

AUTUMN
2021

VOLUME 32
Nº1

Talking Avocados

THE HISTORY OF
SHEPARD IN AUSTRALIA

EXTENSION EVENTS
RETURN

OUR GREEN GOLD
MARKETING CAMPAIGN
LAUNCHED

Talking Avocados

is published by:

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Contents

4 CHAIR'S PERSPECTIVE

5 CEO'S REPORT

6 AROUND AUSTRALIA

10 NEWS

EXTENSION NEWS

- 10 Regional Forum's exciting return
- 13 Avocados Australia special Member event success
- 14 The "A" to the "O" of avocados back in 2021!
- 15 Hort Innovation launches extension team
- 16 Irrigating avocado with less water

DATA NEWS

- 17 Building confidence in industry data
- 19 Hass results from the 2020-21 season

EXPORT NEWS

- 21 New export project to take industry to next level
- 22 New system ready for Japan season
- 23 Australian avocado export and import report 2020
- 24 2020 export market analysis

GENERAL NEWS

- 29 2020 – The year everything about fresh produce consumption changed
- 31 Finding a home for Shepard – the Australian story
- 37 Vale Brian Watson 1937-2020
- 39 Elevating Work Platforms – safety first!

WHS NEWS

- 42 Farm safety and WHS updates

BIOSECURITY NEWS

- 45 Fall armyworm may opportunistically target avocado
- 48 Permit update for lepidopteran pest control

50 MARKETING UPDATE

- 50 Marketing Australian avocados

55 RESEARCH AND DEVELOPMENT

- 55 Fruit quality trace-back casestudy
- 57 Procado®: a new Australian avocado rootstock
- 65 The proportion of self-pollinated Hass fruit increases at greater distance from another cultivar
- 68 Crop count research
- 70 Riverlands and Adelaide Hills tree crop map updated
- 72 New intensification project underway
- 74 Snapshots – International Avocado Research Update

77 INTERNATIONAL NEWS

- 77 Growth and sustainability on New Zealand agenda

COVER IMAGE: Ray Kensington, Avos R Us, Hampton, hosted the orchard walk at the South Queensland forum. Read more on page 10.

CHAIR'S PERSPECTIVE

Jim Kochi, Avocados Australia Limited



As an industry, we can do everything right, but it doesn't help the average consumer identify an Australian avocado. Once again, I encourage everyone to use the industry's Kangaroo Label, to make it easy.

We have a new marketing program (more on Our Green Gold on page 50), funded by our marketing levies. As growers, it's not enough to pay the levies and move on. We have to continue to support the marketing efforts with our own. Part of that picture (especially this year when production is so high) is delivering a quality product. The other part is making it very easy to our customers to recognise an Australian avocado when they see it.

This is why we're avocado growers, so we can sell our fruit to Australian consumers (and also our international avocado admirers).

If there's one simple thing growers can do to protect their business, it's to make it clearer than clear that this avocado is Australian. It's green and gold, and locally grown. There's not much more Australian than the kangaroo. Avocados Australia is also exploring opportunities to leverage greater value between the Australian Avocado branding, the Our Green Gold marketing campaign and the Kangaroo Label, supported by the soon to be completed consumer research.

As we push toward 23 million trays (or more) in production, we're going to have to step up our game.

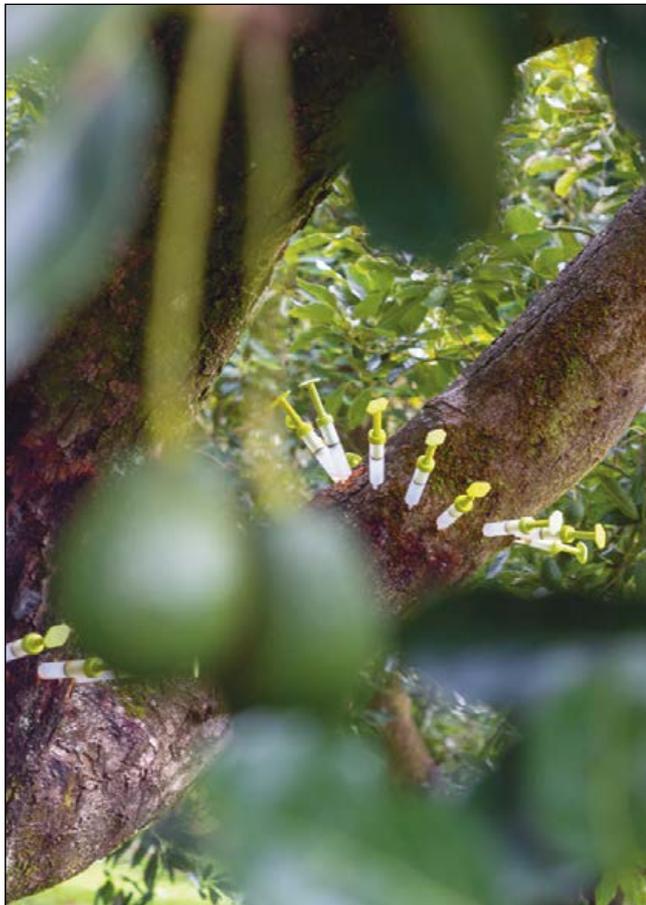
And as I've mentioned, it's not just about our Australian consumers. They are definitely the foundation of our industry and until this year, the fact that Australians have bought more than

95% of our production has perhaps made us slightly complacent.

Our marketing team at Australian Avocados is currently undertaking research into why consumers in our key international markets (Hong Kong, Singapore and Japan) prefer Australian avocados. We're going to be identifying our unique selling proposition in those markets to help increase the consumption of Australian avocados internationally.

And we need to do the same thing here in Australia. It's up to all of us to remind Australians about why they love an avocado, why they want to smash an avo, why avocados are our green gold.

Make it easy for them: deliver quality and brand it.



AONGATETE AVOCADOS LTD ARE SUPPLIERS AND EXPERTS IN THE AVOJECT® SYRINGE

The proven low pressure method for effective phytophthora control in avocado trees.

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CEO'S REPORT

John Tyas, Avocados Australia Limited

Marketing and quality go hand in hand

This is the year where we really start to see how an ever increasing Australian avocado harvest will impact on the market.

Almost all of our production regions are set for a bumper harvest in 2021, and the impact is already being seen from the prices paid to growers, through to the prices paid by consumers.

2021 is really going to be a sample of what's to come. In the next three months, our production is forecast to be 50% higher than the same time last year.

Avocados Australia was instrumental in increasing our industry's marketing spend this year, successfully arguing via the relevant Strategic Investment Advisory Panel that it's necessary for Hort Innovation to pull out all the stops this year.

Why? Because most Australian growing regions are expecting significant output increases for the next 12 months. In total, it's forecast national production could reach 19.7 million trays, between April 2021 and March 2022, 65% more than same period a year ago.

We're definitely on track to harvest at least 115,000 tonnes a year by 2025. With about half of all plantings in Australia yet to reach full production, and new areas still being developed, the long term trend is for ongoing increased production.

What does this mean? It means there is no market for poor quality fruit in 2021. We need to meet consumer expectations to continue to drive demand.

We encourage growers to maintain regular and open

communication with their supply partners on regarding market dynamics.

New Board member

Rob Wheatley from AustOn Corporation has been appointed to fill the casual vacancy left on our Board, with the resignation of Dudley Mitchell as our Western Australian Director.

Rob is the Chief Operating Officer for AustOn, the Australian agricultural arm of the Ontario Teachers' Pension Plan. As a highly experienced and proven agri-business manager with a history of working in the horticultural industries within Australia and New Zealand, Rob is already proving to be an asset to the Board. He has expertise in the management of supply chains, large farm management, agronomy, fruit processing, logistics, and industry leadership.

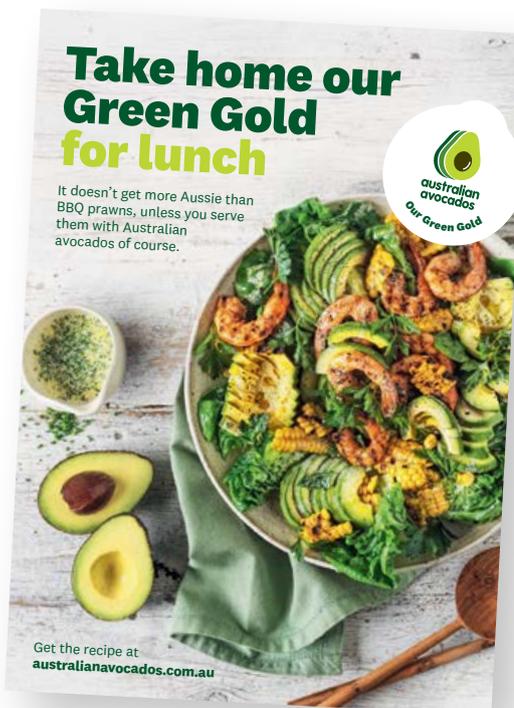


Avocados Australia members will vote to fill this position for a full term at the November 2021 elections.

New industry players

Do you know a new grower who isn't receiving industry communication or doesn't have access to our extensive best practice information? We encourage you to recommend they subscribe (for free) to the fortnightly *Guacamole* newsletter, for the monthly *Avo Alerts*, and for this magazine.

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.



Avocados Australia Director Daryl Boardman, CEO John Tyas, Market Development Manager Hayleigh Dawson and Toowoomba Chamber of Commerce CEO Todd Rohl provided updates to the organisation's members at the Crows Nest breakfast on 24 March. See more photos from this special member event on page 13.

AROUND AUSTRALIA



TRISTATE

By Kym Thiel

With summer now well and truly behind us it's a case of asking ourselves "what summer" here in the Tristate!

Temperatures were well below average, meaning trees had the ideal setting conditions and the ability to carry the exceptionally heavy crop that had set in the region. This means that personally I believe the Tristate is on track to grow the largest crop seen for a number of years if not ever. Certainly, it will be the largest crop in the past 10 years, and I expect us to get very close to the one million tray mark. Coupled with a very large crop out of Western Australia, it will be the first real "test" of the market for quite some time and growers should ready themselves to maximise any market opportunities should they exist.

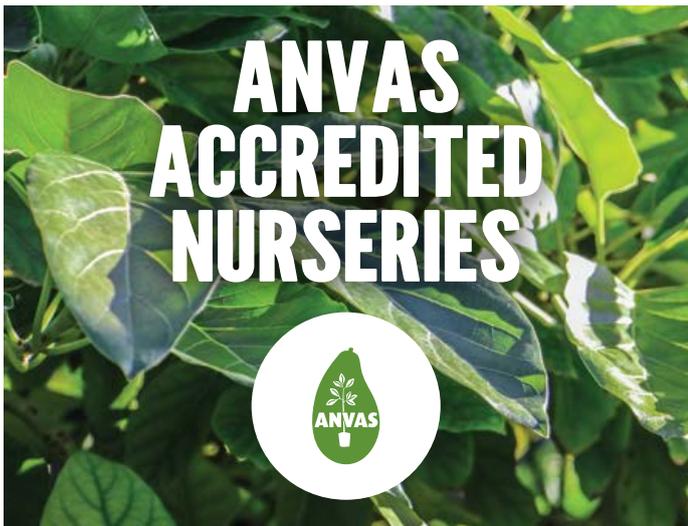
Fruit quality promises to be good with the dry conditions and calmer than average summer winds meaning blemish is better than two years ago. Although the summer was mild, it was also very dry locally but given that, fruit size still looks to be good. All markets will be catered for, even hopefully export markets which are incredibly important given the heavy crop, and the large but not yet fully productive orchards that are set to come into production.

Fruit fly position funding

From 30 June 2021, the South Australian Avocado Growers Association (SAAGA) will help to fund the regional fruit fly position currently held by Brett Kennedy. This position is jointly funded by PIRSA and commodity groups in the Riverland, including citrus, wine grapes and stone fruit growers. SAAGA have negotiated a rebate from Opal packaging on all products purchased specifically by South Australian members who hold a contract with Opal. Therefore, I encourage all members to utilise the Opal products where possible. The regional fruit fly position is an incredibly important one given the level of detections and outbreaks in the past six months.

New marketing campaign

The avocado industry has been looking to rebrand the Aussie Avocado image and for those who have taken the opportunity to watch the concept video (in the BPR Library, under the marketing heading) I hope you are as impressed as I am with everything *Our Green Gold*. We have been talking for a while now about differentiating Aussie fruit in these future heavy years and how to best promote our Australian avocados. It seems everyone has their own opinion on the value of this, but one simple way is of course the usage of the Kangaroo Label which is also undergoing a revamp; get in touch with the Avocados Australia office for further information.



ANVAS ACCREDITED NURSERIES

**ANVAS ACCREDITED TREES
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Contact: Daniel Abbey | Ph: 0438 390 441

Fleming's Nurseries Qld
71-83 Blackall Range Rd, Nambour, Qld
Contact: Liz Darmody | Ph: 07 5442 1611

Turkinje Nursery
100 Henry Hannam Drive, Walkamin, Qld
Contact: Peter and Pam Lavers | Ph: 0419 781 723

The **Avocado Nursery Voluntary Accreditation Scheme** provides a contemporary approach to high health avocado nursery production, providing greater confidence for growers about the health status of plants sourced from accredited nurseries.

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

It promises to be a very busy spring and summer for all Tristate growers.



CENTRAL NEW SOUTH WALES

By Ian Tolson

As reported previously, the drought had been well and truly broken before Christmas 2020. Major rainfall events have been occurring since then. From

December 2020 to the end of March 2021, more than two metres of rain has fallen across the region. Major flooding, erosion and landslides have wreaked havoc from Bellingen to Comboyne. The main road used to Comboyne may not re-open before Christmas 2021!

With the local 'water table' filled beyond capacity, the lower parts of orchards became water logged, our local township had evacuations and three weeks post rainfall, low lying areas are still struggling with the excess water.

Tree and crop losses will be experienced. At this point, it's a case of 'wait and see' to find out just how devastating these floods have been. Considering some areas recorded over 1000mm in a week, it could have been far worse.

Orchard management to recovery is now paramount.

On a more positive note, the sun has shone for five consecutive days as I write this in mid April, accompanied by some wind, which should start to dry things out.

Not really much more to say, except to remind growers of the usual: strive for premiums, make sure your dry matter test meets the requirements before picking, remember, those whose QA is Freshcare, the new version is 4.2.



Flooding impacted on parts of the Central New South Wales this year.



SUNSHINE COAST

By Robert Price

Here on the Sunshine Coast, our fruit growth is going well, but the fruit does seem to be reaching development stages at different timings to the normal.

This will make water management even more important, especially as we have been experiencing dry weather and some of our region's major dams are not full. There is the very real possibility of restrictions later in the season. If you are concerned, I could encourage you to read the article by Victoria's Jeremy Giddings on page 16, to help map out your options. There is also information about irrigation in dry times within the Growing module of the Best Practice Resource (under "irrigation").

One somewhat bright note so far is that we are not experiencing many issues with regard to labour. This may change in future and I would encourage everyone to heed the advice in the last edition of *Talking Avocados* and be ready to advertise earlier, and more widely than we've perhaps had to previously. It's possible that this national labour shortage will hasten the adoption of orchard automation, as we've seen in the news with other industries, such as apples in Tasmania, and various vegetable crops.

We are also going to have to keep an eye on quality in the coming year, as contributors would have seen in the latest quarterly *Infocado*. The total volume for April 2021 to March 2022 is expected to increase by 60+% nationally, compared to the previous period. While the Sunshine Coast's increase is more modest than some regions, it's clear there will be a lot of fruit in the market this year.



TAMBORINE AND NORTHERN RIVERS

By Tom Silver

It has been a tough late growing season for the Tamborine and Northern New South Wales growing region. Extreme rainfall events coupled with what

seemed like a never-ending run of overcast or wet days has left many orchards suffering the effects of prolonged water logging and early signs of phytophthora flare ups, even in well managed orchards.

This has been tough on growers who have endeavoured to follow best practice over the years with great results only for Mother Nature to rule otherwise. I expect some orchards will struggle to recover from the February and March rainfall events and may even need to be removed. A new article has been added to the BPR to help with managing avocado

orchards impacted by extreme rainfall events – [avocado.org.au/public-articles/managing-wet-weather/](https://www.avocado.org.au/public-articles/managing-wet-weather/). This article provides links to the host of useful resources in the Best Practice Resource as well.

For those in New South Wales, don't forget you can also apply for a special disaster grant of up to \$75,000 (conditions apply, obviously), from the Rural Assistance Authority. More information here: raa.nsw.gov.au/disaster-assistance/special-disaster-grants-floods. These grants are for clean up, reinstatement of activities and emergency measures, and can be used for replacing lost or damaged plants and repairing fields. Just a reminder, you can get the first \$15,000 without invoices, but you do have to provide them eventually. And while the grant can't be used for expansion, the guidelines do say "this should not prevent sensible preparation for future events".

Harvest in our region will soon be well underway, and as always I encourage all growers to be aware of their fruit quality, and give customers a reason to keep coming back for repeat purchases. Labour shortages due to the COVID-19 pandemic and its subsequent effect on the traditional backpacker worker pool I expect won't have the same impact upon this growing region like it may have on others, however, if you have relied upon backpackers as a worker source in the past, it is important to start locking in your harvest workforce now especially if you are expecting a large crop. I wish all growers the best of fortune for the upcoming harvest.



WESTERN AUSTRALIA

By Rob Wheatley

As the newest addition to the Avocados Australia Board, I would like to take this opportunity to introduce myself.

I am the Chief Operating Officer for AustOn, which is the Australian agricultural arm of the Ontario Teachers' Pension Plan. I have an extensive history with horticulture in New Zealand, and across Australia, and I'm looking forward to being involved in the avocado industry.

As my fellow West Australian director, Brad Rodgers, pointed out in the last edition of *Talking Avocados*, we have a big national crop coming in 2021, and that includes from Western Australia. In the latest quarterly *Infocado* report, your forecast information puts the WA crop at 233% larger than it was for the previous April to March period, with more than eight million trays forecast.

I would encourage every grower to submit their crop estimates with reasonable accuracy as the information derived from this will help marketers employ good strong sales programmes/strategies that will aid the maximisation of returns to growers. Transparency is the key to this to enable the industry to plan and sell large volumes of fruit.

We will need to keep our focus on quality as our consumers are going to find a lot of avocados on retail shelves in the coming 12 months.

One key component of our preparation for this season is going to be workforce. As is already being experienced by other regions and other industries, we have a very much reduced pool of labour available this year. If you are planning to use the Seasonal Worker Program or Pacific Labour Scheme for the first time, I encourage you to start the application process early. Go to employment.gov.au/seasonal-worker-programme or dfat.gov.au/geo/pacific/engagement/pacific-labour-mobility for more information.

The bumper crop will also no doubt create a renewed interest in export this season. Avocados Australia has established an online application process for access to Japan (a protocol market), and has developed new information sheets and flowcharts so we can plan our activities. You will be able to find these in the Best Practice Resource, in the Export module. Visit www.avocado.org.au/bpr/.

Also, be sure to keep an eye out in the fortnightly *Guacamole* for details of the upcoming Avocado Regional Forum in Western Australia. This forum is currently planned for June, but as we've all seen lately, plans can change quickly.



SOUTH QUEENSLAND

By Daryl Boardman

First, I want to start with some sad news for the South Queensland avocado community: the unexpected passing of well-known grower David Beutel from Googa Farms, at Blackbutt. I would like to pass on our sincere condolences to the entire Beutel family, and friends.

David was a very active member of our avocado community, in fact he was at our South Queensland Regional Avocado Forum in Crows Nest in March (more on page 10 on the event) and our South Queensland Member breakfast (more on page 13). These were the first in-person avocado events since the first lockdowns started last year, and we had a great roll up.

It's going to be a busy year, here in South Queensland. With a large crop forecast (more than 600,000 trays according to the latest *Infocado* Quarterly), we are going to need to have our marketing sorted.

I hope to see everyone at the upcoming Hort Connections, especially for the Avocados Australia shoulder event on 7 June where we've arranged an excellent line up of retail, marketing and supply chain speakers, and I encourage you to also avail yourself of the ongoing webinars being organised for the avocado industry, either via the various R&D projects or by Avocados Australia, to keep you up to date. Keep an eye out in the *Guacamole* or check out the events calendar at avocado.org.au.



A contact of Avocados Australia Director Daryl Boardman was quick to share this image of the new Australian Avocados' billboard in Sydney. It's all part of the new Our Green Gold campaign. You can read more about the latest marketing on page 50.



CENTRAL QUEENSLAND

By John Walsh

Avocado volumes have continued to flow on from a successful Shepard season in both volume and price. The current Hass season is a different story.

The volume being harvested has increased to the point that there is enormous pressure on the market.

This has been compounded by a slow transition from Shepard to Hass. The rainfall events toward the end of autumn and the volume of Shepard hanging about has contributed to mixed messages or assumptions being made that stopped them from promoting. At this point, prices to the retailers and independents should allow them to be able to actively promote the sale and consumption of avocados. Growers and marketers should be consistent in their discussions with their customers and make sure that they use this opportunity to actively promote and hold them to account if they attempt to pocket margin. For those who have been around for some

time realise that things could get worse. For those who are new to the game (within the last 10 years) use this as a learning opportunity. Looking at the latest quarterly *Infocado* forecast this will be an issue into next year.

Oh water, oh water where are you. Growers relying on water supply on the south side of the Burnett River in Bundaberg and Childers will soon see the fruition of probably one of the worst decisions ever made by a government in this area. While the state government hides behind a bureaucratic smokescreen, water users may never ever get the truth behind their decision to let water out of Paradise Dam and reduce the height of the dam wall. It is quite obvious that those behind this decision do not care about the future of agriculture in this region. What does it mean for the avocado crop for next season? Who really knows. Growers are now planning scenarios on what allocations they may get and how much water they can buy for the next water year.

Avocados Australia has run one workshop in the region, with information on irrigating with less water and you can find information in the Best Practice Resource (in the Growing module, under Irrigation). I also urge growers to look after themselves, as well as their trees, families and businesses. There are a range of services available if you need to talk or business assistance. Don't be afraid to reach out.



NORTH QUEENSLAND

By Jim Kochi

As I predicted last edition, it was indeed a monster crop in North Queensland and our main problem was indeed labour. While some growers secured a reasonable team, no-one was over inundated with eager staff.

Also as predicted, supplies to the market has been plentiful this year, a situation that started with our Shepard harvest here in North Queensland and became very evident as the Hass harvest started first in the north and then in Central Queensland.

Once we are finished with the current harvest, we need to continue our work to deliver quality avocados in the 2022 season. This year has been a wake up call, and from here on in it's all going to be about quality.

NEWS

— Extension News —

Regional Forum's exciting return

Liz Singh, Avocados Australia Industry Development Manager

After a year of talking to people via computer the Avocado industry development and extension (AV17005) team got the green light to meet face to face. South Queensland strongly supported the return of the Regional Forum in Crows Nest on Wednesday March 24 with 111 growers and industry members participating.

AV17005 project lead Simon Newett, from the Queensland Department of Agriculture and Fisheries, said it was great to see that the *Avocado Industry Development and Extension project* was valued so highly by the industry.

"It's great that we can get back to delivering in-person events, helping growers to improve best practice," he said.

Avocados Australia CEO John Tyas provided an industry update that highlighted the industry importance of growers completing the annual Avocados Australia *OrchardInfo* survey.

John indicated that the national tree crop map run by the University of New England showed considerably more hectares planted to avocados than were recorded in the *OrchardInfo* report.

"Without an accurate picture of avocado plantings by region and age, it makes it harder to forecast the industry production capacity which can create a window of opportunity for imports," he said.

The *OrchardInfo* tree census link will be emailed in August/September. If you haven't previously received the Avocados Australia census email, please contact us on 07 3846 6566 or admin2@avocado.org.au.

Read about the information presented on the *Implementing best practice of avocado fruit management and handling practices from farm to ripening* (AV18000) and *Monitoring avocado quality at retail* (AV19003) on pages 55 and 19 respectively.

At the Crows Nest event, industry members also heard from Hort Innovation Head of Extension Jane Wightman, who provided an informative update on the R&D corporation's

new extension program.

This program is designed to complement existing industry-specific extension and communication projects, with Hort Innovation's regional extension managers playing a linking role and bring broad coalitions together to share skills and capacity, to solve identified regional problems. Read more on page 15.

Jane is the head of the new 'Extension and adoption' team recently started at Hort Innovation, and she outlined several of the RDC's current activities, including:

1. sustainability plans – various industries are developing these. Consumers are now looking for this type of information (including an industry's efforts to reduce food waste) before they buy
2. Hort Innovation is currently assisting industries (including the avocado industry) to renew their Strategic Industry Plans. These are prepared for five year periods and outline the aims of the R&D and marketing for the next five years
3. the importance of industry statistics.

The main topic "avocado nutrition" was presented by Liz Singh (Avocados Australia Industry Development Manager) who dashed everyone's hopes of a quick fix when she stated that avocado nutrition was complicated, that it was not stationary or repeatable, it required continual monitoring and quick changes to match nutrient requirements to crop load, health and future cropping opportunities.

Liz said that there were seven areas that she would consider when looking at avocado nutrition (Figure 1). Yet, she said that having a better understanding of what happens to fertiliser when it is added to the soil in terms of nutrient interaction and retention could provide the opportunity to maximise nutrient efficiency and avocado nutrition to maintain tree health, support fruit growth and optimise tree function.

Not being able to see what happens to your fertiliser when you add it to the soil doesn't mean that you can't stitch together a good picture of what is happening with information from your soil test and a basic understanding of soil chemistry. Your soil pH will determine availability of nutrients, your

soil type and organic matter levels will help to determine your soil's capacity to hold cation-based nutrients (calcium, potassium, ammonium, magnesium, sodium etc.) through cation exchange capacity (CEC) (Figure 2) and your electrical conductivity will determine salt loading. Liz indicated that by understanding these key factors and selecting your fertilisers accordingly to suit tree phenology we could not only extend tree function but optimise tree performance.

See the *Avocado Nutrition* factsheet put together by Liz Singh and the *Soil and Leaf Testing* flyer developed by Bridie Carr (DAF) as well as all the PowerPoint presentations and presentations from the South Queensland Regional Forum in the BPR Library under Events.

More information

Check the fortnightly *Guacamole* newsletter and the events calendar at avocado.org.au for future dates. If you would like more information on the project, contact Avocados Australia

Industry Development Manager Liz Singh, 0499 854 111 or ldm@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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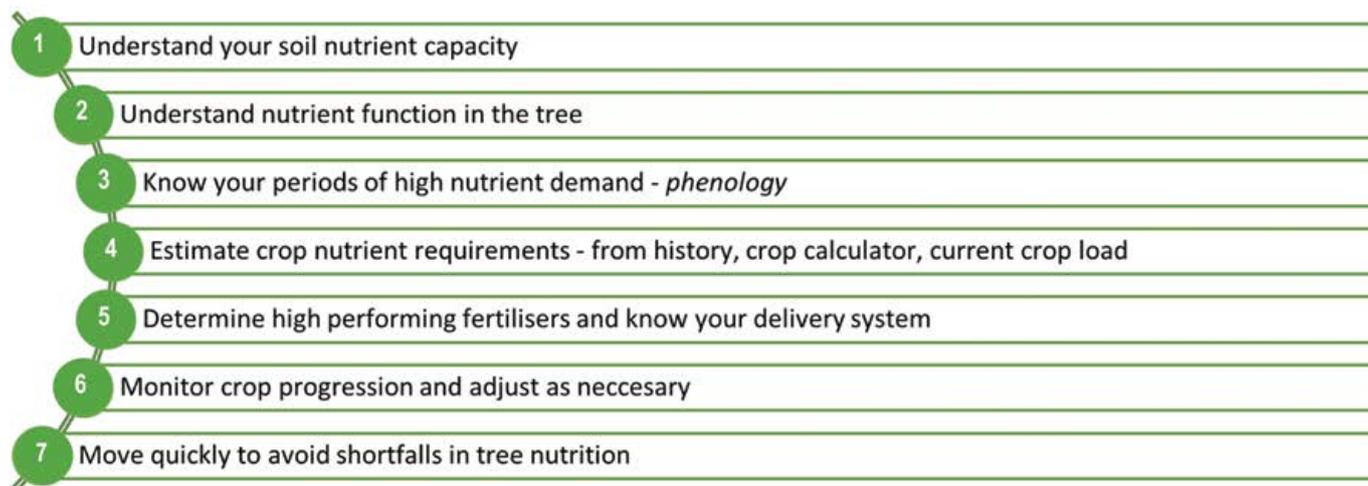


Figure 1. Targeting avocado nutrition. Image: L. Singh

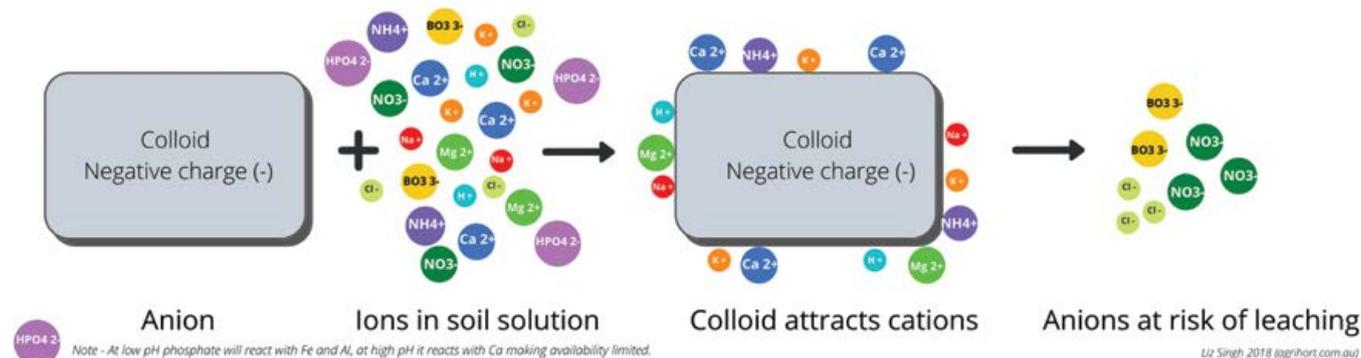


Figure 2. Cation Exchange Capacity (CEC). Image: L. Singh (Agrihort 2018)

OUT AND ABOUT AT THE SQ REGIONAL FORUM

A year to the day, Avocados Australia and the team from AV17005 were back with face-to-face events, at the South Queensland Regional Forum in Crows Nest. Back in 2020, 24 March was our first day of lockdown in Queensland. While the avocado webinars proved to be popular (and will continue), it was certainly good to be out and about again.



John Coates, Balmoral, and John Davies, Redbank Plantation, at the Crows Nest forum in March.



Mary and Peter Annand, Bellthorpe, were in Crows Nest for the first in-person extension event in a year.



Ken and Sherilyn Otte, at the Crows Nest forum, with Justin Clarke, MEA.



Rory Tomlinson, Tanuki and Charlie Colgan, San Carlo Farms, in Crows Nest.



Antony Allen, Avolution, and orchard walk host Sally Boardman, Sunnyspot, at the Crows Nest forum.



Lisa and Andy Fyffe, Avo Tree with Michael Flynn, Balmoral.



As part of the grower experiences session, Robyn Lubach, brought in samples of leaves from her orchard, Redbank Plantation at Gatton, to demonstrate the difference good nutrition can make.

Avocados Australia special Member event success

Avocado Australia members attended a special breakfast in Crows Nest, South Queensland on 24 March. The peak industry body's members enjoyed breakfast while hearing the inside scoop from Avocados Australia Market Development Manager Hayleigh Dawson about increasing domestic consumption and the plans to support avocado sales over the next 12 months. Regional Director Daryl Boardman said he wanted all avocado growers and industry supporters to become members and support the work conducted by the Avocados Australia.



Ilse Kaufmann and Charlie Colgan, San Carlo Farms, Beerwah, at the members breakfast in Crows Nest.



Tammy and Geoff Jago, Hampton, with Jim Gibson and Kate Erbacher, Jim and Kate's Avocados, Blackbutt.



Jo and Chip Saint, Halo Farm, Hampton at the Avocados Australia member breakfast.



John Moloney and Matt Moloney, Shannon Partnership, Peachester, in Crows Nest for the member event.



Cobus Vorster and Chris Peart, Fleetwood Orchard, Beechmont, travelled up for the member event in Crows Nest.



Andy and Judy Veal travelled from Touchwood Farming, Mt Binga, for the Crows Nest event.



Avocados Australia's Market Development Manager Hayleigh Dawson updating the organisation's members in Crows Nest in March.



Avocados Australia Director Daryl Boardman and CEO John Tyas addressing members at the Crows Nest breakfast on 24 March.

The “A” to the “O” of avocados back in 2021!

Keen to learn the “A” to “O” of growing avocados in Australia.

The 2021 workshop is set for Bundaberg on 3-4 August. Places for this free event are strictly limited.

The AvoSkills workshops are tailored toward growers who have recently joined the avocado industry, re-sellers, farm supervisors and farm managers. In this practical, fun and hands-on workshop, the group will explore the essentials of growing good quality fruit productively.

To register your interest in attending, either fill out the online form at <http://bit.ly/AvoSkills2021> or contact Bridie Carr, bridie.carr@daf.qld.gov.au.

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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Hort Innovation launches extension team

Hort Innovation

Horticulture is growing rapidly as an industry in Australia, with a 40% rise in value over the five years to 2017/18 to \$13.2 billion. That growth is expected to continue, with the sector's farm gate production having the potential to increase to between \$20 and \$30 billion by 2030. To support this growth, it's vital that the nation's horticulture Research and Development Corporation is constantly refining business practices to service levy payers and the industries they work in.

In line with that approach, Hort Innovation has launched a new Extension initiative to ensure communication and extension activities truly support business decisions and enhance practices on farm.

Hort Innovation is currently working with its partners – such as industry groups, universities and government agencies – to deliver hundreds of projects for horticulture levy payers, of which 80-odd investments are dedicated to extension in the form of industry development and communication, and more than 80 investments also involve extension components.

What is the purpose of Hort Innovation's extension initiative?

The extension initiative enhances the coordination, communication and application of research and development outcomes, and includes a team of Regional Extension Managers, who work in the regions. These managers play a linking role and bring broad coalitions together to share skills and capacity, to solve identified regional problems. Service providers benefit from building their technical and extension skills and knowledge via across industry networks. Collaborative approaches to solving regional problems enable tangible outcomes for growers to use on farm.

Does this service replace other extension activities?

No. Extension activities offered through Hort Innovation are important to the industries they service. The Extension Framework complements and adds to other work to ensure growers have the best possible access to outcomes from their levy investments.

Where are Regional Extension Managers based?

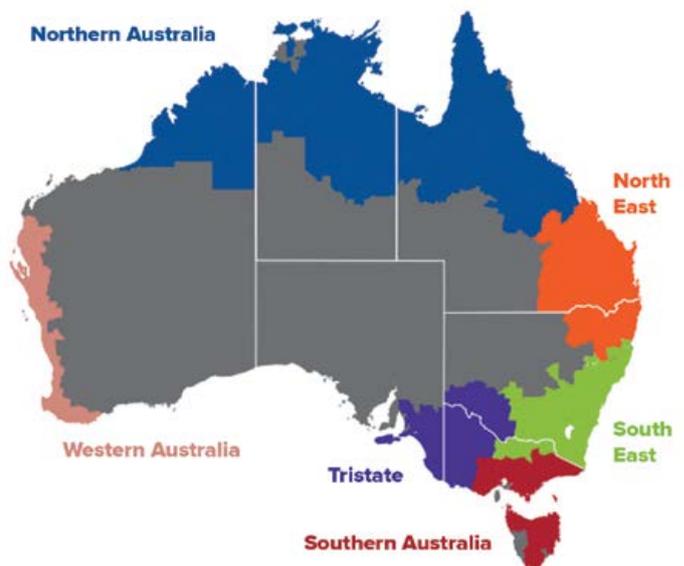
Regional Extension Managers operate in six horticulture regions that have been identified for targeted extension, capturing 94% of horticultural activity in Australia by employment and production value. The Hort Innovation regions are Northern Australia (including North Queensland

and Northern Territory avocado areas), North East (including Central and South Queensland, the Sunshine Coast and Tamborine/Northern Rivers), South East (including Central New South Wales and part of Tristate), the Hort Innovation Tristate region (including parts of South Australia, NSW and Victoria), Southern Australia (Tasmania and parts of Victoria), and Western Australia.

The Head of Extension is Jane Wightman, who spoke at the 2021 South Queensland regional avocado forum. In the South East, the regional manager is Adrian Englefield, for Western Australia it's Bronwyn Walsh, for Southern Australia it's Jason Hingston, for Tristate it's Jay Cummins, and for Northern Australia the regional manager is Olive Hood.

More information

For more information, call Hort Innovation on (02) 8295 2300 or visit horticulture.com.au.



Hort Innovation's Regional Extension Managers are based in six regions nationally.

**Hort
Innovation**

Irrigating avocado with less water

Jeremy Giddings, Mallee Agriculture Victoria Regional Manager Irrigation

Irrigators in the Central Queensland avocado growing region are facing tough decisions due to changes in water availability.

When water is in short supply a range of decisions may need to be made including:

- the purchase of additional water from a low availability market
- prioritise water onto preferred patches
- giving other patches reduced volumes with consequent reductions in production
- abandoning poorly performing patches, and
- possibly removing plantings of lowest priority and bringing forward redevelopment plans.

The success of a reduced irrigation strategy must consider the impacts in both the current season(s) and subsequent seasons. This is particularly the case with avocados, as the effects of inadequate moisture are not temporary. A survival mechanism exists where moisture stress leads to blockages in the tree's water conducting tissues until new conductive tissue is grown (often termed 'drought memory'). Water movement can be reduced for up to two years after the stress period has occurred.

Avocados have relatively high water requirements compared to other horticultural crops, and correct irrigation is the most important cultural practice in their production.

Avocado trees have a relatively shallow root system. Water uptake can be inefficient, with trees unable to search for and extract water that is tightly held to soil particles. Therefore, this crop is less forgiving of poor irrigation practices. About 90% of the roots typically occur in the top 15cm, and little water can be extracted from soil that is drier than -20kPa.

There are some things that growers can adopt relatively quickly which may result in some water savings depending on current irrigation management. These savings are generally minor, the main benefit is ensuring a higher certainty of the water that is available reaching the crop. Some of these include:

- calculating block by block water budgets
- checking and conducting maintenance on the irrigation system to reduce leaks or remove blockages
- installing irrigation scheduling and recording devices such as soil moisture monitoring and irrigation controllers
- reducing canopy size
- mulching the wetted strip
- reducing the wetted area by changing sprinkler heads
- irrigating at night to reduce evaporation

- conducting full weed cover
- managing orchard variability due to soil type and irrigation system performance.

For irrigators who are already highly efficient, there may be very little that can be done to save significant amounts of water. Water budgeting and purchasing additional water to deliver full production potential to selected blocks, canopy reduction, patch prioritisation and possibly bringing forward redevelopment plans are the most effective strategies to be considered when managing low water availability.

Avocado growers in the Mallee experienced significant reductions to water allocations in 2006-2008. Various water saving methods were adopted, including 'staghorning' (Figure 1). These practices had mixed outcomes, with irrigators expressing they would take alternative actions if subjected to the same conditions in the future.

More information

For a detailed account of "Managing Avocados with less water" visit the Agriculture Victoria's facts sheet – <https://agriculture.vic.gov.au/farm-management/water/irrigation/managing-with-less-water/avocado-in-the-mallee>.



Figure 1. Staghorned mature avocado trees. Image: Jeremy Giddings.

Building confidence in industry data

Daniel Martins, Avocados Australia Data Analyst

A key to maintaining the trust and participation of our stakeholders is to ensure consistently accurate and reliable reporting of industry and market data, from trees in the orchards to fruit flowing through the supply chain.

The data verification component of the *Avocado industry data capture and analysis project* (AV20000), regularly verifies collected data with suitable sources and/or techniques throughout the year, as new data becomes available.

The data sets to be verified, the appropriate verification source/s or techniques, the frequency and timing, and any verification reporting needs, are all outlined in a Data Verification Schedule, which is a critical element for the project's success. This schedule considers the seasonality of all avocado producing regions, and the availability of various publications and levy receipts.

Via AV20000, Avocados Australia collects the following three types of data, which are verified in accordance with the Data Verification Schedule:

1. Australian avocado production

Australian supply volume data is verified against quarterly levy receipt reports issued by the Australian Government. These reports, which are provided to Avocados Australia, state production quantities and levy amounts paid every month. We are then able to compare the reported volumes of levied avocados with the reported volumes in our quarterly *Infocado* reports.

Since we started measuring (FY2013/14), we have seen a close relationship between *Infocado* reported volumes and the reported volumes of levied avocados. Variances from month to month are common, due to the timing of data collection, but on an annual basis the total volumes are closely aligned.

2. Seasonal crop forecasts

Seasonal forecast volumes are compared with final dispatch volumes as a measure of forecast accuracy. The figures compared are the 'pre-season' forecasts, which are the regions' last forecast update submitted just before the start of their season.

Therefore, the 'pre-season' forecast is captured at different times for different regions as shown below:

December seasonal forecast	March seasonal forecast	June seasonal forecast
North Queensland	Sunshine Coast,	Tristate
Central Queensland	South Queensland,	Western Australia
	Tamborine /	New Zealand
	Northern Rivers	
	Central New South Wales	

When all packhouses in a region have submitted their final dispatch for the season, we consider that the region's season has come to an end. The total volume that has been dispatched is then compared to the region's pre-season forecasted volume.

The discrepancy threshold for this data is 20%. Any forecast to dispatch variance over that proportion is investigated to determine the reasons for the large discrepancy.

In 2020, for many regions the volume dispatched was well below the volume forecast, for various reasons. It is of paramount importance to keep these forecasts up-to-date, as it is much easier for the industry to deal with smaller regular variations, than larger surprise jumps.

Because of the experiences in 2020, where serious weather events coincided with a global pandemic, we are implementing more regular checks at packhouse level so that unusually large volume discrepancies based on historical data can be more quickly identified, and communicated back to industry.

3. Annual avocado orchard tree census

The avocado orchard planting data maintained by Avocados Australia via the annual tree census is checked against planting data from the Australian Bureau of Statistics.

Every May, the Australian Bureau of Statistics publishes final estimates collected in the Rural Environment and Agricultural Commodities Survey (REACS), in which statistics on land use, crop and horticultural areas are included. Until recently, this has been the only other source of avocado planting data available for comparison.

The benchmark for Avocados Australia's planting data, is that it must represent at least 80% of all plantings reported by ABS and we have consistently achieved this.

The more resources we can have available to validate our industry's data, the greater the confidence we can have in its accuracy. We are therefore looking out for opportunities to incorporate alternative verification sources for all of our data.

Such an opportunity has been recently identified, with the mapping work done by the University of New England's Applied Agricultural Remote Sensing Centre (AV18002), as a verification resource for data on plantings. We will formally introduce this validation resource once we have identified a way to routinely ascertain the accuracy of the mapped data, as it is constantly being updated and ground-truthed.

More information

For more information contact Daniel Martins at data@avocado.org.au or 0458 004 198.

Acknowledgement

The *Avocado industry and market data capture and analysis* (AV20000) project has been funded by Hort Innovation, using the avocado research and development levy, and contributions from the Australian Government.



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Hass results from the 2020-21 season

Adam Goldwater, Applied Horticultural Research

The avocado retail quality monitoring project (AV19003) has now covered a full season of Hass, from May 2020 to February 2021. Results are positive, with industry making progress towards meeting the target of 90% acceptable fruit (fruit with less than 10% flesh damage).

For the first time since retail quality monitoring commenced (AV11015), acceptable Hass fruit quality reached 86% (May 2020 to February 2021), up from 72% acceptable in 2008 (Figure 1). While this is a great result, it will be necessary to see this trend continue into 2021 and 2022 before we can conclude that an improvement has been made.

Where have the quality improvements been made?

Since 2008/15, improvements have been made in bruising, body rots, and flesh discolouration (Figure 2). Stem end rot and vascular browning levels are similar. We only have one season of data so far in AV19003, and while defect levels are likely to vary considerably between years, these early results suggest that investments in production, supply chain and retail improvements have been successful. Although bruising levels have declined slightly, bruising remains the most significant contributor to damaged fruit at retail.

Quality by country of origin

Quality of Australian Hass avocados narrowly exceeded that of imported fruit (Figure 3). There has been considerable interest and concern about quality of imported fruit, especially since Chile began export of Hass avocados to Australia in 2020. Quality of Chilean fruit was not too dissimilar to Australian fruit, with 84% of Chilean fruit acceptable, compared to 87% of Australian fruit. New Zealand fruit quality was similar to that of Chilean, at 83.5%. This was surprising given

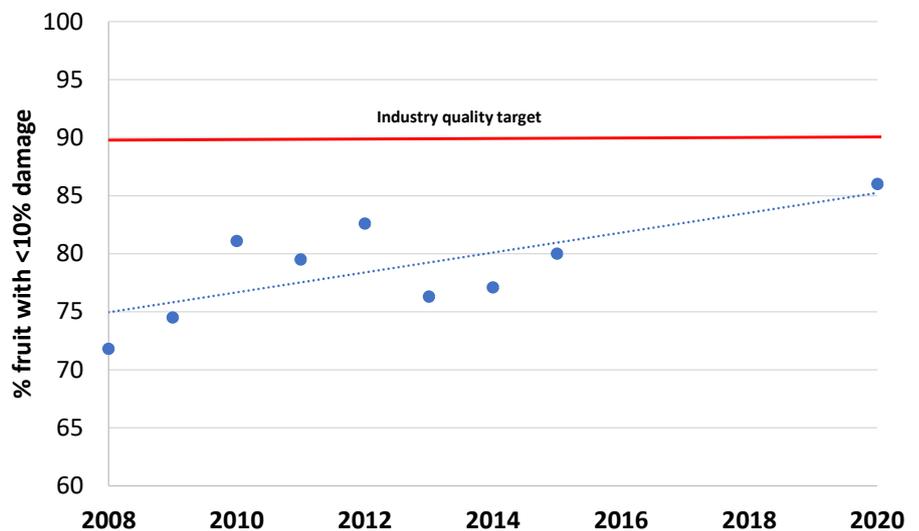


Figure 1. Percentage acceptable Hass fruit in Australian retail stores from 2008 to 2020 (Australian and imported fruit). Datapoints from 2008 to 2015 are from project AV11015, and 2020 data from AV19003.

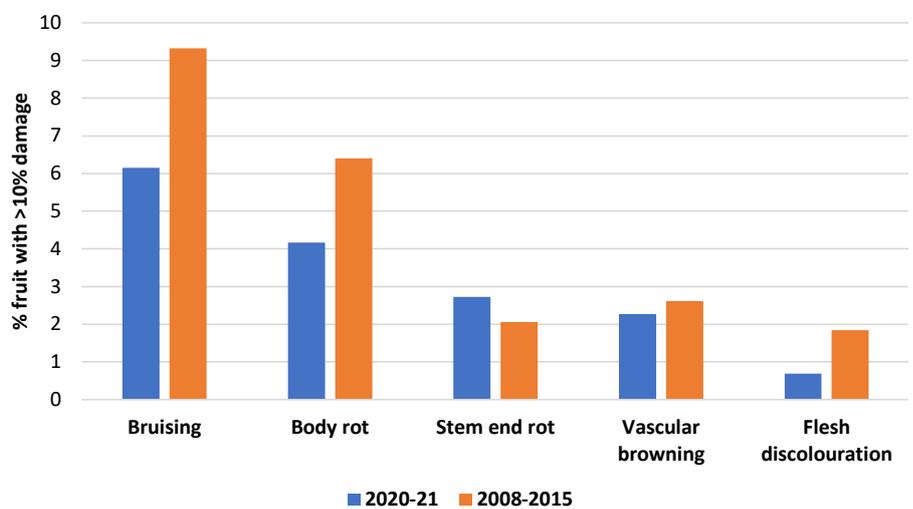


Figure 2. Types of defects causing unacceptable Hass avocados at retail (Australian and imported fruit). Blue columns are May 2020–February 2021 data from AV19003, while orange columns show average data during 2008 to 2015 from AV11015 (Avocados Australia).

that some Chilean fruit we assessed was packed at least 40 days prior to purchase at retail. This result reiterates the importance of the Australian industry's continued focus on quality improvement, in order to remain the preferred supplier over imported product.

Quality by growing region

Western Australia took out the prize for best Hass avocado quality for 2020/21 with 93% of fruit acceptable to consumers. Not far behind was North Queensland, also exceeding the industry target of 90%. Central Queensland and Tristate were not far off the 90% target, while results from South Queensland and New South Wales were below 80% acceptable fruit (Figure 4). Note that the small sample sizes for South Queensland and Tristate (13 and 12 respectively), as this means that results for those two regions may not be representative. More samples will be collected later this year, which will help indicate whether or not these results are an aberration.

The major differences in quality between regions suggests that future investments to improve quality may be best directed at particular production regions, rather than a national approach.

Shepard quality assessments are well underway, so look out for results in the next issue of *Talking Avocados*.

More information

For further details, please contact project leader Adam Goldwater at Applied Horticultural Research (AHR) on 0466 080 693 or adam.goldwater@ahr.com.au.

For up-to-date retail quality data, and more in-depth analysis, log into the Avocados Australia Best Practice Resource at avocado.org.au/bpr/, go to the 'Retail' tab, and select 'Retail Quality'.

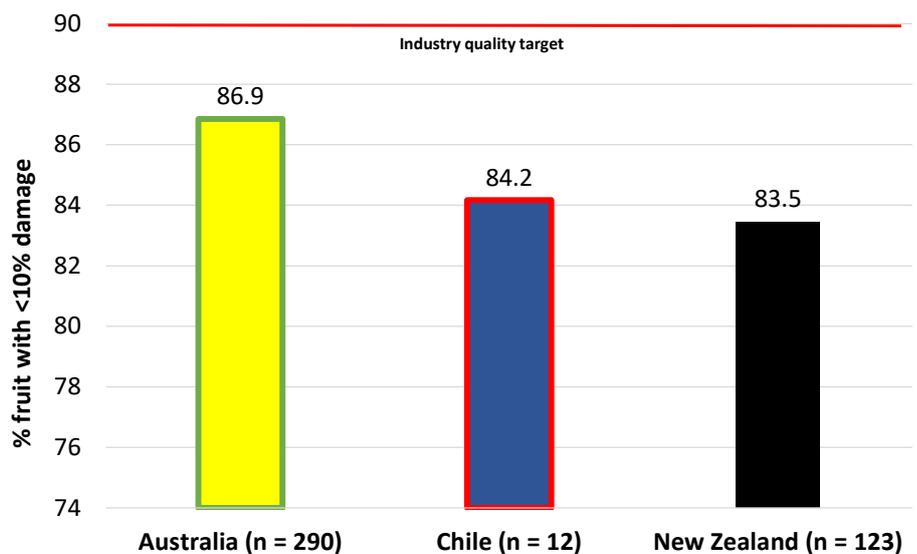


Figure 3. Percentage acceptable Hass fruit by country of origin in Australian retail stores during May 2020 to February 2021 (n is the number of 10-fruit samples collected).

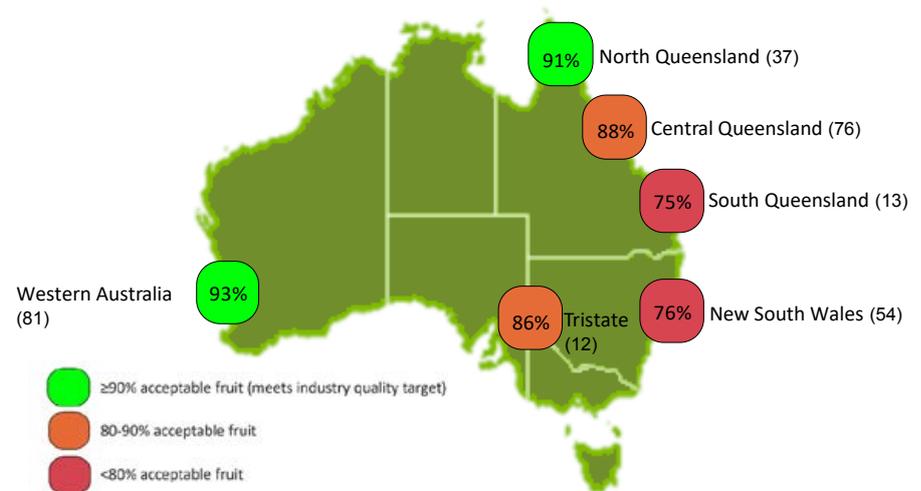


Figure 4. Percentage acceptable Australian Hass avocados by production region during May 2020 to February 2021. Numbers in brackets after each region name are the number of 10-fruit samples collected in the project.

Acknowledgement

The *Monitoring avocado quality in retail* (AV19003) project has been funded by Hort Innovation, using the avocado research and development levy, and contributions from the Australian Government.



New export project to take industry to next level

Avocados Australia will continue to support the development of the industry's export efforts, with a new project underway.

Avocados Australia CEO John Tyas said the *Avocado market access and trade development project*, funded by the Hort Innovation Avocado Fund, would support the industry as it worked to significantly develop new and existing export markets.

"Sadly, our current Export Coordinator Joy Tang is moving on, but our export activities will not miss a beat," he said.

"Joy has agreed to remain with us to provide a comprehensive handover to our new Export Development Manager, Flora Zhang.

"Flora has studied in applied economics, marketing and law, and has tree crop export marketing experience, having worked in both the almond and macadamia industries."

Mr Tyas said Joy's valuable contribution in a part-time capacity during the past three years has provided a very solid foundation for the next phase of export development.

Mr Tyas said the new project was vital, as the domestic industry continued to expand at a rapid rate.

"While the industry has enjoyed strong growth in the domestic market, it is unlikely that the domestic market will expand enough in the coming years to absorb the increased production," Mr Tyas said.

"The industry needs to be on the front foot, and this new project is designed to guide our ongoing market access and trade development agenda and develop tools and training to capitalise on the opportunities being created."

AV20004 will work to grow exports, facilitate export market access, develop and maintain relevant resources, and provide export industry development services including regional education and training workshops.

Acknowledgement

The *Avocado market access and trade development (AV20004)* project has been funded by Hort Innovation, using the avocado research and development levy, and contributions from the Australian Government.



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New system ready for Japan season

Joy Tang, Avocados Australia Export Coordinator

A new online export registration system has been launched for the 2021 Japan export registration, as well as the addition of new materials to support growers and packhouses navigate the protocol requirements for Japan.

These new resources which have been funded through two Australian Government Package Assisting Small Exporter (PASE) grants, will be launched in time for growers and packhouses to use for Japan export registration in 2021.

The Online Export Registration system for avocado industry has been developed by adapting the existing Australian Table Grape Association (AGTA) online registration system. Avocados Australia and AGTA have successfully run through the new system in early March. The system was further tested by the Australian Government Department of Agriculture, Water and Environment in April. Avocados Australia ran a training workshop on how to use the online system for growers and packhouses in Western Australia before the export to Japan season starts. This workshop was held in Manjimup on 1 June. A recording will be available in the BPR for those who could not attend.

The new support materials, which provide specific information for those seeking to access the Japanese market, will also be uploaded to the Best Practice Resource in time for the growers and packhouses to use for the Japan export registration 2021. The new materials aim to simplify the key requirements for growers and packhouses wishing to export to Japan including guidance for record keeping and the audit process.

We expect the two PASE projects to provide a simplified and transparent export registration process for avocado growers and packhouses when exporting to protocol markets.

More information

Contact Avocados Australia on 07 3846 6566, or email export@avocado.org.au.



Avocados Australia CEO John Tyas and Export Coordinator Joy Tang work with Australian Table Grape Association's Jeff Scott.

There are a number of regulatory requirements that must be satisfied if you want to supply fruit for export to Japan. If you can meet the requirements you will be able to register as an 'accredited property' for growing fruit for export to Japan. Registration to become an 'accredited property' must be undertaken annually and is managed jointly by Avocados Australia and the Australian Government Department of Agriculture, Water and the Environment (DAWE). All growers will be audited by DAWE each year.

Although the requirements are summarised in this resource, growers should also do their own due diligence before deciding to register their orchard. The source documents outlining the requirements are the Japan Avocado Protocol and Japan Avocado Workplan, both of which can be found at <https://micor.agriculture.gov.au/Plants/Pages/Apply-for-Plants-access.aspx> to apply for access. Once you have registered for access, you can find the link to the "Work Plans and Protocols" documents on this page <https://micor.agriculture.gov.au/Plants/Pages/Documents.aspx>.

To be eligible to supply fruit for export to Japan, you must:

1. Produce Hass variety (all other varieties are not permitted).
2. Produce fruit in WA or Riverland Pest Free Area. If there is a fruit fly outbreak in your production location, you may not be permitted to export until the outbreak is resolved.
3. Produce 'hard mature fruit' (pick hard fruit from healthy trees).
 - The technical definition is: 'hard mature condition means fruit must be deliberately detached from healthy branches of living trees and show no signs of softening or spotted areas. Fruit must not have any areas of breakdown or broken skin on any part of the fruit.'

- To be compliant, before harvest, growers must ensure that all fallen fruit has been removed from the ground and disposed of.
- 4. Pick, transport and store at packhouse within 24 hours.
 - The technical definition is: 'be transported to the packhouse on the same day of harvest, and packed; or enter into secure cold room storage within 24 hours from the time of harvest and packed'.
- 5. Be able to keep fruit from blocks registered for export to Japan segregated from other avocado fruit at all times.
- 6. Have connections to a packhouse accredited to send avocados to Japan. Both the farm and the packhouse must hold their own accreditation for Japan.
- 7. Have a Good Agricultural Practices (GAP) system in place, specifically processes related to:
 - routine in-field monitoring and controls
 - integrated pest management (IPM) program for pests
 - spraying
 - traceability system
 - orchard/block hygiene program which includes:
 - weed control
 - mulch
 - destruction or removal of fallen fruit
 - clearly identify avocado trees other than Hass varieties within the approved orchard.
 - identification of grafted trees.

EXPORTING TO JAPAN | GROWER REQUIREMENTS | MAY 2021 | 1

Australian avocado export and import report 2020

Export

Australian avocado exports for January to December 2020 were 2,301 tonnes, which was 46% lower compared to same period last year and valued at AU\$19.14 million. Unit prices were 44.7% higher at AU\$8.32 per kg.

Malaysia was the leading destination taking 794 tonnes or 34% share followed by Singapore with 723 tonnes. Australia's supply to both markets were over 50% lower than the previous year. Supply to Hong Kong lifted 5% to 693 tonnes. These markets combined accounted for 95% of the total exports of avocados from Australia. Trade to Japan for 2020 was six (6) tonnes, all in January and February with no further recorded trade.

Asian markets imported 139,000 tonnes of avocados in 2020, which was 2% more than the previous year and showing a growth trend of 5% per year over five years.

Australia had a significant share of Malaysia and Singapore markets, although has given up market share in 2020 mainly to Mexico and United States. Japan is Asia's largest importer accounting for 57% of the region's imports, or 79,000 tonnes of which Australia supplied just 6 tonnes in 2020. Hong Kong imported 8,951 tonnes of which 8% was from Australia, the only market where Australia increased market share.

Import

From January to December 2020 there were 24,688 tonnes of avocados imported by Australia worth AU\$156 million, which was 114% above the previous year. New Zealand was the main supplier supplemented by Chile for the first time. The unit value of imported avocados (CIF) is A\$6.75 for New Zealand and A\$5.20 for Chile.

Chile supplied 2,498 tonnes of avocados in their first year of export to Australia.

More information

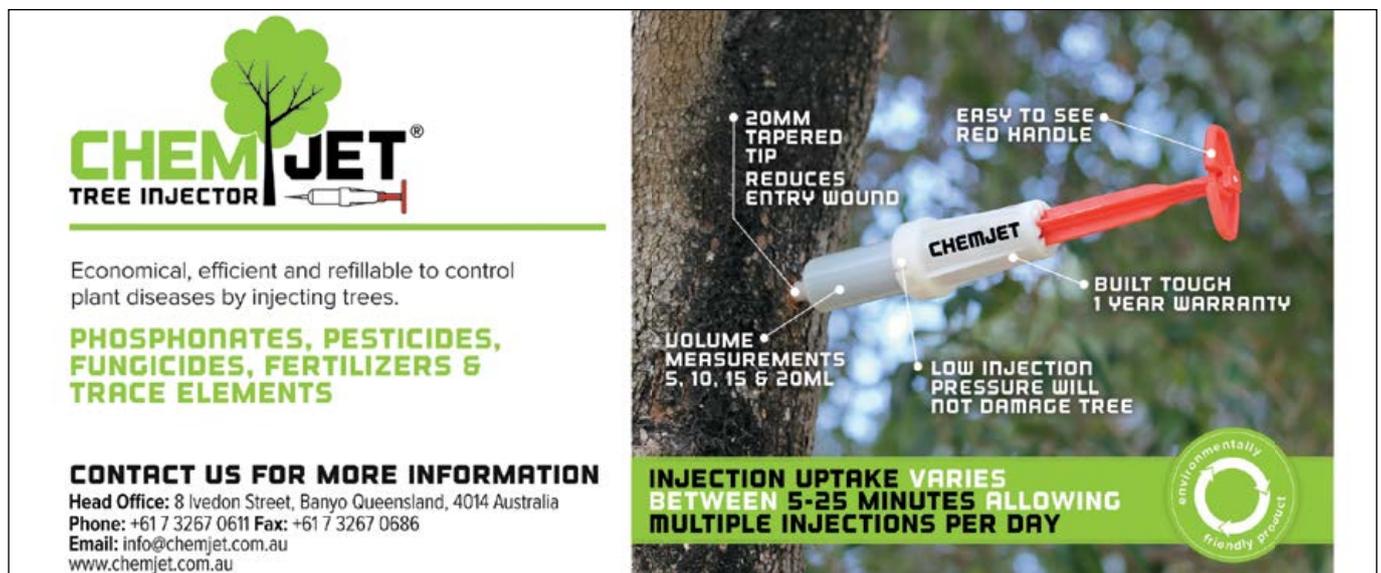
For more information on the Australian avocado export and import, please refer to the export section in BPR library on the Avocados Australia's website avocado.org.au/best-practice-resource/library/.

Acknowledgement

The *Avocado market access and trade development (AV20004)* project has been funded by Hort Innovation, using the avocado research and development levy, and contributions from the Australian Government.

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2020 export market analysis

Wayne Prowse, Fresh Intelligence Consulting

After reaching a record level of 4,272 tonnes exported in 2019, the export results in 2020 took a tumble: down 46% to 2,300 tonnes. Simply, the word COVID has been front left and centre for all of us in the past year and its impact on Australian avocado exports cannot be understated.

Avocado export markets

The impact on air freight was most significant, then a severe crop shortage in Western Australia drove domestic prices higher causing a disincentive to export. Our key international markets, Singapore and Malaysia, were filled with avocados mainly from Mexico and Kenya at price points that were around 50% of the Australian domestic prices and very few could be sold to importers at the prices that Australian growers could achieve in the domestic market.

The hard fought access to Japan yielded just six (6) tonnes in 2020, all being in February, which was negligible in the 80,000 tonnes market dominated by the Mexican supply.

Hong Kong was the only market that defied the trend and took 698 tonnes, an increase of 6% on last year.

In this section we will take a brief look at the global situation and then at the 4 markets of interest to understand more of the market dynamics and import demand though this last year, and Australia's position.

Global

Global avocado production continues to experience sustained growth above the rates for overall fruit production in the past decade. Global avocado increased 5.8% to 7.2 million tonnes in 2019 and some 40% of the world's avocados are internationally traded. In contrast Australia's production reached 87,000 tonnes or 1.2% of the global production with less than 2.6% exported. This shows that Australia remains strongly domestic focussed.

The growing acceptance of avocados by European and North American consumers for use in a wide variety of meal situations, and the emerging interest from North Asian markets is fuelling the production growth. Investment in promotion and the good news stories of avocado health benefits are helping increase demand along with improved distribution and ripening systems.

Almost 70% of avocados are produced in Latin America, notably Mexico, Peru and Colombia, and from there the distribution lanes reach as far as Europe, Asia and North America. Kenya is now the largest exporter of avocados in Africa and is making an impact in South East Asian markets of interest to Australia.

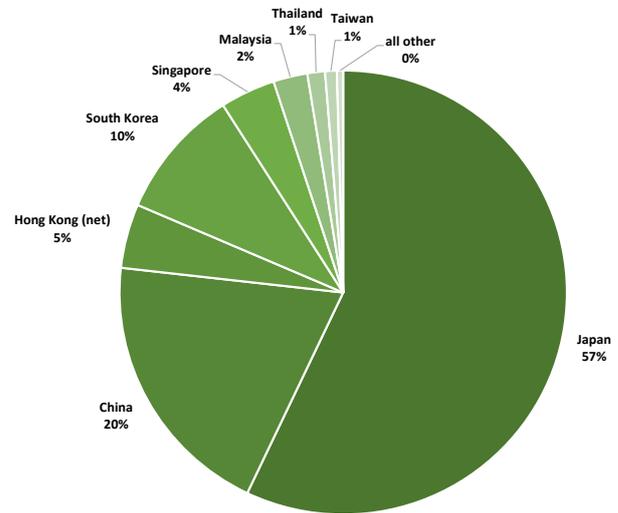


Figure 1. Avocado Imports by Asian market share. Source: ITC Trademap; Fresh Intelligence analysis

Avocado Key Measures (Calendar Years)

	2019	2020	Change
Volume (tonnes)	4,272	2,300	-46.2%
Value (M AUD)	24.5	19.1	-22.0%
\$ per kg	\$5.74	\$8.32	44.9%

Source: IHS Global Trade Atlas; Fresh Intelligence analysis

Mexico, Peru, Chile, South Africa and Kenya combined account for 90% of the global avocado export trade, which stood at 2.5 million tonnes in 2019. The United States is the single largest importer of 1.2 million tonnes of avocados, mostly from Mexico while Europe collectively imported 500,000 tonnes (excluding internal trade), mostly from Peru, Chile, Colombia and Mexico.

Asian markets imported 140,000 tonnes of which 80,000 tonnes were imported by Japan and almost 35,000 tonnes by China and Hong Kong.

China's imports have receded after rapid growth and part of this is due to the increasing local production. Some reports suggest that up to 100,000 tonnes of production is due to come online from plantings mainly in the southern Yunnan Province by 2025 which is starting to impact on import demand.

Australia's major export markets were again Singapore and Malaysia, which account for 6% of the total avocados imported by the region even though Australia's trade fell away by over 50%.

Singapore

Nowhere is the demand and supply impact on pricing more evident than in Singapore. With a small affluent population of 5.6 million, Singapore is Australia’s leading destination for avocados and also Australia was the leading supplier of avocados until 2020. Imports from Australia dropped 54% offset mainly by the United States. As Australia’s prices increased the volumes collapsed and the share shifted to the United States while the Mexican volume remained steady. Kenya also increased although it appears to have offset South Africa’s decline. Regardless of the shifts in supply the overall market demand was virtually unchanged, up just 1.6% to 5,553 tonnes.

Figure 2 shows the price movements through 2020 highlighting Australia’s CIF price (average A\$8.82) steadily increasing to over an insane \$18.00 per kg in December albeit with almost no trade. The price of Mexican avocados (average A\$5.40), decreased to around A\$4.20 per kg by December. Mexico’s highest volumes were from September to March. During this period Australia’s CIF price was below Mexico although there was almost no trade from Mexico from April to June. Kenya is in the market year-round with prices below A\$4.00 per kg, while New Zealand is in the market from September to January at A\$4.64 per kg average. The United States maintained price points between A\$5.50 to A\$6.00 for the year and raised volumes by over 5-fold to 1,284 tonnes offsetting Australia’s decrease.

Malaysia

With a population of 32 million, Malaysia is Australia’s second leading destination after Singapore for avocados and again Australia is the leading supplier accounting for almost 26% of all avocados imported. Like Singapore, Malaysia has unrestricted access and is therefore open to many suppliers although despite a much larger population the imports were under 4,000 tonnes in 2020. Australia’s advantage is being the closest supplier and having a strong quality reputation although this cannot guarantee on going demand if price premiums get too far ahead as they did in 2020.

Imports of avocados by Singapore in 2020

	Tonnes	Change	Share	A\$ / kg CIF
Australia	853	-54.3%	15.4%	\$8.82
Mexico	1,591	-4.6%	28.7%	\$5.40
United States	1,284	514.4%	23.1%	\$5.72
Kenya	755	47.5%	13.6%	\$3.29
New Zealand	467	-25.2%	8.4%	\$4.64
South Africa	263	-40.6%	4.7%	\$4.10
Other	340		6.1%	
Total	5,553	1.6%	100%	\$5.52

Source: ITC Trademap; Fresh Intelligence analysis

Imports of avocados by Malaysia in 2020

	Tonnes	Change	Share	A\$ / kg CIF
Australia	896	-52.9%	26.1%	\$8.85
Mexico	724	258.4%	21.1%	\$4.29
United States	493	61.1%	14.3%	\$4.77
Kenya	485	-17.7%	14.1%	\$3.17
New Zealand	192	45.5%	5.6%	\$5.77
Other	646		18.8%	
Total	3,436	-12.2%	100%	\$5.19

Source: ITC Trademap; Fresh Intelligence analysis

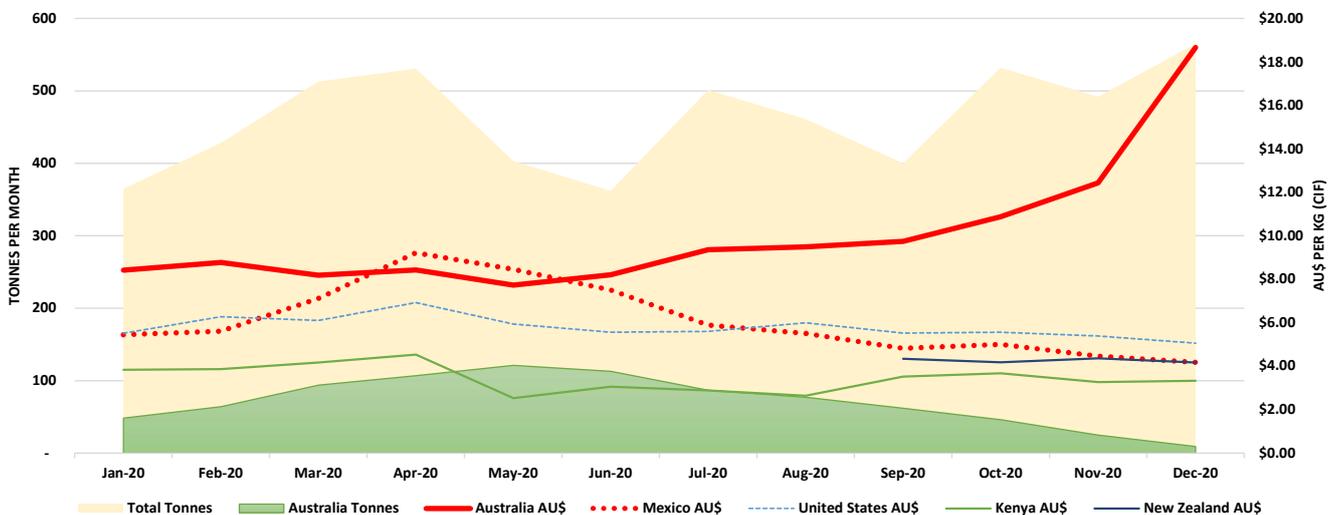


Figure 2. Singapore avocado CIF prices per month overlaid with the total and Australian share of import volumes.

Figure 3 shows the price movements through 2020, highlighting Australia's CIF price (average A\$8.85, although nudging A\$12.00 in September) and that of Mexico (average A\$4.29), which made substantial inroads to the Malaysian market and eroded Australia's market share. United States and New Zealand both increased volumes to Malaysia with prices around the A\$5.00 mark. Kenya's decreased volumes by 17% even though the price points were the lowest of all suppliers.

Hong Kong

Hong Kong trade is strongly influenced by China. With a population of 7.4 million, Hong Kong has developed a strong demand for avocados for local consumption, particularly since Mexico, United States, Chile and Peru can export direct to China. However approximately 55% of this volume is re-exported to China leaving around 6,500 tonnes for domestic consumption.

Total imports dropped almost 17%, mainly due to reduced supply from Mexico and Chile allowing Australia's market share to increase from 4.1 to 5.6% of the 14,750 tonnes imported. Hong Kong has unrestricted access, and some suppliers use Hong Kong as a pathway to China.

Figure 4 shows the price movements through 2020 based on Hong Kong statistics, and highlights Australia's CIF price (average A\$8.80) was the highest of all major suppliers. Australia's highest volumes were not surprisingly in April and May when the prices were below A\$8 per kg with Mexico and Chile not supplying the market at that time.

Japan

Japan is the largest importer of avocados in Asia with a population of 125 million. In 2020 the country imported 79,560 tonnes of avocados and has increased 2.9% since the previous year. Mexico has long been Japan's dominant supplier though access from several markets notably Peru, New Zealand and now Colombia is challenging Mexico's dominance pushing its market share below 90% for the first time.

Imports of avocados by Hong Kong in 2020

	Tonnes	Change	Share	A\$ / kg CIF
Australia	819	12.1%	5.6%	\$8.80
Mexico	4,417	-11.5%	29.9%	\$3.46
Peru	4,672	32.6	31.7%	\$3.05
Chile	2,785	-62.1%	18.9%	\$3.81
United States	1,213	300.3%	8.2%	\$5.55
New Zealand	172	132.5%	1.2%	\$7.03
Other	671		4.6%	
Total	14,750	-16.8%	100%	\$3.95

Source: ITC Trademap; Fresh Intelligence analysis

Imports of avocados by Japan in 2020

	Tonnes	Change	Share	A\$ per kg CIF
Australia	6	-83.8%	0.0%	\$5.50
Mexico	68,514	-3.2%	86.1%	\$4.02
Peru	8,360	86.6%	10.5%	\$4.11
United States	2,467	190.6%	3.1%	\$5.67
Colombia	213	1,083.3%	0.3%	\$3.83
Other	0		0.0%	
Total	79,560	2.9%	100%	\$4.08

Source: ITC Trademap; Fresh Intelligence analysis

Australia gained access for avocados to the Japanese market in May 2018, from Western Australia and other areas that are free of Queensland fruit fly. This means that our supply window correlates with Mexico's national peak export season to all destinations (December to April) and their lowest price period below A\$4.00 per kg shown in Figure 5. Australia exported 37 tonnes in 2019 and this reduced to 6 tonnes in 2020 consisting of 2 consignments in February 2020.

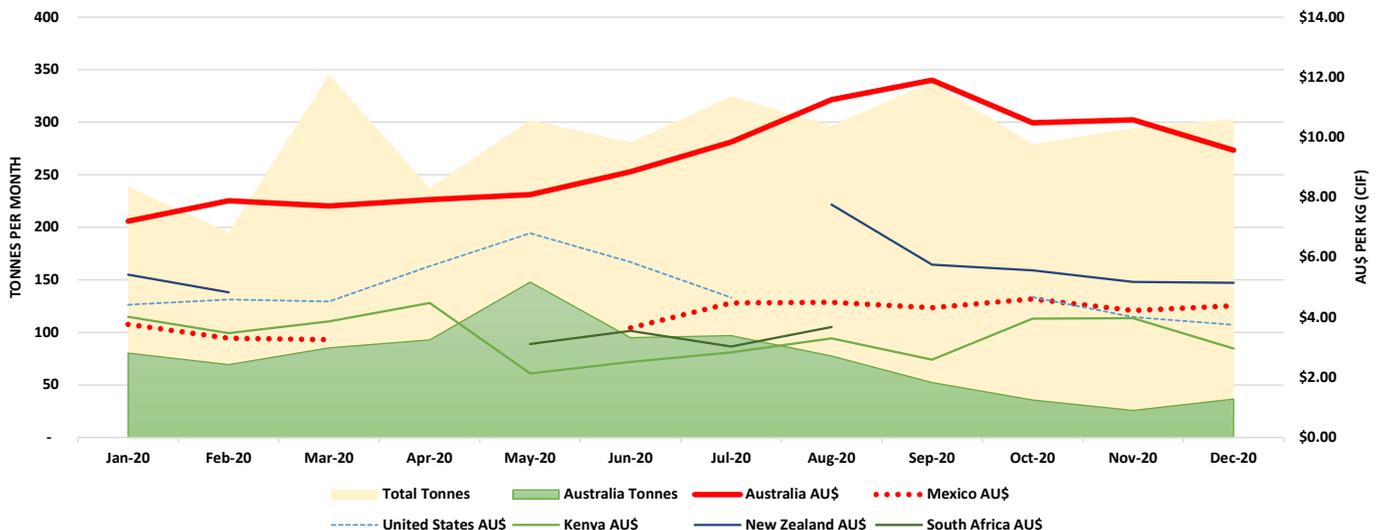


Figure 3. Malaysia avocado CIF prices per month overlaid with the total and Australian share of import volumes.

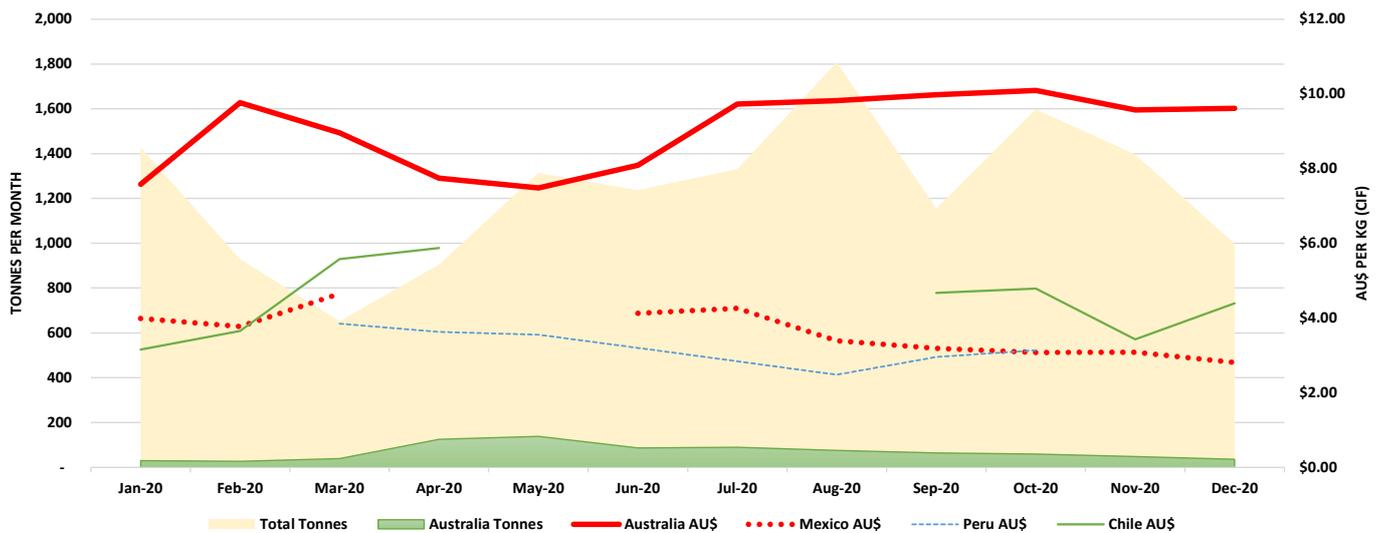


Figure 4. Hong Kong avocado CIF prices per month overlaid with the total and Australian share of import volumes.

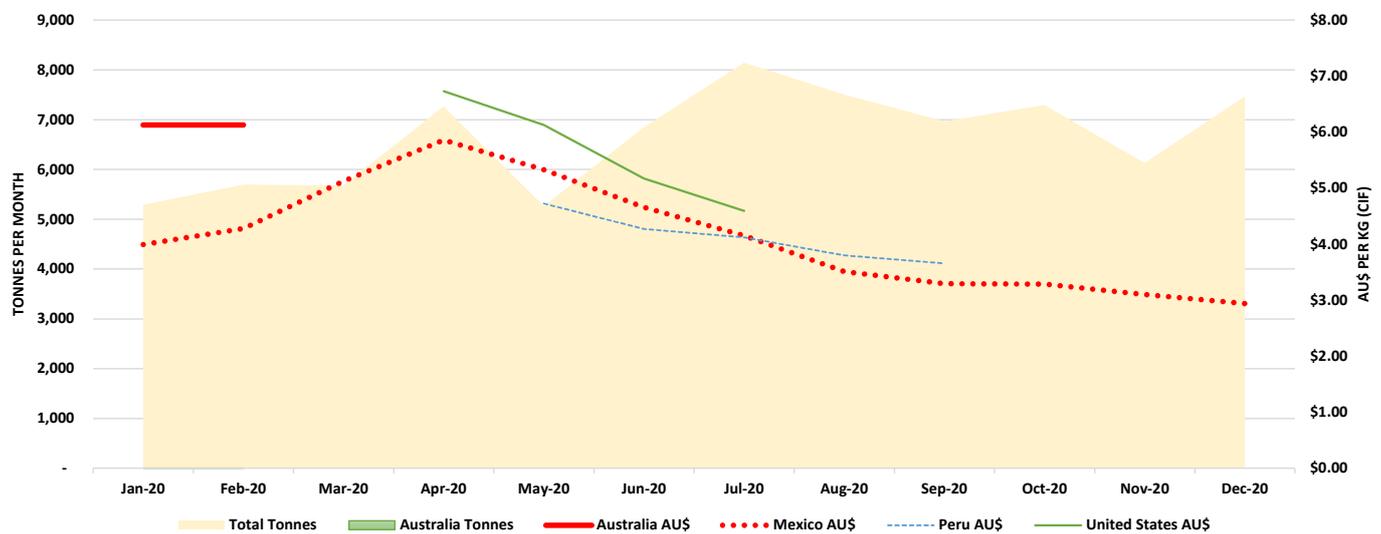


Figure 5. Japan avocado CIF prices per month overlaid with the total and Australian share of import volumes. *Source: ITC Trademap; Fresh Intelligence analysis*

Figure 5 shows the price movements through 2020, highlighting Australia’s CIF price (average A\$5.50) and that of Mexico (average A\$4.02), against the background of total volumes and Australia’s market share by month, albeit negligible on this scale. Mexico’s highest volumes are in March and April with over 8,000 tonnes per month correlating with their lower price points while Peru peaks in July with over 2,000 tonnes even though Mexico barely falls below 4,000 tonnes in any given month in their off season. In 2019/20 Australian avocados were in the market from September to March, albeit very small volumes, though not repeated in 2020 after being impacted by the supply shortage in Western Australia. The high domestic prices manifested in CIF prices in other markets of more than A\$8.00 or 100% premium to Mexican avocados imported by Japan meant no further trade succeeded in 2020.

More information

Monthly import and export updates are regularly uploaded to the industry’s Best Practice Resource Library: avocado.org.au/bpr/.

Acknowledgement

The *Avocado industry and market data capture and analysis (AV20000)* project has been funded by Hort Innovation, using the avocado research and development levy, and contributions from the Australian Government.



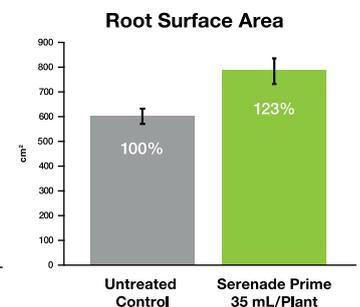
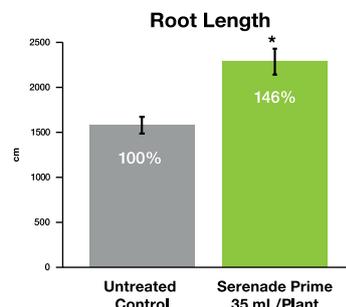
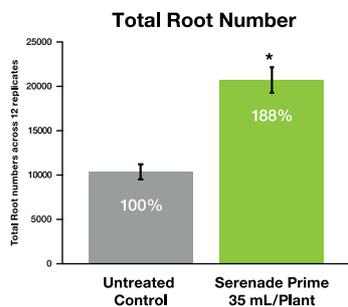
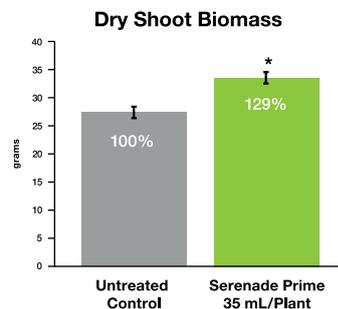
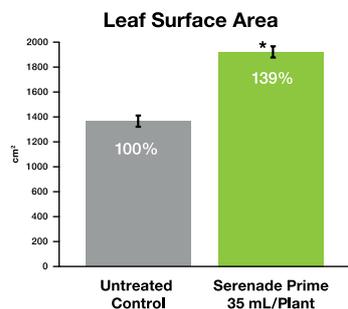


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2020 – The year everything about fresh produce consumption changed

A study into consumer shopping and consumption behaviour during the COVID-19 pandemic has highlighted the important role of Australian horticulture in helping people find health and wellbeing through the benefits of fresh fruit, vegetables, nuts, nursery and turf products. Australians also wanted to show their support for Australian growers by purchasing locally made produce.

“COVID-19 has shown how valuable horticulture is to maintaining a mentally and physically healthy nation. I think people can see that and that’s why they support Australian growers, who continue to work hard and deliver produce through challenging times,” Hort Innovation CEO Matt Brand said.

“The pandemic impacted every element of the Australian way of life and drove behaviour change which meant consumers interacted with horticulture through the consumption of fruit, vegetables and nuts with meal preparation at home, through to people spending more time in the garden increasing consumption of nursery items and turf.

“Hort Innovation was able to provide weekly overviews of the data and insights for growers, highlighting particularly interesting and noteworthy trends to help them prepare for the increases in domestic demand.”

Consumer insights

The pandemic resulted in one event that heavily impacted how we consume: lockdown. Spending more time at home resulted in more gardening, exercise, cleaning and cooking. A rise in cooking from home – especially cooking from ‘scratch’ – meant that fresh, quality, Australian ingredients instantly became more important.

During 2020, Hort Innovation worked with research company Fiftyfive5 to provide the Australian horticulture sector access to regularly updated information on a weekly basis about consumer attitudes and behaviours during the time of COVID-19 disruption, through Fiftyfive5’s *Category and Consumer Impact Monitor* (ST19031).

Across the 9 months that the monitor was running, they found the biggest concern Australians had was around their ability to find a job (50%). A similar proportion were worried about experiencing future waves and these concerns translated into concerns about health and wellbeing for themselves and their families. These concerns had a profound impact on shopping and consumption behaviour.

Lockdown had a profound impact on how we prepared food. No commuting and more time at home gave us the freedom to get creative in the kitchen. From sourdough to spaghetti sauce, Australians were getting busy making fresh food. Almost half (46%) of main grocery buyers reported cooking more meals from scratch and over a third (38%) reported doing more baking. This behaviour increased demand for fresh produce through retail channels.

4 in 10 buy more fresh produce

Australians looked to fresh produce as core ingredients. Between March and December, on average 39% more Australian grocery buyers reported buying more fresh produce as part of their shop.



Maintaining a healthy diet became even more important as gyms and restaurants temporarily closed, with 39% of Australians wanting to cook more healthy and nutritious meals. The research saw considerable momentum for staple fruits with 34% reporting buying more bananas, 28% buying more apples, and 23% buying more oranges. The purchase frequency for staple vegetables such as carrots (28%), broccoli (25%), and mushrooms (24%) also increased.

Australian grown

The research showed that being grown in Australia, has become significantly more important (compared to before the start of the pandemic). 60% of main grocery buyers in Australia reported that being Australian grown had become more important when choosing fresh produce.

In addition, 42% of all main grocery buyers want to buy Australian fresh produce to support local farmers. You can read more about the new Australian Avocados campaign, positioning avocados as *Our Green Gold*, on page 50.

Snacking

The research investigated snacking behaviours from July and found that 27% of Australians were eating more snacks. Compared to consumption before the pandemic began, many fresh produce categories were consumed more regularly (as snacks), including berries, bananas, and nuts.

More information

You can find the full final report for ST19031, and the monthly reports from 2020, at horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/st19031/.

Acknowledgement

This Category and Consumer Impact Monitor (ST19031) activity was funded through Hort Innovation's risk management reserves, as part of the organisation's response to assist the horticulture sector through the effects of COVID-19, drought, floods and bushfires.



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Finding a home for Shepard – the Australian story

Tony Whiley, Sunshine Horticultural Services and Don Lavers, Lavers Orchards

There is no better example of matching variety (genotype) with environment for a successful outcome than that played out by the protracted journey of the Shepard avocado from California where it languished as a non-performer, to its acceptance as a mainstream variety in Australia on the Atherton Tablelands, and later in Central Queensland.

This journey had several pitfalls that could easily have seen the variety lost to the Australian industry. However, thanks to the stubbornness of a nurseryman who didn't quit on the variety that wouldn't crop, and the persistence of a horticulturist to find a better avocado for a fledgling industry, we now have significant production of a high-quality, early-maturing fruit that supplies the Australian market from February to April. Furthermore, Australia still remains the only country to grow Shepard on a commercial basis – possibly due to the diversity of environments we have for production. A couple of years before Brian Watson died, he set out to tell the story of Shepard in Australia but with deteriorating health the project was abandoned. However, his notes and recollections were forwarded to the authors of this article who have stepped forward to complete his work.

The Shepard journey begins

Post WW II, Stanley L. Shepard was a prominent citrus and avocado grower in California with a keen interest in variety improvement. He is best known for the avocado variety that carries his name, Shepard (Figure 1) that commercially failed in California due to consistent low production. Stan planted avocado seeds on his farm in the hope of developing a new variety. In 1952 he selected an open-pollinated Edranol seedling and named it Shepard. Stan thought the world of his variety and each Christmas presented members of his extended family with one fruit telling them at the present cost of production it was worth \$1,000. Unfortunately, Stan died without knowing how successful his variety would become in another country, on the other side of the world.

Shepard reaches Australia

The arrival of Shepard in Australia was probably a fortunate coincidence due to the connection of two families: the Shepards in California and the Sharpes in Queensland. This came about through the marriage of Brisbane-based Lieutenant Colonel Sir Frank Sharpe's sister-in-law, Jessica Gardner, to Stan's brother John H. Shepard, who ran a subtropical tree fruits nursery in Carpinteria, California.

Apart from a distinguished army career and aviation interests, Sir Frank was a passionate avocado grower and

collector/breeder of new varieties on farms at Redland Bay, and a jointly-owned property with grower/nurseryman Jim Wilson, at Eagle Heights, Mount Tamborine. John Shepard brought the cv. Shepard to Australia with a number of other Californian varieties, in the early-mid 1950s when he visited searching for macadamia varieties (C. Stucky, 2020, California Avocado Society, personal communication). The avocado varieties were propagated and planted on the Redland Bay and Eagle Heights properties. Due to its similar performance in California, Shepard never gained commercial traction on either of these farms although both growers recognised its traits of early maturity and good fruit quality. Later, Jim Wilson planted Shepard on his farm at Hunchy near Nambour but once again met with failure in setting commercially viable crops. Interestingly, in a conversation with the Jim Wilson, he suggested that Sharwil was a progeny of Shepard, from a seed planted on the Sharpe's Redland Bay farm.

In 1969, Jim Wilson retired and moved from Mount Tamborine to a small acreage block on Buderim, bringing with him several avocado varieties including Shepard. Once trees began fruiting Jim invited the senior author to visit his

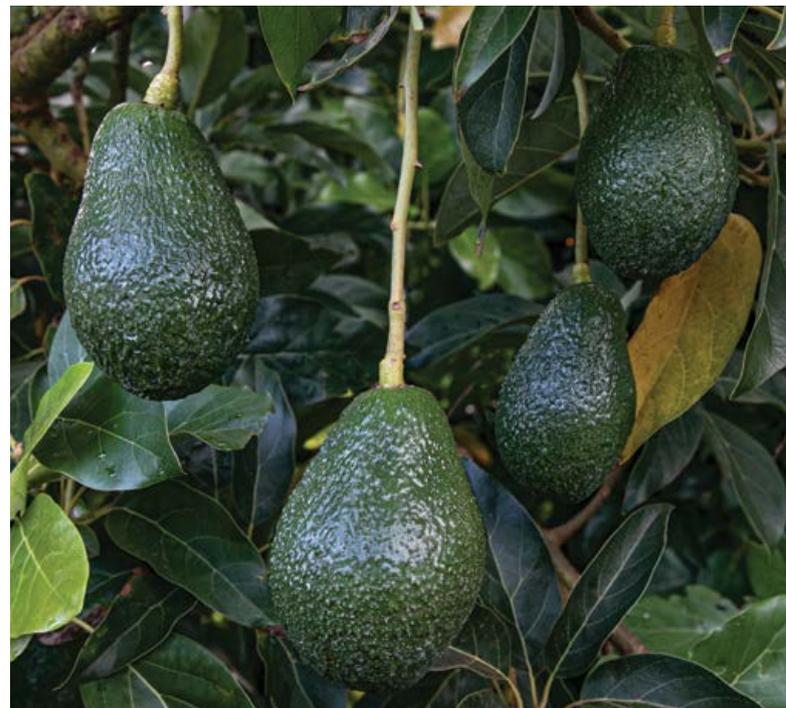


Figure 1. Shepard avocado growing near Childers, in the Central Queensland region.

property to inspect the varietal collection. Over a number of years, it became evident that Shepard had some commercial potential provided regular, heavy crops could be set. However, the Buderim site did not show evidence of commercial cropping on Shepard, unlike the Hass tree planted alongside. At this stage it was shown that Shepard belonged to the “B” flower type group that requires warmer temperatures than “A” flower type varieties, eg Hass, during flowering for a commercially viable fruit set. In April 1978, Brian Watson visited the senior author at the Maroochy horticultural research station (HRS), and following discussions on alternative, early-maturing avocado varieties, met with Jim Wilson at Buderim. Brian argued strongly that the Tablelands industry needed a more pest and disease resistant, early maturing variety and perhaps Shepard would crop more reliably in the north where spring temperatures were higher. Some weeks later Jim unconditionally released Shepard scion wood for propagation and distribution for evaluation in climates more favoured to production of varieties with “B” type flowers.

North Queensland

Shepard bud-sticks were prepared and sent to Kamerunga HRS for propagation. Nursery trees grown by Brian were released to interested growers on the Atherton Tablelands. Entries in his diary reveal that five trees were planted on the Walkamin RS, 11 trees were given to Bruce Watkins at Walkamin, three trees were given to Ron Butler at Tolga and a little later three trees to Don Lavers on the lower side of the Walkamin “jump-up”. This distribution covered a range of micro-environments. By February/March 1982, trees at the first three sites were carrying good crops and mature fruit were sent to Brian Brown for postharvest evaluation at the Sandy Trout Food Preservation Laboratories, QDPI, Brisbane. Brian’s results on fruit quality and shelf-life plus positive market feed-back were sufficiently encouraging for Bruce

Watkins to commit to establishing a commercial Shepard orchard of approximately 500 trees in 1983/84.

Other growers also began planting around this time for further cropping and market assessment, but with smaller numbers of trees. In Mareeba, Ron Knowlton had opened Rainforest Nursery to provide the Tableland growers with planting stock since the nearest supply of trees was in South East Queensland. Ron also visited the senior author at Maroochy HRS where he was provided with propagation material of Shepard and Velvick, the latter being GxWI hybrid rootstock that had been selected by the senior author. Initially Ron grafted trees to Duke seedlings but as Velvick seed material increased he provided trees on this rootstock. When Ron retired in 2009 his nursery business was sold to Peter Lavers, and moved to Walkamin being reincarnated as Turkinje Nursery (Aboriginal for fire stick), taking its name from a siding on the now defunct Mareeba to Atherton railway line. Turkinje Nursery has continued with ANVAS accreditation and expanded its operation to service the growing demand for avocado trees from local growers. They have developed a novel propagation technique for producing cloned rootstocks and supply trees propagated on Dusa, Procado™ (SHSR-04), and Velvick.

Apart from the 5,000 plus Shepard trees planted in 1983/84, only a few additional trees were planted through until 1990 when numbers surged and growers in Central Queensland (Wide Bay) embraced the variety. It’s likely this planting activity was encouraged by the growing volume of fruit reaching the market from the 1983/84 event thus creating awareness of a “new player in town”. In recent years the number of Shepard trees planted has rapidly grown with in excess of 170,000 trees planted from 2015 to 2020 (Figure 2). The Atherton Tablelands continues to lead production based on tree numbers.

Shepard trees planted by year in Central and North Queensland

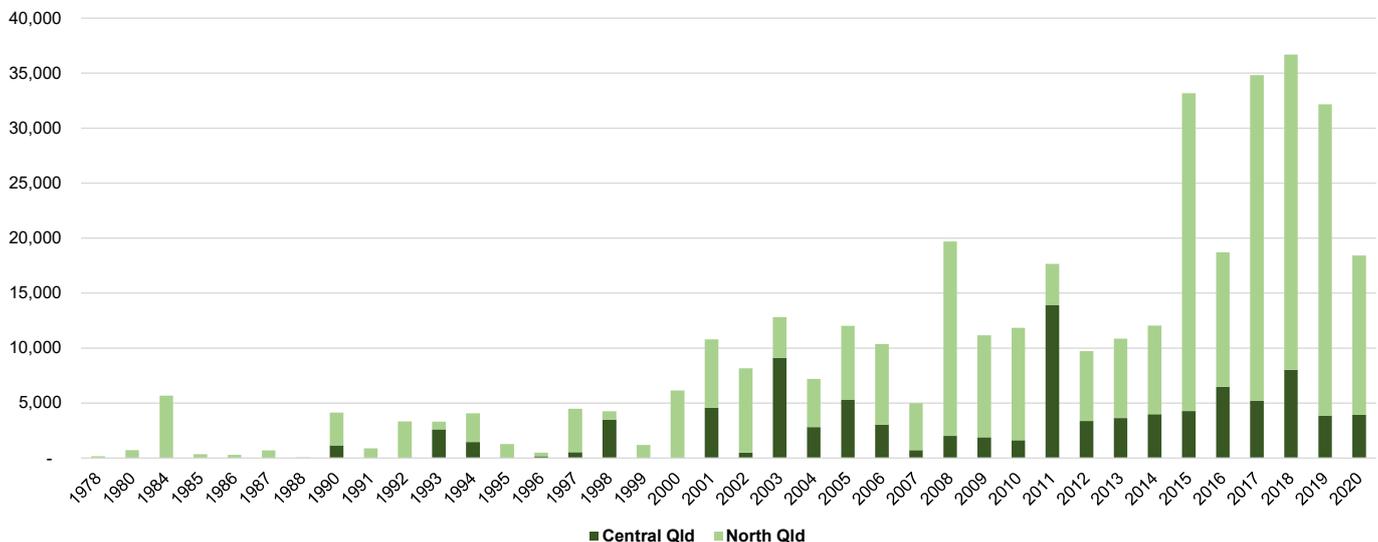


Figure 2. Annual number of Shepard trees planted in Central and North Queensland. Source: Avocados Australia.

Launching Shepard

Launching a new fruit variety in a market against well-established varieties has its challenges and although Fuerte and Rincon were falling from favour, Hass was entrenching itself as the preferred variety of retailers. In 1992, a small group of Shepard growers on the Atherton Tablelands gathered at Mareeba DPI for a meeting facilitated by representatives of the Harvest Company (a Brisbane-based marketing company) and QDPI. After much discussion a grower/marketer co-operative was born operating under the banner of Shepard Australia (name suggested by Terry Campbell of QDPI). Mary Ravello (Figure 3) became the inaugural chairperson followed by Don Lavers then Jim Kochi (current chair of Avocados Australia). This collaborative marketing arrangement gave Shepard a greater presence in the market and consolidated its acceptance as a new player of substance. The Shepard Australia marketing story is most adequately covered in the April 2003 *Good Fruit and Vegetables* article by Tony Biggs. After successfully operating for 23 years, Shepard Australia was wound up in 2015 since several other marketing groups had formed giving growers greater choice in selling their fruit.

Growing the crop – what we have learnt?

Being the junior partner to Hass, there appears to have been few agronomic research projects funded specifically for



Figure 3. Mary Ravello, first chairperson of Shepard Australia.

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Shepard. Albeit, many of the results from Hass field research can be directly implemented in Shepard orchards. However, with the recent growth in Shepard tree numbers (Figure 2), the time may be right to address some of the issues specifically related to this variety.

Climatic requirements

As discussed earlier in this article, with respect to temperatures at flowering, Shepard is a finicky variety with a narrow band of temperatures for pollination and fruit set. To the authors' knowledge the temperature band has not been defined but through practical experience we do have knowledge of the best places to grow this variety. Broadly speaking, judged on reliable fruit set, commercial production is viable on the Atherton Tablelands and in Central Queensland (Bundaberg/Childers). With respect to the Atherton Tablelands, Tolga is the southern limit for production through to Dimbulah in the north-western part of the district. There are several micro-environment changes between these two boundaries that include both temperature and soil variables. Walkamin is considered the "sweet spot" for Shepard production with its well-drained basaltic soils, its temperatures in the "Goldilocks zone" and moderate rainfall. At Tolga, cooler temperatures during flowering begin to impact on fruit set while at Dimbulah below average spring temperatures can reduce fruit set and high temperatures during fruit development reduce fruit size.

In general, production in Central Queensland is more tenuous since favourable spring temperatures during Shepard flowering are not reliable. There appears to be no yield gradient across the district and in an "off" year all growers "share the pain".

Of the two geographic areas the Atherton Tablelands is the most reliable in terms of fruit set and crop load although is more exposed to natural disasters such as cyclones and excess rainfall. While it is possible that Shepard-favourable environmental niches exist south of Childers, generally speaking Shepard is not a viable commercial variety grown in more southern districts.

Rootstocks

The Australian rootstock evaluation program that ran across all major production centres from 2002 until 2013 included Shepard as a scion in the field trials at Simpson Farms near Childers and Lavers Orchards at Walkamin. Based on the cumulative yield for the last six fruiting cycles, seedling Velvick rootstocks grafted to Shepard at both experimental sites, produced significantly more fruit than any of the other rootstocks tested.

We also know from this research that fruit quality (postharvest disease resistance and internal quality) was superior when grown on Guatemalan or Guatemalan x West Indian race rootstocks compare to rootstocks of Mexican race. Since the above trials were planted, two Mexican race rootstocks have come into general use – BW2 and Dusa.



Figure 4. 2021 is an "on" year for Shepard in Central Queensland.

Both have useful attributes: BW2 has less vigour than Velvick while Dusa has good Phytophthora root rot resistance, but their impact on postharvest fruit performance is unknown. Perhaps this could be looked at in the future along with other rootstocks that are coming online.

Reliable cropping

Consistent annual cropping of many fruit tree crops can be challenging due to varying factors. Alternate or biennial bearing is well documented where distinct "on"/ "off" years cycle in a predictable pattern. This cropping pattern can be imposed on early and midseason maturing avocados through hanging fruit late for marketing purposes. Fortunately, this doesn't usually happen with Shepard since growers take advantage of its early maturing timeslot and harvest before the supply new-seasons Hass arrives on markets. The comparative early removal of fruit provides Shepard trees with several months of recovery prior to the main flowering/ fruit set time, giving carbohydrate levels that drive this event time to recover. It's interesting that the six years yield data from the *Rootstock improvement for the Australian avocado industry – Phase 3 (AV08000)* project at Walkamin showed an incremental increase in production across all rootstocks while at the Childers site there was strong evidence of irregular bearing. In one year, a complete crop failure occurred that was replicated across the district.

This data illustrates the environmental superiority of Walkamin over Childers with respect to Shepard production, however, even on the Tablelands irregular bearing is reported in mature orchards. There are two possible drivers of this phenomenon: cool temperatures at flowering disrupting floral dichogamy (the overlap of male and female flowers), or aggressive mechanical pruning.

In subtropical and tropical Queensland exploratory research was not able to improve Hass yields by introducing polliniser varieties into orchards as sufficient overlap between male and female flowers occurs to provide adequate pollination. However, the “B” type flowers of Shepard are much more temperature sensitive and the dichogamy rhythm can be more easily disrupted if slightly cooler conditions occur during flowering. An obvious way to increase the reliability of fruit set is to include polliniser varieties in the orchard. These are varieties that have “A” type flowers with dichogamy patterns that complement Shepard, ie when Shepard flowers are open in the female stage (Figure 5) the polliniser will be open in the male stage and vice versa. There are two potential pollinisers for Shepard – Hass and Pinkerton. Hass is the most common used by those orchards that have incorporated pollinisers and in Central Queensland there is about one week of overlap at the conclusion of Shepard flowering and the beginning of Hass enhancing the opportunity for fruit set. Pinkerton has the advantage of more closely matching the flowering of Shepard but its fruit has no market demand.



Figure 5. Female floral stage of avocados – note the anthers are flat against the sepals and only discharge pollen when upright in the male phase of flowering.

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Data collected during the rootstock evaluation project showed that in an “off” year, production on trees directly adjacent Hass pollinisers could improve by up to 20% while in “on” years improvements up to 15% were measured. Due to trial layout it was not possible to get this data at Walkamin but the expectations are that pollinisers would be beneficial in offsetting “off” years of production. Opportunities exist in researching this area to provide information on optimum polliniser variety and placement within the orchard.

There is no obvious answer to mechanical pruning as while strategic hand pruning will generally result in less disruption to cropping, it’s time consuming and expensive and requires a much larger labour force.

Acknowledgement

The authors acknowledge the contribution of the late Brian Watson who played a small but essential role in “Finding a Home for Shepard”. Brian resigned from QDPI in 1991 and took on several consultancies in Papua New Guinea and other Pacific island nations. Returning to Cairns he was pleasantly surprised to see how much the Shepard industry had grown in his absence. We trust we have done justice to his desire to record how Shepard found its home and is contributing to the wellbeing of both orchardist and Australian consumers. It has truly been a team effort with many players involved but Jim Wilson and Brian Watson started the journey. Finally, a big thank you to Stan Shepard who generously shared his new avocado variety with the folks down under.

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Vale Brian Watson 1937-2020

Tony Whiley, Sunshine Horticultural Services

Brian was born and raised in Dunedin, New Zealand and graduated with a Bachelor of Horticulture degree from Lincoln College, Canterbury University in the late 1950s. His horticultural interests were in subtropical and tropical fruit crops, spices and vegetables leaving New Zealand in 1962 for employment in Sabah as an agronomist with the UN Special Fund Labuk Valley Natural Resources Project followed by a term in Sarawak where he worked as an agronomist for the UN and Sarawak Department of Agriculture developing tropical food crops.

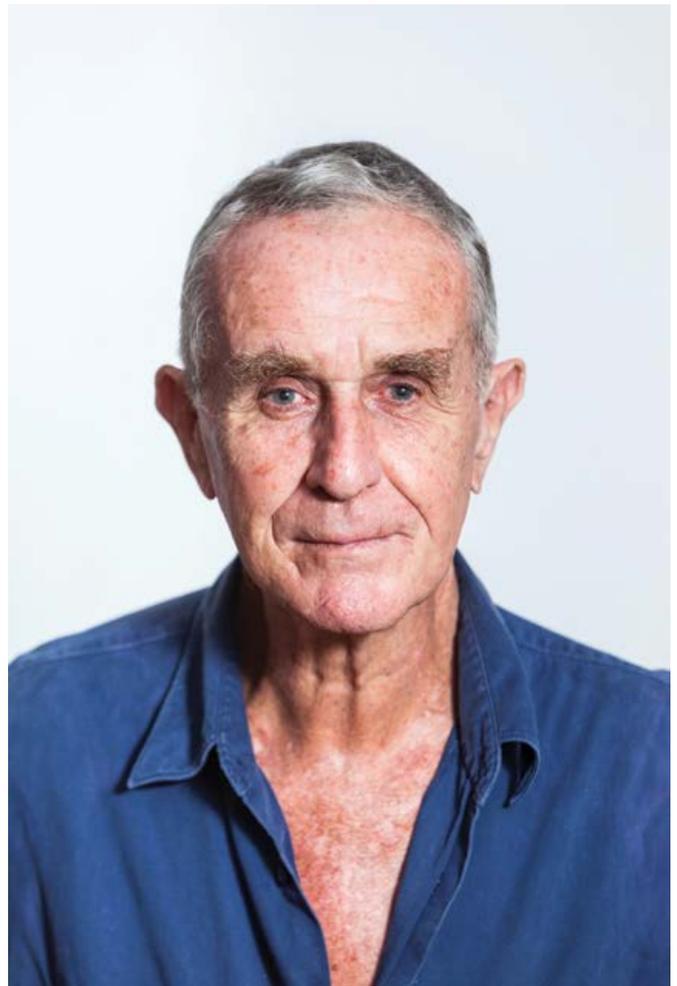
In late 1968, Brian was appointed as a Research Horticulturist with the then Queensland Department of Primary Industries at Nambour, primarily working with pineapples. In 1974 he accepted a promotion to shift to the wet tropics horticulture program based at Kamerunga horticultural research station (HRS), located a short distance from Cairns. During the 17 years at Kamerunga HRS, Brian involved himself with “hands-on” research with an enormous range of tropical fruits, nuts, spices that included bananas, pineapples, mangoes, avocados, lychees, longans, pummelo, custard apples, passionfruit, durians, mangosteens, rambutans, breadfruits, carambolas, grapes, papaya, jackfruit, chempedak, abiu, star apple, langsat, sapodilla, coconut, cashew, macadamia and turmeric.

He was an avid collector of new varieties across all species and was responsible for enriching the subtropical and tropical genetic material we have available today through overseeing the importation of improved varieties from the subtropical and tropical regions of the world. Some of these varieties found commercial success while others have been used in breeding programs with successful outcomes.

Brian is remembered by the North Queensland avocado industry for the significant role he played in establishing Shepard as a mainstream variety in Australia. In the late 1970s, he took great interest in the fledgling Atherton Tablelands avocado industry at a time when farmers were being discouraged from tobacco production. The climate and soils of the area were favourable for production and early maturing of avocados during a period of low market supply (February to April), provided orchardists with an attractive commercial opportunity. The mainstream varieties at the time were Fuerte and Rincon, both of which had thin skins making them highly susceptible to spoilage from pests and diseases. Brian accessed Shepard budwood from Maroochy Horticultural Research Station at Nambour for evaluation

in North Queensland and distributed trees to a number of interested growers across the Tablelands. Having a thicker skin, with greater pest and disease resistance and early maturing fruit, its potential was quickly recognised and within a short time Shepard replaced Fuerte and Rincon as the variety of choice for northern production for the February to April timeslot.

All sectors of the Australian avocado industry owe a great debt of gratitude, to a perceptive and enthusiastic horticulturist who helped establish what has become a very successful variety, filling an important role in the avocado industry in Australia. We extend our sincere sympathy to Brian’s wife Agnes and children Barbara and Andrew in their very sad loss.





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Elevating Work Platforms – safety first!

Liz Singh, Avocados Australia Industry Development Manager

As a “person conducting a business or undertaking (PCBU)”, it is your responsibility to ensure that you provide and maintain a work environment that is without risks to the physical and psychological health and safety for you and your workers.

Working with Elevating Work Platforms (EWP) when picking avocados can pose significant health and safety risks to the operator and those around them.

Safety must come first but what does safety look like?

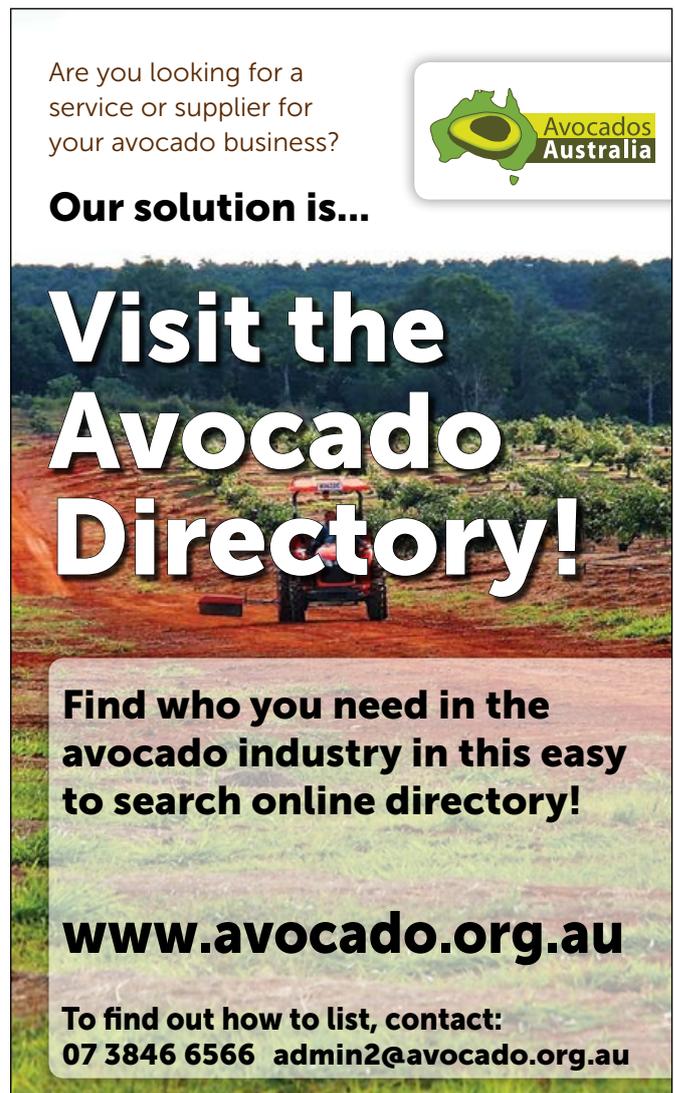
1. Do you have an EWP Standard Operating Procedure?
2. Do you have a training and operations log for your EWP operators?
3. Do you have the correct safety equipment to operate an EWP?
4. Do you conduct a risk assessment prior to the use of the EWP?
5. Do you need a licence to operate an EWP?
6. Do you supervise the operation of the EWP?
7. Do you have your EWP inspected annually?

Standard Operating Procedure (SOP)

A standard operating procedure is a document specific to your operation and the equipment that you use. It is a necessary document that forms part of your training requirements for workers in the operation of equipment such as an EWP. A SOP should contain the following elements.

- A **title, author, document version, date and approved for use by**.
- The SOP should outline the purpose of the document eg “This SOP outlines the procedures to be followed by trained operators when operating elevated work platforms to harvest avocados”.
- An **application/scope** should outline where and by who the document should be used by in dot points eg, “This SOP concentrates solely on the operation of EWP (model x). All operators must have significant and documented training before operating the EWP (model x). This SOP concentrates solely on the operation of EWP (model x) in Orchard x. All questions should be directed to person x before commencing operation etc”.
- The **resources/equipment** should be outlined including the EWP model, location of manufactures operating and maintenance manuals, required safety equipment and storage location, first aid requirements and locations, EWP inspection logs etc.

- A **warnings** section will highlight specific dangers that trained operators must consider when operating the EWP (model x).
- A **description of activities** will outline again the purpose for use of the EWP and step by step instructions, including pre-system checks and use of use of safety equipment.
- **References** can point the EWP operator to the use of other SOP and safety document that must be used in cooperation with this specific SOP. They can include SOPs for first aid, harness use, use of fuel stations, traffic plans and management as well as legal codes and guides or manufactures information.



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- **Appendices** can be attached including training documents, risk assessment documents, licence documents, maintenance inspection logs, supervision logs etc.
- A **compliance and review log** should be attached to the back of the SOP. As part of the compliance log all who have been trained and operate the EWP should sign and date the log to show they have read and understood the instructions of SOP version x. The review log will detail when the SOP document has been reviewed and had a version update. These documents should remain with the SOP throughout its life and beyond as legal documents of compliance.

Training and operations logs

As a “person conducting a business or undertaking (PCBU)”, it is your responsibility to provide appropriate and sufficient training before allowing a worker to operate an EWP. If you are the owner and the operator of an EWP, you will require training from the manufacturer upon receipt of the EWP and it may be worth while undertaking an “Operate an Elevated Work Platform” course with a registered training organisation (RTO) in your region.

When training a worker to operate an EWP, use your SOPs and manufactures manuals, pre-operating procedures, emergency controls, ensure that they understand what you are telling them, show them how to operate the EWP under different conditions, observe them operating the EWP, provide feedback and continue this cycle before making an assessment on whether they are **competent** of using the EWP independently or whether they need more training. Record this information in a training log that both you and your worker sign off on.

Safety equipment

Ensure that you have the correct safety equipment for operation of the EWP. The safety equipment must be stored correctly and be in a suitable condition. Did you know that best practice for an EWP operator involves the use of a ‘travel restraint system’? This is a short lanyard attached to the bucket and to a waist belt worn by the operator. This prevents the operator from getting their feet onto the mid-rail of the bucket and ensures the operator stands on the floor of the bucket only.

Risk assessments

Risk assessment should be conducted prior to the use of an EWP in consultation with your workers. This means every time not just once. The purpose of the risk assessment is to identify hazards. Common hazards related to EWP use include:

- uneven or unstable ground
- working around or beneath overhead structures, trees or electrical lines
- traffic and pedestrians
- weather hazards (strong winds, rain etc)

- falling objects, and failure of the machine
- Equipment maintenance.

Once the hazards are identified, the risks associated with these hazards are assessed, control measures are implemented to eliminate or minimise the risk. It is important that you and your workers return safely to your homes and families everyday after a day’s working in your avocado orchard.

EWP licence

The High Risk Work (HRW) License is regulated by each State and Territory’s relevant authority. If you are operating an EWP with a boom length of 11 metres or more, then you must comply with your state or territory regulations.



Working with Elevating Work Platforms (EWP) when picking avocados can pose significant health and safety risks to the operator and those around them.

Supervision

An EWP is a high risk piece of equipment. While a risk assessment will help to identify and minimise the risk, supervision of the use of EWPs in avocado orchards will assist in monitoring hazards and keeping the operator and those around the EWP safe.

Annual EWP inspections

In January 2021, Safe Work Australia released a new guide to inspecting and maintaining elevating work platforms (EWPs). *Elevating work platforms need to be inspected at least annually.*

EWPs are high-risk equipment that have caused nine worker fatalities in the past five years (2015-2019). An inspection, maintenance and testing program is crucial to assess their safe operation.

Employers are responsible for keeping workers safe and this includes ensuring that plant equipment is inspected and maintained.

Employers must also ensure that workers are given the necessary information, training, instruction and supervision to use elevating work platforms safely.

Download the guide here: safeworkaustralia.gov.au/doc/guide-inspecting-and-maintaining-elevating-work-platforms.

More information

Check out the specific EWP page in the WHS module of the Best Practice Resource, and visit safeworkaustralia.gov.au/topic/elevating-work-platforms.

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Farm safety and WHS updates

COVID-19 vaccination guide for workplaces

Employers have a duty under the model Work Health and Safety (WHS) laws to eliminate, or if that is not reasonably practicable, minimise the risk of exposure to COVID-19 in the workplace. Avocados Australia has curated links to the various national and state-based requirements in the Best Practice Resource WHS Module, avocado.org.au/bpr/.

According to Safe Work Australia, a safe and effective vaccine is only one part of keeping the Australian community safe and healthy. To meet your duties under the model WHS laws and minimise the risk of exposure to COVID-19 in your workplace, you must continue to apply all reasonably practicable COVID-19 control measures including physical distancing, good hygiene and regular cleaning and maintenance and ensuring your workers do not attend work if they are unwell.

It is unlikely that a requirement for workers to be vaccinated will be reasonably practicable.

You must also comply with any public health orders made by state and territory governments that apply to you and your workplace.

State and territory health agencies may make public health orders that require some workers to be vaccinated, for example, those considered to be working in high risk workplaces. If public health orders are made, you must follow them. You should stay up to date with the advice of your health agency.

There are currently no laws or public health orders in other states or territories that specifically enable employers to require their employees to be vaccinated against COVID-19.

For more information, visit: safeworkaustralia.gov.au/covid-19-information-workplaces/industry-information/general-industry-information/vaccination.

People at Work

People at Work is Australia's only validated psychosocial risk assessment tool. It is now online and ready for use by workplaces.

This free digital tool, supported by Australian work health and safety regulators, helps workplaces meet their legislative responsibility to identify, assess and manage risks to psychological health and safety.

You can use the People at Work tool to self-administer a tailored organisational survey to assess your workplace psychosocial hazards and factors. Once the survey has been completed by your workforce, a comprehensive report will show you how your organisation's results compare with

Australian benchmarks. The website also provides detailed support materials, and interactive learning modules that will support you to implement a psychosocial risk assessment process and evaluate the effectiveness of your chosen controls over time.

Find out more at peopleatwork.gov.au.

NSW: ride-on mower accident

An avocado and macadamia grower severely injured in a farm accident over Easter says he owes his life to his neighbour's dog. According to the ABC, Graham Bilbe was working on his Comboyne orchard when his industrial-sized ride-on lawnmower had mechanical trouble. According to the ABC story, Mr Bilbe first had to get out from under the overturned mower, and then get far enough up the hill for his neighbours to hear his calls for help.

Queensland: worker fatally injured jump starting tractor

In December 2020, a worker suffered fatal injuries attempting to jump start a tractor in Queensland. Investigations are continuing but the early investigations indicated two men were working together and one of them drove a car into the machinery shed where the tractor was parked. The automatic vehicle was left in drive with the handbrake on. After applying jumper leads to the tractor, one of the workers opened the car door, and whilst standing next to the vehicle on the driver's side, pushed the accelerator. At this time, it appears the car lurched forward and trapped the man.

Queensland company fined for providing unlicensed labour

A South-east Queensland company has been fined for providing labour hire without a licence.

Handed down at a hearing in the Brisbane Magistrates Court in February, the \$60,000 fine for K.T.D. Poultry Pty Ltd takes the total fines for unlicensed labour hire offences at the B&E Poultry (Qld) Pty Ltd factory at Ormeau to \$370,000.

At a hearing a few days earlier at the Beenleigh Magistrates Court, several unlicensed labour hire providers, and B&E Poultry, the poultry processor who engaged them to provide workers for its Ormeau operation when they did not have a labour hire licence, received fines totalling \$260,000.

This followed a joint compliance activity between Queensland's Labour Hire Licensing Compliance Unit and Workplace Health and Safety Queensland two years ago which discovered the offences.

Queensland's pioneering labour hire licensing scheme protects vulnerable workers and raises the standards in the

industry. You can find out more about labour hire licencing in Queensland at labourhire.qld.gov.au.

Victoria: WorkSafe visits 40 orchards, issue 91 notices

WorkSafe, Department of Health and Labour Hire Authority inspectors visited almost 40 orchards across the Shepparton region in February as part of a co-ordinated approach to workplace safety. Inspectors visited growers to ensure they were complying with occupational health and safety regulations, staying COVID-safe and supporting vulnerable workers as part of the three-day operation.

WorkSafe inspectors issued 91 improvement notices to duty holders at 18 of the 22 properties inspected.

WorkSafe Regional Operations Director Kate Maheras said while it was disappointing so many employers continued to put themselves and their workers at risk, many of the improvements required were small changes that would deliver big safety benefits.

Among the most common safety issues were a lack of roll-over protection and helmets worn on quad bikes and missing or broken guarding on tractor power take-offs and other machinery.

Department of Health Compliance and Enforcement Commander Chris Webb said officers undertook 19 inspections as part of the co-ordinated effort, with the majority of issues around COVID safety worked through on site without the need for further compliance action.

Department of Health officers sighted a COVIDSafe plan at just over half of the sites visited, while non-compliance with worker “bubbles”, cleaning schedules, record keeping and COVID induction and training were among the other most common issues.

More information

The avocado WHS module in the Best Practice Resource features avocado industry-specific hazard checklists, management tools, safety guides and safety induction information. Visit avocado.org.au/bpr/.



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Fall armyworm may opportunistically target avocado

Lisa Yorkston, Avocados Australia Communication Manager

While avocados aren't the main target of the fall armyworm, it would seem the new pest might attack avocado trees if they happen to be near an area of high infestation, but researchers remain confident it will not be a significant issue for the Australian industry.

Queensland Department of Agriculture and Fisheries (QDAF) researcher Dr Ian Newton said was one report of fall armyworm (*Spodoptera frugiperda*) in avocados on the Atherton Tablelands of North Queensland, in early 2021.

"However, we are pretty sure this is what we refer to as a 'spill-over' event," Dr Newton said.

"The fall armyworm's main host crop is corn (and perhaps some grasses/weeds), where it will breed-up in huge densities over the course of the growing season.

"Under these densities other neighbouring crops will sometimes get attacked to some extent."

Dr Newton says the instance on the Atherton Tablelands involves an orchard "very close" to very heavily infested maize and Rhodes grass.

"We still believe the avocado is not a true host of fall armyworm, and that these "spill-over" cases are probably somewhat rare," he says.

"On the Atherton Tablelands during this period, we saw huge numbers of fall armyworm in corn/maize in areas where there were a lot of avocados in the general area, yet this was the only case of fall armyworm in avocados that has been reported.

"I think it's unlikely to cause significant issues for avocado growers."

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The fall armyworm moth. The moth is 32-40mm from wing tip to wing tip, with a brown or grey forewing, and white hind wing. Males have more patterns with a distinct white spot on forewings. Image (wing spread): Robert J. Bauernfeind, Kansas State University, Bugwood.org. Image (wings closed): William Lambert, University of Georgia, Bugwood.org.



Fall armyworm larvae. The close up shows the inverted “Y” on the head, used for identification. The larvae is a light green to brown in colour, with white lengthwise lines and dark spots with spines develop as larvae mature. There is a distinctive pattern of four spots on second to last body segment and an inverted “Y” shape pattern on its head. When newly hatched, they are about 1.7mm, eventually reaching a length of about 34mm. Image (whole caterpillar): Russ Ottens, University of Georgia, Bugwood.org. Image (close up): Steve L. Brown, University of Georgia, Bugwood.org.



The eggs of the fall armyworm can be seen here on a cotton leaf. The eggs are a pale yellow, and less than 0.5mm in size. There are 100-200 eggs in a “mass” and this is covered in a pale mould-like furry substance. Image: Phillip Roberts, University of Georgia, Bugwood.org.

Top tips for avocado growers

If fall armyworm does become established in your area and your orchard borders broadacre (especially corn or maize) or vegetable crops, the top tip is to continuously monitor, especially in the rows closest to the neighbouring crops.

However, keep in mind that the fall armyworm moth is capable of easily travelling large distances, so it isn't only the exterior or your orchard that will need monitoring.

If you have grassed areas, these should also be monitored. Overseas, fall armyworm is known to attack Johnson grass, Rhodes grass, bent grasses, digit or finger grasses, couch grass, winter grass and panic grass.

You can find factsheets for a range of crops (not avocados) and ID guides (including larvae and symptoms) via the Queensland Department of Agriculture and Fisheries (QDAF).

Apart from the larvae and moths, you are looking for leaf damage, including pinholes, windowing, and tattered leaf margins.

Available treatment options

Hort Innovation, utilising grower levies from across horticulture, has worked with the other research and development corporations, the Australian Pesticides and Veterinary Medicines Authority and chemical registrants on the response.

If it becomes necessary, you can download a permit for Chlorantraniliprole via horticulture.com.au/hort-innovation/news-events/fall-armyworm-update-and-alert/. This minor use permit is for fall armyworm in avocados and blueberries.

Upcoming treatment options

Researchers are exploring two potential future treatment options, one a virus used successfully overseas and the other an Australian native fungus.

Dr Newton told the ABC he has been investigating the effectiveness of a naturally-occurring fungus that eats the grub from the inside out.

However, he warns it's unlikely the pest will ever be eradicated completely.

"The fungus is not going to be a silver bullet but these biological options would be a good tool because they are very specific and only kill the pest, not the beneficial insects including the pollinators," he told the ABC.

As for the virus product from overseas, Dr Newton told the ABC the Federal Department of Agriculture, Water and the Environment had approved the importation of the biopesticide, Fawligen, a naturally occurring caterpillar virus which specifically targets fall armyworm.

"The product needs to be registered in Australia and, to do that, we need to prove that it works and is safe, so that is going to take some time."

Pest risk

Fall armyworm caterpillars eat more than 350 different plants, including corn, sugarcane, rice and many vegetable and fruit crops. Crops can be ruined almost overnight without control measures when population levels are high.

It was first detected on the Torres Strait islands of Saibai and Erub in January 2020. Since then, it has been found in North and Central Queensland, the Northern Territory, New South Wales, and while it was first found in northern Western Australia, it has recently been found near Gingin (February 2021).

What should I do?

The Queensland Department of Agriculture and Fisheries is the lead agency in the national response. If you think you've seen fall armyworm, call QDAF on 13 25 23. For more information, contact the Department of Agriculture and Fisheries on 13 25 23 or visit daf.qld.gov.au.

Western Australia

General enquiries or suspect reports can be made to PaDIS by calling +61 (0)8 9368 3080 or email padis@dpird.wa.gov.au. WA industry enquiries can be directed to Helen Spafford, Senior Research Scientist +61 (0)8 9166 4074.

New South Wales

Report anything unusual to 1800 084 881.

Northern Territory

To find out about control measures, call 08 8999 2258 or email insectinfo@nt.gov.au and for advice on pesticide use, call 08 8999 2344 or email chemicals@nt.gov.au.

More information

You can find an online version of this article at avocado.org.au/public-articles/fall-armyworm-2021/. The online version includes links to a host of relevant resources and videos, and news articles.

Permit update for lepidopteran pest control

A permit for the use of Chlorantraniliprole in avocados to control lepidopteran pests including ectropis looper and the avocado leaf roller has been updated by the Australian Pesticides and Veterinary Medicines Authority (APVMA).

The permit holder has been changed from Avocados Australia Limited to Horticulture Innovation Limited (Hort Innovation), and is in place until 30 April 2023 for New South Wales, Queensland and Western Australia only. Download PER81560 from <https://portal.apvma.gov.au/permits> for all of the conditions associated with this minor use permit.

If you use this permit, or any others, and an adverse experience occurs as a result of using the permit, the *Non-Performance Reporting Form for Horticultural Pesticides* should be completed. You can download the form via <https://www.horticulture.com.au/contentassets/423f690686a74d278752978a403e7a91/aa-non-performance-reporting-form-for-horticultural-pesticides-2018.docx>.

A 'non-performance' is an unintended or unexpected effect on plants, plant products, animals, human beings or the

environment, including injury, sensitivity reactions or lack of efficacy associated with the use of an agricultural chemical product(s) when used according to label (or permit) directions.

Please return the *Non-Performance Reporting Form for Horticultural Pesticides* to jodie.pedrana@horticulture.com.au.

If you require any 'non-performance' information to be provided to the APVMA, please complete their online Adverse Experience Report Form. This can be found at: <http://apvma.gov.au/node/311> or <https://portal.apvma.gov.au>.

Acknowledgement

The *Avocado industry minor use permit program (AV16002)* has been funded by Hort Innovation, using the avocado research and development levy, and contributions from the Australian Government.

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Farm in One is a complete multi-tool farm management app that facilitates day-to-day Avocado farming and enables more accurate and informed decision making. It utilises a web-based platform and its patented hardware to communicate across multiple devices and machinery. Eliminating the need for multiple software solutions or having to buy all new equipment. Using mobile technology, Farm in One allows remote access, maximises crop performance, and reduces input costs. It is not hard to understand why farmers are embracing technology. Farm in One is unique in the market when it comes to technological advancement in agriculture.



The Gallo family have been growing crops on the Tablelands since the 1930's. The family grew everything from potatoes, peanuts, corn, legumes, and had dairy cattle for many years as well. In 2005 the family diversified into growing avocados and now majority of the farm is under Hass and Shepard trees.

The family has their own their pack house and market their fruit locally as well as nationally and James Gallo uses the Farm in ONE app to monitor his daily farm management. In 2020 due to Covid restrictions John Gallo was inspired to build the big avocado located on the family farm, now an icon on the Tablelands.

Farm in ONE offers a complete visual display of your avocado farm showing all blocks and devices through the integrated mapping platform which allows the user to manage multiple avocado farms in different locations.

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MARKETING UPDATE

Marketing Australian avocados

Adele Nowakowska, Hort Innovation



May 2021 marked the launch of the new brand positioning and messaging for Australian Avocados, with a new campaign designed to drive mass awareness to drive avocado demand.

The *Our Green Gold* strategy has been developed from the overarching avocado category strategy and through consultation with the Avocado Strategic Industry Advisory Panel (SIAP).

We secured well-known comedian Nazeem Hussain, and we will also “officially, unofficially” sponsor one of the country’s oldest bowls clubs.

The initial burst of activity is scheduled for May and June 2021, in line with the highest volume supply forecast.



The new *Our Green Gold* campaign features well-known comedian Nazeem Hussain (centre) and one of Australia’s oldest bowls clubs.

Brand campaign objective

The objective was to develop a campaign that emotionally connects with Australian consumers by leveraging the inherent love people have for avocados. By building brand love, we will help drive preference of Australian Avocados, grow unaided brand recall (awareness) and drive consideration, which will contribute to increasing frequency of purchase. All of which are important when faced with a volume uplift of 30% YOY.

The integrated campaign will feature activity across television, out of home advertising, social media (Facebook and Instagram), digital advertising, and public relations, and will run until the end of June 2021.

The case for change

Whilst the Australian Avocados' *Smash an Avo* campaign has driven awareness of functional benefits (such as use and versatility), it is a creative articulation that somewhat limits distinctiveness, brand building and on-going relevance.

The creative inspiration for the campaign started with the fact that while avocados were not "born" in Australia, we've made them our own.

They're everywhere. At our cafés, our dinner parties, our restaurants and our taco trucks. In fact, they're so universal, they've almost become invisible. And we've forgotten how precious they are. Every mouthful is a premium. Every slice is golden. Every cube is a little treasure. To be artfully arranged in our sushi. Masterfully mashed on our toast. And divvied up democratically. (Or else.)

Isn't it time that we reminded Australians of how much we love them? That we celebrated their iconic status? They're our national treasure. Our Green Gold.

Creative idea

It's green, it's gold. It's a national treasure. In order to celebrate the iconic status of the Avocado and elevate it beyond the plate and into culture. Let's give the avocado its rightful place. Officially... but actually unofficially.

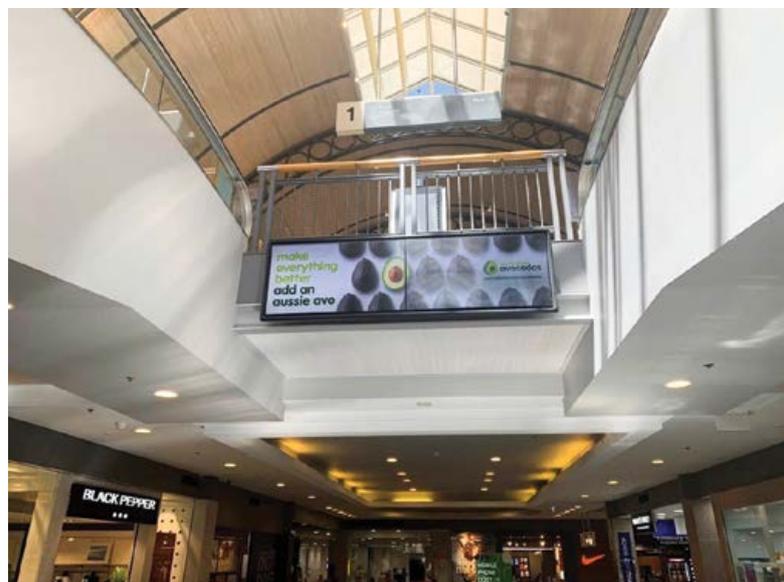
PR campaign

As part of the PR activity, Australian Avocados will 'officially unofficially' sponsor small community and/or sporting groups. In order to create a strong earned media moment and provide a springboard for our national call out for sponsorship, we will engage with one Australian green and gold institution to kick things off and bring the essence of the campaign to life.

By engaging with one community group/ team, we are providing an example of what an 'official unofficial' sponsorship looks like. Media are in need of an example to provide the call to action for involvement with context.



Our Green Gold will take over this giant mural space overlooking Kings Cross, Sydney.



The Australian Avocados shopping centre promotions were spotted in the wild by Avocados Australia staff in February. This shot is of an electronic advertising board in the Maroochydore Sunshine Plaza, in Queensland. This sign is above the escalators moving between floors.

We have chosen a bowlo as it is an Aussie icon and the heart of many community, which makes it a beacon for the types of small community and or sporting groups we are looking to receive sponsorship requests from.

The bowlo we have chosen (the historic Balmain Bowling Club) is based in Sydney but has great history in that it is the oldest in New South Wales. The club has also been hit by hard times in this past year, nearly closing its doors permanently because of the impacts of COVID-19.

Social

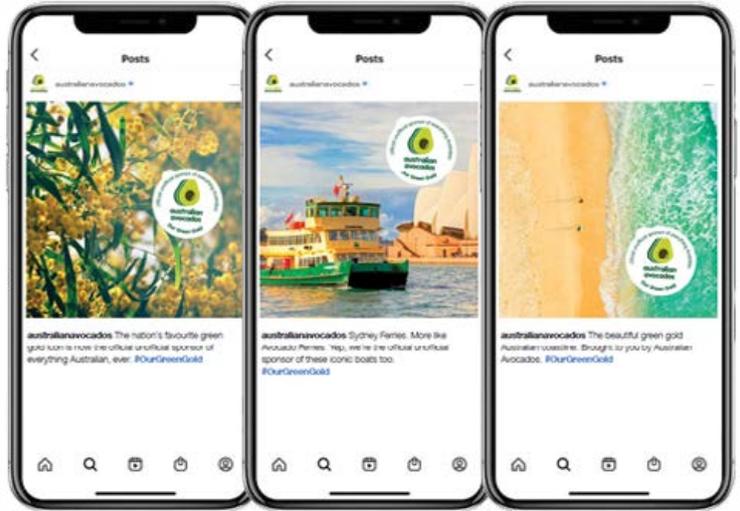
Having an online presence on any of our social media forums like Facebook or Instagram is a great way to interact with our audience and to really connect with them on a personal level.

Our content pillars have evolved based on the new campaign. These are:

1. Sponsors of Green Gold – content that amplifies our platform and motivates community participation to build an emotional connection
2. Mastering Green Gold – content that educates people about Australian avocados and their health & wellbeing benefits
3. Green Gold moments – food and recipe content that inspires people to choose and use Australian Avocados more frequently.

IGA Merchandising Competition: Go for Green Gold

In addition to this activity, to support the brand campaign from an instore and consumer experience point of view, a merchandising competition across 1,400 IGA stores will run from 7 July, for a four week period. The activation will encourage IGA stores to create amazing displays in order to win a green gold avocado trophy.



An example of the social media content that will be shared for the Our Green Gold campaign.

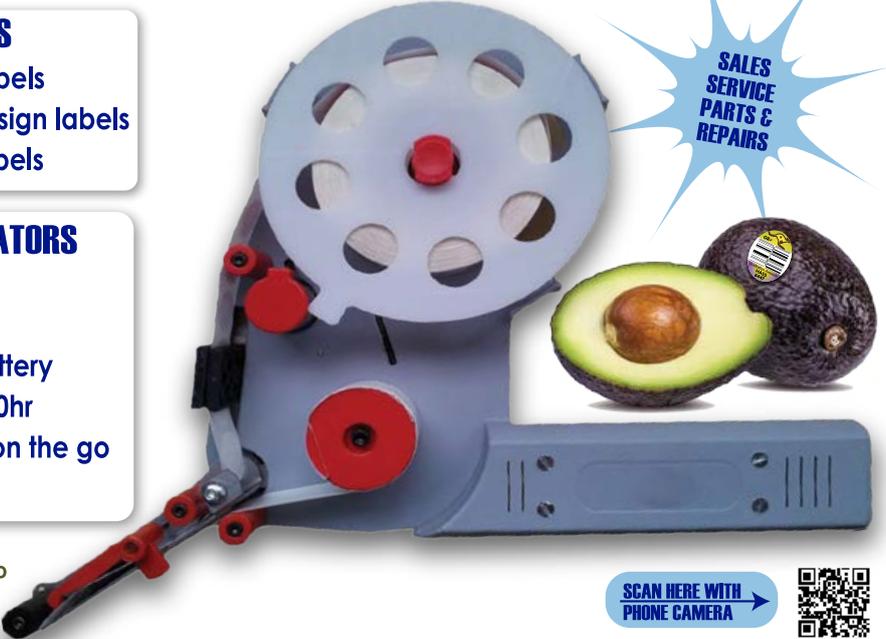


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Shepard promotion

In line with expected peak supply times, the Australian Avocados' promotion for Shepard ran between February and April, including radio, out-of-home displays and social media content. This included working with retailers, including Woolworths (pictured). The activities also included activities with foodie and personal trainer Luke Hines, who told *Body+Soul* that the Shepard was just misunderstood, and produced a new recipe as well, a charred BBQ avocado salad.

"I think Aussies simply aren't aware of what makes them so great or don't understand how to make the most of them," Luke told the publication. "For example, our research shows that over half of Aussies (54%) aren't aware that the skin remains green, even when ripe and 62% don't know that their flesh won't oxidise when cut or go brown when stored in the fridge.

"I find them ideal for slicing and dicing in salads, sandwiches or even a ceviche as opposed to smashing," he says.

Adam Liaw talks avocado

A partnership with well-known television presenter, author and celebrity chef Adam Liaw also helped to provide inspiration and drive preference for Australian avocados. Adam, who specialises in Asian home cooking, has 230,000 followers on Instagram and is a regular columnist for *goodfood*, *Sunday Life* and *the Guardian Australia*.

Avocados in popular culture

It was an opportunity too good to miss, when *Married at First Sight* star Beck Zemek used the classic line "you're not an avocado, not everyone likes you" when talking to another participant in an episode first aired on 17 March 2021.

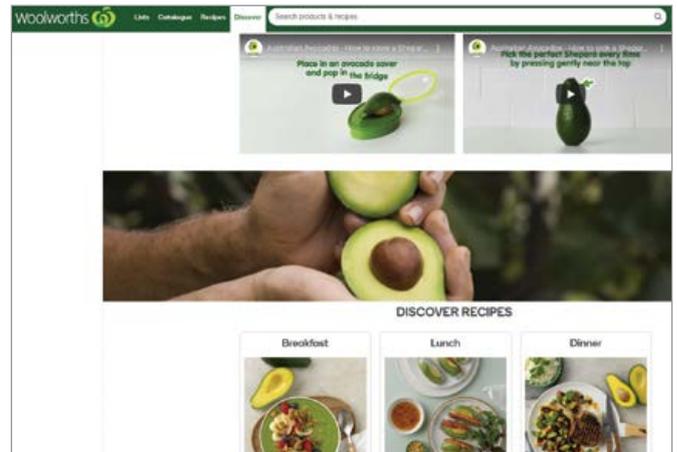
Australian Avocados immediately took the opportunity to be involved in the conversation, commenting on the quote on the MAFS social media, and developing a meme (pictured).

Acknowledgement

This activity is managed by Hort Innovation, on behalf of the industry, and is funded by the avocado marketing levy. You can find links to a range of the online content via our industry marketing blog at bit.ly/AusAvos2021, including the new *Our Green Gold* ad featuring comedian Nazeem Hussain.

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Retailer Woolworths featured Australian Avocados content, to promote Shepards.



Adam Liaw's avocado dessert is a winner on the goodfood website.



On social, it's not all about what's posted on the Australian Avocados Instagram and Facebook pages. In March, the team behind the consumer-facing social were there when a *Married At First Sight* participant told a fellow contestant "you're not an avocado, not everyone likes you".

HAWK

Your Business – Our Focus – Working Together

Fibre Packaging for a Sustainable Future

Hawk Group is a family-owned company that manufactures moulded fibre fruit packaging from its purpose-built facility in Hastings, New Zealand.

With our origins dating back to the early 1970's and now spanning three generations, the family's industry knowledge and experience of fibre recovery, recycling and moulded fibre manufacturing has seen Hawk become an industry leader in their field. Hawk currently supplies more than 80% of NZ's apple and avocado trays and has also had a successful presence in the Australian market through the supply of apple trays since 2016.

One of our primary goals is to make it easy for our customers to work together with us. As such, service excellence is at the forefront of our offering. Continuous improvement across product, service, systems, and strong industry understanding are areas we strive to excel in every day. Our trays are specifically designed for the protection of fruit during the packing, storage, and transport process - from packhouse to end customer. From consignment stock and virtual inventory management to tray design, marketing and automation - we have built an offering that supports all aspects of our customer's operations.

Energy efficiency and sustainability are key drivers in our manufacturing process. This is the best strategy to future proof not just our business, but our customer's business also. All products are made from 100% recycled paper. We do not use any bleaches, pigments, biocides, or toxic chemicals in our manufacturing. Our products are recyclable and compostable after end-use. Hawk is compliant with internationally recognised standards including HACCP Food Safety, ISO 9001:2015, ISO45001:2008 and FSC Chain of Custody Certification. Certificates are available to view or be downloaded from our website. For avocado, we have a full count range available from fruit size 16 to 30. We also have a full range of RDT trays for plastic crates available if required.

Please contact us or view our website for full product specifications at www.hawk.net.nz.

We are here to help and answer all of your questions! Our Australian representative, Craig Fraser, can be reached on 041 931 1191 or call **freephone 1800 845 256** or email sales@hawk.net.nz.

Craig is happy to meet personally with you and discuss in more detail how Hawk can benefit your business.



RESEARCH AND DEVELOPMENT

Fruit quality trace-back case study

Noel Ainsworth, Queensland Department of Agriculture and Fisheries

Investigating the root cause of poor fruit quality is a new component of the *Avocado Supply Chain Feedback project* (AV18000). During a 2020 assessment of fruit quality in a consignment, we came across the darkened flesh symptoms above and below the seed (Figure 1).

The initial diagnosis was based on photos shown to Queensland Department of Agriculture and Fisheries (QDAF) and Queensland Alliance for Agriculture and Food Innovation (QAAFI) colleagues. It was suspected that the symptoms may be related to calcium deficiency, boron deficiency, frost damage or a combination of all three. These were compared with photos of vascular browning frost damage (p116), boron deficiency (p120) and calcium deficiency flesh discolouration (p121) images in *The Avocado Problem Solver Field Guide* (2013) and symptoms described by Smith (1997).

To confirm the initial diagnosis, a traceback was initiated involving discussions with the packshed manager and the grower who supplied the fruit. This included details about frost incidence and leaf damage, tree age, tree vigour and rootstocks used plus the fertiliser program and results of leaf analysis. Naturally that information was vital to working out what might

have gone wrong and where improvements could be made.

Information provided by the grower suggested that calcium nutrition may be a key factor. A sample of fruit from the source block plus a fruit sample from another block nearby (for comparison) were sent to Symbio Laboratories in Brisbane for nutrient analysis. Results are presented in Table 1, the most relevant result in these analyses is probably the N/Ca ratio. The fruit with symptoms had a ratio below the proposed threshold value of 33 whereas the symptomless fruit had a ratio above this threshold. In addition, both calcium and boron levels were lower in the affected fruit.

The advice provided to the grower was to consider making suitable changes to their nutritional program, especially shifting the N:Ca balance and boron levels. It is important to remember that too much nitrogen promotes excessive vegetative growth which diverts calcium away from developing fruit. Timing is also important when it comes to calcium application, noting that there is a limited window of opportunity to apply calcium and this needs to be within the first six (6) to eight (8) weeks after fruit set, when calcium is deposited into the fruit.

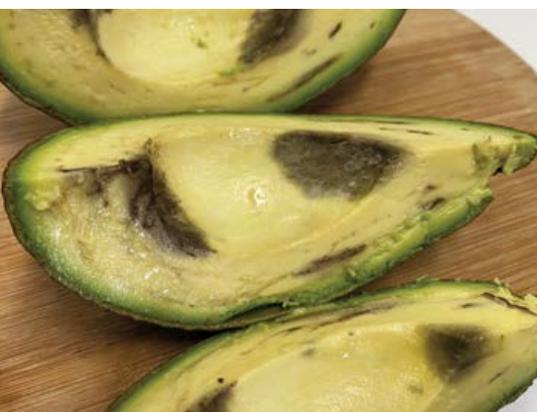


Figure 1. Symptoms observed at medium-soft ripe.

Table 1. Fruit analysis results

	Other sample	Poor quality	Recommendation*
Total Kjeldahl Nitrogen (N) (%w/w)	0.42	0.31	
Calcium (Ca) (mg/kg)	160	87	
Magnesium (Mg) (mg/kg)	365	353	
Zinc (Zn) (mg/kg)	5.4	9.2	
Potassium (K) (mg/kg)	7200	7400	
Silicon (Si - Acid Soluble) (mg/kg)	5.2	3	
Boron (B) (mg/kg)	38	11	
N/Ca ratio	26.3	35.6	<33
(Ca + Mg)/K ratio	0.073	0.059	>0.065

* Perkins M et al (2021) pers. comm.

While the cause of the fruit quality symptoms is rarely definitive, this case study illustrates the value of obtaining feedback on ripe fruit quality. This, combined with a little bit of investigation, provides an early warning and likely corrective action before a little problem becomes a big one. The AV18000 project team use commercial fruit quality assessors in Sydney and Melbourne. This service, through Rudge Produce Systems, is also available to avocado growers on a fee-for-service basis.

Further information on how to improve fertiliser / nutrition management can be found in:

- Newett, S., Rigden, P., and Weinert, M. (2013) *The Avocado Problem Solver Field Guide* (2013) p161, State of Queensland
- BPR content under Growing / Nutrition / Calcium (avocado.org.au/bpr/)
- Newett, S., Rigden, P., and Carr, B. (2018) Avocado plant nutrition review, Department of Agriculture and Fisheries. https://avocado.org.au/wp-content/uploads/2018/08/AVOCADO-PLANT-NUTRITION-REVIEW-2018_cover.pdf
- Newett, S., Perkins, M., Coates, L., Irvine-Brown, S., and Joyce, D. (2021) 'Review of pre-harvest mineral nutrition for post-harvest quality', Talking Avocados, Summer V31#4, p54-57.
- Smith, T.E., Hofman, P.J., Stephenson, R.A., Asher, C.J., and Hetherington, S.E. (1997) Improving boron nutrition improves 'Hass' avocado fruit size and quality. Proceedings

from Conference '97: Searching for Quality. Joint Meeting of the Australian Avocado Grower's Federation, Inc. and NZ Avocado Growers Association, Inc., 23-26 September 1997. J. G. Cutting (Ed.). Pages 131 – 137, http://www.avocadosource.com/Journals/AUSNZ/CONF97/CONFERENCE_1997_PG_131-137.pdf

More information

Contact QDAF Principal Supply Chain Horticulturist Noel Ainsworth, on 0409 003 909 or email noel.ainsworth@daf.qld.gov.au.

Acknowledgement

The AV18000 project has been funded by Hort Innovation, using avocado research and development levy, co-investment from the Queensland Department of Agriculture and Fisheries, Western Australian Department of Primary Industries and Regional Development, and contributions from the Australian Government. Key project delivery partners also include Avocados Australia and Rudge Produce Systems.



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Procado®: a new Australian avocado rootstock

Tony Whiley, Sunshine Horticultural Services and Liz Dann, University of Queensland

Phytophthora root rot (*Phytophthora cinnamomi* Rands) has arguably the greatest impact on the field-loss of avocado production worldwide. Trees in all countries commercially growing this crop are now affected to a greater or lesser extent with this disease, which, left untreated, becomes fatal. Effective chemical management of Phytophthora root rot (PRR) in high disease pressure environments is available via phosphonate-based and metalaxyl/mefenoxam fungicides. Phosphonates are applied at key phenological stages preventatively and curatively (read more in the Summer 2021 edition of *Talking Avocados*), while application of metalaxyl/mefenoxam is generally only cost effective at planting. Growers should not rely solely on fungicides to manage PRR but embrace a holistic approach to manage this disease.

Resistance or tolerance amongst rootstocks to PRR in avocados has been a key selection trait for the past 35 years with varying levels of success. The Californian program identified that the Duke series of rootstocks were moderately resistant to Phytophthora, and Duke 7 was released as a clonal rootstock in the mid-1970s. Since then, Dusa, from the South African selection program, has become the international benchmark for resistance and has been planted in Australia for a number of years. Velvick, a Queensland selection, is also extensively planted as a seedling rootstock in Australia, and is a vigorous rootstock that performs well under high PRR disease pressure. None of these rootstocks are completely resistant to PRR, but rather form an important component of an effective management package to control PRR in trees under high disease pressure.

Procado®

In the early 2000s a healthy “escape” avocado tree (Hass grafted to an unidentified seedling rootstock) was noticed growing in an orchard at South Kolan near Bundaberg, where the condition of surrounding trees had significantly declined due to Phytophthora root rot. The tree was cut below the graft union in spring, leaving only the rootstock to regenerate shoots. Once the new growth had sufficiently hardened, scion wood was cut and vegetatively propagated using the micro-cloning technique described by Ernst (1999) and Ernst et al. (2012). The rootstock was given the accession code of SHSR-04 and was grafted with Hass in preparation for field evaluation for resistance to Phytophthora root rot.

To secure the Intellectual Property a second set of trees was prepared with SHSR-04 grafted to seedling Velvick rootstock and planted in a commercial orchard in North Queensland, to provide descriptive data for Plant Breeders Rights (PBR).

An application was made for PBR under the name of SHSR-04 and given preliminary approval on 24 August, 2019. This immediately provides IP protection through until the application is finalised, which is expected by August 2021. More recently (October 2020), a Trade Mark was granted for the rootstock and the name Procado® was successful, which will be used for marketing purposes.

From data collected to-date we know that Procado® is predominantly of the Guatemalan horticultural race with fruit maturing mid-season (May/June). The tree has a semi-upright growth habit of moderate vigour and despite the “A” type flower, crop load at the PBR experimental site has been low since fruiting began. This has no reflection on it being used as a rootstock where it induced a high level of precocity in trees grafted to Hass planted in Central Queensland in their first flowering season (developing fruit were removed to maximise vegetative growth in their first year of establishment). Obviously, more cropping data is required to support these early observations.

Procado® fruit has a thick, pebbly skin and very palatable flesh with a rich nutty flavour. The fruit has a flesh recovery of about 80% with a mean size of about 345 grams (Figure 1). Fruit characteristics are required for PBR and Plant Patent descriptions but are irrelevant for its use as a rootstock. Procado® seeds have been grown as rootstocks and grafted with Hass then tested for PRR resistance but gave no commercially useful protection.



Figure 1. Procado® fruit showing thick, pebbly skin.

DNA fingerprinting was kindly provided by Prof Iñaki Hormaza (Institute of Subtropical and Mediterranean Horticulture, Malaga, Spain), utilising 12 simple sequence repeat (SSR) molecular markers, that demonstrated Procado® was different to all the other genotype profiles held in the collection in Spain, which include Velvick and the South African and Californian rootstocks.

Evaluation of SHSR-04 (Procado®)

A series of replicated trials to evaluate SHSR-04 (Procado®) and other rootstocks, were undertaken between 2006 and 2014 in a field at Duranbah, NSW, which had previously grown avocados that were removed due to PRR decline. Soil sampling and lupin baiting confirmed the presence of high levels of *Phytophthora cinnamomi*.

Trial 1. Replicates of 11 rootstocks propagated as seedlings and/or clones and grafted to Hass were planted in May 2006. At planting all nursery trees were assessed as having a health rating of 1, i.e. full health. To assist with the field establishment, Ridomil® (metalaxyl) granules were spread around trees at planting, and a full phosphonate program (pre-planting Agri-Fos® pot drench and post-planting bark-painting with Agri-Fos®) was applied for the first 12 months. In May 2007, all PRR control management was withdrawn from the trees. Regular disease assessments were started in November 2006 and continued through to March 2008 using the 1-10 rating scale where 1 = healthy and 10 = dead. Trunk girth circumferences were measured in April 2008 as a secondary indicator of tree health.

Full details including statistical analyses are available in Smith et al., (2011), and are represented here as simple plots of health over time for each rootstock. Health of all trees declined when rated six (6) months after planting despite support from the metalaxyl and phosphonate program (Figure 2). This may be partly due to trees being rated after winter and before new summer growth had occurred.

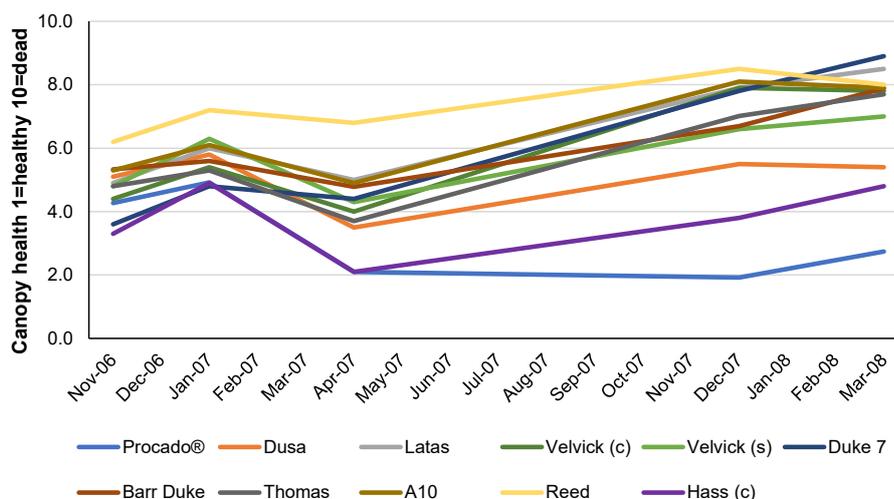


Figure 2. Average health of Hass trees grafted to different rootstocks 6-22 months after planting at Duranbah in May 2006 (Trial 1). Assessed using a rating scale of 1-10, where 1 = healthy and 10 = dead.

At the end of the first summer (11 months after planting) Hass, SHSR-04/Procado®, Dusa and Thomas had the lowest health ratings, i.e. were the healthiest trees but not statistically different to some of the other rootstocks. Most rootstocks declined significantly in health 19 and 22 months after planting, the exceptions being SHSR-04 (Procado®), Hass and Dusa (Figure 2). Of these three, SHSR-04 (Procado®) (Figure 3) had a significantly better health rating than Dusa but was not different to Hass, which at this point in time performed strongly. The clone of Hass has no graft union since it's basically a rooted cutting and this may be that reason for its "pseudo-resistance" to PRR as beyond the scope of this data these trees declined rapidly in health and succumbed to root rot. Girth data (Table 1) largely mirrored the health ratings. The exception was Hass grafted to Thomas, which had the greatest trunk circumference when measured despite the trees being in significant PRR decline. Observations from other rootstock experiments in the HAL AV08000 project showed that the Hass/Thomas tree combination is particularly vigorous and these trees generally grew faster than any other of the rootstock combinations. In this instance, it is likely that Thomas



Figure 3. Dr Ken Pegg with Hass grafted to SHSR-04 (Procado®) at Duranbah, 2008.

rootstock trees put on greater growth than other trees during the first year after planting when all were protected by fungicides and before *Phytophthora* decline set in. Several years after the trial was planted, 70% of Procado®, Dusa and clonal Hass trees were still alive, while most other trees of other rootstocks had died in that time (Table 1).

Trial 2. Replicates of seven (7) rootstocks propagated as seedlings or clones and grafted to Hass were planted at the same site in Duranbah in April 2010. In addition to SHSR-04 (Procado®) and Reed (as the known susceptible control), the rootstocks included SHSR-05 (seedlings) from a tree north of Bundaberg, seedling Kidd and two selections from Anderson Horticulture, assigned here Anderson 1 and Anderson 2. The trial also included trees grafted with an open-pollinated seedling Dusa (OPD). These seed were sourced from a Shepard orchard where the Dusa rootstock in several trees had been allowed to escape and fruit. While the maternal parent of each seed is known to be Dusa, the pollen donor (father) could be either Dusa or Shepard.

A year after planting, trees on Procado® were significantly healthier than all other rootstocks, except those grafted with Kidd or Anderson 2 (Figure 4). Reed rootstock is considered extremely susceptible and declined more rapidly than other rootstocks after planting. Canopy health continued to decline over time, and at three years after planting, trees grafted with Procado® and SHSR-05 were the healthiest (Figure 4). At the conclusion of the trial, approximately four (4) years after planting, more than 50% of trees grafted to Procado® were alive, 40% of SHSR-05 and 30% of OPD and Anderson 1. Only 5-10% of trees on other rootstocks were still alive. It is noted that the OPD rootstock planted in this trial is not a true clonal Dusa and likely did not perform as well as Dusa would have, in terms of tree health over time and survival. This demonstrates why it is important to protect the integrity of these superior

Table 1. Average trunk girth and percentage survival of trees grafted to different rootstocks planted at Duranbah in May 2006 (Trial 1). Trunk girth measurements were taken immediately above the graft union two years after planting. Tree survival is the % of living trees compared with total numbers planted. Mean values followed by the same letter are not significantly different at P = 0.05. Girth data are from Smith et al., 2011.

Rootstock	Girth (mm) at 2 years		Tree survival % at 6 years
Latas	128	bcd	30
Dusa	112	bcd	70
Velvick clonal	125	bcd	20
Velvick seedling	99.0	d	50
Duke 7	108	cd	10
Barr Duke	132	abcd	30
Thomas	179	ab	30
A10	83.7	d	0
Reed	78.4	d	10
SHSR-04 (Procado®)	179	a	70
Hass	143	abc	70

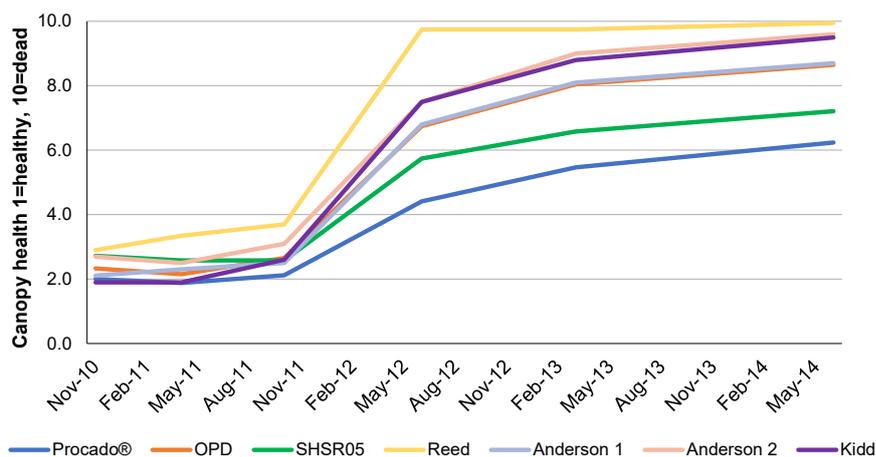


Figure 4. Average health of Hass trees grafted to different rootstocks 7-50 months after planting at Duranbah in April 2010 (Trial 2). Assessed using a rating scale of 1-10, where 1 = healthy and 10 = dead.

proprietary rootstocks by licences and non-propagation agreements. They simply do not perform as seedling rootstocks, due to the genetic variability introduced by the outcrossing.

Trial 3. Surviving trees from previous trials were removed and a third experiment to evaluate resistance of seedling or cloned rootstocks to PRR was planted into the same sites at Duranbah in May 2013, and similarly protected from PRR for the first year following planting. SHSR-07 and SHSR-08 were cloned from seedling trees surviving under high PRR

disease pressure in an earlier rootstock trial, planted in 2007. SS3-1 was from the Canary Islands PRR selection program. As the population of Pc varies according to the availability of roots to infect, the new plantings were grouped according to the health of their previous occupant, ie empty for about three (3) years or tree removed two (2) months prior to planting the new trial.

After two years from planting, rootstocks indicating the highest tolerance to PRR were SHSR-08, SHSR-04 (Procado®) and Velvick however, they are not significantly different to

Dusa and SHSR-07. Reed, SS3-1 and Zutano were the worst affected and in significant decline when assessed less than a year after planting. (Figure 5).

Approximately 18 months after planting, counts of developing fruit were higher on the healthiest trees (Table 2), and at the end of the data collection period, nearly two years after planting, tree survival was greatest on Velvick, SHSR-04 (Procado®) and SHSR-08. Despite the severe PRR decline, there was still a reasonably high survival rate of trees on Zutano and Reed.

An interesting link to the planting site history was revealed, where the majority of tree deaths occurred at sites where live trees had been removed only 2 months prior to planting, compared with those which were planted into sites which had been cleared for a few years. This shows the benefit of a period of fallow for replant orchards to allow *P. cinnamomi* inoculum in the soil to decline.

Commercial planting of Procado®

The first commercial planting of 600 Hass grafted to Procado® was made near Childers in July 2020 (Figure 6), in a replant orchard block that was replaced because of significant tree decline due to *Phytophthora* root rot. Tree spacing is at 7.5 x 3m (443 trees/ha), which is somewhere between a commonly used commercial spacing and a true high density orchard. The reason for this is the same block has trees planted on the more vigorous rootstocks of Dusa and Velvick and the spacing used provides greater opportunity to manage all rootstock/scion combinations with strategic pruning and PGR application.

Despite the drier than average spring and summer conditions that followed, trees have established well (Figure 7). A full program of *Phytophthora* suppression was implemented starting from soil preparation through to fungicidal treatments that were continued after planting. Tree height and diameters were recorded two (2) weeks after planting along with

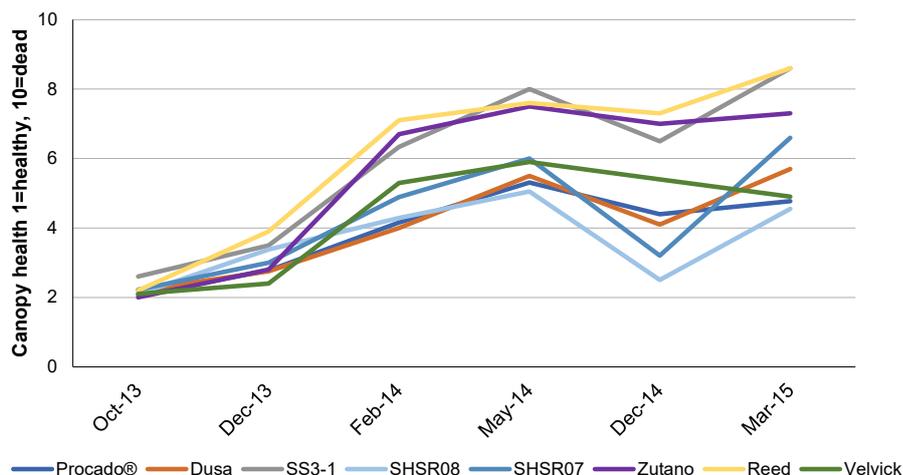


Figure 5. Health of Hass trees grafted to different rootstocks 6-22 months after planting at Duranbah in May 2013 (Trial 3). Tree health is rated on a scale where 1 = healthy and 10 = dead.

Table 2. Fruit counts and % tree survival of trees grafted to different clonal rootstocks 19-22 months after planting at Duranbah in May 2013 (Trial 3). Tree survival is the % of living trees compared with total numbers planted. Means followed by the same letter are not significantly different ($P \leq 0.05$).

Rootstock ¹	Fruit counts/tree 19 months	Tree survival % 22 months
SHSR-08 (clonal)	18 abc	91
SHSR-04 (Procado®) (clonal)	23 ab	79 (85) ²
Dusa (clonal)	32 a	64
Velvick (seedling)	11 bcd	100
SHSR-07 (clonal)	25 ab	60
Zutano (seedling)	3.8 cd	90
Reed (seedling)	2.0 d	70
SS3-1 (clonal)	3.3 bcd	23

¹ SHSR-07 and SHSR-08 were cloned from seedling trees surviving under high PRR disease pressure in an earlier rootstock trial, planted in 2007.

² One of the three tree deaths was due to *Phellinus noxius*, not PRR. If this death is not included, the tree survival is 85%.



Figure 6. Newly planted block of Hass grafted to Procado® near Childers, July 2020.

measurements from similar aged Hass trees planted on Dusa and cloned Velvick rootstock, so that comparative growth rates can be tracked with age. These will be reported as data is accumulated.

Early observations on tree vigour and yield

Whilst Procado® produces a tree of moderate vigour when grown as the scion (variety), when used as a rootstock it appears to produce smaller trees, at least in its early years. This is illustrated in Figure 8, where Shepard was grafted to 3 different cloned rootstocks, Velvick seedlings, Velvick mother tree and Procado®. Velvick has long been recognised as producing vigorous growing trees when grafted to Hass and Shepard so it's not surprising that Shepard grafted to cloned Velvick seedlings (seedlings from where the tip was removed and rooted as a cutting for rootstock use) has produced the largest trees (24.6m³) during the 2.5 year period since planting. Shepard

grafted to rooted cuttings from the Velvick mother source produced the second largest trees at 20.2m³, while the Shepard trees grafted to Procado® were less than half the size of trees on the other two rootstocks at 8.9m³ (yield data not available at the time of publication).

The implication from this “lower vigour” trait of the Procado® rootstock is the potential to grow high density orchards with tree height capped to 2-3m with less reliance on plant growth regulators (PGRs). Chile has been the leader in moving from low to high density avocado production as a matter of necessity to avoid damaging frost, where orchards have been increasingly planted on steep mountain slopes with use of mechanisation limited.

Orchards are planted at several densities depending on location and management skills of the growers but range from 555 to 1000+ trees/ha (Figure 9). By comparison, standard tree densities in most avocado orchards



Figure 7. Nine-month-old Hass on Procado® growing in a replant orchard near Childers, March 2021.

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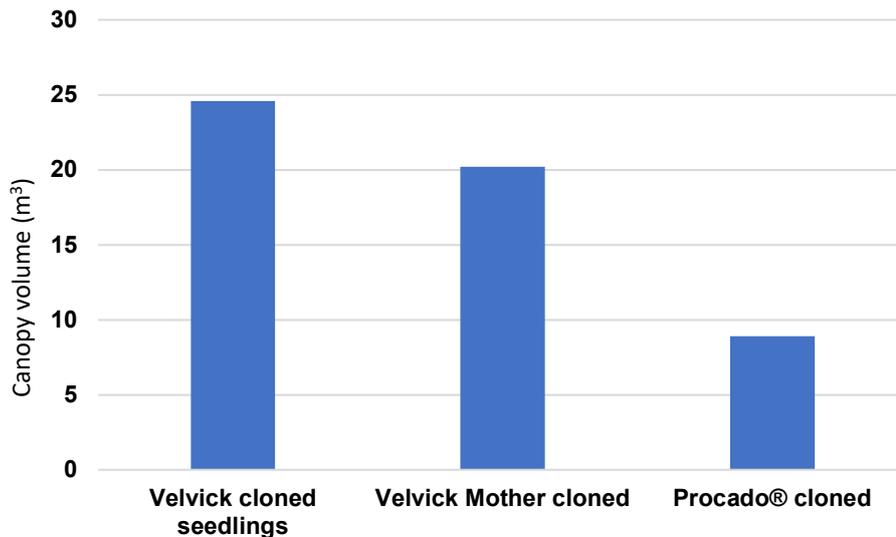


Figure 8. Canopy volume (m³) of Shepard trees grafted to cloned rootstocks of Velvick seedlings, Velvick mother and Procado®. The 2.5-year-old trees were growing in an orchard at Walkamin, NQ and were planted within four (4) months of each other. Data are mean values of 10 trees for each rootstock/scion combination. Shepard trees on cloned Procado® are significantly smaller than Shepard on cloned seedling and cloned mother Velvick (P<0.001).



Figure 9. A hillside, high density avocado orchard in Chile where tree size is managed by strategic pruning and fertiligated PGRs.



Figure 10. High density orchard in New Zealand's Far North where tree size is managed with strategic pruning and fertiligated PGRs.

across Australia are somewhere between 166 to 200 trees/ha. Tree height in Chilean high-density orchards is contained to 1.5-2m using soil-applied PGRs and hand pruning, which are assisted to some extent by climatic and edaphic factors (Whiley et al. 2012). However, most nursery trees are propagated on seedling Mexicola rootstocks that impart moderate to high tree vigour. Hass is the main variety grown and well-managed high density orchards consistently achieve between 15 to 25t/ha, albeit there are years when yield crashes due to inclement weather affecting flowering/fruit set.

Closer to home, for a number of years the senior author has been assisting with the development of high-density avocado production in the Far North of New Zealand, where an orchard has been planted on the slopes of ancient sand dunes. With much of the planted area not suitable for machinery access, a decision was made to plant at high densities, initially at 3.5 x 3.5m (814 trees/ha) then later at 5 x 3m (825 tree/ha) to provide inter-row access for small orchard vehicles (Figure 10). Most of the orchard has been planted with Hass grafted to seedling Zutano rootstock, which is quite a vigorous growth combination. Some Hass grafted to cloned Dusa were also planted, which has produced trees with greater vigour than Hass on seedling Zutano, thereby increasing the difficulty of managing smaller trees. The aim is to contain tree height at 2.5m since hydraulic ladders can't be used due to the sloping terrain. Pesticides and pelletised fertiliser are applied by helicopter. It's been a steep learning curve with blocks escaping from tree size control in the early years as management techniques were being developed. Success comes to those who persist and tree height in blocks planted more recently are being controlled with production over the past four (4) years averaging around 18t/ha, that is, consistently carrying heavy crops. It's noted that the most successful blocks in the orchard are those where tree vigour has been suppressed by soil conditions. Both Chile and the New Zealand orchard documented in this article use polliniser trees throughout

the orchard and introduce beehives during flowering to maximise pollination opportunities, since flowering for Hass often occurs during periods of inclement weather for floral dichogamy to operate successfully. This provides an additional layer of “insurance” over all other management inputs given prior to the flowering/fruit set event.

Chilean and New Zealand production conditions differ from most of Australia’s growing regions with both labour and agronomic factors that make high and ultra-high density orchards viable for them. However, both countries are having to deal with relatively high-vigour rootstocks. The concept of producing economic yields from smaller trees is universal across all fruit tree crops and for many fruits has been made possible by the use of genetic combinations (rootstocks/scions) developed from 100+ years of targeted breeding and selection programs, that reduce tree vigour and growth, eg apples and citrus. Smaller tree canopies increase the efficiency of light interception to the total orchard canopy, generally resulting in yield improvements through greater cropping efficiency per cubic meter of canopy (Figure 11). When tree vigour is controlled an increased percentage of energy is diverted from shoot growth to fruiting (Wolstenholme et al., 1990). While we are still learning the growth and cropping habits of trees grafted to Procado®, the data to date suggest that this rootstock could be a very useful tool in managing growth in high density orchards in Australia as the key features it provides are reduced vigour and good field resistance to Phytophthora root rot.

Evaluation of the yield capacity of SHSR-04 (Procado®)

To evaluate preliminary yield performance of SHSR-04 (Procado®), 10 trees of this rootstock were clonally propagated together with 10 trees of Velvick, each as a seedling or cloned rootstock giving a total of 30 trees. Velvick was chosen as the standard for comparison since it is widely used across the Australian avocado industry and has been shown to be one of the most productive rootstocks used in Australia (Whiley

et al., 2013). The trees were planted in February 2007 in a Phytophthora-free site at Hampton in southeast Queensland. Yield data was first recorded in 2010 which was the first crop the trees had set and carried to maturity, and subsequently measured in 2011 and 2012. The HAL Project AV08000 concluded in 2012. Yield is reported in mean kg/tree and t/ha for three years (Table 3). Yield data was collected for SHSR-04 (Procado®) in 2013 but not for Hass on Velvick rootstock trees.

There were no significant differences between rootstock yield in 2010, however, in 2011 yield of Velvick seedling rootstock was significantly ($P \leq 0.05$) greater than either the cloned Velvick or SHSR-04 (Procado®) rootstocks. The crop across the whole orchard was low in 2012 due to inclement climatic conditions during flowering and fruit set in the preceding 2011 spring, and there were no significant differences between rootstock yield this year (Table 3).



Figure 11. Crop load on a two metre high tree in a high density orchard in New Zealand’s Far North managed with strategic pruning and fertiligated PGRs.

Table 3. Yield, and cumulative yield of the SHSR-04 (Procado®) cloned rootstock in comparison with seedling and cloned rootstocks of Velvick growing in a Phytophthora root rot-free site at Hampton in south east Queensland. Values in columns followed by different letters are significantly different ($P \leq 0.05$) and are the mean of 10 trees for each rootstock/scion combination.

Rootstock ¹	Yield (kg/tree)				t/ha ²				Cumulative Yield (kg/tree)
	2010	2011	2012	2013	2010	2011	2012	2013	
SHSR-04 ^c	6.8	30.6 b	3.6	58.9	1.3	5.7	0.7	10.9	41.0 ⁴
Velvick ^s	5.3	61.2 a	10.1	-	1.0	11.3	1.9	-	76.6
Velvick ^c	7.3	32.7 b	1.8	-	1.4	6.0	0.3	-	41.8
	ns ³		ns						

¹ C = cloned rootstock and S = seedling rootstock.

² t/ha is based on 185 trees/ha (9 x 6m orchard spacing).

³ ns = non significant ($P > 0.05$).

⁴ 2013 data for SHSR-04/Procado® has not been added to this total. Data are from Whiley et al., 2013.

When comparisons are made with the seedling and cloned Velvick rootstocks in this experiment against the same rootstocks planted at Hampton in 2004, it's noted that the Velvick seedling rootstock outperformed the Velvick cloned rootstock in the early years of the experiment but after five fruiting cycles there was no significant difference between the two rootstocks. From Table 3 data it's too early to predict the comparative yield performance of SHSR-04 (Procado®) in a Phytophthora-free site. However, more recent growth data with Shepard as a scion, indicates that Procado® produces trees with lower vigour than other rootstocks in common use (Figure 8) and comparative yields should be made on a canopy efficiency basis (kg/m³) since when growing high density orchards, the number of individual canopies/ha can be 3-4 times greater than in conventionally planted orchards.

Conclusions

Procado® is an Australian developed rootstock with a level of commercially useful resistance to Phytophthora root rot, which used with other disease management practices, will assist in maintaining orchard health. The rootstock belongs to the Guatemalan race of avocados differentiating it from the South African and Californian rootstocks with Phytophthora root rot resistance that are predominantly of Mexican race origin. The Horticulture Australia Ltd (HAL) project *Rootstock Improvement for the Australian industry – Phase 3* (AV08000) project clearly demonstrated that under most Australian production conditions Guatemalan and Guatemalan x West Indian race hybrids outperformed Mexican race rootstocks. Establishment and performance of trees grafted to Procado®, under additional stressful conditions, for example, salinity, will continue to be evaluated. With current knowledge, it appears the lower tree vigour induced by the Procado® rootstock will be more suited to higher density orchards than those currently planted by Australia growers and thus row and tree spacings should be carefully considered for a more timely return on investment per hectares planted.

Where to buy trees grafted to Procado®

Propagation licenses have been signed with Andersons Horticulture Pty Ltd, Duranbah, NSW, Flemings Nurseries Qld (Nambour, Queensland) and Turkinje Nursery (Walkamin, Queensland). Future license agreements with other ANVAS nurseries are expected.

Acknowledgement

The research leading to this result was funded by the Horticulture Australia Ltd (HAL) project *Rootstock Improvement for the Australian industry – Phase 3* (AV08000), that recovered and cloned the rootstock in collaboration with George Green and Sunshine Horticultural Services. (As IP owners George Green and Sunshine Horticultural Services contributed resources supporting the development of the rootstock, including recovering the original rootstock and subsequent propagation to allow field testing).

The HAL/Hort Innovation funded projects *Improving yield and quality in avocado through disease management* (AV07000 and AV10001) carried out field evaluations of Phytophthora root rot resistance. We thank Graham Anderson and Harold Taylor for their collaboration in this research over several years, and the various project team members who collected data.

The *Avocado rootstock SHSR-04 commercialisation* (AV15005) project was funded by Hort Innovation, using the avocado research and development levy, and contributions from the Australian Government. Its main role was to assist with securing the Intellectual Property vested in the rootstock and negotiating commercialisation agreements with nurseries in collaboration with the other parties with IP ownership.

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The proportion of self-pollinated Hass fruit increases at greater distance from another cultivar

Wiebke Kämper (Griffith University), Steven Ogbourne (University of the Sunshine Coast), David Hawkes (Australian Genome Research Facility), Stephen Trueman (Griffith University)

Avocado flowers are female when they first open and male when they open a second time. In theory, flowers of Type A cultivars such as Hass open as female in the morning, close in the late morning, and re-open as male on the afternoon of the next day. Flowers of Type B cultivars such as Shepard open as female in the afternoon, close in the late afternoon, and re-open as male on the following morning.

Orchards are established with a mixture of Type A and Type B cultivars to maximise the chance that pollen from male-stage flowers is available for pollination of female-stage flowers. However, the timing of the female and male stages may change depending on climatic conditions such as cool temperatures during flowering. There can often be significant overlap between female and male stages within the same cultivar.

Avocado orchards are typically established with each cultivar planted in a wide block, rather than different cultivars being interplanted within the same row or in alternating rows. Wide blocks simplify farm management and may reduce the costs of pest control, disease control and fruit harvesting.

However, planting each cultivar in a wide block might reduce the chance that female-stage flowers are pollinated successfully. Avocado fruit can be produced from self-pollination (by pollen from the same cultivar) or cross-pollination (by pollen from a different cultivar). Therefore, planting each cultivar in a wide block might also increase the chance that most fruit result from self-pollination.

In other crops, such as macadamia, self-pollinated fruit are often smaller and of lower quality than cross-pollinated fruit.

We know comparatively little about the effect of self-pollination on avocado fruit. Here, we assessed the contributions of self-pollination and cross-pollination to avocado fruit production in two Queensland orchards. We also determined whether fruit mass, flesh mass, mineral nutrient concentrations and fatty acid composition differed between self-pollinated and cross-pollinated fruit.

Methods

We harvested Hass fruit from 32 trees in two orchards near Childers, Queensland. The first orchard contained blocks of Hass and Shepard that were 26 rows wide, with row spacing

of 10-11 m. The trees were 13-years-old. The second orchard contained blocks of Hass, Shepard, Lamb Hass and Wurtz that were 6-22 rows wide, with row spacing of 10m. Trees were 18-21-years-old. The 32 harvested Hass trees were located along eight transects, with each transect consisting of four individual trees at: (a) 1 row, (b) 2 rows, (c) 3 rows, and (d) 11-14 rows from another cultivar. The last sampling point represented the middle of a Hass block.

Six fruit per tree were stored at 4°C before being ripened at room temperature for 10-12 days. We measured total fruit mass and flesh mass of each fruit. We analysed mineral nutrient concentrations in the flesh using inductively coupled plasma – atomic emission spectroscopy. We analysed fatty acid composition by gas chromatography – mass spectrometry. We determined the pollen parent of each fruit by extracting DNA from the seed and performing MassARRAY genotyping using methods that we developed for avocado.

Results

A total of 52% of Hass fruit arose from self-pollination and 48% of Hass fruit arose from cross-pollination. Almost all (95%) of the cross-pollinated fruit were pollinated by Shepard. The percentage of self-pollinated fruit increased with increasing distance from another cultivar (Figure 1). Approximately 37% of Hass fruit were self-pollinated and 63% were cross-pollinated in the row next to another cultivar. In contrast, 75% of fruit were self-pollinated and 25% were cross-pollinated in the middle of the Hass blocks, i.e. at 11-14 rows from another cultivar.

Hass fruit that were self-pollinated by Hass did not differ significantly in total fruit mass or flesh mass from Hass fruit that were pollinated by Shepard (Table 1).

The flesh of cross-pollinated fruit had 10% higher calcium and 11% lower phosphorus concentration than self-pollinated fruit (Table 2). Other mineral nutrient concentrations did not differ significantly (data not presented). Self-pollinated and cross-pollinated fruit did not differ significantly in the relative contributions of palmitic, palmitoleic, stearic, oleic, elaidic or linoleic acid to their total fatty acid composition (Table 2).

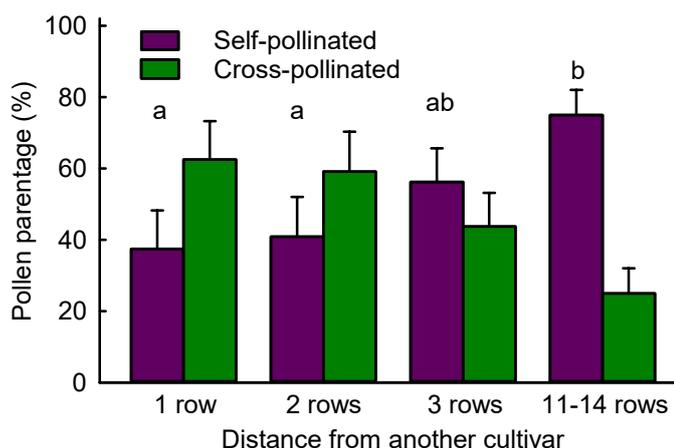


Figure 1. Percentage of self-pollinated and cross-pollinated Hass fruit at increasing numbers of rows from a cross-pollen source. Means (+ SE) for self-parentage with different letters are significantly different (2-way ANOVA and Tukey's HSD test; $P < 0.05$; $n = 8$).

Table 1. Fruit and flesh mass of Hass fruit pollinated by self-pollen (Hass) or cross-pollen (Shepard)

	Pollen parent	
	Hass (self-pollinated)	Shepard (cross-pollinated)
Fruit mass (g)	195.5 ± 6.0	197.8 ± 8.3
Flesh mass (g)	155.8 ± 4.6	161.0 ± 6.7

Means ± SE within a row do not differ significantly (mixed model; $P > 0.05$; $n = 32$ trees)

Table 2. Mineral nutrient concentrations and fatty acid composition of Hass fruit pollinated by self-pollen (Hass) or cross-pollen (Shepard)

Mineral nutrient (mg/kg) or fatty acid (%)	Pollen parent	
	Hass (self-pollinated)	Shepard (cross-pollinated)
Calcium	131.8 ± 9.5 a	144.9 ± 11.4 b
Phosphorus	515.6 ± 18.6 a	461.2 ± 20.1 b
Palmitic - C16:0	31.8 ± 0.9	32.1 ± 0.9
Palmitoleic - C16:1 cis	11.6 ± 0.7	11.9 ± 0.5
Stearic - C18:0	0.4 ± 0.0	0.4 ± 0.0
Oleic - C18:1 cis	40.0 ± 1.3	39.1 ± 1.0
Elaidic - C18:1 trans	7.0 ± 0.3	7.1 ± 0.3
Linoleic - C18:2	9.2 ± 0.5	9.4 ± 0.5

Means ± SE within a row with different letters are significantly different (mixed model; $P > 0.05$; $n = 32$ trees)






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Discussion

We found almost a 50/50 mixture of self-pollinated and cross-pollinated Hass fruit in two Queensland orchards. However, the percentage of self-pollinated fruit increased from 37% to 75% as we moved from the edge to the middle of the wide Hass blocks. Bees and flies are the main pollinators in avocado orchards.

Our results indicate that pollen vectors were only partly effective in transporting Shepard pollen into the middle of Hass blocks that were 22-26 rows wide. This might affect tree yield, because we expect that pollination and fruit set would be greatest when female-stage flowers of the Type A cultivar Hass have the greatest possible access to pollen from the male-stage flowers of Type B cultivars such as Shepard. Further research is warranted to determine whether yields are lower in the middle than at the edge of wide Hass blocks.

Self-pollinated fruit are often smaller and of lower quality than cross-pollinated fruit in other crops. This is an example of xenia, which is the term used for the effect of different pollen donors on the size or quality of the fruit. However, self-pollinated and cross-pollinated Hass fruit did not differ significantly in fruit mass, flesh mass, and the concentrations of most mineral nutrients. Interestingly, though, Hass fruit that were cross-pollinated by Shepard had higher calcium concentrations than self-pollinated Hass fruit, which suggests they might be less prone to rots and other fruit disorders, and they might have longer shelf life.

Self-pollinated and cross-pollinated Hass fruit did not differ significantly in fatty acid composition. Both types of fruit had the same, distinctive fatty acid profile that makes avocado a valuable component of a healthy, nutritious diet.

Acknowledgement

The *Increasing yield and quality in tropical horticulture with better pollination, fruit retention and nutrient distribution* project (PH16001) is funded by the Hort Frontiers Pollination Fund, part of the Hort Frontiers strategic partnership initiative developed by Hort Innovation, with co-investment from Griffith University, University of the Sunshine Coast, Plant & Food Research Ltd and contributions from the Australian Government. This research was also funded by the Ruhr University Research School PLUS, which is funded by Germany's Excellence Initiative [DFG GSC 98/3].

We thank Simpson Farms and Costa Avocado for assistance and access to their orchards. We thank Chris Searle, Helen Wallace, Tarran Richards, Peter Brooks and Tsvakai Gama for advice and assistance.



POLLINATION FUND

KEY MESSAGES

- Interplanting of Type A cultivars (eg Hass) and Type B cultivars (eg Shepard) increases the chance that avocado flowers are pollinated successfully.
- We used DNA markers to determine whether Hass fruit in two orchards had been self-pollinated by Hass or cross-pollinated by another cultivar, mainly Shepard.
- On average, 37% of fruit in the Hass row next to another cultivar were self-pollinated. This increased to 75% of Hass fruit being self-pollinated at 11–14 rows from another cultivar.
- Fruit mass, flesh mass, and fatty acid composition did not differ significantly between the Hass fruit that were self-pollinated by Hass and the Hass fruit that were cross-pollinated by Shepard.
- The flesh of cross-pollinated fruit had 10% higher calcium levels than self-pollinated fruit.

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Crop count research

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For a number of years, the research team at the Applied Agricultural Remote Sensing Centre (AARSC) at the University of New England (UNE), has been evaluating the accuracies of remote sensing for yield forecasting in a number of horticulture tree crops, including avocado. Whilst this evaluation has included UAVs and on ground sensing, a methodology developed for satellite imagery has been determined to be the most effective at delivering consistently accurate measures of yield forecasting for avocado.

Currently, the AARSC, led by AARSC Director, Professor Andrew Robson, are undertaking a Horticulture Innovation funded project *Implementation of precision agricultural solutions in Australian avocado productions systems*.

One of the key outputs of this project is to deliver a minimal viable (MVP) product that will provide avocado growers with access to high resolution satellite imagery as well as the ability to calibrate the imagery for yield, fruit size and tree health. Enter MVP 'Crop Count', a prototype mobile application that has been developed to do just this.

"We've had the pleasure of working alongside a number of progressive growers throughout this project who have provided invaluable support, it's been exciting to see the Crop Count methodology delivering consistent levels of accuracies for yield forecasts," Professor Robson said.

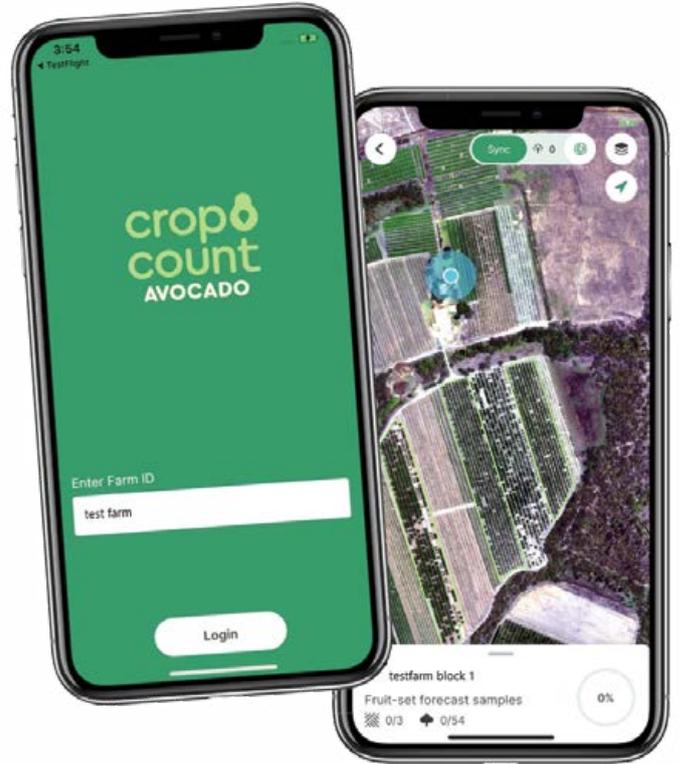
Professor Robson commented that in order to establish support from growers it was important that they were provided with a basic understanding of the technology, as well as evidence that the approach could achieve positive results. It is not just about pushing a technology and hoping it works.

"Researchers can often get caught up in the technical side of explaining the madness behind their methodologies, and that can become a barrier to entry for growers' engagement or their desire to adopt research outputs in their on-farm practices," he said.

"This time around we wanted to do things differently and deliver a tool that could be easily used on farm for the benefit of the grower," Professor Robson said.

To physically put their work into the hands of growers, AARSC teamed up with award winning, digital creative agency, Circul8, who specialise in bridging the gap between research and real life.

Circul8's Head of Production Janine Googan was instrumental in bringing this research to life.



Dr Moshir Rahman (AARSC) and Alanha Stokes (Circul8 Managing Director) in the field.

“Our job was to marry the complicated science stuff with a practical way for farmers to accurately tally their crop.” Ms Googan said.

“To bridge this gap we believe that good design is essential, we don’t mean just making something look good (although we like doing that too). Good design is a process and way of thinking that makes sure that you empathise with your user and understand how your product will work in the context of their lives.”

Circul8 and AARSC engaged with a number of growers, to better understand how growers might use and benefit from an app that could deliver accurate forecasts. The team discovered that whilst forecasts were important, understanding tree health and being able to better manage underperforming areas of a block would really provide value.

“Knowing how many avocados you are going to harvest is good, but knowing how to increase that harvest through better field management was even better,” Ms Googan said.

An additional consideration for the team was connectivity, the app needed to work across the farm with or without mobile reception.

“We also had to consider devices and connectivity which was an issue when out in the field at several locations. This meant that we had to build the app to work effectively offline with the ability to sync when users were back online,” Ms Googan said.

What has resulted is Crop Count, a user friendly prototype that delivers calibrated satellite imagery along with valuable tree health and performance information into the palm of grower’s hands.

The next phase for Crop Count is to test and validate across additional farms and have the back end of the application completed for complete automation. Currently AARSC are in conversations with potential commercial partners globally to assist in the commercialisation of Crop Count.

More information

If you’d like to find out more about Crop Count or be involved in future AARSC trials, please contact the team via email: aarsc@une.edu.au.

Acknowledgement

Crop Count is part of *Implementing precision agriculture solutions in Australian avocado production systems* (AV18002) project, funded by Hort Innovation, using the avocado research and development levy, and contributions from the Australian Government.



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...ISN'T IT TIME YOU CAME ON BOARD?

Riverlands and Adelaide Hills tree crop map updated

The national tree crop map has progressed with the Adelaide Hills and Riverlands growing regions in South Australia now updated.

In total, 327ha of avocado has now been recorded in South Australia and 16,026ha nationally.

If you see any trees missing, or any orchard incorrectly mapped you can update the map by either completing a Land Use Survey (best for mobile) or via the Industry Engagement Web App (best for desktop). You can find all the various applications via une.edu.au/webapps.

The Applied Agricultural Remote Sensing Centre (AARSC) team is now progressing the update of the map for Sunraysia, Riverina and Goulburn Valley growing regions with fieldwork scheduled for late April.

AARSC Senior Research Craig Shephard said the demographics for each crop had been updated in the Australian Tree Crop Map Dashboard.

He said the Severe Weather App (covered in detailed in the Summer 2021 edition of Talking Avocados) now included historical information for tropical cyclones and thunderstorm cells.

“Summary statistics for the potential impacts to your tree crops from recorded events are available in a pop-up,” he said.

More information

Users can launch a web app at une.edu.au/webapps and for more information, contact Craig Shephard at the Applied Agricultural Remote Sensing Centre on 02 6773 4085 or aarsc@une.edu.au, or follow them on Twitter at twitter.com/une_aarsc.

Acknowledgement

This mapping is a component of two greater projects: *Multi-scale monitoring tools for managing Australian tree crops: industry meets innovation* (ST15016) and *Implementing precision agriculture solutions in Australian avocado production systems* (AV18002). These projects are funded by the Australian Government’s Rural Research and Development for Profit scheme and Hort Innovation respectively. Both projects are led by the University of New England.

PROVIDING FEEDBACK

You can check out your orchard on the map, and provide feedback. Go to www.une.edu.au/webapps and open the Industry Engagement Web App.

1. Select a crop: To limit the view to a specific commodity, select one from the drop-down and click apply. (Click reset to return the view to include all commodities.)
2. Show/hide layers: Each layer can be turned on or off using the check boxes to manage the amount of information being displayed.
3. Add a comment: Use the polygon feature to draw a specific extent or the point feature for a less specific location. Choose a commodity from the drop-down, and provide a comment. The comment is automatically saved, just click close when you are finished. (Note, users cannot edit or remove comments once created.)

Sharing points of interest

Found an area-of-interest on the map that you wish to share? You can “Add a marker” to the map and share it as a URL link:

1. Click a feature in the map to launch its pop-up, which displays: area (ha), crop type and its currency.
2. At the bottom-right of the pop-up, you can access additional actions by clicking the “...”
3. “Add a marker” to drop a pin on the map (appears in your browser session only).
4. Left-click the pin and copy the URL link.
5. You can now share this URL link with anyone, it will open the app for them and automatically zoom to your pin.



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New intensification project underway

The avocado industry is one of five tree crops, along with almond, citrus, macadamia and mango, set to radically benefit from new research into the possibilities and practicalities of more intensified orchard systems as part of the *National Tree Crop Intensification in Horticulture Program (AS18000)*, funded by the Hort Frontiers Advanced Production Systems Fund, with co-investment from the Queensland Government.

The research is being led by the Queensland Department of Agriculture and Fisheries (DAF), in partnership with the Department of Primary Industries and Regional Development (DPIRD) in Western Australia and the Queensland Alliance for Agriculture and Food Innovation- University of Queensland (QAAFI-UQ). It aims to advance understanding of rootstock and scion combinations, plant density, tree structure, training and pruning options in high and medium density plantings to increase the industry's potential to broadly adopt more intensive orchard systems.

The five-year research project is comprised of several components. These include both continuing and new studies on existing planting system and high-density rootstock trials located at the Bundaberg Research Facility (BRF).

"It is important to consolidate the findings of previous years (AI13004) by continuing to assess the effects of planting densities, rootstocks and pruning times on maturing orchard systems whilst investigating new options and technologies as part of the current project, AS18000," Project Leader for DAF, Dr Ian Bally, said.

This new research will investigate carbohydrate and resource allocations in trees, canopy light distribution, and patterns of root density, including its effect on yield, in the established seven-year-old planting systems trial on the BRF. Managing vigour in high density avocado plantings is an ongoing challenge, particularly as trees mature. Further insight into these factors and the relationships between them will build understanding of how avocado trees grow and respond to management under a range of planting scenarios and densities.

A high-density rootstock trial, comparing nine rootstocks, planted in May 2016 at 4.5m x 2m with trees trained to central leaders on a single plane trellis, found when Ashdot was used as the rootstock, trees yielded twice as much as other rootstocks in the first two years of cropping and demonstrated the highest tree-to-tree yield consistency. New research now aims to focus upon issues of excessive growth that creates a low light environment, causing branch death and low yield.

"We will develop our knowledge in how to limit excessive vegetative growth, especially through the use of growth regulator soil drench and tree height limits," Dr Bally said.

A second high-density rootstock trial, planted in 2018 at 4.5m x 2m on a 3m high trellis, was previously established



Figure 1. Avocado trees under netting near Carabooda, Western Australia.



Figure 2. The project reference group in the orchard.

to investigate eight rootstock/scion treatments (including Maluma Hass and Gem), adding a structural factor to the trial from 2019 (two-dimensional espaliered trees v three-dimensional shaping). Evaluation of fruit-set, yield, fruit quality, total light interception, root investigations and architectural studies will continue in this trial through the AS18000 avocado project.

AS18000 will also deliver three new field trials in Queensland and one in Western Australia. The Queensland trials include:

1. a medium density planting using open vase shaping (6m x 3m, 3-4 leaders, 2-3 controlled heights) at BRF, including plant growth regulator product, rate, timing and application methods
2. a demonstration plot at Peirson Farms, also using a medium density open vase shaping
3. high-density trellis planting(s) (4m x 3m) at BRF, including variations of branch structures, pruning timing and nutrition treatments.

Research in Western Australia is focussed on high-density production under shade netting. DPIRD will conduct environmental and plant monitoring over five years to determine the benefits of netting in a trial at Avowest in Carabooda. In this trial, low density planting systems (408 trees/ha) are compared with and without nets, and high-density planting systems (1,108 trees/ha) are compared with low density planting systems under nets.

The high-density planting will undergo intensive pruning and growth retardant applications to keep the trees under four metres high.

“We hope to demonstrate that the shade netting will result in greater water use efficiency, less fruit drop from hot, dry winds and improved fruit quality by protecting against sunburn and wind rub,” Neil Lantzke, DPIRD’s leader of Vegetable and Horticulture Systems, said.

“The overall tree microclimate should experience higher levels of humidity and we should experience longer growing periods. In terms of the economics, if we have higher yields from high density plantings, this may also justify the effort of netting.”

As well as the in-field research effort, the QAAFI-UQ will undertake functional and structural modelling of selected aspects of orchard planting systems and DAF will evaluate the potential cost benefit of intensified avocado orchard systems. The aim is to compare the feasibility of newly identified production systems with current industry best practice.

A Crop Reference Group comprised of growers, industry advisors and research team members is providing feedback on research activities and findings to guide interpretation and relevance for industry. The project will also conduct frequent field and training events to give industry stakeholders opportunity to engage in the research and experience these innovative management systems for themselves.

More information

For more, contact Bridie Carr, Development Horticulturalist on 0436 675 740 or bridie.carr@daf.qld.gov.au.

Acknowledgement

This is a project of the *National Tree Crop Intensification in Horticulture Program* (AS18000), funded by the Hort Frontiers Advanced Production Systems Fund, part of the Hort Frontiers strategic partnership initiative developed by Hort Innovation, with co-investment from Queensland’s Department of Agriculture and Fisheries, Queensland Alliance for Agriculture and Food Innovation – The University of Queensland, Plant & Food Research, and the Western Australian Department of Primary Industries and Regional Development, and contributions from the Australian Government.



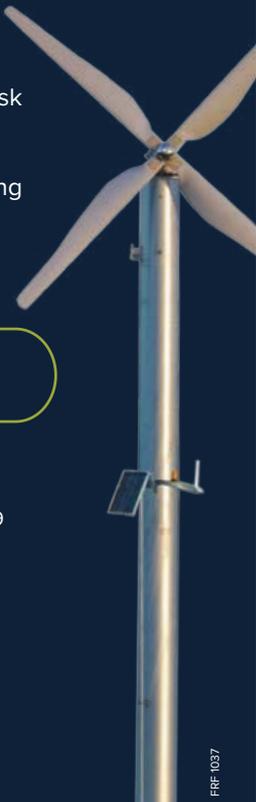
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Snapshots – International Avocado Research Update

This series of research snapshots is compiled from abstracts of published scientific papers accessed through CAB Direct as well as Google Scholar searches. Dates provided reflect the date research was published.

PROTECTED GROWING SYSTEMS

Evaluation of aerial and root plant growth behavior, water and nutrient use efficiency and carbohydrate dynamics for Hass avocado grown in a soilless and protected growing system

Avocado production is nowadays questioned worldwide and at risk due to climate change and the high water footprint of this crop. Thus, there is need for the development or adoption of new strategies such as alternative production systems. In this study, Hass avocado plants grafted on two rootstocks (Mexicola -seed propagated and Dusa® - vegetative-propagated and referred as clonal) were grown in a greenhouse and substrate (coir growth container, 55 L of volume and 500×480 mm, H X W) culture system in Valparaiso Region, Chile. Plant growth and development during the vegetative and reproductive phases until end of flowering (63 weeks) were monitored. Plant aerial and root parameters from these two rootstock types (seed and clonal) were monitored by measuring canopy and trunk area, trunk height, root area, type of roots (rhizotron), non-structural carbohydrates dynamics, further primary metabolites, water use efficiency (WUE) and nitrate and phosphate use efficiency (NUE and PUE). Results of this study corroborated that continuous fertigation with nutrient solution provide better growing conditions resulting in prolonged and more continuous growth and flowering than open field conditions. In addition, differences in aerial and root growth between plants grown on these two different rootstocks under similar fertigation and environmental conditions were found. Plants grown on Mexicola rootstock were more efficient energetically as sustained by higher trunk area, tree height and higher root content of the main non-structural carbohydrates (mannoheptulose and perseitol) than plants grown on the clonal rootstock. Our findings suggest that this alternative growing system for Hass avocado, besides being more intensive could have a positive impact on environmental indicators (WUE, NUE and PUE) related to sustainability. Read the paper here: <https://bit.ly/3uHl4i3>.

FRUIT QUALITY

Chemical characterization of two California-grown avocado varieties over the harvest season with an emphasis on sensory-directed flavor analysis

The research objective was to characterize avocado's aroma-active volatiles and use information about its overall composition, such as lipid profile, to discuss likely biosynthetic origins. To achieve this, two varieties, Hass and "3-29-5" (GEM), were evaluated during their commercial harvest period for dry weight, moisture content (freeze-drying), oil content (Soxhlet extraction), fatty acid composition, and aroma profile. Solvent-assisted flavour evaporation and aroma extract dilution analysis were performed on aroma extracts. Oleic acid (>50%) was the prominent fatty acid in the oil of both varieties. The majority of the aroma-active compounds in avocado are lipid-derived. The most notable compounds are 1-octen-3-one (mushroom) with a flavour dilution factor as high as 8192, hexanal (grassy), (Z)-4-decenal, an unknown, and (E,E)-2,4-nonadienal. Over the mid-to-late harvest season, a decline in hexanal and an increase in octanal were observed. In contrast to "Hass", the hexanal content was relatively stable in "3-29-5". Read the paper here: <https://bit.ly/2R5pKjg>.

IRRIGATION MONITORING

In situ measurement of plant hydraulic conductance

Measuring sap flow together with stem water potential and stem water storage can provide an abundance of information about the functioning and physiology of the water-conducting xylem, including its hydraulic conductance and capacitance. As xylem grows, develops, and ages, it changes its capacity to conduct water, as new vessels and tracheids are formed and older ones become dysfunctional when filled with gas, gels, or tyloses. Environmental factors, such as drought, heat waves, irrigation, or flooding can also strongly affect hydraulic conductance and water storage in stems. Some plants even can influence hydraulic conductance by changing the ionic composition of their xylem sap. Destructive measurements using cut stems are the current standard method for measuring hydraulic conductance, but this method is prone to artifacts that could introduce significant differences to actual conductance in intact plants. Continuous, non-destructive

measurements of hydraulic conductance and capacitance require simultaneous recording of sap flux density, the water potential gradient driving the flow, and accounting for radial flow into and out of stem water storage. Here, we describe a simple method to measure apparent hydraulic stem conductance *in situ* and account for storage flows to arrive at an estimate of actual hydraulic conductance. The method is illustrated with examples from two experiments conducted in southern California, including chaparral shrubs grown in large lysimeters and mature Fuerte avocado trees. Water potential gradients in these experiments were established by measuring soil water potentials and stem water potentials via stem psychrometry or by using a basal and distal stem psychrometer. Sap flux density was measured using heat ratio sap flow meters, and stem water storage in avocado was determined using stem dendrometers. Data from these experiments are used to show responses of hydraulic conductance in response to drying and for constructing a xylem vulnerability curve (change in conductance as a function of changing stem water potential) *in situ*. The method provides a promising approach for measuring important parameters of water transport in intact plants under natural conditions. Read the paper here: <https://bit.ly/2SI7Tzg>.

POLLINATION

Native pollinators of avocado as affected by constructed pollinator habitat gardens in Southern California

In three commercial avocado orchards in Southern California, pollinator gardens were constructed and maintained to attract potential avocado pollinator arthropods from 2014 to 2018. Bee species and other insects were monitored in both the gardens, on the avocado flowers, and around the garden and control sites. Twenty-four plant types were used in each garden, consisting of almost equal numbers of California native versus non-native species (and cultivars). An accumulation of 90 bee species were collected from all three orchards, and each year more species were added as the gardens matured. More than 30 insect species were recorded visiting avocado flowers, and half of these were native bee species. The non-bees were mostly flies, and especially in the family *Syrphidae*. Read the paper here: <https://bit.ly/3eEu5CJ>.

ALTERNATE TREATMENTS

Endophytic *Trichoderma* Species Isolated from *Persea americana* and *Cinnamomum verum* roots reduce symptoms caused by *Phytophthora cinnamomi* in avocado

Avocado root rot caused by the oomycete *Phytophthora cinnamomi* is a severe disease that affects avocado production in Mexico and worldwide. The use of biological control agents such as *Trichoderma* species isolated from places where the disease is always present, represents an efficient alternative to reduce losses. Thus, the objective of this research was to evaluate the biocontrol ability of 10 endophytic *Trichoderma* spp. strains against *P. cinnamomi* tested both *in vitro* and in the greenhouse. The endophytic *Trichoderma* spp. were recovered from *Persea americana* and *Cinnamomum verum* roots, isolated and purified on potato–dextrose–agar medium. Ten strains were identified by phylogenetic reconstruction of the internal transcribed spacer region of rDNA sequences as *T. asperellum* (T-AS1, T-AS2, T-AS6, and T-AS7), *T. harzianum* (T-H3, T-H4, and T-H5), *T. hamatum* (T-A12), *T. koningiopsis* (T-K8 and T-K11), and *P. cinnamomi* (CPO-PCU). *In vitro* dual-culture assay, the percentage of inhibition of radial growth (PIRG) between *Trichoderma* spp. and *P. cinnamomi* strains was measured according to the Bell's scale. PIRG results indicated that T-AS2 reached the highest value of 78.32%, and T-H5 reached the lowest value of 38.66%. In the greenhouse, the infection was evaluated according to the percentage of disease incidence. Plants with the lowest incidence of dead by avocado root rot were those whose seedlings were inoculated with T-AS2 and T-AS7, resulting in only 5% death by root rot caused by *P. cinnamomi*. The disease incidence of seedlings with wilt symptoms and death decreased more than 50% in the presence of *Trichoderma* spp. Relying on the results, we conclude that *T. asperellum* and *T. harzianum* contribute to the biocontrol of soil-borne pathogenic oomycete *P. cinnamomi*. Read the paper here: <https://bit.ly/3eDYNw3>.

Stimulation of light-emitting diode treatment on defence system and changes in mesocarp metabolites of avocados cultivars (hass and fuerte) during simulated market shelf conditions

The ability of light-emitting diode (LED) light treatment to reduce the anthracnose decay via its eliciting effects and thus induce resistance in the avocado (*Persea americana*), was investigated in this study to replace the current postharvest fungicide treatment. In experiment 1, the effect of blue or red LED lights (6 h per day) on the incidence of anthracnose in artificially inoculated (*Colletotrichum gloeosporioides*)

and naturally infected avocados (cv. Fuerte and Hass) at 12–14°C (simulated market shelf) for 4, 8, 14, and 16 days was investigated. In experiment 2, the effect of blue or red LED lights on the induced defence mechanism, fruit metabolites, antioxidant activity, and percentage of fruit reaching ready-to-eat stage was determined. Exposure to red LED light significantly reduced the anthracnose decay incidence in naturally infected cv. Fuerte on day 12 and in cv. Hass on day 16 compared to the prochloraz fungicide treatment by upregulating the PAL genes and maintaining the epicatechin content. Blue LED light accelerated the ripening in both cultivars, probably due to reduced D-mannoheptulose content. Red LED light exposure for 6 h per day and 12 days storage showed potential to replace the prochloraz treatment with improved ascorbic acid content and antioxidant activity. Read the paper here: <https://bit.ly/3uEUmGR>.

More information

If you would like more details on any of the snapshots, please contact Avocados Australia on 07 3846 6566.

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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INTERNATIONAL NEWS

Growth and sustainability on New Zealand agenda

By Nichola McGregor, FreshPlaza

The New Zealand avocado industry has grown from a high of \$68 million in 2011 to a forecast of more than \$200 million in 2020. Almost 44,000 tonnes of avocados were harvested this season, with 4.9 million trays exported, and sales in the domestic market expected to top 2.5 million trays.

Avocado supply to the New Zealand market runs year-round, and exports begin in July, with the main export season running from September to February.

New Zealand avocados are exported to 11 export markets including Australia, Thailand, China, Korea, Singapore, Taiwan, Japan and India.

“An increased global focus on health and keeping well has resulted in great opportunity for New Zealand to supply our natural, highly nutritious avocados to consumers,” explains Jen Scoular, CEO NZ Avocado.

“The New Zealand avocado industry is vibrant and growing and on track to achieve its vision to quadruple sales to \$280m and triple productivity by 2023, and has a long term strategy to become a billion dollar industry by 2040.”

New Zealand has over 4,000 hectares of avocado trees in production with a further 1,000 hectares recently planted now beginning to come into production. In 2020, 54% of avocado production came from the Bay of Plenty with 39% coming out of the Northland. The remaining avocado production came from South Auckland, the Coromandel and Gisborne.

Water requirements

Current research shows that avocado growing regions in New Zealand receive 2-3 times the required amount of annual rainfall to produce avocados, but not all that rainfall comes when the tree needs it. In some cases, avocado growers store and use water for frost protection and irrigation. Avocado growers in New Zealand work within the requirements of their local councils and environmental agencies to ensure that they comply with New Zealand’s Resource Management Act to ensure water allocation and use is carried out in a sustainable way.

Sustainability assessment

NZ Avocado is undertaking a life cycle assessment (LCA) study to determine the carbon footprint of avocados grown in New Zealand. The LCA project will measure inputs and outputs across New Zealand avocado orchards, post-harvest and onward distribution to market. The results will be used to benchmark environmental impacts and sustainability of New Zealand grown avocados.

“As an industry we are embarking on an avocado sustainability journey and we are prepared to review and change practices where it is identified that more positive outcomes could be achieved. NZAGA, the New Zealand growers association, recognises that consumers want to know that the avocados they buy have been produced in a way that looks after the environment, ensuring future generations can grow and enjoy avocados.

First nationwide avocado crop estimate 2021 season

New Zealand is anticipating a near-record crop volume for the 2021 season, with hundreds of hectares of new plantings coming further into production and a good crop currently hanging on the trees. Although it has been dry in some regions for extended periods, the growing season has provided more consistent rainfall than the previous season which is encouraging for tree health and fruit size.

“We are currently undertaking the first nationwide avocado crop estimate for the 2021 season. The final estimate is not yet available, however early indications show a good volume of good sized avocados on healthy trees,” Ms Scoular said.

“We anticipate a total crop volume similar to the season just ended, however the total crop and export packout can still be impacted by environmental factors between now and the end of the export season.”

2020 avocado season

New Zealand has recently completed the 2020 avocado season, which produced the highest volume in four years, with volumes for export up 10% on the previous season.

“Demand for avocados from New Zealand has been strong in our largest export markets (of) Australia, Thailand and Taiwan,” Ms Scoular said.

“New Zealand avocado volumes to Australia are up 45% on the previous season, with a combination of a short Australian domestic supply and good New Zealand export packouts contributing to the increase.

“Volumes are down slightly in New Zealand’s top Asian markets Thailand and Taiwan, and down quite considerably in Korea and China, where sea and air freight disruption has had a major impact on New Zealand’s ability to assure premium quality fruit.

“Exporters have elected to prioritise exports to markets where freight has been more reliable, to avoid disappointing customers and consumers in other markets with fruit age related quality issues.”

The NZ avocado industry worked collaboratively to gain market access and to start exporting to China in 2018 and India in 2013. These are the newest markets for avocados from New Zealand.

“Our first NZ Avocado promotion campaign in Taiwan was executed in 2020,” Ms Scoular said.

“NZ Avocado exports to Taiwan have grown rapidly in the past three seasons, this season Taiwan was New Zealand’s

third largest market by export volume. The campaign focussed on connecting the New Zealand avocado story with target consumers in Taiwan through a social media campaign and influencer promotion activity.”

World Avocado Congress 2023

New Zealand was voted by global avocado growers as the next country to host the World Avocado Congress to showcase the global avocado industry in 2023.

“We feel a strong sense of responsibility to avocado growers and marketers around the world to demonstrate the advances being made in responsible and sustainable avocado growing, and New Zealand will be the ideal location to do that in 2023,” Ms Scoular said.

April 2023 has been identified as a likely time to host the event and a committee of world avocado leaders is being formed to steer the event preparation and decide upon the theme and focus of the congress.

“With advances being made around the world in avocado growing, reducing environmental impacts, improving efficiencies in the supply chain, as well as amazing avocado nutrition and health research it is sure to be a popular event. We look forward to demonstrating some of New Zealand’s own avocado innovations at the event also.”

Read the original article here: bit.ly/TA321nz.



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Once you have completed this form please tear off and place it in an envelope addressed to:

Avocados Australia
Reply Paid 87929
Brisbane Market Qld 4106

(no stamp required within Australia)

Or email admin@avocado.org.au

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