the 'Readycado' developed under project AV12009. In-store consumer testing suggested that the 'Readycado' device could be well-received by shoppers.

Knowledge generated by the project was shared with other researchers and with industry stakeholders, including growers, packers, ripeners, retailers, consumers and Avocados Australia. Indications are that more can be done to protect fruit from damage during handling.

Grower recommendations

- Cool fruit to 5-12°C and pack within 24 hours after harvest
- Avoid impact damage during harvest and packing
- 'Hass' avocado fruit should be harvested at more than 23 per cent dry matter, which is the current industry recommendation
- Fruit should pass through the supply chain as quickly as possible
- Drop heights be kept below 10 cm for fruit at the rubbery to softening ripeness stages
- Fruit be handled carefully without dropping or excessive squeezing from firm-ripe stage onwards
- Ripened Hass avocado fruit should be maintained at 5°C
- Regularly monitor avocado fruit quality at retail to gauge effectiveness of bruise-reduction measures.

This project included co-investment from the Queensland Department of Agriculture & Fisheries.

You can find the full report in the BPR Library, under the R&D Report heading, and read more articles from the project team via www.avocado.org.au/news-publications/talking-avocados/feature-articles/.

Avocado retail sampling (AV18006)

Service Provider Applied Horticultural Research

Project Leader Adam Goldwater



Start Date 12/2018

End Date 01/2019

Funding Type Hort Innovation Avocado Fund

COMPLETED PROJECT

Improving avocado fruit quality is essential in order to continue to grow demand for Australian avocados, and so gaining a better understanding of where quality issues are occurring is important for the industry.

This investment was tasked with investigating reports of declined fruit quality in late 2018. The project team assessed the quality of avocados available in Australian supermarkets over that summer, to help quantify the extent of the quality issues and identify the source of affected fruit.

During summer, avocados are mostly supplied by Western Australia, with the gap between demand and what the state can supply filled by imported fruit from New Zealand. During

October and November 2018, anecdotal evidence suggested that rots were a major issue in avocados on the Australian market, with many fruit failing to meet consumer expectations. To better understand the situation, the project team measured fruit quality at retail for both Australian and New Zealand avocados.

Fruit was sampled at retail stores in Brisbane and Sydney in late December 2018 and in early January 2019. In total, 31 samples (representing 310 avocados) of New Zealand fruit from five suppliers/exporters and 32 samples (representing 320 avocados) of Australian fruit from six suppliers/packhouses were assessed for internal quality.

Overall, 22% of the New Zealand fruit had significant damage (mainly rots), compared to 10% of Australian fruit (mainly bruising).

The project team concluded that above-average rainfall and flooding events earlier in the New Zealand growing season were likely to be the underlying cause of the high incidence of rots in the New Zealand fruit. Delays during transport and ripening, due to quarantine intervals, may have also contributed.

They noted, however, that the severity of rots can be influenced by many other pre- and postharvest practices, and encouraged

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Avocado Strategic R&D Levy Investment Program Overview *continued*

all growers and packers to follow postharvest best practice to try and minimise the issue:

- applying postharvest fungicides within 24 hours of harvest
- using sanitisers in bin dumps
- removing field heat as soon as possible after harvest
- keeping fruit at the recommended storage temperature (5°C) through the cold chain
- not exceeding maximum recommended storage times before ripening
- ripening fruit at 16 to 18°C, and maintaining air circulation through trays
- minimising the interval between ripening and retail.

The project team also noted that mature, late season fruit tends to be more susceptible to rots than earlier season fruit. If possible, they said, fruit with a higher disease load should be harvested and ripened first.

You can find the full report in the BPR Library, under the R&D Report heading.

Implementing best practice of avocado fruit management and handling practices from farm to ripening (AV18000)

Service Provider Queensland Department of Agriculture and Fisheries

Project Leader Noel Ainsworth

Start Date 07/02/2019

End Date 03/01/2022

Funding Type Hort Innovation Avocado Fund

This project will help the avocado industry achieve further improvements in fruit quality, by facilitating the adoption of better practices – from what happens on the farm through to dispatch from the ripener.

The project team are looking at the current level of quality-related best practice adoption in the industry and where improvements can be made, with a focus on those practices that are known to impact on fruit quality, as revealed by previous levy-funded R&D.

These insights will then be used to deliver knowledge and technical support to growers, packhouse operators, transporters and ripeners. This is occurring through workshops and training activities, as well as the development of supply chain case studies. Here, the project team will be working with two chains to monitor current performance, implement improvements, and measure the benefits.

Objective 3: By 2021, over 10% of production will be exported to markets where customers have a willingness and capacity to pay for a premium for Australian avocados

Avocado export readiness and market access (AV17000)

Service Provider Avocados Australia

Project Leader John Tyas

Start Date 01/11/2018

End Date 20/10/2020

Funding Type Hort Innovation Avocado Fund

Major outcomes from this project in the past 12 months have included gaining access to the Japanese market (for specified growing regions), and the development of a new export strategy for the Australian industry.

This project acknowledges that a rapid increase in avocado production in Australia has created a need for the industry to access and develop new markets. It will ensure that the industry is prepared to export, that there is capacity to pursue new and improved market access, and will provide necessary support for government negotiations with intended markets.

Avocados Australia has employed an Export Coordinator and is working with the Australian Government Department of Agriculture on various export market access applications.

Specific project activities include updating of the industry's Best Practice Resource export module and export strategy; implementing an export registration and audit process; and providing input into other export-related initiatives.



Australian exporter Jennie Franceschi with a group interested in Australian Avocados, at Asia Fruit Logistica 2019.

Trade Facilitation (MT15029)

Service Provider Hort Innovation

Project Leader Jenny Van de Meeberg

Start Date 07/03/2016

End Date 31/12/2019

Funding Type Hort Innovation Avocado Fund



This project provides an administrative vehicle for Hort Innovation to deliver on its three constitutional objects regarding trade, namely: market access (including new access, improvement and maintenance), market development and in-market promotion/consumer demand.

In the past year, this has included work on a market study of India, a launch event following the opening of the Japanese market to the Australian avocado industry, and in-market promotion in countries such as Malaysia.

We provide information on these activities via *Talking Avocados* and the *Guacamole* as they occur.

Avocado presence at key international trade events

Service Provider Hort Innovation

Project Leader Julie Willis

Start Date This is an ongoing project

Funding Type Hort Innovation Asian Markets Fund



The avocado industry has a presence at key international trade shows – including Asia Fruit Logistica in Hong Kong and the FoodEx in Japan – via ongoing Hort Innovation projects. Most recently, these activities occurred under the Taste Australia banner.

Taste Australia is the whole-of-horticulture brand used by industry and Hort Innovation to help increase the profile, sales and consumption of premium Australian horticulture products in key export markets, particularly Asia and the Middle East.

Through Taste Australia, Hort Innovation undertakes export market development activities including trade shows, trade missions and retail marketing activities.



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Producing better fruit by innovation

Avocado Strategic R&D Levy Investment Program Overview continued

Objective 4: By 2021, productivity (marketable yield per hectare) has improved by 15 per cent on average without increased production costs per kilogram

Implementation of recommendations from the Avocado Nursery Voluntary Accreditation Scheme review (AV16013)

Service Provider Nursery & Garden Industry Australia

Project Leader John McDonald

Start Date 30/08/2017

End Date 30/08/2018

Funding Type Hort Innovation Avocado Fund

COMPLETED PROJECT

The long-running Avocado Nursery Voluntary Accreditation Scheme (ANVAS) was established to provide superior planting material for the avocado industry. It has supported sound nursery practices, the use of virus-tested and registered sources of seed and budwood, and the exclusion of soil-borne plant

pathogens and roots diseases. Participation in the scheme has been voluntary, with any nursery operator that meets ANVAS requirements able to apply for accreditation. Updating and improving the scheme and its guidelines to ensure they are best placed to protect the industry's productivity and profitability, and that they are aligned with new technologies and emergent pathogens, was part of this project. This was to include transitioning the ANVAS nursery production requirements into the Nursery Industry Accreditation Scheme Australia (NIASA).

The work involved mapping synergies and gaps between ANVAS and NIASA, and producing an expanded nursery production module dealing specifically with current avocado production challenges and risks, to ensure the best possible stock to industry customers. The NIASA 'High Health Avocado Production' requirements now form part of revised NIASA guidelines and NIASA's National Audit Portal.

Ongoing updates and improvements to the avocado production procedures will continue to be overseen by a committee involving both Avocados Australia and Nursery and Garden Industry Australia representatives.

Transition of technical ANVAS requirements for avocado production nurseries to the new NIASA requirements began in January 2019, with the final transition to be achieved by January 2020. ANVAS accreditation will still be managed by Avocados Australia, with production nurseries required to provide evidence



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Avocado Strategic R&D Levy Investment Program Overview *continued*

of NIASA High Health Avocado Production accreditation to support their applications. Look for more details in industry channels as they arise.

You can find the current ANVAS nurseries (and information on how to become an accredited nursery) at www.avocado.org.au/our-programs/anvas/. Australian avocado industry members can find the report from this project in the BPR Library, under the R&D Reports heading.

Avocado industry development and extension (AV17005)

Service Provider Queensland Department of Agriculture and Fisheries

Project Leader Simon Newett

Start Date 20/04/2019

End Date 31/03/2022

Funding Type Hort Innovation Avocado Fund

This industry development and extension project is responsible for delivering a range of events and resources to help the avocado industry access, understand and implement best practice information. This includes information from current and previous Hort Innovation Avocado Fund R&D investments. The avocado industry in Australia continues to expand, however, to remain profitable in the long term quality and yields need to improve to raise consumption and successfully compete with countries with lower production costs.

The project is being led by the Department of Agriculture and Fisheries (DAF) Queensland and co-delivered with Avocados Australia, with collaboration from the Western Australian Department of Primary Industries and Regional Development (DPIRD).

A range of events will be delivered, including Regional Forums (shed and field sessions, with one per year in each of the eight major production regions), AvoSkills workshops (two-day events incorporating instructional and practical aspects), advanced



The orchard portion of the first day of the Mareeba Q AvoSkills workshop (July 2019) was hosted by Blue Sky Produce. The AvoSkills workshops are two-day events, providing the “A” to the “O” of avocado orchard management.

management workshops (three invitation-only events will explore key topics such as canopy management, irrigation and nutrition), capital city wholesaler meetings (two meetings over the life of the project in each of the five capital city markets to keep agents and wholesalers up-to-date with recommended fruit handling procedures and relevant industry developments), and a study tour of the avocado industry in California and attendance at the World Avocado Congress in Colombia in September 2019.

Additional resources and services produced as part of this new project will include: *Avo Alerts* (monthly orchard task reminders), updating the Avocado Problem Solver Field Guide, updating the Best Practice Resource (www.avocado.org.au/bpr/), sharing relevant scientific literature, an online forum (accessed via the BPR, this will be a new module for growers questions and answers), new educational/instructional posters for growers, new growth cycles, and three new educational/instructional videos.

You will find a full overview of the project in the Autumn 2019 edition of *Talking Avocados*, and an update on page 11 of this edition.

Avocado industry capacity building – Western Australia (AV17006)

Service Provider Department of Primary Industries and Regional Development, Western Australia

Project Leader Rohan Prince

Start Date 30/06/2018

End Date 31/05/2021

Funding Type Hort Innovation Avocado Fund

This project supports the role and activities of a West Australian Avocado Research Officer, to help develop the capacity and productivity of the state's avocado industry. The officer will deliver best practice management information to growers and other industry participants in Western Australia, support national



West Australian Avocado Research Officer Declan McCauley (second from right), in the field at an AV17005 event near Wanerie this year.

development activities within the region (such as forums and workshops), and help address identified orchard productivity issues in the state through research activities.

DPIRD has appointed Declan McCauley to the role. He graduated from the University of Western Australia in 2017 with a Bachelor of Science with First Class Honours, majoring in Agricultural Science.

The yield component of the project has two primary aims:

1. Guided adoption of best practice research will be the principal extension activity - this project will assist growers to find and adopt best practice research. Research includes, but is not limited to, pollination, pruning, growth regulators, mulching and relatively new varieties to replace Hass
2. Irregular bearing requires understanding; while a component of irregular bearing is due to certain production practices, these practices can most likely be improved to an acceptable level by fulfilling aim 1. What isn't known is why so many fertilised fruitlets drop off after they have attained a size of 4.4 mm. Understanding this is required to improve yield. Note: This is not summer fruit drop which is more related to production practices (see aim 1).

As well as communicating best practice in avocado growing in the state, one specific area of research for the project has been identified, with work being conducted into fruitlet drop shortly after flowering, after fruitlets have exceeded a size of 5.5mm. Here, Declan's work is tying into that of another Hort Innovation Avocado Fund project, *Maximising yield and reducing seasonal variation* (AV16005).

Implementing precision agriculture solutions in Australian avocado production systems (AV18002)

Service Provider University of New England

Project Leader Andrew Robson

Start Date 01/06/2019

End Date 30/03/2022

Funding Type Hort Innovation Avocado Fund

This investment is refining and working towards commercialising technologies and innovations to help the avocado industry improve production and efficiency. There is a particular focus on delivering solutions to help growers predict yield, look at yield variability and map factors such as disease to, in turn, support on-farm decision making.

The work builds on the previous project *Multi-scale monitoring tools for managing Australian tree crops initiative*, supported by Hort Innovation under the Australian Government's Rural R&D for Profit program.

Specific project activities include, but aren't limited to:

- keeping the Australian Tree Crop Rapid Response map (bit.ly/2KkpG97) and its associated app (bit.ly/2KsNiXZ) updated with information on commercial avocado orchards. This mapping tool was a key output of the multi-scale monitoring tools program. At a top level, it's designed to assist with natural disaster recovery efforts and biosecurity work, but when combined with other innovations such as remote sensing and analytic technologies, it can be used to support on-farm decision making, and
- developing a mobile app to provide avocado growers with up-to-date, high-resolution satellite imagery and other capabilities to support pre-harvest yield forecasts and mapping of tree health and vigour, yield parameters including fruit size, and disease with a focus on phytophthora.

Maximising yield and reducing seasonal variation (AV16005)

Service Provider CSIRO

Project Leader Harley Smith

Start Date 31/05/2017

End Date 31/12/2020

Funding Type Hort Innovation Avocado Fund

This project is developing the knowledge and tools needed to manipulate and maximise avocado tree yields, to help improve production and profitability in the industry. Specifically, it is looking at resource competition between shoots and fruits, potentially opening the door for new methods of reducing fruit drop. It is also looking at how high, sustainable production can be achieved from year to year, through progressing the understanding of high-yielding tree development.

The project team report that experimental studies indicate that early fruit drop (fruitlet abscission) is caused by growth of the spring flush. Following this early fruit abscission event, immature fruit drop occurs during the summer, either in a wave or at a steady rate until the amount of fruit is stabilised on the tree.

Trials are ongoing to gain a better understanding of the dominance inhibition and/or competition between roots and shoots, to help deliver better management solutions to reduce the effect of shoot growth on fruitlet development. New trials for these studies have been established in South Australia.

The researchers are also continuing to look at the physiological mechanisms of early fruitlet abscission and summer fruit drop, with field trials in Western Australia.

Insights will be collected over the project period, before being collated and communicated to industry.

Read more from this project on page 60.

Avocado Strategic R&D Levy Investment Program Overview continued

Transforming subtropical/tropical tree crop productivity (AI13004)

Service Provider	Queensland Department of Agriculture and Fisheries
Project Leader	John Wilkie
Start Date	20/11/2013
End Date	30/09/2019
Funding Type	Horticulture Transformational Industry Fund

This project is investigating the potential for orchard intensification in tropical orchard production systems, and has recently been extended until September this year.

The goal: small trees, high productivity. Trial blocks for trial crops including mango, avocado and macadamia are established in Queensland and northern New South Wales. The Key Research Components (KRCs) are: vigour management, architecture, canopy light relations, and crop load.

The knowledge from these diverse research components is being integrated using planting systems trials (assessing the effect of rootstock, planting density, pruning and training, and crop load on performance), genetic and physiological analysis, and functional-structural modelling. Aspects of each of the research components will be focussed on understanding the underlying physiological, genetic and molecular principles involved, leading to project components that focus on applying this understanding to develop modern, highly productive planting systems that can be adopted by industry. The initiative will primarily focus research on avocado, macadamia and mango. This ambitious research initiative is inherently a long-term proposition, due to the plant breeding/germplasm selection component, the long-term nature of any tree crop research, and the requirement to integrate multi-disciplinary research findings.

Among the project's recent activities, was a field day in Bundaberg Q in April 2019. This included an update on results to date from rootstock trials for high-density plantings, planting system trials, and from a baseline study of Hass trees for light interception and yield



In the orchard... QDAF's Helen Hofman provides growers with an update on avocado planting systems trial (high versus medium versus conventional density), including results to date, plus a discussion on what to try next, at the department's research station, Bundaberg, Queensland. This AI13004 activity was held in April 2019.



QDAF's John Wilkie talks light interception at a Bundaberg workshop in April 2019, as part of the Small Tree High Productivity initiative. The workshop attracted 59 attendees (including 46 growers), and the areas of most interest was pruning, factors influencing fruit set, tree density and rootstocks.

National tree genomics project (AS17000)

Service Provider	The University of Queensland and Queensland University of Technology
Project Leader	Robert Henry, Roger Hellens, Craig Hardner
Start Date	21/06/2019
End Date	01/12/2023
Funding Type	Hort Innovation Advanced Production Systems Fund

This program is about harnessing genetic technologies for the benefit of Australian tree crop industries. These technologies can be developed and used in breeding (to deliver cultivars with key productivity and profitability traits) and to deliver improved management techniques, however, this is an area that's still in its infancy for tree crops, due to their unique challenges such as long generation times.

This program involves separate components working together to deliver a deeper understanding of the relationship between tree crop traits (phenotypes) and their underlying genetics (genotypes) and genetic mechanisms. This will then feed into the ultimate development of tools and opportunities for rapidly and more efficiently addressing current and future needs of industry. Each program component is developing a genetic toolbox for this use, with a genomics toolbox, a genotype prediction toolbox and a phenotype prediction toolbox.

Crops that will be used as case studies in the program include almond, avocado, citrus, mango and macadamia.

Managing flies for crop pollination (PH16002)

Service Provider Department of Primary Industries and Regional Development, Western Australia

Project Leader Dr David Cook

Start Date 01/05/2017

End Date 01/09/2023

Funding Type Hort Innovation Pollination Fund

This project is part of the Hort Frontiers Pollination Fund and involves levy funds from the avocado industry. It is looking into the potential of using flies as alternative crop pollinators, including considering the effectiveness of specific fly species in pollinating avocado as well as berry (blueberry, raspberry and strawberry), hybrid carrot seed and brassica seed crops.

Potential benefits of flies as alternate pollinators to bees include:

- different fly species mean that flies can be present all year round
- flies have high sugar demand and naturally visit flowers for nectar
- flies are hairy and so can pick up and move pollen
- flies can be readily mass-reared with reasonable minimal inputs and do not sting workers.

The project is first identifying the best candidate fly species for various crops via surveys of field populations of flies visiting crops at the time of flowering. Once the fly species and their crop preferences have been determined, the project will then focus on developing novel technologies to mass rear candidate fly species for use in horticultural settings.

An article on results from some of the trials was included in the Autumn 2019 edition of *Talking Avocados*.



Increasing yield and quality in tropical horticulture with better pollination, fruit retention and nutrient distribution (PH16001)

Service Provider University of Sunshine Coast

Project Leader Stephen Trueman

Start Date 23/06/2017

End Date 01/07/2023

Funding Type Hort Innovation Pollination Fund

This program aims to increase the productivity, profitability and global competitiveness of Australia's horticultural industries by helping to optimise crop pollination efficiency.

Key objectives are to increase yield and quality through better understanding of crop nutrition during crop pollination and through improved understanding of the effects of cross pollination on fruit quality.

The project team will develop non-destructive tools (using hyperspectral imaging) to quantify nutrient concentrations and produce guidelines to help growers maximise crop pollination efficiency, optimise fertiliser applications and increase fruit set.

New knowledge and technologies developed from this research will be relevant to both tropical and temperate fruit industries, and nut industries. Field work is set to involve the following crops: avocado, almond, custard apple, lychee, macadamia, mango, and strawberry.

The program will also support capacity building in Australia by developing new international collaborations among pollination and plant physiology science groups in Australia, New Zealand and Germany, and support new students into the horticulture sector.

Stingless bees as effective managed pollinators for Australian horticulture (PH16000)

Service Provider University of Western Sydney

Project Leader James Cook

Start Date 22/09/2017

End Date 30/08/2022

Funding Type Hort Innovation Pollination Fund

This project is examining Australia's native stingless bees for their suitability as alternative pollinators to honey bees in horticulture crops.

While honey bees are excellent pollinators in many situations, their availability as both managed and wild pollinators faces various threats. This includes Varroa mite, which could lead to the collapse of wild honey bee populations if it establishes in Australia.

Avocado Strategic R&D Levy Investment Program Overview *continued*

The industry therefore needs to consider alternative pollinators, investigate their performance in different crops, and find better ways to propagate and deploy them.

The leading alternative pollinator candidates are stingless bees, which live in large colonies like honey bees, pollinate a wide variety of plants, and can be kept in managed hives. There are indeed a growing number of stingless beekeepers, and stingless bees are already used in macadamia farms. Managed stingless bees may therefore have wide but underdeveloped potential for crop pollination. Stingless bees (particularly *Tetragonula* species) are also used in crop pollination in several Asian countries, including in India and Thailand, so there is good scope to exchange knowledge and expertise on bee biology, husbandry and deployment in horticulture.

In looking at stingless bees, this investment is conducting studies across a range of fruit and vegetable crops – testing first if the bees visit the flowers and transport the crop pollen. Where they do, the effectiveness of stingless bee pollination and its impact on crop set, yield and quality is set to be examined. For the most promising crop/bee combinations, the project team will then conduct studies of the potential of stingless bees to be effective managed pollinators in glasshouse conditions.

Specific crops involved in field work include: avocado, almond, lychee, macadamia, mango, and vegetable crops.

Enhanced National Bee Surveillance Program 2016-2021 (MT16005)

Service Provider Plant Health Australia

Project Leader Jenny Shanks

Start Date 12/12/2016

End Date 12/12/2021

Funding Type Hort Frontiers Pollination Fund

This multi-industry investment (including the avocado R&D levy) is delivering a nationally coordinated bee-pest surveillance program to help safeguard honey-bee and pollinator-dependent industries in Australia. It includes upgrading sentinel hive arrays, strengthening relationships with surveillance operators, the introduction of new elements such as Asian hornet screening and more. The surveillance is designed to enable the early detection of high-priority pest incursions that can impact on honey bees, providing the best opportunity for successful pest eradication. The avocado industry is one of several contributors to the project's work.



Development and implementation of protocols to enable importation of improved honey bee genetics to Australia (MT18019)

Service Provider CSIRO

Project Leader John Roberts

Start Date 12/07/2019

End Date 15/06/2021

Funding Type Hort Innovation Avocado Fund

This investment is laying the groundwork to allow the first importation of desirable honey bee germplasm into Australia, with a focus on sourcing genetic material from bees with a tolerance to Varroa mite and its associated viruses.

Import of and access to this material for breeding purposes will allow both the honey bee and horticulture industries to prepare for the threat of Varroa, by pre-emptively establishing Varroa-tolerant genetics in Australia's honey bee population.

Specific project activities include: exploring and updating virus testing protocols for honey bee germplasm, to allow testing of imported material for biosecurity risks, building capacity for receiving imported germplasm through the new Post-Entry Quarantine facility at Mickleham in Victoria, and establishing relationships with overseas honey bee breeding programs that are selecting for Varroa tolerance, and identifying suitable sources of Varroa-tolerant germplasm for importation (an element of which includes reviewing and recommending germplasm selection protocols).

The project team will also evaluate the first successfully imported and propagated Varroa-tolerant germplasm prior to its release to industry.

This project also involves contributions from the almond and melon funds.



Review of national biosecurity plans (MT17003)

Service Provider Plant Health Australia

Project Leader Rodney Turner

Start Date 10/11/2017

End Date 30/11/2020

Funding Type Hort Innovation Avocado Fund

This project provides the strategic framework for the avocado and mango industries to improve preparedness for and response to potential biosecurity threats. The project entails the review and update of each industries' biosecurity plans through a partnership approach. These top-level documents identify high-priority endemic and exotic pests and diseases. They include the risk mitigation activities required to reduce their biosecurity threats, and surveillance and diagnostic activities.



On 7 November 2018, avocado industry members and scientific experts met to identify and prioritise high priority exotic pests and diseases for avocados. The meeting was attended by representatives from Avocados Australia, Hort Innovation, the NSW Department of Primary Industries (NSW DPI), Plant Health Australia (PHA), the Queensland Department of Agriculture and Fisheries (QDAF), The University of Queensland (UQ), and the Victorian Department of Economic Development, Jobs, Transport and Resources.

On 8 May 2019, representatives met to review the implementation roadmap for future biosecurity-related investment activities for the avocado industry. It considered what industry and government can do together to be more prepared for an exotic pest incursion. This related to:

- surveillance
- diagnostics
- established pests
- capacity and capability building
- plant biosecurity education and awareness
- preparedness and response
- research, development and extension.

When it is finalised, the biosecurity plan will be endorsed through Avocados Australia, and at the government level, through the Plant Health Committee.

You can find the current avocado industry biosecurity planning documents (2011) in the Best Practice Resource Library, in the Education Materials section.

This project also involves contributions from the Mango Fund.

Avocado sunblotch viroid survey (AV18007)

Service Provider The University of Queensland

Project Leader Andrew Geering

Start Date 21/06/2019

End Date 30/09/2019

Funding Type Hort Innovation Avocado Fund

This investment is surveying for avocado sunblotch viroid in growing regions across Australia, to provide evidence to support declarations of regional or national freedom from the pathogen.

A declaration of 'pest freedom' – whether at a farm, region or national level – could facilitate export to countries that have their own domestic industry and may be concerned about the introduction of avocado sunblotch viroid, such as New Zealand. Understanding any current distribution of the viroid will also allow a better assessment of the risk of importing avocados to Australia from countries where the pathogen is common.

Importantly, the work and protocols this investment is establishing – such as its use of databases, its surveillance

approaches and its analytical techniques – will have broad applicability across a number of biosecurity threats relevant to the Australian avocado industry, now and into the future.

Xylella coordinator (MT17006)

Service Provider Plant Biosecurity Research Initiative

Project Leader Dr Jo Luck

Start Date 16/03/2018

End Date 13/09/2020

Funding Type Hort Innovation Avocado Fund

This multi-industry and multi-sector investment supports the role and activities of a national Xylella coordinator, through the Plant Biosecurity Research Initiative (PBRI).

Xylella fastidiosa is an exotic bacteria that prevents a plant from feeding by impeding the movement of rising sap. While Australia is currently free from the pathogen, it has the potential to threaten more than 350 commercial, ornamental and native plant species across the country.

The coordinator role includes developing R&D priorities and projects to help protect Australia's horticulture and wine sectors from Xylella.

Experienced biosecurity and emergency response coordinator, Craig Elliott, has been appointed to work with a national steering committee and coordinate the program. Mr Elliott has previously worked in senior management roles with state biosecurity agencies in Queensland and Tasmania, as well as with the National Biosecurity Response Team, and he has extensive experience in leading emergency responses and training government and industry personnel in biosecurity and emergency management.

The coordinator's priorities will be working with local and international researchers to find simple and quick ways of detecting the disease in plant and insect samples, and to develop containment and eradication strategies should there be an outbreak.

The PBRI brings together and helps coordinate the efforts of Australia's seven plant-focused research and development corporations, with additional involvement from Plant Health Australia, the Department of Agriculture and Water Resources, industry, state and federal biosecurity stakeholders.

This project is a multi-industry and multi-sector/organisation investment, with funding from a range of levy industries, including the Avocado Fund.



Avocado Strategic R&D Levy Investment Program Overview continued

Pest Status and Management of Six-Spotted Mite (AV15012)

Service Provider Western Australian Agricultural Authority
(Department of Agriculture and Food Western Australia)

Project Leader Stewart Learmonth



Start Date 01/07/2016

End Date 01/07/2018

Funding Type Hort Innovation Avocado Fund

COMPLETED PROJECT

Avocado orchards in south-west of Australia are vulnerable to attack by the six-spotted mite (SSM), *Eotetranychus sexmaculatus*. If left untreated, trees in infested orchards will be defoliated resulting in sunburnt, unmarketable fruit and reduced tree vigour. Miticides are available to control SSM but currently products containing only three different active ingredients are available, two of which have a reputation as being toxic to predatory mites. Also, the risk of miticide resistance occurring is ever present and alternative or complementary management practices are required.

This project sought to assist growers in undertaking their own monitoring and implement appropriate management techniques to protect trees from damage by SSM and to assess the role of predatory mites in suppressing SSM.

Identification kits were prepared and distributed to growers at talks about SSM. Growers developed knowledge on identifying leaf symptoms of SSM presence and how to identify SSM and associated fauna.

The role of at least four species of predatory mites was assessed, but differences were observed between glasshouse and field trials.

Field monitoring showed predatory mites can play a role in the suppression of SSM, and that this occurred despite releasing the mass reared species.

Results of SSM monitoring which clarified its seasonality, indicated that prevention of spring outbreaks of SSM is best achieved by reducing their abundance in late summer/early autumn. If present in reasonable numbers at this time in association with low or no predatory mites, falling temperatures reduce the impact of predatory mites and miticides are likely to be less effective in cooler weather. In all cases, some monitoring for SSM through winter is recommended.

Over the duration of this project, the area where SSM has required action expanded and so more orchardists are now potentially affected by this mite. Meetings with avocado growers to discuss results of this project and on-going interchange on developments will be encouraged.

The report from this project is in the BPR Library, under the R&D Reports heading. Phase two of this project (AV19002) is currently being developed.

Investigating Tree Mortality During Early Field Establishment (AV14012)

Service Provider The University of Queensland

Project Leader Dr Elizabeth Dann



Start Date 01/08/2014

End Date 31/05/2018

Funding Type Hort Innovation Avocado Fund

COMPLETED PROJECT

Black root rot, a severe disease of young avocado trees, is caused by soilborne fungal pathogens in the Nectriaceae family, with symptoms including black rotten roots, tree stunting and leaf wilt, often resulting in tree death within a year after transplanting into the orchard.

This project set out to investigate the species of fungi associated with black root rot and their relative ability to cause disease, with a view to developing a diagnostic test and some insights on how this disease may be managed.

The researchers began by collecting more than 120 fungal isolates from roots of avocado trees, and a further 30 from other trees including peanuts, blueberry, papaya and custard apple.

Six main types of fungi were found and further analysis established some species names as well. The varieties were assessed for the ability to cause disease.

The main findings were:

- one species, *Calonectria ilicicola*, was the most aggressive of the fungi tested
- it was found to affect peanut, papaya and custard apple in addition to avocado
- four species of *Dactylonectria* caused disease in avocado seedlings, although to a lesser extent.

The research team developed a diagnostic test that can detect the two damaging species in tree roots in around half an hour. It will be an invaluable tool for the avocado industry, especially for the ANVAS clean planting scheme, but will also be valuable for other industries impacted by these pathogens. The test has already been successfully employed in a sample of avocado roots sent to a commercial diagnostic laboratory.

Options for managing black root rot were explored and one fungicide, fludioxonil (Scholar), was effective at inhibiting growth of the key fungi in the lab and reduced root damage in seedlings.

The researchers believe that fludioxonil could be a powerful tool for growers in conjunction with careful post-planting care.

The outcomes from the study pave the way for future plantings of avocados to be free of black root rot. Researchers recommend discussions with the avocado and nursery industries to identify the best way to make screening services available to all nurseries.

The report from this project in the BPR Library, under the R&D Reports heading.

Improving avocado orchard productivity through disease management (AV16007)

Service Provider The University of Queensland & Murdoch University

Project Leader Dr Elizabeth Dann & Giles Hardy



Start Date 09/11/2017

End Date 05/11/2021

Funding Type Hort Innovation Avocado Fund

This investment will identify strategies to minimise the effects of key diseases in avocado orchards and in fruit as it progresses through the supply chain – helping the avocado industry increase orchard productivity and fruit quality. The project will have a focus on diseases and issues including phytophthora root rot; phellinus brown root rot; Nectriaceous black root rot; stem end rot; and branch and graft dieback.

The dedicated Phytophthora component involves the work of a Murdoch University team, whose work includes a closer look at phosphite treatments, including the issue of residues, potential for Phytophthora pathogens to develop tolerance, alternatives and more. You can read more about this work in the Summer 2019 edition of *Talking Avocados*.

A significant achievement has been the establishment of three field trials for assessing different mulches, soil amendments and other treatments on avocado tree health, fruit yields and quality. Two trials have been initiated in south-west Western Australia and one trial at Childers, Queensland. All trees were rated for canopy health, and soil and leaf samples were taken for analyses to provide the start of treatment reference point for key physio-chemical and nutritional properties. The grower collaborators have had significant input into the selection of treatments for their orchards.

The treatments will be conducted over the next three cropping seasons. Effects of the treatments on soil properties, including microbial activity, tree canopy health and nutritional status, fruit yield and postharvest quality will be assessed annually.

A field trial in northern New South Wales is investigating the efficacy of brassica biofumigant crops or chicken manure as pre-plant treatments, at a site with a high natural infestation with *Phytophthora cinnamomi*. The brassica crop was macerated and thoroughly incorporated into the top 10cm of soil. Half the plots were covered in plastic. Hass trees grafted onto susceptible rootstock Reed were recently planted, and will be monitored over the coming months for establishment success and canopy health.

Phosphonate injections or foliar sprays are a key component in orchard management for Phytophthora root rot. The application timing is critical to ensure maximum translocation to the roots,

and minimal translocation to the developing fruit. Monitoring concentrations in roots has been commonplace for several years, however, measuring residues in fruit is not routinely undertaken. Agronomists, growers and the project leader sampled fruit at commercial maturity from more than 40 blocks from North Queensland around to south-west Western Australia during 2018. Samples have been processed for dry matter determination and analysed by the commercial lab for phosphorous acid residues. Collaborators have provided corresponding results from root testing, and data analyses will be conducted over coming months.

The project team has also been conducting surveys for fungi involved in stem end rot in fruit, graft and branch dieback, to better understand and tackle the pathogens. Field trials into Phellinus brown root rot management have also begun.

Meanwhile, in the winter of 2018 a significant issue emerged for many growers in Western Australia, with trees snapping off at ground level and blowing over. The project team are involved in ongoing efforts to identify the likely cause or causes of the problem, and produced a basic tree blow-over handout with pictures and descriptions of symptoms, what was known at the time, and preliminary results from lab testings. You can read a full report (with images) in the Summer 2019 edition of *Talking Avocados*.

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Avocado Strategic R&D Levy Investment Program Overview continued

Avocado industry biosecurity capacity building (AV16010)

Service Provider The University of Queensland

Project Leader Dr Andrew Geering



Start Date 06/11/2017

End Date 05/11/2021

Funding Type Hort Innovation Avocado Fund

This investment is responsible for bolstering biosecurity for the avocado industry. It is tasked with developing new diagnostic protocols for high-risk biosecurity threats to the industry, such as avocado scab fungus *Sphaceloma perseae*, and maintaining existing diagnostic protocols for quarantinable pests and pathogens; monitoring emerging biosecurity threats and allowing rapid responses to any incursions that arise; and providing diagnostic support for other levy-funded avocado plant health projects. The researchers will also be looking at the diversity of scolytid beetles and associated fungi affecting avocados in Australia.

Now halfway through the investment, key outcomes of the project to date have included:

- development of two real time tests for detecting the exotic avocado fruit scab fungus, *Elsinoë perseae*
- a large collection of ambrosia beetles was gathered from trees in avocado growing regions in Queensland with many species identified
- a collection of fungal isolates associated with Fusarium dieback of avocado trees was established, with identification underway
- reference specimens of high priority exotic pest and disease threats to industry were obtained through international collaborations, improving the ability to identify those species should they make it to Australia.

Together the components will build to make the Australian avocado industry more sustainable, through limiting the introduction or spread of new pests and diseases as well as greater trade access by knowing more about pests already in growing regions.

Generation of data for pesticide applications in horticulture crops 2018 (ST17000)

Service Provider Peracto & Eurofins

Start Date 27/04/2018

End Date 30/11/2020

Funding Type Hort Innovation Avocado Fund



The generation of pesticide residue, efficacy and crop safety data is required to support label registration and minor use permit applications made to the Australian Pesticides and Veterinary Medicines Authority (APVMA) which, when approved, provide access to safe and effective chemicals for the management of pests, weeds and diseases. For the avocado industry, this multi-industry investment will produce the data required to support a Bayer DC-163 label registration, for the control of Lepidoptera including avocado leafrollers and loopers, and flower-eating caterpillar.

Data generation for other applications relevant to the avocado industry is also supported by the projects *Generation of residue data for permit applications 2017* (MT17012) and *Generation of residue, efficacy and crop safety data for pesticide applications in horticulture crops 2017* (ST16006).

Avocado industry minor use program (AV16002)

Service Provider Hort Innovation

Project leader Jodie Pedrana

End Date ongoing

Funding Type Hort Innovation Avocado Fund



Through this project, levy funds and Australian Government contributions are used to submit renewals and applications for new minor use permits for the avocado industry, as required. These submissions are prepared and submitted to the Australian Pesticides and Veterinary Medicines Authority (APVMA).

All current minor use permits for the industry are searchable at portal.apvma.gov.au/permits or via www.horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/minor-use-permits-for-the-avocado-industry/.



Underpinning projects

National Avocado Industry Communications Program (AV15002)

Service Provider Avocados Australia Limited
Project Leader John Tyas 
Start Date 02/11/2015
End Date 02/11/2018
Funding Type Hort Innovation Avocado Fund

COMPLETED PROJECT

This project was responsible for producing and implementing numerous communications vehicles to ensure stakeholders receive the latest news and research updates, including:

- the quarterly *Talking Avocados* magazine
- the fortnightly *Guacamole* newsletter, as well as various grower and industry notices
- industry-facing social media activities
- the provision of up-to-date relevant industry news from around Australia and the world at www.avocado.org.au/news-publications/latest-news/
- media relations
- crisis management.

Through effective communication, avocado growers (levy payers) and other industry stakeholders, receive up-to date information regarding challenges confronting the industry, available opportunities, along with research and development outcomes which will benefit the profitability and sustainability of the Australian avocado industry.

This project was reviewed in 2018, via *Independent mid-term review of the avocado communication program* (AV17003). Recommendations from this review were implemented during this project, and carry through to the new communications project (AV18003).


National Avocado Industry Communications Program (AV18003)

Service Provider Avocados Australia Limited
Project Leader John Tyas 
Start Date 02/11/2015
End Date 02/11/2018
Funding Type Hort Innovation Avocado Fund

Carrying on from the *National avocado industry communications program* (AV15002), this investment ensures the Australian avocado industry remains up-to-date with the latest R&D,

marketing, emerging information, trends and issues both in Australia and overseas. By providing a consistent flow of relevant information, it keeps growers and other industry stakeholders in a position to make informed business decisions and best-practices changes. A number of communication channels are produced and maintained by this project, including but not limited to the *Talking Avocados* magazine; *Guacamole* newsletter; the Avocados Australia website, including its Best Practice Resource (BPR); industry social media channels; video content; and media releases and other industry articles.

Industry Annual Reports & Industry Advice and Grower Consultation

Service Provider Hort Innovation 
Project Leader Corrine Jasper
End Date ongoing
Funding Type Hort Innovation Avocado Fund

Hort Innovation has ongoing projects to fund the advisory mechanism under Hort Innovation. This includes the strategic investment advisory panel (SIAP) and attendance by growers at meetings to provide advice on strategic R&D investment and marketing investment through individual project committees, such as evaluation panels and other meetings. It includes the strategic investment advisory panel flights, accommodation and attendance and also evaluation panel time and attendance and input into various project steering committees by growers and industry stakeholders as needed.

In addition, Hort Innovation produces and Industry Annual Report, available at www.horticulture.com.au/growers/avocado-fund/

Australian Horticulture Statistics Handbook 2018-19 to 2020-21 (HA18002)

Service Provider Freshlogic
Project leader Adam Briggs, Hort Innovation
Start Date 24/05/2019
End Date 25/02/2022
Funding Type Hort Innovation

This whole-of-horticulture investment is responsible for producing Hort Innovation's annual *Australian Horticulture Statistics Handbook*, which offers comprehensive and contemporary data available on all sectors of the Australian horticulture industry. The handbook features data and insights relating to production, international trade, processing volumes and fresh market distribution for 75 different horticultural categories. You can find the most recent edition online at www.horticulture.com.au.

Avocado Strategic R&D Levy Investment Program Overview continued

Upcoming projects

Hort Innovation has either recently called for proposals, or closed the application period, for a number of projects that may be of interest to avocados. We will provide updates on these projects in future editions of *Talking Avocados*.

Investigation into citrus blossom bugs in avocados (AV19000)

The objectives of the project are to:

- review the occurrence of Citrus blossom bugs (CBB) in avocado orchards and better understand their status as a pest problem to Australian avocados
- develop key knowledge and insights into the biology and ecology of CBB, including lifecycle, life history, host, distribution and natural enemies
- develop industry guides for identification and integrated pest management of CBB.

The proposal period for this project closed on 21 June 2019.

Review and extension of avocado arthropod pests and their management (AV19001)

The overarching objective of the program is to better understand current grower practice and develop resources that support current best practice and enhance integrated pest management (IPM) on farm. Specifically, the objectives are to:

- gain a clearer understanding of current orchard practices
- explore areas identified by growers as needing further extension and identify areas for potential further investment
- develop materials that collate information on IPM strategies that growers can incorporate into their orchards
- work with other relevant projects such as communications and extension.

The proposal period for this project closed on 28 June 2019.

Management of six-spotted mite in WA avocado orchards - Phase 2 (AV19002)

The objective of the services being sought is to identify and extend effective options for the integrated pest management



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of six spotted mite in avocado orchards. The proposal period for this project closed on 1 July 2019.

National tree crop intensification program in horticulture (AS18000)

The key objectives of this project are to: develop intensive planting systems trials for a range of horticulture tree crops; and establish demonstration plots for growers and industry stakeholders.

The proposal period for this project closed on 5 July 2019.

Monitoring avocado quality in retail (AV19003)

The objectives of the services being sought are to monitor the quality of avocados in retail, on a frequent and consistent basis with a strong focus on country of origin; and provide confidential feedback to retailers, marketing groups, growers and packers, where appropriate, and de-identified results to the avocado industry via the Avocados Australia website, with the aim of improving the quality of avocados in retail.

The proposal period for this project closes on 23 August, 2019.

More information

For further details on specific projects, we encourage you to contact Corrine Jasper on corrine.jasper@horticulture.com.au, visit www.horticulture.com.au or check for final reports in the Best Practice Resource Library.



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Building biosecurity capacity

Louisa Parkinson and Andrew Geering, Queensland Alliance for Agriculture and Food Innovation (QAAFI), The University of Queensland

The Australian avocado industry is relatively free from exotic pests and diseases, due to its geographic isolation and strong quarantine system. However, there are threats of exotic pest incursions that require novel diagnostic and surveillance tools to provide a capacity to respond to incursions.

This R&D update will summarise the biosecurity innovations that are being adopted in the Australian avocado industry, including the roll-out of a digital social networking tool (Checkpoint™) for pest surveillance; new molecular tests for detecting avocado scab fungus, *Elsinoë perseae* (syn. *Sphaceloma perseae*); an investigation of the fungal pathogens vectored by the Tea Shot Hole Borer (TSHB) *Euwallacea fornicatus*; and a new survey project investigating avocado sunblotch viroid (ASBVd).

Monitoring pest and disease threats with Checkpoint™

Checkpoint™ is an online social networking tool for on-farm recording of plant health data. The tool enables growers and crop protection consultants to instantly make an enquiry about a symptomatic tree and have direct access to diagnosticians in the laboratory. Checkpoint can be accessed via www.checkpoint.tools and can be used on smartphones and tablets for instant image uploading and record keeping. Pest and disease surveillance activities are recorded in real time with photographs, GPS coordinates, chat logs and steps in the diagnostic chain instantly saved to an online database via smart devices (Figure 1). Expertise can be drawn upon from anywhere in the country and scientists in a different capital city can be invited to contribute to the conversation to accelerate the diagnosis.

The aim of this project activity was to establish a network of researchers, extension officers, agronomists and growers who work in the industry that can report on current pest or disease issues in their region. A network, *Australian Avocado Plant Health*, comprising 39 industry stakeholders across all growing regions has been established through use of the Checkpoint tool. This project activity resulted in the adoption of private use of Checkpoint by two major avocado producing organisations in Australia for monitoring health of individual trees. Outcomes of the project include contributions and collaboration with software developers to improve the Checkpoint tool to suit industry needs; and building connections with avocado producers and agronomists through site visits for sample collection and providing plant pathology services.

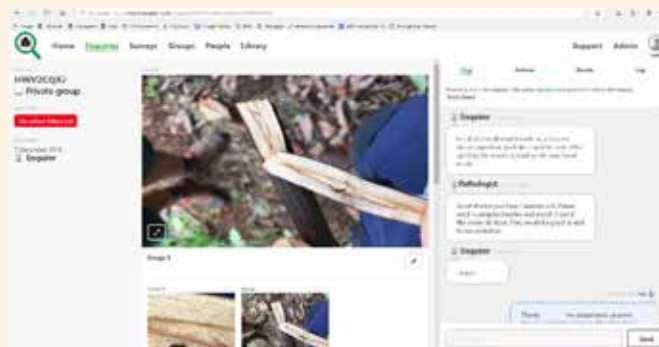


Figure 1. Use of Checkpoint for recording branch dieback of avocado trees associated with ambrosia beetles.

qPCR detection of the high risk biosecurity threat, avocado scab fungus

The avocado scab fungus, *Elsinoë perseae* (syn. *Sphaceloma perseae*), is a high priority biosecurity threat for avocados in Australia. Avocado scab results in premature fruit drop and reduced fruit quality, which heavily impacts marketability and can restrict market access to pest-free countries. Scab symptoms begin with scattered corky, raised brown to purplish-brown lesions or 'scabs' which coalesce as the disease progresses, causing deep brown fissures covering the fruit surface.

Although scab symptoms are recognisable, confirmation of presence of *E. perseae* can be difficult, as the fungus is slow growing and can take up to two months for the fungal colony to grow on culture media in a lab. There is a need for a rapid, real-time molecular detection test for *E. perseae* to enable rapid responses to potential incursions.

A real-time quantitative Polymerase Chain Reaction (qPCR) diagnostic test has been developed for the rapid detection of *E. perseae*. PCR-based molecular tests amplifies nucleic acid sequences (such as DNA) of target pathogens by making millions of copies of the target sequence using primers which bind to the target sequences and an enzyme which catalyses the reaction to make the sequence copies. The *E. perseae* qPCR test incorporates fluorescent probes which specifically bind to target DNA sequences, are cleaved by the enzyme and release fluorescent molecules for detection in the qPCR machine. Detection can be visualised in real time (Figure 2) as more fluorescent molecules are released during the DNA sequence amplification process. The molecular test also checks for potential user error in sample loading by including an avocado endogenous gene which is simultaneously detected; samples should always give a positive result for avocado DNA regardless of pathogen presence in the plant sample.

This project activity has resulted in having the diagnostic capacity to quickly respond to potential *E. perseae* incursions if it were to happen to the Australian avocado industry.

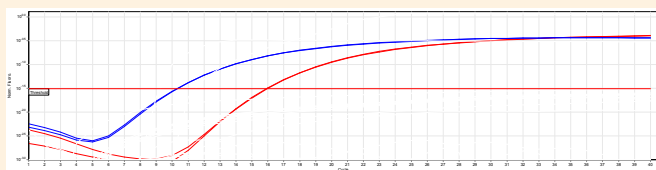


Figure 2 Real time qPCR amplification of *Elsinoë perseae*. The red and blue lines represent amplification of two *E. perseae* cloned DNA samples (target pathogen DNA was artificially synthesized and cloned for use in validating the diagnostic).

Fusarium spp.

Fusarium dieback of avocado trees in Australia is vectored by ambrosia (scolytid) beetles in the *Euwallacea fornicatus* cryptic species complex (a group of closely related organisms). In Australia, the beetle species is known as the Tea Shot Hot Borer (TSHB), and it is found in South East Asia, Australasia and parts of the USA. The beetles carry symbiotic fungi in their mouthparts, bore into tree branches and deposit the fungus onto xylem tissue within the brood gallery for beetles and larvae to feed. Symptoms of ambrosia beetle related branch dieback include pin holes on branches with leaf wilt and localised branch death due to the vascular damage caused by the fungus.

During the last decade, there have been sporadic infestations of TSHB in avocado orchards in Australia and it appears to be the most severe on the Atherton Tableland in Far North Queensland. This research is investigating the phylogenetic diversity and pathogenicity of *Fusarium* species associated with branch dieback of avocado and other woody tree hosts in Australia.

The project activities to date include ambrosia beetle and branch dieback surveys across growing regions in Queensland, in Far North and Central Queensland and the Sunshine Coast region. Fungal isolates were obtained from symptomatic heartwood of borer-beetle affected branches of avocado trees and other hosts (including macadamia, mango, blueberry, Acacia, Cupaniopsis, Cyclophyllum and Alectryon), and from *Euwallacea* sp. beetle specimens collected from tree branches and traps. Fungal isolates were then identified and the fungal isolate collection contains now 142 isolates and the genera found associated with branch dieback of multiple tree hosts including *Fusarium*, *Bionectria*, *Colletotrichum*, *Lasiodiplodia*, *Phomopsis*, *Nectria* and *Nigrospora*. The preliminary work on the *Fusarium* genus has identified a possible new species of *Fusaria* associated with ambrosia beetles. Formal classification and descriptions of the new fungal species will be carried out in the next phase of the project, along with pathogenicity testing of selected fungal isolates on avocado and alternate hosts to identify the causal agents of beetle-mediated branch dieback.

Avocado sunblotch viroid – a new project

In 2018, a review of the status of avocado sunblotch viroid (ASBVd) in Australia was published and strategies for achieving

pest-freedom status provided (Geering 2018). It was concluded that ASBVd is uncommon in Australia and is likely to be eradicated through continuation of disease management programs such as the Australian Avocado Nursery Accreditation Scheme (ANVAS). To date, the only records of ASBVd are from the Tristate region, northern NSW, south-eastern Queensland, and the Atherton Tableland. An ASBVd survey project (AV18007) has started, to provide updated data on the national distribution of the viroid, and will continue through to December 2021.

More information

If you would like to be a part of the Australian Avocado Plant Health network and/or trial the use of Checkpoint for your business, or if you suspect any of the biosecurity pest or diseases in your orchard or nursery, please email Louisa Parkinson (l.parkinson@uq.edu.au).

If you suspect you've found a new pest or disease, call the Exotic Plant Pest Hotline (Plant Health Australia) on 1800 084 881.

Further reading

Geering, A. D. (2018). A review of the status of Avocado sunblotch viroid in Australia. *Australasian Plant Pathology*, 47(6), 555-559. <https://doi.org/10.1007/s13313-018-0592-6>

Acknowledgement

This research is part of *Avocado industry biosecurity capacity building* (AV16010), funded by Hort Innovation using the avocado research and development levy and contributions from the Australian Government. This project is jointly supported by the Queensland Department of Agriculture and Fisheries (DAF) and the University of Queensland.



Improving avocado orchard productivity through disease management

Liz Dann, Akila Prabhakaran, Emily Lancaster, Kaylene Bransgrove, Montana Hickey & Eugenie Singh

The disease management project AV16007 started in November 2018 and concludes in May 2022. There are several activities being undertaken, across the major root, fruit and nursery diseases impacting avocado productivity in Australia. This article presents an overview of the project and update on experimental results obtained so far. More detailed research articles will be published in future issues of *Talking Avocados*.

Monitoring phosphonate residues in fruit

This activity is being conducted in collaboration with Graeme Thomas, GLT Horticulture, and several growers and agronomists across Australia who have kindly sent fruit samples for analyses. Hard green fruit was collected at commercial maturity from 40 blocks across Queensland and Western Australia. The ranges of phosphorous acid residues are presented in *Table 1*.

Table 1. Phosphorous acid residues in fruit harvested at commercial maturity in 2018

Region	No of blocks	Minimum phos. acid (mg/kg fresh)	Maximum phos. acid (mg/kg fresh)
North QLD	12	15	96
Central and southeast QLD	13	3	93
Southwest WA	12	53	210

The maximum residue limit (MRL) for fruit sold within Australia is 500mg/kg, so none of the fruit tested came close to exceeding domestic MRL. Growers and exporters should be mindful of MRLs imposed by our current and potential overseas markets of all crop protectants used within the orchard, (see the updated MRL comparison table at in the Best Practice Resource Library, under the Export heading (www.avocado.org.au/bpr/)). Results from the phosphonate residue testing have been communicated to participating growers and the Avocado Export Project Reference Group, and we are currently collecting Bundaberg/Childers fruit from the same blocks for the second year of testing. Information provided by growers on dates of phosphonate applications and concentrations in roots will be analysed with fruit residue data, providing important information on optimal delivery and timing of applications. We will also look for correlations with crop load (yield) and tree age.

Biofumigation for *Phytophthora* infested replant sites

A trial was initiated in northern NSW at a site where trees declining from *Phytophthora* root rot had recently been removed. Despite the high natural inoculum, we broadcast



Figure 1. Biofumigation trial site in Northern NSW. A length of black builders plastic covered half the row for two weeks after incorporation of the Brassica cover crops or chicken manure. Hass on Reed trees were planted two weeks after plastic was removed.



*Figure 2. Biofumigation trial 7 months after planting into a site heavily infested with *Phytophthora cinnamomi*. Trees planted into plots covered with plastic (left row) for 2 weeks after biofumigant incorporation are clearly healthier with fewer deaths than those planted into uncovered plots (right).*



Figure 3. Soft, ripe Reed fruit with severe fungal disease through to the seed cavity.

wheat grain colonised with *Phytophthora cinnamomi* to ensure consistent and even distribution of inoculum. A row (about 100m long) was cultivated and some plots sown with either Caliente 199™ or BQ Mulch, which are both Brassica cover crops commercialised specifically for their biofumigation effects, or left fallow. At flowering, the brassica crops were mown with several passes of the slasher and incorporated by rotary hoe. Chicken manure was incorporated into half of the fallow plots, and the other half left as untreated controls. One side of the row was covered in heavy duty black builders film, as shown in (Figure 1) for two weeks. Nursery trees (Hass on Reed) were planted two weeks after removal of the black plastic, with eight trees per treatment plot (four in each of the plastic covered and uncovered halves of the plots). Tree health and other growth parameters has been assessed at least monthly since planting. At six months after planting, the health of trees in covered plots was significantly better than those in uncovered plots (Figure 2), although there were no statistical effects amongst biofumigation treatments. We will continue to record tree health for the next couple of months.

Field trials to assess effects of new chemicals and soil amendments on tree health, fruit yields and quality

This is a major component of the project. Two trials in south-west WA and one trial in Central Queensland were established nearly 12 months ago in partnership with growers and agronomists. Treatments common to each site include woodchip + chicken manure + gypsum (as the recommended “best practice”), as well as Mineral Mulch (building board waste with high available Si and Ca, see *Talking Avocados*, Summer 2018) and anti-oomycete metalaxyl-M + unregistered product. There are additional microbial formulations, biochar and other mulches specific to each trial. Tree health assessments have been undertaken at each visit. Our first fruit harvest is coming

up in July for the Childers trial, with WA later in the year. We will be assessing yields and packouts for each treatment, as well as levels of postharvest disease, anthracnose and stem end rot. We will sample leaves, fruit and soil for major nutrients and look for useful correlations as potential predictors of tree health and fruit quality. The treatment programs and assessments at all sites will continue until the conclusion of the project in May 2022.

Stem end rot, graft dieback (nursery), branch cankers and branch dieback

A range of fungi are associated with fruit stem end rot, graft dieback (in the nursery and sometimes after planting), branch cankers and branch dieback. These include Botryosphaeriaceae family (eg. *Lasiodiplodia theobromae* and *Neofusicoccum parvum*), *Colletotrichum* spp., *Pestalotiopsis* sp. and *Diaporthe* sp. While we frequently isolate these fungi onto agar media, we have little knowledge about which are the most pathogenic, ie. cause the most severe disease, or how they enter the fruit or branch. A PhD student commenced in April 2019 to investigate the fungi associated with the different symptoms in the major growing regions of Australia. So far more than 200 isolates have been collected from several orchards and nurseries, and these will be accurately identified by microscopy and molecular DNA sequencing. Any patterns showing which fungi are more prevalent with a particular symptom type or region will be determined. Modes of infection will be investigated, eg, whether they are carried as symptomless infections in nursery trees (as “endophytes”¹), or enter via wounds or at flowering. A field trial in an unsprayed orchard in SE QLD is planned for later this year, where several treatments including fungicides and microbial/biological products will be sprayed at flowering and resulting fruit collected and assessed for development of stem end rot. This trial will also provide some information about new fungicides or products which may be safe to apply without burning sensitive flowers.



Figure 4a and 4b. Reed seed with discrete brown lesions caused by *Botryosphaeria* fungi.

Improving avocado orchard productivity through disease management continued



Figure 5 Endophytic fungi internally infect living plant tissues without causing any visible disease for at least part of their life cycle

Some preliminary lab and glasshouse work by an undergraduate student has shown that *L. theobromae* and *N. parvum* causing Stem End Rot and disease in fruit (Figure 3) are able to colonise the seed coat and seed (Figure 4). When these infected seed are planted (Figure 4b) the seedling stems are also infected by these fungi even though they may not show obvious symptoms.

This can potentially cause graft failure in the nursery (Figure 5), or dieback from the graft after planting, as the infection may remain dormant in the graft until trees are stressed. It is extremely important that nurseries collect only clean fruit and extract the seed when the fruit is still hard prior to ripening (but must be physiologically mature). This removes the seed coat and reduces the risk of transfer of these endophytic fungal pathogens. This recommendation has been included in the recently-revised guidelines for ANVAS nurseries, and is available in the Nursery Industry Accreditation Scheme Australia (NIASA) Best Management Practice Guidelines, 7th Edition, updated 2018, Appendix 13 Avocado High Health Production. The guidelines are an excellent resource for any nursery, and can be purchased for \$99 from <http://nurseryproductionfms.com.au/niasa-accreditation/>.

Other diseases and activities

The project also includes field and glasshouse experiments evaluating Trichoderma and fungicide drench management options for Phellinus brown root rot and black root rot (see *Talking Avocados* Spring 2017). There is also a significant industry support component including participation in grower field days and biosecurity advisory panels. We also interact directly with growers, agronomists and nursery operators and

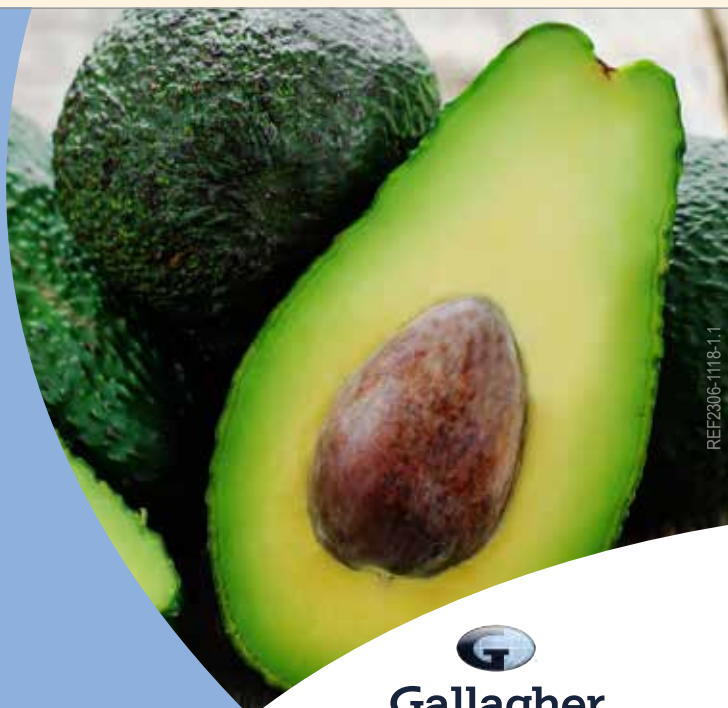
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process samples to assist with diagnosing diseases or non-disease disorders, which may be impacting tree health or fruit quality. One of the more challenging of these has been the tree lodging problem (see *Talking Avocados*, Summer 2019 edition for more on that), which most likely arose from planting root-bound trees, rather than from a disease.

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Acknowledgement

The *Improving avocado orchard productivity through disease management* (AV16007) project has been funded by Hort Innovation, using the avocado research and development levy and contributions from the Australian Government.

What is ANVAS?

The Avocado Nursery Voluntary Accreditation Scheme (ANVAS), was established in 1978 to foster sound nursery practices, the use of virus-tested sources of budwood (of primary concern was avocado sunblotch viroid), and the exclusion of soil-borne plant pathogens and root disease. The latter is particularly important, as root diseases can be present in nursery stock without obvious above-ground symptoms.

The scheme is managed by Avocados Australia. Accredited nurseries pay a fee to be part of the scheme, their trees (including roots) are routinely inspected, and they have to adhere to strict guidelines. Last year the scheme was reviewed and specific requirements for avocado production incorporated into the existing Nursery Industry Accreditation Scheme Australia (NIASA) certification framework.

To achieve ANVAS accreditation, the nursery must first have NIASA accreditation and meet the additional requirements in Appendix 13, (Avocado High Health Production). The nursery can then apply to Avocados Australia for recognition of ANVAS equivalence and be awarded ANVAS accreditation by Avocados Australia if appropriate. All nurseries are strongly encouraged to become ANVAS accredited, and growers are advised to source plant stock ANVAS accredited nurseries.

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Positioning for better management of avocado fruit drop

Amnon Haberman and Harley M. Smith, CSIRO Agriculture and Food

Avocado is a low yielding tree crop with average annual production levels equivalent to approximately 10t/ha, which is considerably lower than the theoretical value of 32.5t/ha, as estimated by Wolstenholme 1987. Low yields are attributed to the semi-domesticated nature of avocado¹, due to unfavourable traits including vigorous shoot growth, excessive flowering, low fruit set and high fruit abscission^{2,3}. In addition, avocado has a high propensity for alternate (biennial) bearing⁴. The predicted rise in global temperatures will likely enhance these traits and further reduce annual yields⁵. Together, the additive effects of these yield-associated traits limit production and present a major challenge for Australian orchard management for maximising yields and reducing seasonal variation.

Challenges in Australian avocado production

Yield associated traits are controlled by the interaction between the genetics, climate and management inputs⁶, as well as the age of the tree. To increase Hass yields, new management tools must be developed to reduce the impact of excessive vigour, low fruit set, high fruit abscission and biennial bearing. To achieve this, it is necessary to have a basic understanding of the physiology that drives these yield associated traits. Fruit abscission is a central component controlling fruit production and this process is poorly understood in avocado, as well as other fruit tree crops. Therefore, this article is focused on fruit drop, which is the major aim of the Hort Innovation funded project, AV16005.

Early fruit abscission

During the early fruit abscission event, a majority of fruitlets abscise within the first five weeks after fruit set^{7,8}. The initial phase of the early fruit drop event is due to the abscission of

unfertilised fruitlets⁷. The later phase of this fruit abscission event involves the abscission of fertilised fruitlets, typically between 6-10mm in size. Growers estimate that approximately 30-50% of the fertilised fruitlets drop during the early fruit abscission event.

Interaction between the spring flush and developing fruitlets

Due to the coincidence of vegetative and reproductive growth in the spring, it has been proposed that the early fruit abscission event is mediated in part by the growing spring flush, which competes with the developing fruitlet for photosynthates and nutrients (reviewed by Salazar-García et al. 2013). In support of this hypothesis, Salazar-García and Lovatt (1998) reported that 'functionally determinate' inflorescences are three times more productive than indeterminate inflorescence shoots. Paclobutrazol and uniconazole are growth retardants that reduce stem elongation and leaf expansion via inhibition of gibberellin biosynthesis. As elongating stems have a high growth potential, an increase in yield by applications of paclobutrazol at flowering was associated with an augmentation in the number of fruits^{11,12}. Applications of paclobutrazol also increased fruit size, which also contributes to higher yields¹³. However, other reports showed that applications of paclobutrazol, as well as uniconazole, at flowering did not increase yield¹⁴⁻¹⁶. In addition, studies showed that removal of the spring flush or applications of paclobutrazol increased fruit set; however, yield was not increased due to a heavy fruit drop during the summer in the treated trees^{17,18}. The discrepancy of the effect of paclobutrazol and/or uniconazole on fruit drop and yield demonstrates the underlying complexity of the early fruit abscission event and mechanism(s) that mediates resource (carbohydrates) distribution to actively growing tissues in the tree.

Challenges for studying the early fruit abscission event

One of the major challenges for studying the early fruit abscission event is the low rate of fruit set followed by a high rate of fruitlet drop (reviewed by Salazar-García et al. 2013). The combined effect of these two traits severely reduces the ability to directly compare developmental profiles between retained and abscising fruitlets. This is extremely important, as studies in model plant systems show that early fruit development is marked by massive changes in fruit physiology, including hormone signalling and gene expression^{19,20}. Therefore, if retained and abscising fruits are not collected at the same developmental age, then it becomes extremely difficult to compare the physiological differences in order to identify the key factors that mediate abscission. Moreover, this hindrance also obstructs the ability to effectively study the interaction

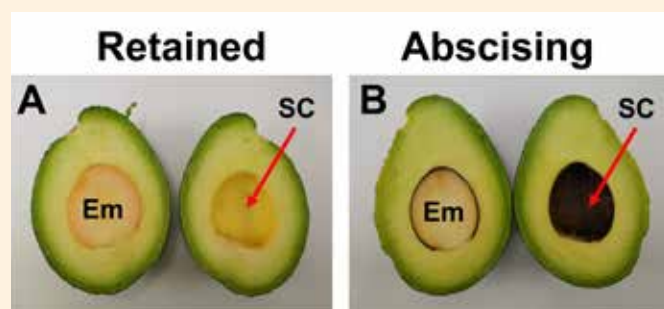


Figure 1. Seed coat senescence is associated with fruit drop. Fruits firmly attached to the tree (A) display little seed coat senescence compared to fruits undergoing fruit abscission (B). Embryo, Em; seed coat, SC

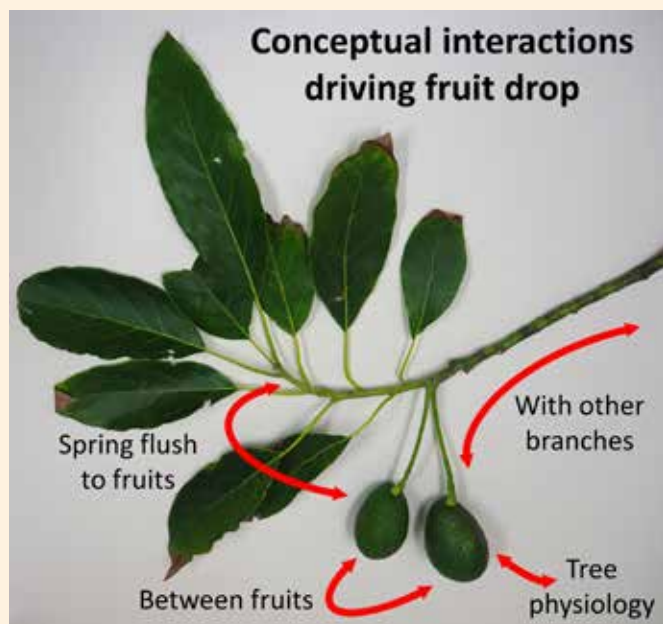


Figure 2. An illustration of resource competition based on an avocado branch with two developing fruits and a vegetative spring flush. Red arrows indicate conceptual interactions between growing vegetative and reproductive units of the shoot that are implicated in the regulation of fruit abscission.

between the vegetative flushes and developing fruits. However, a basic understanding of the physiological basis of the summer fruit drop event will likely apply to the early fruit abscission event.

Summer fruit drop

The integration of genetic determinants, climatic events and management practices has impact on tree physiology and resource (carbohydrates) availability. As tree carbohydrate levels are essential for growth, the adjustment of crop load in response to resource availability is hypothesized to be a major factor that regulates the summer fruit drop event^{3,21}. Therefore, understanding how tree crop load is adjusted in response to resource availability and the physiological mechanism(s) that mediate fruit abscission may provide the knowledge required to develop new management tools to reduce fruit drop and increase production. Moreover, new management tools aimed at reducing the summer fruit drop will likely be effective for reducing the early fruit drop event.

Role of seed coat in fruit abscission

Experimental studies demonstrate that seed development is required for fruit retention and development^{7,8}. The seed coat is the maternal component of the seed, which functions to provide the embryo with photosynthates and nutrients required for growth²². Moreover, the seed coat also synthesises plant growth regulators/hormones critical for regulating embryo development (reviewed by Bower and Cutting 1988; Robert et al. 2018). Interestingly, seed coat senescence is an observable

characteristic associated with abscising fruits^{8,25} (Figure 1). Therefore, the seed coat function appears to be a critical tissue that determines the fate of a fruit, retained versus abscised.

Model of fruit abscission

We have developed a model to explain fruit abscission in avocado. In this model, a subset of fruit in a tree undergoes abscission in response to a resource availability signal(s). As pointed out above, the physiology of the tree is speculated to be a key determinant of fruit drop (illustrated in Figure 2). In addition, competition for resources between fruits and with shoots also drive fruit drop. At this time, the nature of this resource availability signal(s) is unknown. The fruit abscission event is viewed as a multistep process in which the resource availability signal(s) mediate fruit growth cessation.

Given that the seed coat plays a major role in fruit development and senescence of this tissue is associated with abscission, it is highly likely that seed coat mediates the cessation of fruit growth. After growth cessation, the seed coat undergoes senescence and the abscission zone is activated in the pedicel, which leads to the physical separation of the fruit from the tree. Therefore, the primary event of fruit abscission is fruit growth cessation, while the secondary event involves the process that mediates fruit drop. Based on this model, fruit abscission can only be reversed during fruit growth cessation. Once seed coat senescence is initiated, the cessation of fruit growth cannot be reversed. Therefore, in order to develop new tools to limit fruit abscission, an understanding of the physiological basis of fruit growth cessation is required.

The AV16005 Hort Innovation funded project

The primary aim of the AV16005 Hort Innovation funded project is to study the physiology of fruit growth cessation, as well as seed coat senescence and fruit abscission. However, we are lacking the capability to distinguish fruits fate to develop to maturity from fruits targeted for abscission, during early stages of fruit growth cessation. To overcome this problem, trials were performed to identify treatments that would induce a massive fruit drop event by limiting carbohydrate availability. Results from these trials showed that extensive removal of new vegetative growth promotes a massive fruit drop event. Using this approach, different fruit tissues, as well as pedicels and stems, were collected at regular time intervals from treated and control trees.

We are currently analysing the tissues using analytical and molecular methods to identify candidate hormones, metabolites, carbohydrates and genes that correlate with fruit growth cessation. This information will be integrated and used to construct the physiological and developmental pathways that mediate fruit growth cessation. Finally, these pathways will be incorporated into the model above, which will serve as a knowledge base for developing new management tools to limit fruit abscission.

Positioning for better management of avocado fruit drop continued

We acknowledge and thank the contribution of Jasper Farms (WA), Delroy Orchards (WA), Chinoola Orchards (SA) and Thiel Orchards (SA) to the project and technical assistance from Jacinta Foley (Jasper Farms) and Declan McCauley (WA DPIRD).

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World first avocado tissue culture system

Plant tissue-culture (TC) is a cost-effective means of plant propagation that has been widely applied in the horticulture and forestry industries. It is a principal technique for propagating a number of herbaceous crops such as banana and strawberry, and has been successful with tree crops including apple, apricot, cherry and peach (Mohamed-Yasseen, 1993; Dobránszki and da Silva, 2010; Balla and Mansvelt, 2013; Carrasco et al., 2013).

The process of plant tissue culture begins with collecting explants, such as buds or shoot tips, from a high-quality field selection (mother-plant), cleaning and placing these on a sterile, species specific nutrient-rich medium in a controlled environment growth room (Figure 1; Murashige, 1962; Smith, MK & Drew, RA 1990). By providing the perfect conditions for shoot and root growth, these explants will multiply into new plants that are genetically identical to the mother plant. For some species, hundreds to thousands of clonal plants can be produced from a single shoot-tip, making this process extremely high-throughput and resource-effective.

The growth of the avocado industry has increased the demand for plants and placed increasing pressure on traditional propagation capability. We are aware that there are often extended waiting periods for nursery trees, especially on the highest quality rootstocks. This is particularly problematic for propriety rootstock selections such as DUSA®, which must be clonally propagated – a technique that is time-intensive and rate-limited by a number of factors including season (nurse seed-dependency), nurse-plant graft-take and rooting strike rate.

Tissue culture has the potential to address problems in avocado propagation through large-scale propagation of clonal rootstocks with no reliance on seasonally-restricted and heterozygous (non-uniform) seed. Importantly, as the plants are raised in a soil-free, sterile environment, tissue culture can also produce planting material free from pests, fungi and bacterial disease.

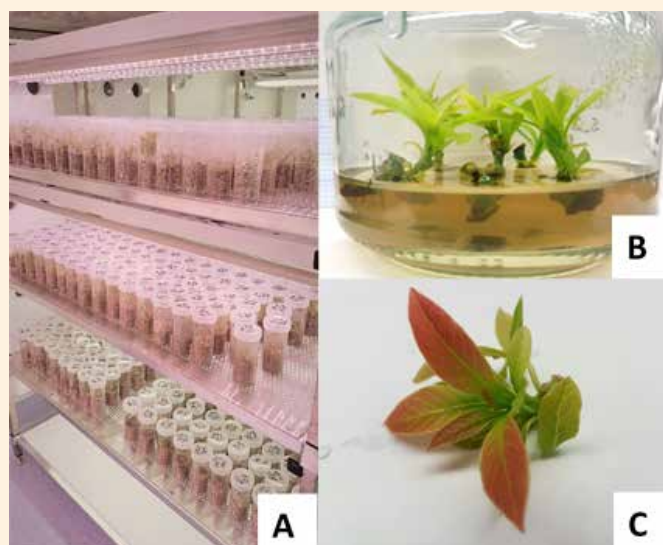


Figure 1. Example of tissue culture: (A) TC controlled environment room, (B) nutrient media with nodal bud shoots, (C) single shoot (avocado rootstock Velvick).

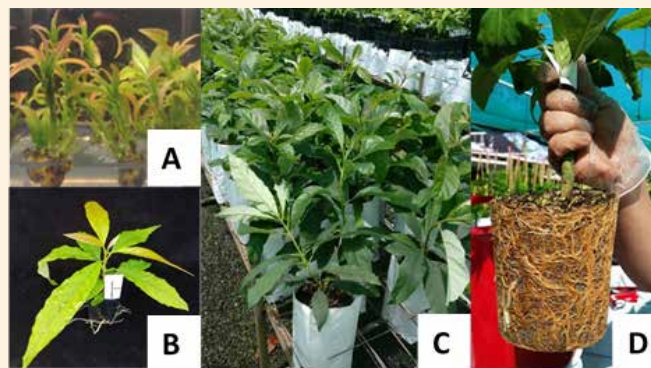


Figure 2: Avocado cv. Reed mature tissue culture pipeline showing (A) shoots on media, (B) rooted and potted plantlet, (C) plants transferred to nursery conditions for grow-out, and (D) root system of TC plant prior to field planting.

Given these advantages, researchers globally have been working on avocado tissue culture for over 50 years, however, no-one has been successful using mature tree material (Hiti-Bandaralage et al, 2017).

World first avocado tissue culture system

At the Queensland Alliance for Agriculture and Food Innovation, The University of Queensland (UQ), we have developed the world's first successful pipeline for avocado tissue culture. With ARC-Linkage funding, our team of researchers, growers and the Queensland Department of Agriculture and Fisheries demonstrated complete proof-of-concept from lab to Orchard. Our system can produce up to 500 clonal plants from a single shoot-tip in culture within 8-12 months. Now, with funding from an Advance Queensland Innovation Partnership (AQIP), we have teamed with Central Queensland University (CQU) and the University of Southern Queensland (USQ) to deliver this technology.

Here, we wish to briefly showcase this technology to Australian avocado growers and reveal the results of our first year of field trials.

Technology development using proof-of-concept with cv. Reed

Our first success with avocado tissue culture was achieved with the commonly available rootstock Reed (Figure 2) and is being adapted for other desired rootstocks including Velvick (Figure 1 C). The process starts with the introduction into culture of a single shoot tip from a mature tree. This is multiplied into many shoots, followed by root formation, and nursery hardening for grafting. For Reed we can produce 500 rooted shoots from a single shoot tip, with 100% rooting success. As such this system is demonstrated to produce clonal plants at a scale many orders of magnitude greater than traditional propagation practise.

World first avocado tissue culture system continued

Field trials of tissue cultured plants

We are now in the stage of field trials for our first tissue cultured Reed rootstocks grafted with Hass scion, and have other cultivars including Velvick and Zutano in the pipeline. To our knowledge, these are the first field-plantings of tissue cultured avocado in the world. Although Reed is *Phytophthora* susceptible and not the favoured cultivar for most growers, these trials allow us to assess the potential for tissue cultured rootstocks for commercial avocado production, while we continue to develop technology for the more desired cultivars.

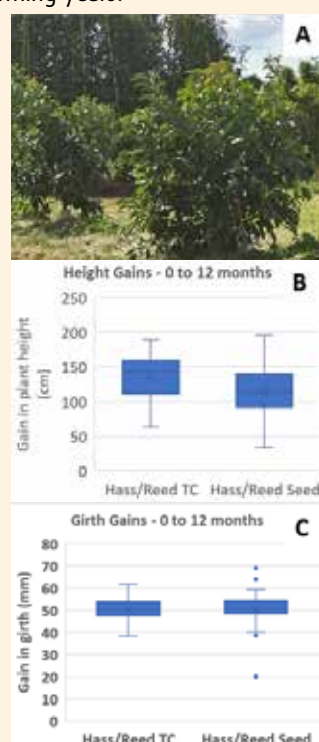
All trials are randomised block design, replicated across five different growing regions in Australia, with our project partners in Central Queensland, Northern NSW, Western Australia as well as pioneering growers in Far-North Queensland adopting the scion cultivar Maluma© more suited to tropical conditions. We will be collecting data on plant height, basal stem girth, canopy area, branching, flowering load and eventually fruit yield. Here we present some of our first set of data, recently collected from our first trial to reach 12 months old, located in Childers, Central Queensland (Figure 3). This site has Hass grafted on Reed TC rootstocks alongside traditional Reed seedling rootstocks as the commercially available control.

To date, our analysis shows no significant differences in the growth of our TC rootstocks alongside conventional seedling rootstocks at this location. This early data suggests that the immediate growth and performance of TC rootstocks is equal to that of commercially available plants of the same cultivars in Australia. We will soon be collecting data from our WA and Far N Queensland sites, to assess the stability of this performance across locations. We look forward to quantifying the results for flowering and fruit yield in the coming years.

Conclusion

The inefficient propagation of avocado plants for commercial production currently represents a bottleneck for intensification of avocado production globally. We present here the world's first avocado tissue cultured

Figure 3. Childers Reed TC rootstock trial. (A) Plants in the field at 12 months, (B) gains in height and (C) gains in girth over the 12-month period. Trials are randomised block design with statistical significance calculated on 43 replicate plants per group using 1-way Anova.



rootstocks, able to be produced in large scale from a very small amount of starting material and free from soil, seed and seasonal constraints. Our early field data suggests that TC rootstocks grow similarly to conventionally propagated rootstocks within the first year of planting. This shows promise for delivering a breakthrough technology to address the industry challenge of plant demand, to support future industry expansion.

Survey Link – views on tissue culture

In collaboration with our project partner CQUniversity, we invite you to complete a short 10-minute survey that asks a series of questions, in order to capture views, knowledge, experiences and perceptions around the potential role of tissue culture technology for the avocado industry. Your participation is anonymous and will enable detailed understanding to support industry needs. The survey is available here:

<https://www.surveymonkey.com/r/TCAvoSurvey>

Further information

We welcome anyone who would like more information to contact Prof Neena Mitter at QAAFI, UQ (<https://qaafi.uq.edu.au/>) at n.mitter@uq.edu.au or on +61 7 334 66513.

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News from Around the World

News from Around the World contains reproduced articles that have been published by various international news sources.

Colombia Hass avocado producers can access to Japan and China

As of July 31, the Colombian Hass avocado can be exported to Japan, according to the Colombian Ministry of Agriculture, Forestry and Weighing.

The Minister of Agriculture and Rural Development, Andrés Valencia Pinzón, said more borders would be opened for Hass avocados, thanks to the policy of sanitary diplomacy and use of strategic markets of President Iván Duque.

The head of the agricultural portfolio said that "these are the results that sanitary diplomacy ... and in which we are committed so that our agricultural products reach other markets, as in this case with the Hass avocado.

In another win for Colombia, on the day the Japanese market access officially opened, China also announced access.

Mr Pinzón said exporters would have to subscribe to a work plan, to meet the required sanitary protocols.

He said the first six containers of avocado would be sent this year, and he believed his country could compete with other suppliers in the market.

The Department says Hass makes up 21% of the total avocado area planted in Colombia, which represents about 15,530 hectares. Colombia also expects its annual production will rise as only 68% of the avocado area is currently at a "productive age", with the rest still in a development stage.

Smart tech could improve Indian cool chains

Harnessing smartphone technology so that Indian farmers make better business decisions could help to tackle the sustainable cooling challenge facing India and the wider world, according to a new report launched in April 2019.

Using mobile apps and data analysis to manage harvesting and logistics could help to reduce the amount of food wasted between farm gate and supermarket shelf, whilst boosting farmers' incomes and reducing the environmental impact of much-needed food cooling.

The recommendation is part of a four-point 'roadmap' developed by experts at the University of Birmingham in the UK, working with the Shakti Sustainable Energy Foundation and MP Ensystems to uncover the cooling needs of farmers in the Indian states of Haryana, Punjab, Maharashtra and Karnataka.



Grower Member Application Form

Avocados Australia Limited

ACN 105 853 807

The Australian avocado industry is a growing, successful and progressive industry. As the Australian avocado industry's peak industry body we work closely with all of the stakeholders that can have a direct impact on the marketplace. If you are looking to gain the maximum benefit from being a part of the Australian avocado industry we recommend that you become a member of Avocados Australia.

Avocados Australia provides online and offline information, programs, materials and events to advance the industry. On top of this there are other services we can provide that are only made possible through the support of our members. Join today. All membership enquiries can be directed to admin@avocado.org.au or call toll free 1300 303 971.

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and/or trading name:

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Key contacts:

Preferred address
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Address of property
(if different):

Contact Details

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Grower Member Application Form continued

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 ☐ Partnership
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 ☐ Cooperative
☐ Other (please specify) _____

Please indicate the area of property that you crop for avocados (please tick)

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 ☐ 6-19 ha
 ☐ 20-49 ha
☐ 50-99 ha
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 ☐ 150-199 ha
☐ 200-499 ha
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Expiry date: _____

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(no stamp required within Australia)

Or email admin@avocado.org.au

For more information or assistance please go to www.avocado.org.au or call on **07 3846 6566**

The problems in India are acute: up to 50% of food is lost post-harvest because of lack of cold chain. The report highlights that only 4% of produce that would benefit from a cold-chain actually does so, compared with around 70% in the UK.

National Centre for Cold-chain Development CEO and Visiting Professor at the University of Birmingham Pawanexh Kohli said cold-chains enhanced economic wealth, cash flow and security for farmers and improved food quality, safety and value to the customer.

Asiafruit reports that India currently possesses only around 11% of the total cold storage capacity demanded by the country's perishable produce industry.

Effective refrigeration is essential to preserve food and medicine. It underpins industries and economic growth, while air conditioning is key to sustainable urbanisation and human productivity and makes much of the world bearable – or even safe – to live in.

Krishan Dhawan, CEO, Shakti Sustainable Energy Foundation said cold chains were expected to grow rapidly in the next couple of years.

“The way forward is for India to transition to cleaner and more efficient cold chains, in order to tackle climate change and to achieve wider socioeconomic benefits.”





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