

TALKING AVOCADOS



Australian avocados now in Japan

Lodging of avocado trees

Unlocking avocado DNA

SUMMER 2019

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Avocados Australia Limited

Avocados Australia Limited ABN 87 105 853 807

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

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

Email: admin@avocado.org.au

Web: www.avocado.org.au

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

Avocados Australia Directors

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

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Editor in Chief: John Tyas

Managing Editor: Lisa Yorkson

PO Box 8005 Woolloongabba Qld 4102

Email: TalkingAvocados@avocado.org.au

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

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Advertising: Avocados Australia Limited PO Box 8005 Woolloongabba Qld 4102
Ph: +61 7 3846 6566 Fax: +61 7 3846 6577 Email: TalkingAvocados@avocado.org.au

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Front Cover

Celebrating the first shipment of Australian avocados to Japan, at the Australian Embassy in Tokyo.

Chairman's Perspective

We all knew this day was coming: for the first time in 20 years demand for Australian avocados can be described as "steady".

Our Australian consumers are eating their way through 3.5kg avocado per person per year. That's impressive on a world scale, actually. We're the highest per capita consumers of avocados in the English-speaking world, but we've got a way to go before we reach the 6.5kg/person consumed in Mexico or the 5kg/person they eat in Peru or Israel.

And according to the latest Nielsen data (page 20), 71% of Australian households have been buying avocados and still, here we are. Steady.

Australian avocado production has increased significantly from 34,515 tonnes in 2005/06 to 77,000 tonnes in 2017/18, in response to domestic demand.

Who would have thought we'd be here at 77,000 tonnes when respected avocado industry stalwart Dr Ken Pegg was told in 1977 that avocado "was an industry without a future" and would receive no support from the then Department of Agriculture in Queensland.

We found a way around Phytophthora Root Rot, we found a way around Australians unfamiliarity with our fruit, both in the markets and in the retail stores.

Now, thanks to the industry's strong data focus, we are quietly confident of our prediction that we will be growing 115,000 tonnes of avocados per year by 2025. Who would have imagined that when the first commercial orchard was planted in 1930?

We saw a 26% increase in the amount of fresh avocado (Australian and New Zealand) dispatched to the Australian market during December 2018, compared to December 2017.

Don't get me wrong. The fact is that demand for avocados continues, and steady is hardly a bad foundation for our industry. It's our job to ensure we continue to grow our existing domestic and international markets and develop new markets.

The national avocado orchard is now above two million trees (that we know of). Our *OrchardInfo* records show that in just the last two years there have been almost half a million new trees planted.

This increase is continuing. We all know someone who is planting, in every region.

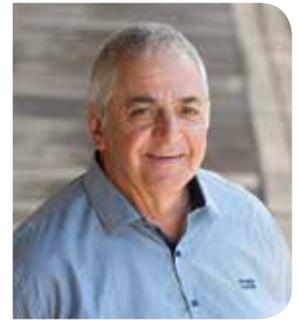
We're producing more and more and the vast majority is still going into our domestic market; we are already definitely shifting more volume.

Steady is no longer going to cut it on the industry side of this. We need our quality to be consistently good or better. We need our domestic marketing to be exceptional. We need our export game to be better than a Roger Federer serve.

Steady is for someone else. Avocados can't be content with "steady".

Jim Kochi

Jim Kochi, Chairman, Avocados Australia Limited



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Nambour Qld
Ph: 07 5442 1611

Turkinje Nursery

Peter & Pam Lavers
100 Henry Hannam Drive
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Ph: 0419 781 723



CEO's Report



Industry state of play

Welcome to our first *Talking Avocados* for 2019. This year, we are going to see the consolidation of a lot of the hard, committed work that's been happening for decades.

As we all know, 2017/18 was our biggest harvest yet, at 77,000 tonnes. Our latest data shows we are heading for an 83,000 tonne crop for 2018/19. With about two million trees in the ground and plantings still going in, we are well and truly on track to produce at least 115,000 tonnes by 2025.

During the latter part of 2018 there were some real concerns with quality of avocados in the Australian market, mainly from New Zealand, which supplied the majority of fruit in December. An independent retail survey over the Christmas/New Year period highlighted very high levels of fruit with rots and there were a number of factors at play. New Zealand experienced a very wet season and there were extended periods of rain during the harvest period.

Then there was disruption in the supply chain with fruit being held up at the border due to delays in quarantine inspections and also many consignments being fumigated. I also understand

consignments of mixed maturity may have exacerbated these problems. All in all, it was a tough period and we need to learn from this and look at how we can address these problems.

We just cannot afford to have avocado consumers disappointed by poor quality fruit when we need them to be buying more.

As production increases, we are also going to have to increase demand for our already popular fruit. According to the latest Nielsen data (page 20), more than 70% of Australian households already buy avocado. We're going to need them to buy more.

In 2018, we added a new international market: Japan (page 11). We're going to need to add more.

We've just been part of an ongoing promotion for Australian fruit and vegetables in China, where we hope to obtain market access in the future (page 14). We need to continue this work in 2019 and beyond.

We're actively working with collaborators in our existing main export markets in Malaysia, Singapore and Honk Kong, and yes, we're going to have to do more.

We need to increase consumption of our premium Australian avocados at home and aboard. As an industry, this will mean implementing the recommendations from our avocado levy-funded research. It will mean making improvements at every step of the supply chain from the tree to the retail shelf to ensure every time one of our customers picks up an Australian avocado, they are delighted, not disappointed.

The Australian avocado industry has a history of backing itself. Our commercial growers pay levies for research and development (2.9c/kg) and marketing and promotion (4.5c/kg).

The R&D levy is an excellent industry investment, but we have to follow through by ensuring the R&D is well targeted to address the industry's priorities and then to ensure it is adopted by industry.

The marketing levy has definitely supported the growth in demand, although it is very difficult to accurately apportion that growth to any one activity. Australians are the highest per capita consumers of avocados in the English-speaking world and we need our marketing investments to work even harder to ensure we continue to hold that title.

Order your Kangaroo Labels

Avocados Australia manages the Kangaroo Label and a set of barcodes for use on Australian avocados.

Kangaroo Labels can be ordered through our registered Kangaroo Label suppliers listed below. Grower packers and packhouses need to apply for a **Packhouse Registration Number (PRN)** with Avocados Australia before an order can be placed.

To apply for a PRN visit www.avocado.org.au or call **07 3846 6566**.



Registered Kangaroo Label Suppliers:

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Mildura Printing Services	ph: 03 5022 1441
Warehouse Design and Packaging:	ph: 02 9905 0963



New data analyst

Avocados Australia now has a new Data Analyst, Daniel Martins, replacing Sue Plunkett-Cole who moved on to another role late last year. We thank Sue for her commitment to the role and the improvements she made to our data reporting, in particular. Daniel will oversee our highly valued data collection, analysis and reporting activities working closely with Amanda Madden who has held the fort for *Infocado* during the staff transition.



Daniel's journey into the avocado world began with a love for great food, and a curiosity for what happens behind the scenes from farm to plate. Originally from Venezuela, Daniel has studied in Sweden and the Netherlands in the areas of business economics and then operations research and logistics and his background includes data management with Driscolls. With a keen interest in data analysis and agriculture, this role is a great fit for Daniel and Avocados Australia and I am very pleased to have him in the team.



International study tour

The North American avocado industry will be under the microscope as part of a study tour run around the same time as the World Avocado Congress in Colombia in September.

As part of an upcoming extension and industry development project (more on that in a future edition), Avocados Australia and the Queensland Department of Agriculture and Fisheries is endeavouring to arrange a pre or post conference study tour in North America. Times and dates will be set to allow Congress attendees ample opportunity to participate in both this Australian-organised event and the official Congress activities in Colombia.

Please email admin2@avocado.org.au if you would like to register your interest. Details will be made available as soon as possible.

Do you know a new grower?

As we all know, new growers have joined the industry in every region in the last few years. Do you know a new grower who isn't receiving industry communication? We encourage you to recommend they subscribe (for free) to the fortnightly *Guacamole* newsletter, for the monthly *Avo Alerts* (more on those on page 23), and for this magazine.

It is important that new growers stay well informed about industry matters and we are very keen to engage with them.

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

John Tyas

John Tyas, CEO, Avocados Australia Limited

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Around Australia

South Queensland Report

By Daryl Boardman,
Avocados Australia Director



The recent heatwave conditions across Australia have not been kind for a lot of primary producers. Here in South Queensland, the lack of rain and hot conditions have been a challenge for our avocado trees. The implications for May/June when we should start picking are possibly small fruit size and fruit drop causing lower yields if it remains dry.

Also the Blackbutt region and Kumbia region that had the devastating hail storms do not need the continued dry conditions on top of this.

Moving away from the immediacy of what's happening in our orchards, 2019 is a big year for the international industry with the World Avocado Congress happening in Colombia in September. This regular international event is our chance to connect with growers, researchers and industry members from every avocado growing region on the planet. Avocados Australia and DAF Queensland are organising a North American tour to coincide with the WAC. We'll be sure to share details as soon as they are available. If you are interested, please email Amanda on admin2@avocado.org.au.



Avocados Australia Director Daryl Boardman at the Australian Embassy in Tokyo.



Avocados Australia Director Daryl Boardman, CEO John Tyas and Australian Ambassador to Japan, Hon. Richard Court AC at the official launch event, as the first Australian avocados reached Japan.

Avocados Australia was recently in Japan, celebrating our new access for hard green Hass avocados to the biggest market in Asia with an event hosted by the Australian Embassy in Tokyo (story page 11). I was there representing Avocados Australia (pictured) and the interest shown in our premium product bodes well for our future in the market. As an industry, we are working toward making sure we have more such events in future. As growers, it's our job to ensure we are providing consistently high-quality fruit to all of our markets, as production continues to increase.

Don't forget, your Avocados Australia memberships are due throughout the year. As an organisation, we rely on your support as we work to grow our thriving, professional industry.

On a final note, there's been reports in the media about how the category has been performing in the last few months.

The latest Nielsen data (page 20) has clearly shown how demand fluctuates throughout the year, but the trend is for a general growth in demand for our Australian avocados. To illustrate, in the 12 months to 8 September 2018, average spend on avocados was down (to \$39.90 from \$41.80) on the same 12-month period previously. By 1 December 2018, the average spend was up to \$40.20 in the 52 weeks to that point.

Central New South Wales Report

By Ian Tolson, Avocados Australia Director



Welcome to 2019 and the challenges that lie ahead for our industry. Last season was a glimpse into the future, with prices failing to reach the highs of 2017 and far from the dizzying heights of Christmas 2017 and early 2018.

So, what does the future hold for our industry? With the continued large plantings across growing regions, the recorded volumes in Infocado of more than 400,000 trays on more than one occasion in 2018, may pale into insignificance. Large volumes of fruit need good management, it gives buyers and consumers a wide range of choice and puts pressure on both the marketing programme and growers to ensure that consumption stays ahead of production.

Growers need to remain vigilant with orchard and crop management; the previous 12 months has been testament to the need to produce premium quality fruit. The larger the volumes, the higher the standards needed. Quality goes beyond the skin to the internal integrity of fruit. Producing fruit with a good shelf life, free of rots and stings can only encourage repeat purchasing. Hort Innovation and the Marketing Strategic Investment Advisory Panel's future marketing campaigns will need to be hard hitting, media savvy and inventive to increase consumption. Avocados may be a 'superfood', however, consumers have quite a few superfoods to choose from, avocados need to be first and foremost in their minds and trolleys.

Quite a long dry spell was broken mid December with 170mm

of rain falling in a 24-hour period. Unfortunately, there hasn't been much follow up follow up rain. We have, however, had had a lot of very hot, windy days.

Harvesting in the local region is far from over. Some Comboyne growers have quite a way to go. It has been a very good harvest, however, 2019 looks set to be a much lower volume of fruit from this region.

Tristate Report

By Kym Thiel, Avocados Australia Director



As harvest winds down and finishes up in the Tristate, growers are turning their attention to next year's crop which at the moment is looking like being one of the heaviest EVER.

The threat of course, is extreme heat. As I write this at 9am on 4 January, the temp has just hit 38 degrees C with a forecast of 44 for the second day in a row – not much fun! This will likely cause a natural fruit drop but it's a case of trying to minimise the damage. All that growers can do is be on top of their irrigation management. The knowledge is there on how to manage these heatwaves and now it's just a matter of growers implementing it to the best of their ability.

As we reflect on the 2018/19 season it might well be a glimpse into the future and shows the importance of growing quality fruit and increasing average yields and production. With increased production nationally and New Zealand imports impacting on price, they are two variables that are not going to go away into the future. Tristate growers were out of sync nationally, and with lower than average yields, felt the impact of the lower prices especially hard. The importance of export is well known within the region with other commodities relying on it but until now the avocado industry has been immune. It was heartening to see fruit go into Japan for the first time out of Western Australia and I have no doubt that if the large crop eventuates there will be fruit out of the Riverland sent there in the 2019/2020 season. This and market access into countries such as China and India are at the forefront of Avocados Australia mandate to maintain a profitable and viable industry for all involved as well as continuing to increase domestic consumption through an effective marketing program.

Sunshine Coast Report

By Robert Price, Avocados Australia Director



The abnormal weather conditions are continuing through the area, although those orchards near the coast have not experienced quite the harshness of those properties over the range.

There was a cool start to Spring then temperatures rose to the 30s. Again, there have been patches of hail damage and some minor flooding.

What we have experienced are a series of short periods of wet weather with good rain, generally between 100mm to, in

some areas, as much as 200mm which is good. However, we've then had little follow up rain, and in the intervening periods, we have been subjected to hot dry winds. During this, the immediate effects could be seen in the grass where it would shoot on then dry out as the surface moisture dissipated.

The crop this year looks like it will be down and reportedly there were large variations in fruit set. Unusual flowering behaviour can be brought on by temperature. It's also been noted that the importance of soil moisture content in the spring of each year, along with availability of mineral nutrition, exerts a general effect on fruit set.

It is of interest that a nearby grower of macadamias that are dryland farmed (that is it's not irrigated) noticed his trees were suffering, which prompted him to seek advice. On counsel from his consultant he was advised that the trees were basically closing down their foliage as a natural method of survival. The reason that the trees were behaving in this way was because of a lack of deep moisture, but in the case of maccas they would recover with improvement in their environment.

The key point here for us as avocado growers with shallow rooted trees, operating in a hot, dry summer with autumn approaching, is that we need to read the natural signs in the environment, so we can take pre-emptive actions to try and lessen the impacts on our orchards.

Central Queensland Report

By Eric Carney, Avocados Australia Director



Happy New Year! It's a new calendar year and the 2019 Central Queensland crop is shaping up nicely. Generally, individual orchard volumes appear to be the same or up on last year. This is due to increased volumes from maturing trees coming online as well as increased crop loads on the 6+ year old trees. My gut tells me final sizing may not be as large as the monster fruit from last year, although this being early January at the time of writing, there is still plenty of time for fruit-fill and there is no expectation the fruit will be small, just not as many 14s, 16s and 18s as there were in 2018.

Select Fruit Spotting Bug (FSB) outbreaks have occurred putting extra pressure on spray programs. A reminder, a good rotation of chemicals is important to ensure the balance of beneficial insects is not upset. Recent reports indicate using newly approved chemicals as the sole or dominant chemical to control FSB have resulted in adverse incursions of other pests.

Albeit drier, weather has been somewhat typical of the long term averages with December having 68mm of rain, whereas the historical average sits around 92mm and temps being typical.

Quality of fruit has been a topic of discussion over the summer months with increased reports of unsatisfied purchasers. When customers have a bad buying experience it puts repeat purchasers off and customers are more likely to complain to

Around Australia continued

their friends about a bad experience rather than the good ones. As we near the harvest for Central Queensland, please ensure your harvested Shepards are at a minimum of 21% dry matter. The BPR on the Avocados Australia website (www.avocado.org.au) has several articles on how to test and collect samples for testing. For example, ensuring a true representative sample of all fruit sizes is collected from all locations around the tree (east, west, interior, exterior, etc).

North Queensland Report

By Jim Kochi, Avocados Australia Director



I have recently fielded some enquiry from growers asking about the future of avocado in North Queensland. Surprisingly, it has been from growers that have recently planted trees and are continuing to plant and from consultants that service these same growers. It is obvious to me that the growers planting new trees are best equipped to see what is happening on their own farm and on those in their locality.

I do not tend to drive around for a "look see" so I will rely on the data collected and presented in the 2018 Annual OrchardInfo Report, released to contributors in October 2018.

Briefly, as at October 2018, North Queensland has 275,642 trees 0-5 year old compared to 101,544 trees that are 6+ years. These numbers show the rapid expansion of tree plantings in North

Queensland in the past five years but the greatest increase is in trees at three years maturity so this wave of production is just starting to come onto the market. The growth in these new plantings surpasses those from Central Queensland and this is the reason why production from North Queensland is likely to be greater than Central Queensland's production for this year.

Still interested? The variety Maluma now has 2.1% of the Australian tree plantings with around 35,000 trees in that 0-5 years age group.

More detailed information on the above subjects is in the 2018 Annual OrchardInfo Report to contributors, available at the Avocados Australia office. I encourage all growers to contribute to this report each year, to continuously improve the accuracy of the industry's available data.

It is going to be a very interesting market in the February-June period this year, regardless of what the weather serves up.

North Queensland had, to late January, missed most of the nastiest weather and after a longer cooler flowering period and a dry spring the summer rains have been relatively gentle and the wandering Cyclone Owen danced all around us before drenching areas further south (Ingham). Fruit quality should be good because of the drier growing conditions so that will be great news for the consumer as the "new" season fruit comes in.







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Western Australia Report

By Brad Rodgers, Avocados Australia Director



Summer is a traditionally busy time for the Western Australian avocado industry. Picking started in the northern regions around August and has been in full swing across the southern regions since December. At the moment, it is anticipated harvest will go through until late January.

Harvest has been slightly above average for most, with reports of yields just surpassing last season. Quality has been good and for some with lower numbers, yields of larger fruit has helped.

We have a lot of new trees under three-year-old trees planted in the west; these orchards have been busy dealing with our late spring and the cooler start to summer. By all reports the majority of these plantings are growing well.

The rumour mill went into overdrive with the risk assessment for Chilean exports to Australia. If or when market access is granted, it will be interesting to see their timing of fruit coming in and how the supermarkets engage with them. Once again, our message is to stay the course with quality as this will be our best long-term point of difference when we are up against any competitors.

Importantly for West Australian growers, we now have access to an additional export market, Japan (story page 11). While this may not be a high-volume market for Australian avocados initially, it is an important one, as it allows us to prove hard mature Hass avocados can be appropriately managed to prevent any risk posed by fruit fly. As production continues to grow, we are going to need steady, reliable international markets to complement our strong domestic market and the addition of Japan is an important step for the industry.

I was fortunate enough to be part of assisting with the visit from the Japanese Government Ministry of Agriculture, Forestry and Fisheries in November 2018. The representative was amazed at the size of Western Australia and the quality operations that are looking to support the new export market. You can find the full protocol for exporting to Japan here: bit.ly/TA294JAPAN.

As your new board member and a new grower representing Western Australia, I encourage you to contact me on b.rodgers@avocado.org.au with any suggestions, ideas or concerns you may have. I particularly look forward to meeting as many of you as I can, at future avocado regional events.

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Around Australia continued

Tamborine and Northern Rivers Report

By Tom Silver, Avocados Australia Director



Despite an excellent early Spring break, conditions throughout the Northern Rivers/ Tamborine growing area have been severely dry throughout the growing season, and at this stage (late January) there is no end in sight. Those with irrigation are giving it a good workout, and I expect those without are now investigating getting irrigation put on. Either way the busiest shop in town is the irrigation supplier closely followed by the pub!

Crop set remains patchy, though some farms are expecting large crops, despite big fruit drops. Quality at this stage looks excellent, insect pressure appears to be quite low, however, size is probably a bit below average for this stage of the growing season. It will rain again, I can promise you that, and when it comes like all good farmers, we'll probably curse it but in the meantime, we just need to do the best we can with what we've got.

On the issue of water, an application has been made to extract water from the Alstonville Plateau to be trucked to Brisbane for

bottling and sale. As farmers we only use what we need, so if it's wet we barely pump, we use micro sprinklers or droppers to limit our water use and we mulch heavily to retain as much soil moisture as we can. This application will allow the business to remove 100% of their allocation.

2019 Calendar	
5-8 Mar	Foodex Japan 2019, Makuhari Messe, Chiba
5-6 Jun	Plant Biosecurity Research Initiative R&D Symposium, Brisbane Q
24-26 Jun	Hort Connections, Melbourne V
31 Jul-2 Aug	Horticulture Conference, Waikato, New Zealand
3 Spt	Asiafruit Congress, Hong Kong
4-6 Spt	Asia Fruit Logistica, Hong Kong
23-27 Spt	IX World Avocado Congress, Colombia
11-13 Nov	TropAg2019, Brisbane Q

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Australian avocados now in Japan

The Australian avocado industry recently added an important international market, finalising access to Japan in December 2018 with the first shipments.

Avocados Australia CEO John Tyas said as a result of the recently completed market access protocol, Japanese consumers would be enjoying premium Australian Hass avocados.

“This is very exciting news for the Australian industry, and the culmination of work by Avocados Australia, the Australian Government Department of Agriculture and Water Resources, Austrade, various state departments, Hort Innovation, and of course the Japanese Government Ministry of Agriculture, Fisheries and Forestry (MAFF),” Mr Tyas said.

“The MAFF inspector was in Western Australia at the end of November/early December, to follow the first shipment from the trees all the way through to Japan.”

Mr Tyas said access to the Japanese market would be important for all of the regions that met the access criteria, that is, providing hard mature Hass avocados sourced from areas officially recognised as free of Queensland fruit fly – Western Australia, part of South Australia’s Riverland and Tasmania.

“I thank the Japanese and Australian governments for working together to facilitate this market access protocol in a very timely manner, based on the least trade restrictive requirements,” he said.

“At the moment, Australia produces about 77,000 tonnes of avocados annually, of which we export less than 5% a year into premium markets.

“It is very exciting for the industry that we can now add Japan to our exclusive list of export destinations for our top-quality premium Hass avocados.”

Mr Tyas said the development of new export markets was important for the Australian industry.



Australian avocado exporter Jennie Franceschi, Western Australia, with Avocados Australia CEO John Tyas and Director Daryl Boardman, and Hort Innovation R&D Manager – Trade Astrid Hughes in Japan for the official launch.



Australian Ambassador to Japan, Hon. Richard Court AC, speaking at the launch on 11 December 2018, held at the Australian Embassy in Tokyo, Japan.

“The industry in Australia is growing rapidly and I am very confident that Australia will be producing about 115,000 tonnes of avocados per year by 2025. This is 50% more than our current production.

“Gaining access to new markets ahead of that increased supply



The materials developed for the PASE project have been updated for the Japanese market.



The official launch to mark the entry of the first Australian avocado shipment to Japan was held in the Australian Embassy in Tokyo, hosted by the Australian Ambassador to Japan, Hon. Richard Court AC.

Australian avocados now in Japan continued

Launch draws local interest

The first export of Australian Avocados to Japan was marked by an official launch hosted by the Australian Embassy in Tokyo on 11 December, 2018.

Avocados Australia, Austrade and Hort Innovation representatives were in attendance, along with a range of Japanese importers, fruit marketers and wholesalers interested in Australian avocados.

This included:

- AISS Corporation – an importer of fruits and vegetables, mainly in Tokyo and Kobe, and wholesale
- Diamond Star – a producer and importer of tropical fruits, also providing heat treatment services
- Dole Japan – Dole produces fruits and vegetables in the US, Latin America and a number of Asian countries
- Farmind Corporation – imports, exports, processes, and sells vegetables and fresh flowers. Farmind has ripening and repacking centres across Japan
- Funasho Group – imports fruit and fresh produce, including avocados, for wholesale markets, supermarkets and mass retailers
- Global Fruit Co – business includes the wholesale distribution of fresh fruits and vegetables, with a mail order service
- Kobe Yoko – imports (including from Australia), exports, and wholesales fruits, vegetables and other products
- Royal Co – import and export of fresh fruits/vegetables and dried fruits
- Tokyo Seika – operates an import and export business, and wholesales and distributes food products including fruits, vegetables, processed foods, and other products
- Union Co – operates wholesales and distributes fruits and vegetable throughout Japan, and does repacking. The company currently imports avocado from Mexico
- Wismettac – the agricultural & seafood products trading business supplies fresh fruit and vegetables, frozen processed produce to wholesale markets, food manufacturers, volume retailers, the food service sector and other users, mainly in Japan.



Avocados Australia CEO John Tyas outlining the importance of access to the Japanese market during the official launch event.

is a high priority for the Australian industry, as is boosting our current markets, Malaysia and Singapore in particular.”

More information

Avocados Australia Export Coordinator Joy Tang, 07 3846 6566 or export@avocado.org.au.

Acknowledgement

Avocados Australia’s work in the export field is supported by the *Avocado Export Readiness and Market Access Project (AV17004)*, funded by Hort Innovation, using the avocado research and development levy and contributions from the Australian Government.





Hirotooshi Umemoto (third from right) from the Japanese Ministry of Agriculture, Forestry and Fisheries was in Western Australia in late November, to inspect avocado operations from picking to export.

The inspection by Mr Umemoto is the last step in finalising a protocol to export Hass avocado to Japan, from regions free of the Queensland Fruit Fly. Joining Mr Umemoto at the start of the inspection week were new Avocados Australia Director Brad Rodgers, John Sicari, Peter Ikin and Miles Dixon from the Australian Government Department of Agriculture and Water Resources, and Fiona Goss from the Western Australian Department of Primary Industries and Regional Development. Japan is the largest import market in Asia and is almost totally reliant on imports for avocados, which are showing strong growth. In the past five years in Japan, avocado imports have had an exponential increase, going from about AU\$156 million in 2012 to AU\$268 million in 2017, a 171% increase.

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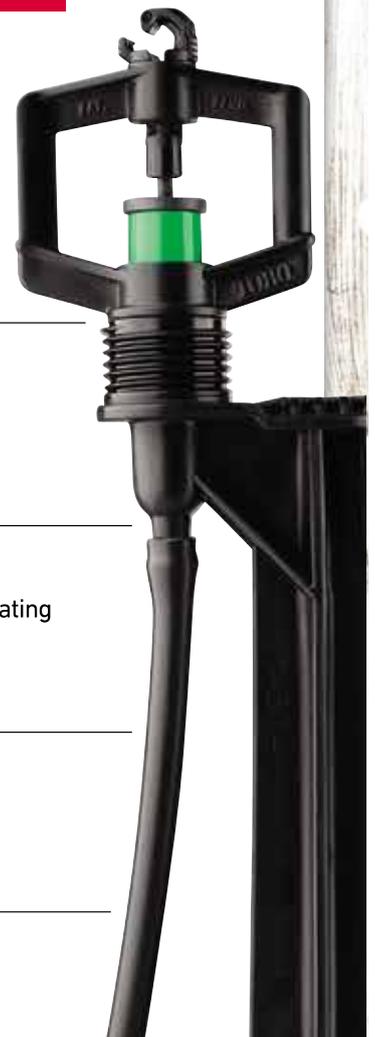
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Chinese market important for Australia

John Tyas, Avocados Australia CEO

Avocados Australia continued its market development work in November, attending the China International Fruit and Vegetable Fair as part of the Hort Innovation Taste Australia activity.

Avocados Australia has been participating in this fair since 2012, keeping the industry's interest in this expansive market front of mind.

Australian avocados do not yet have market access to China, though we are very committed and enthusiastic to enter this market.

According to *Asiafruit* magazine, demand for avocado in China has increased 28% year-on-year, with imports of 32,100 tonnes in 2017. That's quite a jump from just 31.8t in 2011.

While there are also reports about growing domestic production and imports from a range of other sources including Chile and Mexico, there remains potential for Australia in this market. As a provider of premium fruit, from a country recognised as a "safe" supplier by Chinese consumers, Australian avocados have an advantage. Of course, first we need access!

Importantly, while the fair is considered "modestly sized" for China, it is well attended by business executives and Chinese government inspection officials.

For Australia, it's important to keep in mind that this "modest" event attracted 33 countries, 1,000 brands, 227 exhibitors, 10,500 professional visitors and more than 33,000 public visitors.



Avocados Australia CEO John Tyas, with interpreter, in Beijing for the annual fruit and vegetable fair. Photograph courtesy of FreshPlaza.

Australia was in the top 10 international countries by number of exhibitors, with an audience that was largely domestic. Just 11% of visitors to the 2018 event were international. Of the Chinese attendees, 55% were traders, wholesalers and retailers. Six percent of the visitors were from the government and associations, another important audience for Australian avocados as we seek to gain entry.

Encouragingly, when surveyed about their interest areas, 72% of visitors were there to look at fresh fruit.

Avocados Australia is actively pursuing access to China, through the appropriate channels here in Australia. By 2025, we expect our production to be 50% greater than current levels so access to premium markets in our region will be important.

More information

Avocados Australia Export Coordinator Joy Tang, 07 3846 6566 or export@avocado.org.au.

Acknowledgement

Avocados Australia attended the Beijing International Fruit and Vegetable Fair as part of the Hort Innovation Taste Australia initiative.



Export committee meets

The avocado industry’s export Project Reference Group met in Brisbane in December, hearing the latest on the industry’s current and potential international markets.

Attendees included (from left) Josh Franceschi (APMS, Western Australia), Cormac te Kloot (Costa Group), Jennie Franceschi (Karri Country Produce, Western Australia), Avocados Australia CEO John Tyas, Antony Allen (The Avolution), Astrid Hughes (Hort Innovation), Daryl Boardman (Avocados Australia director) and Jenny Van de Meeberg (Hort Innovation).

The Project Reference Group provides guidance to the *Avocado Export Readiness and Market Access Project (AV17004)*, funded by Hort Innovation, using the avocado research and development levy and contributions from the Australian Government.

Avocados Australia CEO John Tyas said the main purpose of this meeting was to seek input from the group for the development of the new Australian Avocado Export Strategy 2019-2021.

“This strategy maps out the selection of Australia’s key international target markets (existing and potential) as well as the key steps needed within the industry to access, develop and support these markets,” Mr Tyas said.

“As soon as the strategy is finalised, it will be made available to the wider industry.”



The avocado industry’s export Project Reference Group including (from left) Josh Franceschi (APMS, Western Australia), Cormac te Kloot (Costa Group), Jennie Franceschi (Karri Country Produce, Western Australia), Avocados Australia CEO John Tyas, Antony Allen (The Avolution), Astrid Hughes (Hort Innovation), Daryl Boardman (Avocado Australia director) and Jenny Van de Meeberg (Hort Innovation).

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Air freight security changes coming

On 1 March 2019, export air cargo, regardless of destination, will need to be examined at piece-level by a Regulated Air Cargo Agent under an Enhanced Air Cargo Examination Notice, or originate from a Known Consignor.

According to the Australian Government Department of Home Affairs, this change is necessary to ensure Australia is responding to the evolving terrorist threat.

If you haven't already done so, please talk to your air cargo supply chain about:

- if and how the change will impact your current export arrangements. For example, possible changes to delivery times or delays, and possible increases in costs
- your options to minimise the impact of the change. Think about things such as packaging of your products, handling of consolidated cargo, scheduling of your deliveries, and how your cargo is transported
- considerations for your business becoming a Known Consignor. Information on the Known Consignor Scheme is available on the Home Affairs website via bit.ly/TA294AIR.

More information

Information on the Known Consignor scheme is available via bit.ly/TA294AIR.

If you have questions, please contact the Department of Home Affairs at guidancecentre@homeaffairs.gov.au or call 1300 791 581.



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- Established food service market
- Fresh exporter
- Avocado Export Company (AEC) has established export markets in Singapore, United Arab Emirates and Malaysia



Contact Us



40 Ralston Road, Ringbark
Western Australia 6258



+61 8 9771 1632



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



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Mexico takes Costa Rica to WTO for avocado access

Mexico has taken Costa Rica to the World Trade Organization (WTO), seeking access for its avocado industry.

Costa Rica will now face a special investigative group, after the WTO accepted Mexico's second request for a panel to rule on Costa Rica's import restrictions on fresh avocados. Costa Rica blocked Mexico's first request at the Dispute Settlement Board (DSB) meeting in December 2018.

According to the WTO, Mexico is challenging measures which ban or severely limit the importation of fresh avocados from Mexico, including Costa Rica's alleged failure to adapt its regulations to take account of the low prevalence of pests or disease in certain regions and make such regionalisation operative.

According to *Fresh Plaza*, Costa Rica is concerned the import of Hass avocados from Mexico could "open the doors to sunblotch plague". Costa Rica has previously imported avocados from Mexico. According to *Fresh Plaza*, Costa Rica's phytosanitary restrictions were implemented in 2015.

"Mexico noted that Costa Rica is a trading partner distinguished by its commitment to free trade and that it (Mexico) had been exporting fresh avocados to Costa Rica for more than 20 years without any problem," the DSB statement said.

"Mexico said it has no choice but to request the panel a second time to review its claims.

"Costa Rica said its measures were fully in line with WTO requirements and backed by WTO-consistent risk assessments. The DSB agreed to the establishment of a panel," the DSB statement said.

Avocados Australia CEO John Tyas said the case was an interesting one for Australia to watch.

"As we've noted in previous editions of *Talking Avocados*, Mexico is one of the countries keen to access our domestic market, more for the premium prices than for quantity, particularly when you consider the scale of Mexico's current exports," he said.



The 2017/18 *Facts at a Glance* shows Australians consumed 3.5kg/person, more than 80,000 tonnes in total. By comparison, the recent *Avocado Producers & Market Suppliers* 2018 report says Mexico exported a total of 897,000t in 2017, from a total production of 1.9 million tonnes.

"While Australia isn't going to be a major market for Mexico, and their application for entry to Australia dates back more than a decade, recent events are no doubt making them reassess their international markets," Mr Tyas said.

At the end of 2018, a strike in Mexico cut exports of the country's major customer, the US, for 16 days, and earlier in the year, uncertainty surrounded the renegotiation of the North American Free Trade Agreement (NAFTA), which will eventually be replaced by the United States-Mexico-Canada Agreement (USMCA) in 2020.

"Given that the US takes more than 75% of Mexico's avocado exports, it's easy to see why they may now be willing to take additional steps, such as this dispute resolution process with the WTO, to secure additional markets," Mr Tyas said.

According to *Fresh Plaza*, Hass accounts for 80% of Costa Rica's domestic avocado production and the country both imports and exports and in 2017, imports helped meet 65% of the domestic demand (7,738 metric tons).

"As a comparison, in 2017, Australia was the destination for 15,214t of avocados from New Zealand," Mr Tyas said.

"While Costa Rica clearly has some transport advantages for Mexican producers because of its proximity (especially compared to markets in Asia or the Pacific), this move with the WTO does signal Mexico's commitment to securing markets for its growing avocado production, no matter the size of that market.

"As international avocado production increases, we can expect to see increased competition in all current markets, and also a push to open additional markets by all avocado exporting nations.

"Given the scale of Australian production, our focus needs to be on producing high-quality fruit for the premium end of the market. We cannot compete against bulk producers such as Mexico on price, we have to offer something different."

More information

Read more on Mexico's 2018/19 production in International News, page 59.

Facts at a Glance: <http://bit.ly/TA294FACTS>

The *Avocado Producers & Market Suppliers* 2018 report is available in the Export section of the BPR Library, www.avocado.org.au/best-practice-resource/library/.

Infocado details record supplies to the market

Domestic demand for Australian avocados continues to be steady, with Australians consuming 3.5kg of avocado per person in 2017/18 and slightly higher for the 2018 calendar year.

The last quarter of 2018 saw solid supplies into the Australian market with some records broken. Avocados Australia's weekly *Infocado* system recorded more than 400,000 trays per week dispatched on two occasions, one week in September and one week in November.

The weekly average supply for the quarter was about 390,000 trays per week (based on seasonal data adjusted for packhouses not contributing weekly).

The volume of fresh avocado (Australia and New Zealand combined) supplied to the Australian market during the quarter was about 8% more than the same period last year.

The outlook for 2019 is for continued solid supply with an increase of about 7% more supply than 2018.

"The rapid rate of increase in avocado production makes it imperative for the industry to access and develop new markets," Avocados Australia CEO John Tyas said.

"This latest data from *Infocado*, backs up what we've seen from our annual *OrchardInfo* Tree Census reports, where we've seen the national tree numbers reach the two million mark."

Mr Tyas said the expected growth in avocado supply, to about

115,000 tonnes a year by 2025, was well above previous consumption growth.

"This data, which has been collected and reported over many years has assisted the industry to plan and manage its growth. As we move into an era of rapid increased supply, this data will become even more valuable and it will be imperative that all packhouses contribute so we can provide the best information," he said.

Jan 18 to Dec 18 Dispatches (5.5kg eqv trays)

Region	Jan18 to Dec18
North Queensland	4,382,808
Central Queensland	3,483,743
Sunshine Coast	253,460
Southern Queensland	882,586
Tamborine/Northern Rivers	322,599
Central New South Wales	1,516,944
Tristate	461,307
Western Australia	3,975,879
New Zealand	2,088,325
Total	17,367,651

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“Because of this data, the Australian industry has worked hard on building the domestic market, and some export markets.

“Now, it is this data that’s showing us how much further we need to go, to ensure we build domestic demand and open new export markets to keep pace with our production.”

Reports for industry

Avocados Australia produces a number of regular reports, to support our industry:

- weekly *Infocado* reports
- weekly *Online Retail Pricing* reports
- quarterly *Infocado* reports
- annual *OrchardInfo*.

These reports are provided to those who contribute data, and some are subsequently published on the Avocados Australia website at www.avocado.org.au/our-programs/supply-chain-data/.

It’s vital a high level of industry participation is maintained throughout this project and into the future.

Not only does the avocado industry have more than a decade of industry data and reports, but also, growers, packers and traders maintain strong participation in the data programs.

The motivation for the program was, and is, to even out avocado supply in the market. The benefits of maintaining consistent supply rates are: to achieve the best possible returns for avocado industry participants; to maintain stable retail prices; and to ensure fruit remains in top condition right through to the consumer via an efficient supply chain.

More information

For more information on the avocado industry data program, please contact Daniel Martins or Amanda Madden on 07 3846 6566 or infocado@avocado.org.au.

Acknowledgement

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

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Producing better fruit by innovation

Majority of Australian households buy avocados

The industry now has access to quarterly reports on fresh avocado sales in Australia. Provided by Nielsen, these reports are funded through the avocado R&D levy program.

A majority of Australian households are purchasing avocados as part of their weekly shop, according to the latest data from Nielsen.

In the 52 weeks to 1 December 2018, 71% of Australian households were purchasing avocados, compared to 69% for the 12 months prior (Figure 1). While the average spend in the 52 weeks to 1 December declined to \$40.20 (from \$41.30 in the prior year), this is on the way back up, after a drop to \$39.90 in the 52 weeks to 8 September 2018.

Also on the way back up in the latest quarter's data is the average weight purchased. In the 12 months to 8 December, buyers took home 5.5kg (an 8.6% increase on the same 12 month period previously), compared to 5.1kg in the 12 months to 8 September.

According to Nielsen, avocados were relatively flat in the 52 weeks to 8 September, compared to the last year in dollar sales

but by the 1 December report, avocados grew 2.5% in terms of dollars (Figure 2).

According to the Nielsen data, avocados grew 8.6% in volume growth for the 52 weeks to 1 December 2018, compared to a 1.6% drop for total fruit (Figure 3).

Avocados Australia CEO John Tyas said the industry needed to take into account that the data did not include the most recent Christmas period, when solid volumes were still being dispatched, and absorbed, by the domestic market.

"Household consumption will always bounce around a bit at different times of the year, but there are no signs that the general avocado consumption trend is anything but upwards," Mr Tyas said.

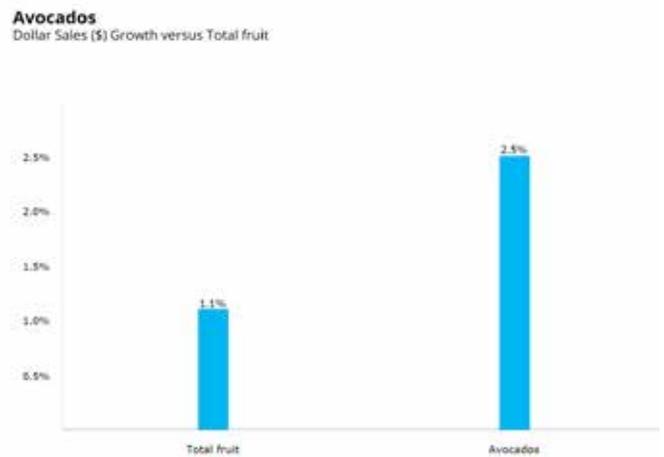
"As an industry we certainly need that trend to continue, but it will require even greater effort in the years ahead.

"This new quarterly reporting system from Nielsen will be useful to monitor the category on an ongoing basis to see changes over time."



Source: Nielsen Homescan for the 52 weeks ending 01/12/2018 for the Australian market. Copyright © 2019 The Nielsen Company.

Figure 1. Avocados household buying behaviour. Source: Nielsen Homescan for the 52 weeks ending to 01/12/2018 for the Australian market.

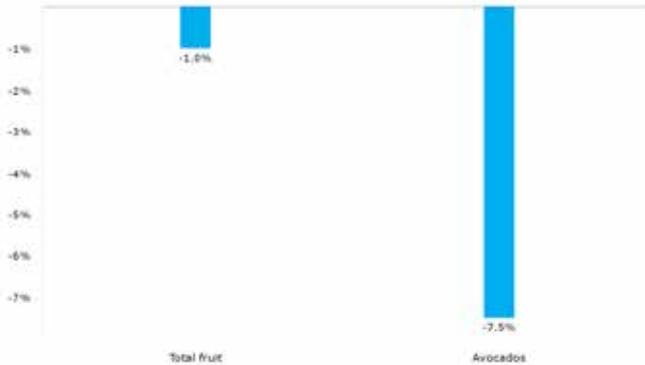


Source: Nielsen Homescan for the 52 weeks ending 01/12/2018 for the Australian market. Copyright © 2019 The Nielsen Company.

Figure 2. Avocado dollar sales growth vs total fruit trade. Source: Nielsen Homescan for the 52 weeks ending to 01/12/2018 for the Australian market.

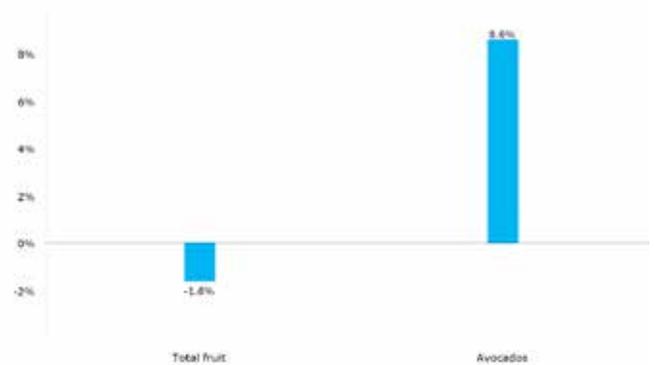


Avocados
Volume (kg) Growth versus Total fruit
September Volume Growth



Source: Nielsen Homescan for the 52 weeks ending 08/09/2018 for the Australian market.
Copyright © 2019 The Nielsen Company.

Avocados
Volume (kg) Growth versus Total fruit
December Volume Growth



Source: Nielsen Homescan for the 52 weeks ending 01/12/2018 for the Australian market.
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Figure 3. Avocado volume (kg) growth versus total fruit, for the year ending 8 September 2018 and 1 December 2018: Source: Nielsen Homescan for the 52 weeks ending to 08/09/2018 and 01/12/2018 for the Australian market.

More information

The avocado industry now has access to regularly updated data from Nielsen, as part of Hort Innovation’s Harvest to Home. Visit bit.ly/TA294DATA. New data will be available on 20 April, 2019 (for the period to 23 March, 2019).



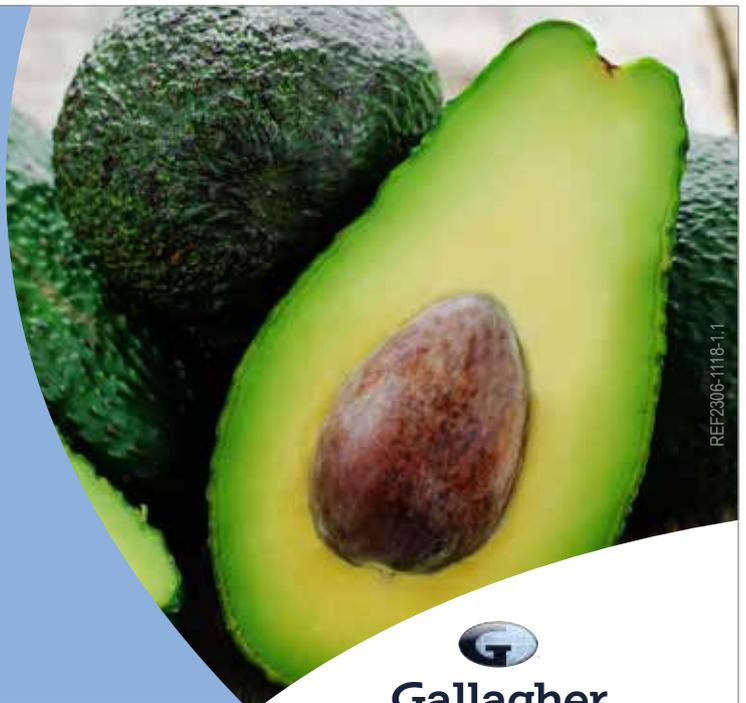
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ANVAS updated

The Avocado Nursery Voluntary Accreditation Scheme (ANVAS), managed by Avocados Australia, was established in the late 1970s to provide superior planting material for the avocado industry.

The scheme has evolved over many years to meet the needs of industry and a major upgrade of the scheme was completed in 2018 in collaboration with the Nursery and Garden Industry Australia (NGIA).

The new scheme provides a contemporary approach to high health avocado nursery production and covers a wider range of potential pathogens, providing greater confidence for growers about the health status of plants sourced from ANVAS accredited nurseries.

For growers

The aim of ANVAS is to provide assurance that avocado nursery stock purchased meets an industry standard, is true to type, and that appropriate steps have been taken to reduce the chance of introduction of serious pathogens into the production environment.



ANVAS accredited nurseries are required to adhere to specific production practices, undertake pathogen testing of plant material, undertake monitoring of stock throughout its growth stages and be independently audited each year to confirm their adherence to ANVAS requirements.

For nurseries

Participation in ANVAS is voluntary and any nursery operator who can meet the ANVAS requirements may apply for accreditation under the scheme.

In order for an avocado production nursery to be eligible to apply to Avocados Australia for ANVAS accreditation, the production nursery must be:

- Nursery Industry Accreditation Scheme Australia (NIASA) accredited; and
- implement the requirements specified within the NIASA Avocado High Health Production Appendix; and
- be found at audit to have implemented the procedures within the Appendix to a Satisfactory standard; and
- demonstrate this through provision of a NIASA Avocado High Health Production Accreditation certificate.

More information

Read more at www.avocado.org.au/our-programs/anvas/. Growers can find a list of accredited nurseries in this section of our website, and nurseries can find more information on the application process.

Acknowledgement

The ANVAS upgrade was undertaken via the *Implementation of recommendations from the Avocado Nursery Voluntary Accreditation Scheme review (AV16013)*, funded by Hort Innovation, using the avocado research and development levy and contributions from the Australian Government.

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New Best Practice resources

The industry best practice resource (bpr) is a key component of the avocados australia industry website.

What's new in the BPR

Updated global market report

The *Global Market Data Analysis Avocado Import Markets* report has been updated with additional countries, now including India, Taiwan and Vietnam. This report provides information on 17 of the world's avocado importers.

Potential impact of imports from Chile and Peru

The final report for Potential Impact of *Chilean and Peruvian Avocado Imports for the Australian Avocado Industry* (AV17004) is now available in the R&D Reports section of the Library. Importantly, this report includes recommendations for the industry to mitigate any potential impacts.

Tree mortality research already in use

The final report of *Investigating Tree Mortality During Early Field Establishment* (AV14014) is now available in the BPR Library. This project enhanced knowledge of the fungi associated with black root rot, their relative ability to cause disease, some insights on how this disease may be managed, and has

provided a molecular diagnostic test for rapid identification of the key pathogens.

The outputs from this project have been communicated to the international scientific and avocado communities, ANVAS nursery scheme reviewers as well as diagnostic laboratories.

Workplace Health & Safety

Preventing injury and keeping those people that work for you safe is important for your business.

Specific resources have been developed for the avocado industry which will help you to manage Work Health and Safety (WHS) and meet your legal obligations.

There are three practical resources which form the base of the information included within the BPR: *Avocado Growing and Packing – A Practical Safety Guide*, *WHS Implementation checklist*, and a *WHS Policy and Plan*. You can download all of these resources from the WHS section of the BPR.

Avo Alerts

Avo Alert notices have been developed for each major production region to act as a prompt to all Australian avocado growers about what orchard activities should be considered throughout the year.

These notes are developed with technical input coordinated by DAF Queensland's Simon Newett and Bridie Carr and the most recent editions can always be found in the Australian Agronomy section of the BPR Library.

Avo Alerts are sent to all growers every month and cover orchard activities for the current month and the month ahead. If you are a grower or service provider who would like to receive the *Avo Alerts*, please email admin2@avocado.org.au and be sure to register for the BPR as well.

Acknowledgement

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

More information

You can log in (or request access!) via www.avocado.org.au/best-practice-resource/.



Global Market Data Analysis
Avocado Import Markets 2018



Prepared for
Avocados Australia Limited

By:
Wayne Prowse
Fresh Intelligence Consulting
20th September 2018
Updated 31st December 2018

avocado.org.au

1



Summer flush critical to flowering

Shane Singh, AgriHort Solutions Australia

Flowering might seem like a long time away, but a critical event is about to occur now, namely the Summer flush, that impacts the flowering later this year, in Spring.

Avocado phenology or the cropping cycle is a grower's guide to the critical events that impact fruit production and quality. *Figure 1* depicts the general phenology cycle of the avocado. Phenology crop cycle calendars specific to your growing region are available from the BPR on the Avocados Australia website, www.avocado.org.au/best-practice-resource/.



The Summer flush is often overlooked with growers concentrating on the current season fruit development and not the new canopy. The amount and quality of the Summer flush, however, is critical for determining the quantity of buds per tree that have the potential to be flowering points for next season's crop. The growth needs to be well balanced, excessive growth can negatively impact bud formation; too little growth can lead to reduced bud numbers per tree.

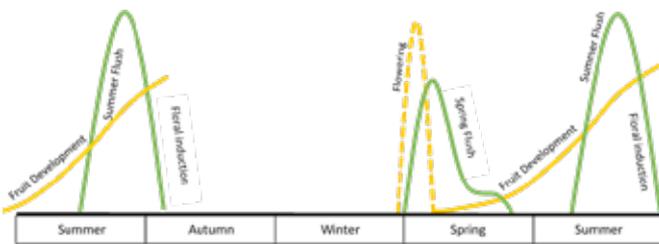


Figure 1 - General Avocado Phenology cycle.

Diagram: AgriHort Solutions





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AVOCADOS®

This development period has a high energy requirement in which avocado trees are likely to call on carbohydrate reserves to help support the existing crop requirements and the new flush if nutrient and water availability are not adequate.

Based on information from the New South Wales DPI crop nutrient calculator, a 12 tonne avocado crop (fruit only) removes 46kg Nitrogen (N), 8kg Phosphorous, 68kg Potassium (K), 6kg Calcium (Ca) and 7kg Magnesium (Mg) – bit.ly/TA294CALC

These nutrients are recorded for the harvested crop only and do not account for leaching, nutrient efficiency or nutrients locked up in the soil. It is important that you concentrate on meeting the nutrient requirements for both the current fruit crop and next season's crop developing in the summer flush. It is also important that you do not just focus on nitrogen as all nutrients play a significant role.

Two nutrients that you should consider for the developing summer flush are zinc and boron. Zinc is well known for being important as a base ingredient for hormone production, in particular auxins which are critical to new growth and development.

Boron requirements are associated with reproductive growth and flowering, but boron is also used by the plant in the development of new cell walls and deficiencies can negatively impact new growth. These nutrients are micronutrients and

should be used in moderation, get advice before applying.

As the growth rate of the Summer flush declines and a cooler change in temperature arrives, floral induction will occur. Floral induction determines if the buds formed during the summer flush will develop into flowers or leaves. The outcome is reliant on light intensity, temperatures, hormones, nutrition, water availability etc. Tree stress during this time should be avoided if possible.

After floral induction occurs, it is time to concentrate on tree health and assisting the tree to increase carbohydrate reserves especially in regions where the crop will be held on the tree for an extended period. Concentrate on maximising photosynthesis and maintain good levels of magnesium as it is the central molecule in the chlorophyll green leaf pigment essential for the photosynthesis process.

It is hard to think about next season's crop when you are concentrating on what is good for this season's crop but by taking the time now to support the summer flush you are getting a head start and nutrition has a vital part to play.

More information

Visit the Growing section of the Best Practice Resource at www.avocado.org.au.

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Hort Marketing

Welcome to the Avocado Summer 2018 marketing update. This activity is managed by Hort Innovation on behalf of the industry and is funded by the avocado marketing levy.

Television

Television plays a key role in driving mass awareness of campaign communications, ensuring key messages for Australian Avocados are established at scale.

The Australian Avocados television campaign kicked off on 9 September 2018, and was on air for four weeks. In Burst 2, Brisbane wasn't included as that market was flush with New Zealand avocado product. This spend was reallocated to the remaining four metro markets (Sydney, Melbourne, Adelaide and Perth) where Western Australian fruit was in good supply, and the ad also on air in northern and southern New South Wales Regional Markets.

The campaign was very successful, hitting all the reach goals: at least 40% of our target audience saw the avocados ad two or more times.

During the campaign, Australian Avocados appeared in nine of the top 10 programs across September and October, including *Masterchef*, *Australian Survivor* and *The Bachelor*. Australian Avocados underpinned this key programming by appearing in consistently rating programs such as news, current affairs shows, *Family Feud* and *The Project*. The television campaign



Corrine Jasper
Relationship Management Lead
Hort Innovation

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

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

horticulture.com.au



then wrapped with a *Block* finale spot in all markets with the show pulling its largest audience for a finale since 2014, and ensuring the ad was seen by a huge amount of Australians.

Out of home

Out of home advertising plays a key role in driving a frequent reminder of key messages, prompting the audience to consider and act.

The second burst of out of home retail activity for the *Smash an Avo* campaign launched included three pieces of advertising creative featuring three different meal ideas, encouraging shoppers to 'smash an avo' to 'make sangas better', 'make desserts better' and 'make salads better'. This was delivered with the overarching campaign message that 'avos make everything better', as well as delivering inspiration and purchase reminder, the materials pointed consumers to the www.australianavocados.com.au website.

The advertisements were placed on television screens located at select shopping centres across Australia to inspire consumers while grocery shopping. Australian Avocados were booked on a total of 336 screens nationwide from 5 August to 22 September 2018, across a variety of shopping targeting Grocery Buyers 25-54. The activity reached more than three million people on average of 5.3 times. These results were achieved across 48 paid HD screens and five bonus screens per week across the seven-week campaign. These placements were crucial as a last point of contact for the buyers as this is one of the last interactions on their path to purchase.



Social media



The ‘always on’ approach to social media for the industry has continued, ensuring avocados remain top of mind for consumers. For the month of October 2018 alone, the Australian Avocados Facebook activity reached 731,758 Australians and served 1.7 million impressions. What is great to see is that since 1 August 2018, 92% of Facebook reaction sentiment has been positive.



Myfoodbook

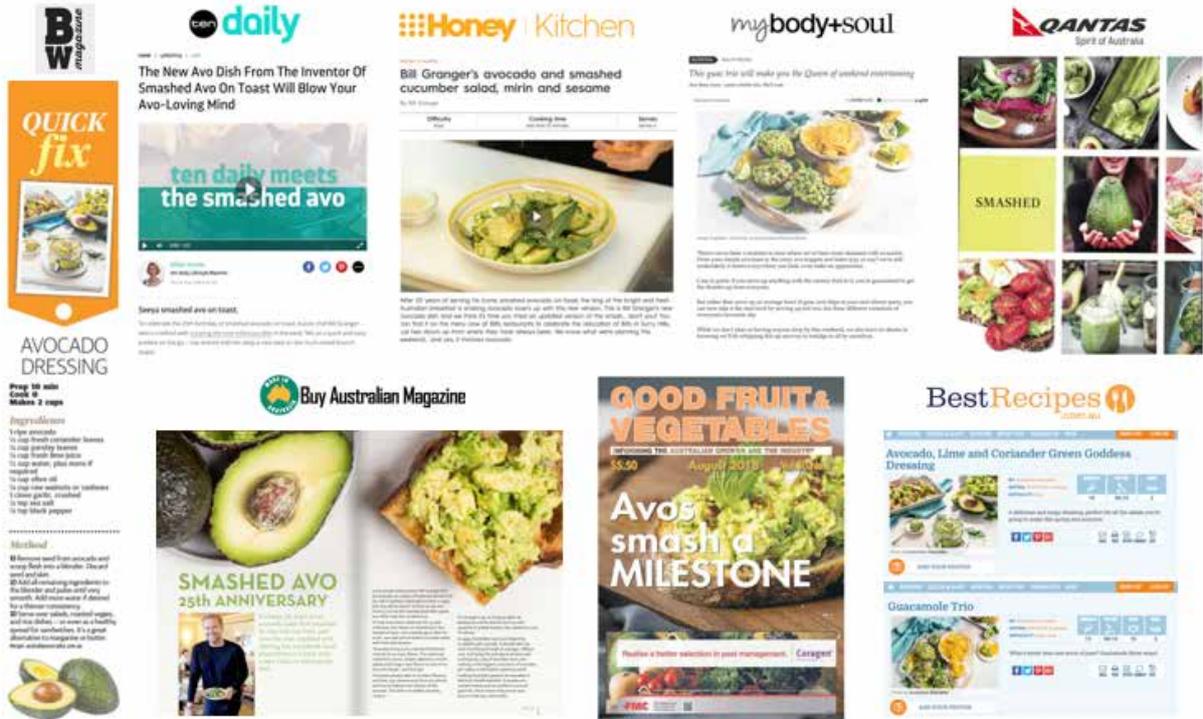
The Australian Avocados subscription with *Myfoodbook* has been active since November 2017. In that time, there were more than 255,000 recipe views and loyalist actions (saving/sharing recipe). Video content has also been created and shared, with more than 92,500 views, and there are nearly 27,000 engagements with Avocado content on the *Myfoodbook* social



media page. The most popular recipe was the Avocado and Salmon Poke Bowl, viewed by 35,000 people. These figures all show that consumers are loving avocado content!

Avocado recipes have also been featured in the ‘Good for you’ foodbook, which has been downloaded more than 12,600 times, and the ‘Around the World’ foodbook which launched in August 2018 and has already been downloaded nearly 9,000 times. Find all the recipe content and cookbooks at bit.ly/TA294FOOD.

Hort Marketing continued



Public relations

The aim of the public relations campaign is to give less frequent avocado buyers the confidence to purchase more avocados more often **BY** reminding, educating and inspiring them with selecting/storing hacks, health tips and mouth-watering recipes **BECAUSE** avocados make everything better!

To celebrate 25-years of smashed avocado in Australia, Australian Avocados collaborated with Ambassador Bill Granger to create the new avocado dish of 2018. You can find the recipe for Bill's avocado and smashed cucumber salad, with mirin and sesame at bit.ly/TA294BILL.

The dish was seeded to media, alongside a beautifully designed Australian Avocado infographic timeline and a series of new avo-dishes. The program photographed three new exclusive recipes for Australian Avocados to offer to media as ongoing content that celebrates 25 years of 'smashed avo'. The recipes were developed to showcase the versatility of avocados. The PR program reached more than 12 million Australians, well exceeding the anticipated KPIs of eight million.

Acknowledgement

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

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Fair Farms Training and Certification Program launching

By Growcom

Exploitation of workers has again hit the headlines following the release of the Fair Work Ombudsman's Harvest Trail Inquiry report in November 2018. The report highlights the need for proper education of employers around their legal requirements.

Growcom is leading a proactive response to these issues in the horticulture industry. With in-principle support from the Fair Work Ombudsman (FWO) and major retailers in the domestic market, Growcom is working to establish the Fair Farms Training and Certification Program. The program will support Australian fresh produce production and packing enterprises to implement fair and responsible employment practices.

In early November, the Federal Government acknowledged the significance of such a program, announcing it will commit \$1.5 million towards the initiative from next financial year.

The funding will support the roll-out of a practical, industry-lead certification scheme, enabling farm businesses to demonstrate to their customers and the public that their employment practices comply with Australian law and industry standards.

Growcom recently appointed Thomas Hertel as the national Program Manager for the Fair Farms Training and Certification Program.

A key feature of the program is a strong training element to help employers understand their obligations under Fair Work laws and how to maintain good workplace practices. Over time, the program aims to drive a significant improvement in employment standards across the fresh produce production and packing sector. The training offered through the program will give growers clear guidance on the procedures and records they must have in place prior to proceeding to audit.

As a grower organisation, Growcom is committed to providing support to growers in how to meet emerging requirements in the supply chain and demonstrate good employment practices. Growcom will maintain ownership of the program so there is a responsible entity to manage any concerns, complaints and opportunities to improve.

The pilot phase is now underway, and the team is working towards having the program operational for horticulture businesses across Australia by April 2019.

Growers who would like to be kept informed about the progress of the pilot and contacted once the program starts in early 2019, can register their details online via the Growcom website: www.growcom.com.au/fairfarmsinitiative.

Mis-use of piece rates highlighted in report

The Fair Work Ombudsman's report from its Inquiry into workplace arrangements along the Harvest Trail was released in November. Its key finding raised concerns regarding:

- the extent of non-compliance with workplace relations law by horticulture employers
- the poor practices and outcomes for workers that often arise when labour hire arrangements are used
- the high level of vulnerability of overseas workers, particularly those with limited English language skills and poor understanding of their entitlement in Australian workplaces
- the widespread mis-use of piecework arrangements.

The use of piece rates is allowed for within the Horticulture Award. The key issue for growers is to ensure the piece rate is set to ensure that the "average competent employee" can earn 15% above the minimum hourly rate.

Some general tips for setting the rate are:

- make sure all employees engaged on piece rates have a proper, written piece rate agreement
- check that at least 50-60% of your competent workers are achieving the piece rate target on any given day
- provide workers with adequate training so that they have a reasonable chance of achieving the piece rate target
- take into account weather conditions and volume of available produce to pick. If conditions are poor, the piece rate must be set higher to reflect that the rate of harvest will be slower.

More information

You can read more about the Fair Work Ombudsman's Harvest Trail report on page 31.

Acknowledgement

The Fair Farms Initiative is delivered by Growcom, in collaboration with industry and supply chain stakeholders. It is supported with seed funds from the Fair Work Ombudsman community engagement grants program.



Harvest Trail finds widespread non-compliance

A recent inquiry into the nation's Harvest Trail found more than 50% of investigated employers failed to comply with Australian workplace laws.

The 'Harvest Trail' comprises thousands of horticulture and viticulture enterprises across Australia. The Harvest Trail is a pathway in regional Australia that follows the seasonal harvesting of fresh fruit, vegetables and wine grapes.

The Fair Work Ombudsman (FWO) recently released a report detailing a review of workplace arrangements along the Harvest Trail, after employee and community concerns were raised in 2013.

The five-year inquiry found:

- widespread non-compliance among the employers investigated
- misuse of piece rates
- significant reliance by growers on overseas workers
- a negative impact where labour hire arrangements were illegally used.

According to the *Harvest Trail Inquiry* report, Fair Work Inspectors completed 836 investigations, involving 444 growers and 194 labour hire contractors across all states in Australia and the Northern Territory, leading to:

- 150 Formal Cautions
- 132 Infringement Notices, totalling \$155,390 in fines for record-keeping and pay slip breaches



- 13 Compliance Notices, of which 11 were complied with, recovering back pay of \$87,649.62 for 32 employees
- seven (7) Enforceable Undertakings, through which a total of \$233,569.04 was recovered for 584 employees
- of the eight (8) legal proceedings started during the inquiry, as the time of the report's release, penalties had been obtained against six businesses.

Because of the high proportion of vulnerable workers and ongoing uncertainty on matters such as the application of piece rates, the FWO report says they will continue to "maintain a key focus" on the Harvest Trail sector.

Widespread non-compliance

In more than half (465 or 55.6%) of the investigations, the FWO determined that there had been a failure to comply with Australian workplace laws. Breaches included:

- 236 (or 28.2% of all investigations) monetary breaches – mainly in relation to underpayment of the hourly rate and not being paid for time worked
- 120 (or 14.4% of all investigations) non-monetary breaches – mainly a failure to keep records and payslips
- 109 (or 13% of all investigations) both monetary and non-monetary breaches.

In the 465 investigations in which non-compliance was found, the FWO identified a total of 693 individual breaches. Underpayment or non-payment of wages (44% of breaches) and failure to meet pay slip and record-keeping obligations (41%) were the most common types of breaches identified, with the balance comprising casual loading, penalty rate, leave and leave loading, overtime and other technical breaches.

As a result of these activities, the FWO recovered \$1,022,698 for 2,503 employees. The largest recovery arising from a single investigation was \$125,053 for 15 employees.

As Fair Work Inspectors were unable to assess and determine the full extent of underpayments in many cases due to issues such as poor record-keeping, cash payments and a transient workforce, the FWO believes the full extent of worker underpayments is significantly higher than this.

Misuse of piecework arrangements

The FWO found that more than a third of employers were paying piece rates or a combination of piece and hourly rates, which is acceptable under the Horticulture and Wine Industry awards. However, more than 100 of those employers were not engaging pieceworkers correctly by having no written piecework agreement or having an invalid piecework agreement.

Fair Work Inspectors observed some growers and labour hire

Harvest Trail finds widespread non-compliance continued

contractors applying group rates for pieceworker employees. This practice involves a group of employees working together to fill a unit of measurement (for example filling a bin of mangoes) for which they are paid an equal share. This method of arranging work does not take into consideration the actual contribution of each employee and can lead to situations where more productive employees are financially disadvantaged.

The FWO treats these arrangements as inconsistent with the piecework arrangements contemplated under the Awards because piecework arrangements are between an individual employee and their employer.

The FWO's position is that an employer must be able to demonstrate that the piece rate offered will allow an average competent employee to earn at least 15% more per hour than the minimum hourly rate prescribed by the Horticulture Award, and at least 20% of the rate prescribed by the Wine Industry Award.

Fair Farms

In order to help support growers with tools and information to implement employment practices that comply with workplace laws and industry standards, the FWO partnered with Growcom in 2017 to support the Fair Farms Initiative. You can read more about this on page 30.

Reliance on overseas workers

The Inquiry found Harvest Trail growers rely heavily on overseas labour. Offsetting the positives of drawing workers to regional areas, the FWO's experience indicates Harvest Trail workers from overseas are often young adults who have limited English language skills, face cultural barriers and commonly do not have a good understanding of workplace rights and entitlements – or where to get help. When these factors are coupled with a strong desire to stay in Australia, overseas workers are more vulnerable to exploitation than Australian-born workers.

Negative impacts of labour hire arrangements

To secure a workforce at the times required, growers on the Harvest Trail source labour directly and indirectly, with labour hire contractors playing a significant role.

However, the Inquiry found several issues with:

- overseas nationals and visa holders running labour hire companies
- governance of labour supply chain contracts
- itinerant labour hire contractors.

The report indicates the Harvest Trail Inquiry and media attention on the issue of underpayments in the sector had a

positive impact on culture in at least some parts of the industry.

The Inquiry heard from growers who had responded to 'negative media' about employment practices on the Harvest Trail by changing from using labour hire contractors to direct employment practices.

Others who continued to hire indirectly conveyed how they were careful to use recognised labour hire contractors with a reputation for 'doing the right thing', and conducted thorough 'checks' to ensure workers on their property had Australian work rights.

Seasonal Worker Programme (SWP)

The Inquiry also found issues with labour hire contractors and the SWP. During the Inquiry, 17 investigations were completed that involved SWP employees who were employed by approved employers. Of these, 11 investigations detected that the employer was non-compliant with Australian workplace laws. Four investigations involved monetary breaches only, two detected non-monetary breaches only and five investigations found that the employer had breached both their monetary and non-monetary obligations.

A total of \$150,356 was recovered for 96 employees as a result of investigations involving employees in Australia under the SWP.

Accommodation, transport and job service providers

As well as underpayments, the FWO witnessed other exploitation including substandard accommodation, transport and extra charges.

Accommodation options and other service providers are limited in many of the crop areas of the Harvest Trail. The Inquiry found that labour hire contractors and ancillary service providers had entered into arrangements that were to their advantage but which disadvantaged workers, including:

- charging job finding/placement bonds
- restricting accommodation options to the use of specific labour hire contractors, which at times meant visa holders were without work while accruing accommodation debts
- offering over-crowded, sub-standard accommodation at above market rates
- requiring workers to use specific transport providers between accommodation and the work site.

More information

Read the full Harvest Trail report: bit.ly/TA294HARV.

Hort Connections 2019: early-bird registrations open

Delegate registrations are now open for Hort Connections 2019, the biggest business and networking destination for the Australian horticulture industry, to be held at the Melbourne Convention Centre from 24-26 June 2019.

This event will explore the theme of *Growing our Food Future*, bringing together thousands of attendees from the local and international horticulture supply chain to discuss on-farm and supply chain practices, review consumer behaviour and consumption trends, and focus on the future of food production.

Avocados Australia has signed on as an industry partner for the 2019 event. CEO John Tyas said the annual event was an important opportunity for avocado industry members to access information about the latest horticultural news, developments and research.

"Avocados Australia is proud to be an industry partner for this significant event in 2019."

Hort Connections is a joint initiative between AUSVEG and the Produce Marketing Association Australia-New Zealand (PMA A-NZ). More than 3,250 delegates are expected to walk through the doors of the 2019 conference.

AUSVEG National Marketing Manager Nathan McIntyre said Hort Connections was a huge event for the horticultural industry.

"This year's Hort Connections conference in Melbourne is being designed to deliver as much value as possible for growers and everyone else in the horticulture supply chain, from presenting world-leading research to offering a huge range of business opportunities on the trade show floor," he said.

The Hort Connections 2019 conference will incorporate networking opportunities for the horticulture supply chain, a trade show showcasing leading local and global businesses, world-class speakers, a retail tour and a horticultural field day.

Key speakers will include celebrity chef, author, TV presenter and MasterChef winner Adam Liaw, who will share his expert insights into trends in the food service sector.

"We're looking forward to hearing Adam's first-hand insights into food service trends. As businesses at every point in the horticulture supply chain become more sophisticated, this will definitely be a can't-miss session for delegates," Mr McIntyre said.

Hort Connections 2019 is being supported by the Victorian government, with Agriculture Victoria signing up as the State Partner. Victoria has a booming horticulture sector with a combined value of more than \$2 billion, which is supported through initiatives like the Victorian Government's Horticulture Innovation Fund.

"Anyone thinking about attending Hort Connections 2019 should take advantage of the early bird rates on offer and register for what's shaping up to be an industry-leading event," Mr McIntyre said.

More information

Delegates can register online at <https://hortconnections.com.au/delegates/registration/>



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Avo enthusiasts gather in WA

Beautiful days brought almost 2,000 people to the Perth Hills in November, for the 2018 Araluen Avocado Festival.

Araluen Botanic Park Foundation Event Officer Marie-Adeline Paris said the festival celebrated all things avocado, including fresh avocados, trees for sale, avocado ice cream and even avocado cocktails.

Keep an eye out for future plans at www.araluenbotanicpark.com.au.

Acknowledgement

Photographs courtesy of Michael Archer (IG: [@_michaelarcher](https://www.instagram.com/_michaelarcher/)).



The AvoStar family, led by Angelo and Roma Spiccia during the event.



Lynne Blackman and Carissa Geary from the Araluen Botanic Park helped visitors choose just the right avocado tree for their Western Australian backyard during the festival.



Chef Vince Garreffa whips up some avocado goodness during the festival.



It was all things avo, all the time, for Kaitlyn Francis and Briony Muslow-Davies at the Araluen Avocado Festival in November 2018.



Verity James enticing the crowds with avocado recipe samples during the festival.



The Thorny Devil's team share a quenching avocado beer with festival goers.



Avocado cocktail anyone? The Mojito Bar's team keeps the crowds appropriately hydrated at the Araluen Avocado Festival.



Avocado yoghurt popsicles were a special festival offering from Pash Dessert Co.



Moody Cow's avocado cider was a talking point for the festival crowds.



SubZero Gelato's avocado ice cream was among the avo-deliciousness at the festival.



Food safety and avocados

Consumers worldwide have been advised to wash their avocados, after a late 2018 report from the United States Food and Drug Administration (FDA) released findings of sampling research testing the prevalence of *Salmonella* and *Listeria monocytogenes*.

The FDA found the overall prevalence of *Salmonella* on the samples collected to be 0.74% (12 positive skin samples) and overall prevalence of *Listeria monocytogenes* in the avocado pulp samples to be 0.24% (three positive samples) and in the avocado skin samples to be 17.73% (64 positive samples).

The FDA's sampling

In 18 months from May 2014, the FDA sampled avocados in the United States, collecting about 70% of its samples from imported avocados and the remainder from domestic supplies. The avocados were collected from ports of entry, retail stockrooms, distribution centres, growers and packhouses. Hass accounted for 69.3% of the samples, and greenskin varieties 30.7%.

In all, 1,615 were sampled for *Salmonella*, 1,254 pulp samples were taken and 361 skin samples.

Three months into the sampling, the FDA updated its approach

to its *Listeria monocytogenes* testing to focus on the avocado pulp, as opposed to its exterior, because, at the time, no outbreaks or individual illnesses had been linked to *Listeria monocytogenes* on the fruit's exterior.

All three of the *Listeria monocytogenes*-positive samples of avocado pulp were detected in imported avocados. Of the 64 positive avocado skin samples (*Listeria monocytogenes*), 33 were from domestic avocados and 31 were from imported avocados.



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Salmonella was detected by the FDA in 12 avocado skin samples from domestically grown product. No samples from imported avocados tested positive for *Salmonella*.

The FDA's assignment was not designed to determine the concentrations of the pathogens in the samples. At low levels of exposure, *Listeria monocytogenes* does not cause severe illness in healthy adults. However, pregnant women, older adults and persons with weakened immune systems (such as organ transplant recipients, or those with diabetes or cancer) are susceptible to small amounts of the pathogen.

Advice for consumers

According to the report, consumers should wash all produce thoroughly under running water before eating, cooking or cutting. Foodsafety.gov (a US site) also recommends consumers scrub firm produce (including avocados) with a clean produce brush, and then dry it with a clean cloth towel or paper towel to further reduce bacteria that may be present. This helps prevent anything on the skin being transferred by the knife into the pulp of the fruit.

Other practices associated with avocado consumption may reduce the risk to consumers as well, the report says. Consumers commonly slice avocados and extract the fruit's pulp prior to eating it, discarding the fruit's peel and eating the pulp shortly after slicing the fruit as its pulp tends to brown quickly once exposed to oxygen. These practices generally limit the amount of the pathogen, if present, to which consumers may be exposed.

For processors

In 2017 the FDA started to sample processed avocados for *Salmonella* and *Listeria monocytogenes* to determine the extent to which those pathogens may be present in the processed product, the main ingredient in guacamole. The processed avocado assignment is slated to conclude in 2019.

Early in the follow-up sampling assignment in November 2017, the FDA identified a contaminated guacamole product that the processor then immediately recalled.

"Importantly, in carrying out our two avocado assignments, we learned that several largescale processors are using in-package, high-pressure pasteurization, a 'kill step,' to eliminate pathogens," the FDA's Susan Mayne and William Correll said.

"We will continue work with industry and other food safety experts on best practices that may be used to reduce contamination of avocado skin with *Listeria monocytogenes*."

More information

Read the full report here (PDF link): bit.ly/TA294FDA.

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Hort Innovation strategic plan consultation

Help shape the future of how Hort Innovation works to invest Australian horticultural levies.

The grower-owned Research & Development Corporation is in the process of developing a new Strategic Plan, replacing their current corporate plan.

In developing the plan, Hort Innovation has scheduled workshops across the country for growers and members to share their thoughts and ideas on how Hort Innovation invests levies on behalf of the horticulture sector.

The outcomes of the consultation (scheduled between January and April) will be integrated into the development of the new Hort Innovation Strategic Plan, to be released mid-2019.

This consultation is separate to that undertaken for the individual levy fund Strategy Investment Plans (SIPs) that were created during the last two years, and for the SIPs that will be developed in the future.

Your ideas

The ideas Hort Innovation is seeking have been structured around four key questions:

- What are the most important priorities for Hort Innovation?
- What are the top goals for Hort Innovation?
- What are Hort Innovation's strengths?
- What are Hort Innovation's obstacles?

In person

The workshops are a chance to learn more about how Hort Innovation currently works to invest levy funds, and to freely discuss any views and ideas on how this can be done better in the future to meet the needs and priorities of the sector.

The outcomes of these workshops will be integrated into the development of the new company Strategic Plan.

Griffith, NSW	4 February
Western Sydney, NSW	6 February
Coffs Harbour, NSW	7 February
Lismore, NSW	8 February
Northern Tasmania, TAS	15 February
Gingin, WA	18 February
Bunbury, WA	19 February
Gatton, QLD	11 March
Bundaberg, QLD	13 March
Darwin, NT	18 March
Mareeba, QLD	21 March
Bowen, QLD	22 March
Mildura, VIC	25 March
Loxton, SA	26 March
Sunshine Coast, QLD	2 April

Online portal

If you can't make it to one of the workshops, you can share your ideas via Hort Innovation's online portal at www.bit.ly/2AQ5dDW.

More information

To register for an event, visit www.bit.ly/2AQ5dDW or contact Hort Innovation on 02 8295 2300 or email communications@horticulture.com.au.



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Lodging of avocado trees

Liz Dann, Kaylene Bransgrove (UQ), Simon Newett, Graeme Thomas (GLT Hort), and several growers

In early June 2018, the south-west Western Australian growing region experienced strong, gusty winds, which resulted in hundreds of avocado trees snapping off at or just below ground level and lodging.

within Australia than previously thought, with trees being lost (albeit in lower numbers) sporadically over the years in the Tristate area, Comboyne Plateau, Childers/Bundaberg and also Atherton Tablelands. From the photos sent by growers, symptoms were very characteristic.

There was frequently a swelling or bulge in the lower trunk

Research and Development



Figure 1a



Figure 1b



Figure 1c



Figure 1d



Figure 1e



Figure 1f



Figure 1g



Figure 1h

Figure 1 (a-h) - Examples of 3-4 year-old trees which have snapped off at the root collar and lodged.

There was no apparent pattern of lodging, with some trees blowing over while neighbours remained upright. The affected trees (Figure 1) had been typically very healthy, with good crop loads on the 3-4 year-old trees, and displayed no obvious signs of poor development of anchoring lateral roots. Young trees of one to two years were also affected (Figure 2). Something similar happened in 2016 in another growing region with cool winters, but fewer trees were lost, and in that case strong winds were not a factor, but the trees had heavy crop loads. We developed theories at that time, but there were no conclusive causes identified.

Emails to our colleagues in horticulture within Australia and internationally, and to Australian growers elicited some interesting responses. Thank you to everybody who replied! Firstly, we learnt that the lodging issue was more widespread

just above the "snap-off" point, and a constriction below the swelling at the snap point. The disconnection/excision between the lower trunk and major structural roots seemed to have happened several months before final lodging, with club-shaped residual roots sometimes evident at or below the soil surface (Figure 3). Sometimes a single anchoring root was still intact (Figure 4), and these trees were often leaning over rather than fully lodged. There was often evidence of root strangulation and/or severe coiling which had occurred well after planting (Figure 5). The lodging was not associated with the graft unions, which were normal.

Samples of the lower trunk portion were sent to Liz's lab in Brisbane to isolate for potential fungal pathogens. Further samples were collected by Liz after visiting several affected orchards in September 2018. There was no soft wet or dry



Figure 2a



Figure 2b



Figure 2c



Figure 2d

Figure 2 (a-d) – Young (1-2 year-old) trees were also affected

internal rot observed in the collar or lower trunk (this is occasionally observed causing weakness and lodging of mature trees). Sections sawn through the root collar at the snap off zone showed segmented root development, and lines of black decay (necrosis) (Figure 6) but the decay was not actively spreading. Fungi consistently isolated from necrotic tissue (the black internal necrosis) include *Fusarium*, *Dactylonectria*, *Ilyonectria*, *Mariannaea*, and *Gliocladiopsis*. All of these fungi are in the same family as those causing black root rot. *Dactylonectria* is a known root pathogen of avocado.



Figure 3a



Figure 3b

Figure 3 (a, b) – The disconnection happens underground several months before final lodging.



Figure 4a



Figure 4b

Figure 4 (a, b) – It is common to see a single anchoring root still attached, which had supported the tree and fruit development until the strong wind event.



Figure 5a



Figure 5b



Figure 5c



Figure 5d

Figure 5 (a-d) – There were several examples of where the main trunk had been strangled by developing roots, or where roots had not resumed straight lateral growth after being coiled in planter bags/pots.

Lodging of avocado trees continued

Research and Development



Figure 6a



Figure 6b



Figure 6c



Figure 6d

Figure 6 (a-d) - Section through the constricted area at the snap off zone shows segmented root development, and lines of black decay (necrosis).



Figure 7

Figure 7 - Root system of healthy tree showing abundant structural roots (bark stripped by high pressure washing).



Figure 8

Figure 8 - Transverse section through root zone of healthy tree, showing similar pattern of root formation and architecture as for the blowovers. Some fungi were isolated from these black lines, but not the ones we know to be black root rot pathogens.



Figure 9a



Figure 9b



Figure 9c



Figure 9d

Figure 9 (a-d) - Nursery and glasshouse trees with symptoms of J root, "knee roots" and constriction at the root collar.



Figure 10a



Figure 10b



Figure 10d



Figure 10c

Figure 10 (a-d) - Healthy looking nursery trees with white roots on the outsides of the bags may hide a poorly developed internal root structure - growers would not be aware of this when they plant trees. Photos b-d are the same tree.



Figure 11a

Figure 11b

Figure 11 (a,b) – Could root coiling at the bottom of pots/bags set the tree up for more serious root coiling after transplanting?

While we frequently isolate *Ilyonectria* and *Gliocladiopsis* from unhealthy roots, they didn't cause severe root damage in our previous glasshouse tests. *Mariannaea* is less commonly isolated from roots, and we are currently determining its relative pathogenicity (ability to cause disease), as it wasn't included in the initial studies of black root rot.

The internal root structure and presence of potential fungal pathogens prompted us to ask the question "What does a 'healthy' root system look like?" One grower was kind enough to "take one for the team" and dug out a healthy four-year-old tree. Abundant healthy lateral anchoring roots had developed evenly around the circumference of the lower trunk, with no signs of root death or excision (Figure 7). Transverse sections (perpendicular to trunk) sawn through the root zone of the healthy sacrificial tree exposed a similar pattern

of root formation and internal zonation as for the lodged trees (Figure 8), including the restricted black necrotic lines. Laboratory isolations revealed the presence of *Gliocladiopsis* and *Mariannaea*, but not *Ilyonectria* or *Dactylonectria*.

The most common theme amongst comments received by survey respondents was that the problem related back to poor root structure of trees prior to planting, caused by poor nursery transplanting practices and/or stock being potbound at the time of planting. Some anonymous comments below.

"I have not lost any trees to this. It looks to me to be the result of poor nursery practice. Similar to this is seen often in ornamental plants. It comes generally from transplant of the seedling into a larger pot and nursery employees not caring enough about how they place the roots. They can be bent or crushed which results in self-strangulation as the tree grows older and root/trunk size increases."

"From the photos it looks very much like the roots have circled after the tree has been left in a container too long before planting out. When the circling roots grow, they eventually strangle the tree. I have seen this before with ornamentals."

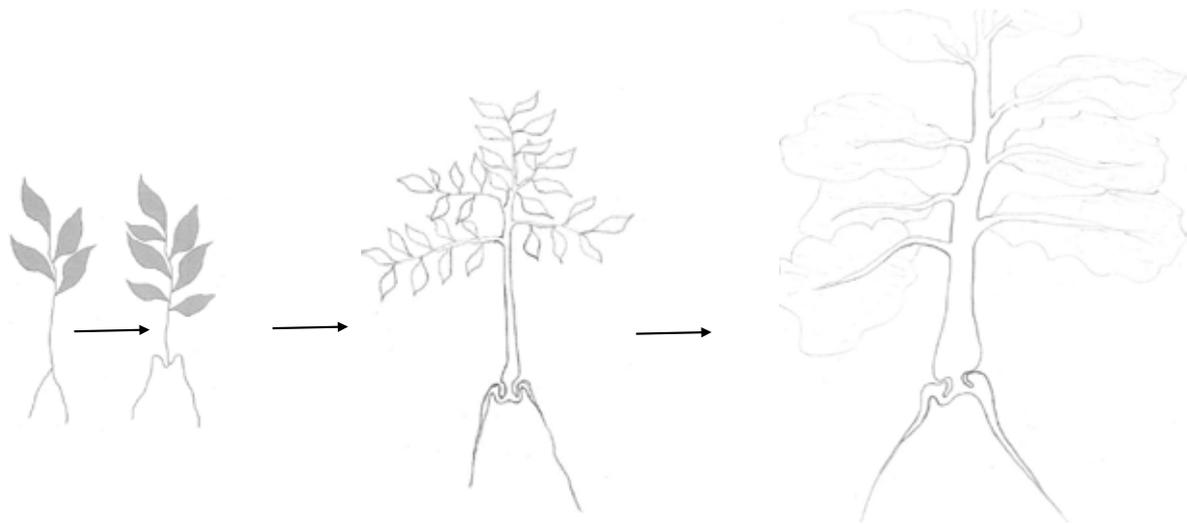
"The photos show the typical constriction coffee trees get when the small seedlings are transplanted incorrectly from seedling trays into pots. If the delicate taproot is pushed down into the potting mix it invariably bends and does not cause problems until the tree and root system are carrying fruit and heavy leaf canopy. By then the root system has curled around rather than growing down and out from the tree base and the 'J' root has expanded virtually strangled itself. To overcome this problem a dibble stick is used to make a hole in the potting mix for the small tap root to extend down rather than start circulating around the pot. We rarely have this problem now. I wasn't going to comment on an avocado problem until I saw the photos which showed similar symptoms to those which caused

Management implications

Successful block establishment relies on both nursery operators and growers employing best practice at every stage through propagation and block establishment. Frequent communication between the nursery and grower is absolutely necessary to ensure quality trees are delivered at the agreed time.

- Avoid holding trees for several weeks or months after receipt from nursery and prior to planting. Liaise with nursery to keep updated on delivery date.
- Make sure trees are not pot-bound at planting. Review this YouTube video on tree planting: <http://bit.ly/TA294HOW>.
- Pull off the tape securing tree to the nursery stake, especially if it has slipped down to rest at ground level, as this could be a source of constriction.
- Nurseries could consider planting seeds straight into bags, avoiding transplanting from pots to bags, which is obviously damaging some of the structural roots, and these may not recover after planting out. Planting into the bags also allows for a greater length of tap root from which lateral structural roots develop, compared with starting seeds in tubes, then replanting.

Lodging of avocado trees continued



Roots of tree in nursery get pushed up during transplanting resulting in a bend at the top

In the orchard, the bend of the damaged roots start to push against the trunk causing indentations

The indentations develop further to produce a constricted tree butt that is prone to snapping off

Figure 12 – Simon Newett’s schematic of potentially long-lasting effects from rough nursery transplant procedure, or potbound roots

major problems in the coffee industry in past years. I don’t know how this translates to nursery practices with avocados or whether plants are held in pots too long or the soil is too tight around the plant at planting, but that’s my two bobs worth from a coffee tree perspective.”

“... also poor root development in the nursery or many roots developing from one point just below the ground that eventually strangle each other.”

“I have seen some similar symptoms in blueberry over the last few years. Some speculation over early root disease or pest pressure that the tree has overcome but when tree gets to a certain size it simply doesn’t have the strength to hold it up. I have floated another idea that also provides an explanation and that is that some plants may have been root bound in the pot at planting. This may have been due to delay in planting of just a few older rootstock plants. As the roots grow thicker, they start to strangle each other and die off weakening the plant. The plant will often show signs of recovery growing a new root system outside the old, but wind can put this new growth under pressure and the tree collapses. Both situations above weaken the root system early on and the symptoms are not obvious till it’s too late.”

“Sure looks like J roots to me. They were kept in the containers too long in the nursery and they grew around and around and girdled themselves. I’ve seen this from trees that were grown back in the 1970s when there was a huge tree demand and

growers were propagating themselves and left the trees too long in the pots while they messed with other things.”

Liz’s team looked more closely at root structure and development in nursery trees. Nursery trees may have an abundance of white feeder roots against the planter bag or pot, but these may obscure pot-bound root symptoms, eg 90 degree roots or J roots and coiled roots at the bottom of the pot (Figure 9, Figure 10, Figure 11). Do these roots ever straighten up? The same fungal genera as outlined above are commonly isolated from nursery and glasshouse tree roots.

Current theories

- Any constriction to root development by pot size, planting late etc. causing a poor root system to develop could restrict carbohydrate movement to the roots, causing swelling above the root system, and constriction below the swelling point. Rough transplanting in the nursery may have pushed the seedling downwards into the potting medium making the roots double up into an ‘S’ shape and against the base of the stem (Figure 12).
- The depth of the “snap zone” in the field may depend on planting depth.
- Tie tape slipping down to the base of the trunk and not breaking off, causing constriction which has not outgrown in the field.

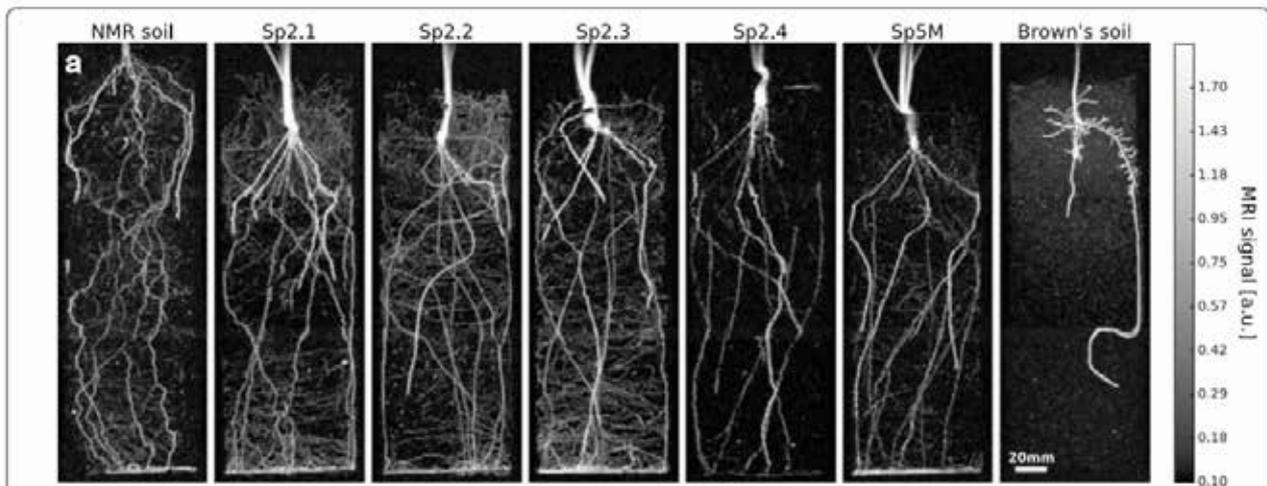


Figure 13 – MRI image of barley root systems. Could this (or other imaging) be used to check root structure and health of avocado nursery trees?

- Strangulation by own roots coiling around, but there was no evidence for this in all cases (eg no residual culprit root, although these may have decayed).
- A cold/frost theory is based on damage at ground level, killing some of the tissue in a ring around the trunk where it meets the soil. This fits with the areas where this is a problem (south-west WA, Tasmania).
- Another theory relates to relative time of planting of trees, with the regions experiencing cold, wet winters preferentially planting in spring through to early autumn. Does this mean that seedling rootstock trees are in the nursery for longer?
- Damage of young trees by larvae of African black beetle or weevils, chewing on young trunk and roots underground, effectively ringbarking. Liz talked to WA Entomologist Stewart Learmonth about this. It is unlikely that the larvae are present in sufficient numbers to do the damage but is still possible.
- It is unlikely that a disease (eg fungal infection arising in the nursery or field) has been severe enough to be responsible, but may have contributed to general weakening of the root system
- Plants where rootstock seedling is initially raised in a tube (eg <1L volume), rather than the final planter bag (4-5L), may not develop the depth of lateral structural roots, and can be severely damaged when transplanted into planter bags.

Further work

Unfortunately, it is likely that there will be further reports of tree lodging. Our investigations are a “work in progress” and we would like to hear from you if you have examples of similar symptoms and/or theories on cause.

- We will be investigating MRI or CT imaging of nursery tree

root systems (Figure 13). We may also grow some trees in clear pots, to look at root binding (J root and coiling) and whether roots continue in this pattern after planting

- Further testing of *Fusarium*, *Mariannaea* and *Ilyonectria* fungal isolates for pathogenicity. A very high proportion of these were isolated from diseased tissue. Molecular (DNA) work to confirm identity of fungi consistently isolated.
- Is the seed potentially a site of constriction, or if it is decaying, is it a source of root or stem pathogens?
- Encourage nurseries and growers to employ best practice at every step!

Further information

We greatly appreciate the emails, comments and samples sent by several growers, consultants, nursery operators and research colleagues. Keep them coming ;)

Liz Dann e.dann@uq.edu.au, Simon Newett Simon.Newett@daf.qld.gov.au, Kaylene Bransgrove k.bransgrove@uq.edu.au.

Acknowledgements

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North Queensland growers support avocado maturity testing

Ebony Faichney, Geoff Dickinson and Pat O'Farrell, Queensland Department of Agriculture and Fisheries

Supplying high quality, mature avocados to the marketplace that meet consumer expectations has been a driving force behind increased consumer demands for avocados in Australia.

Improved monitoring of crop maturity using fruit dry matter testing has assisted North Queensland Hass and Shepard avocado growers to make more informed decisions on the timing of harvest and has helped growers to supply the marketplace with fruit of optimum maturity. Avocados have a strong relationship between fruit maturity and dry matter per cent (DM%). Minimum DM% standards are 21% for Shepard and 23% for Hass varieties.

DAF Maturity testing

The Queensland Department of Agriculture and Fisheries (DAF) Mareeba Research Facility has been offering an avocado maturity testing service for local growers since the early 1980s. The drop-off service is offered once a week and clients are notified the next day of their DM% results. During the past 30 years, changes in technology have improved the efficiency and accuracy of DM% analysis methods. Today's practice uses the Hofshi corer technique (*Figure 1*), and takes about five minutes per five-fruit sample to prepare. In this technique, the cores are extracted from each of the five fruit, then finely chopped, bulked, weighed, dried at 70°C for 24 hours and then re-weighed to calculate DM%.



Figure 1: Ebony Faichney demonstrating the Hofshi corer technique.

The popularity of DAF's avocado maturity testing service has increased over time as the area of orchards in North Queensland has expanded and the industry has placed greater priority on meeting fruit quality and maturity standards in the marketplace. This summary gives a review of the trends in the avocado dry matter testing service from the DAF Mareeba Facility, based on detailed records over the past 18 years (2000 to 2018). Key information within these records include the number of growers, dates of sample submission, sample variety and DM% result.

Sample Numbers

The annual number of DM% samples processed by Mareeba DAF has steadily increased over time from 2000 to 2018, with a record 449 samples submitted in the past season (*Figure 2*). The total number of clients submitting samples each season has also increased, with 96 clients now using the service. There has been a dramatic increase in grower and industry adoption of the DM% service (both number of samples and number of clients) since 2014, as the size of the local industry has increased and fruit quality standards have improved. The wide-scale industry

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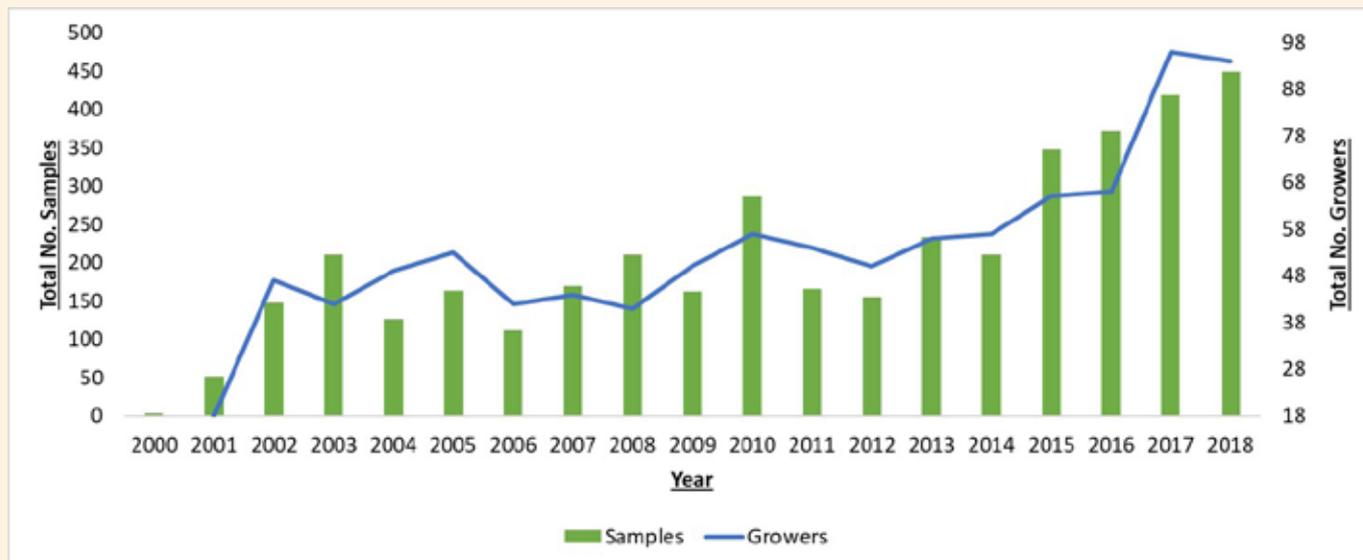


Figure 2. Annual total number of samples and grower submissions processed between 2000 and 2018

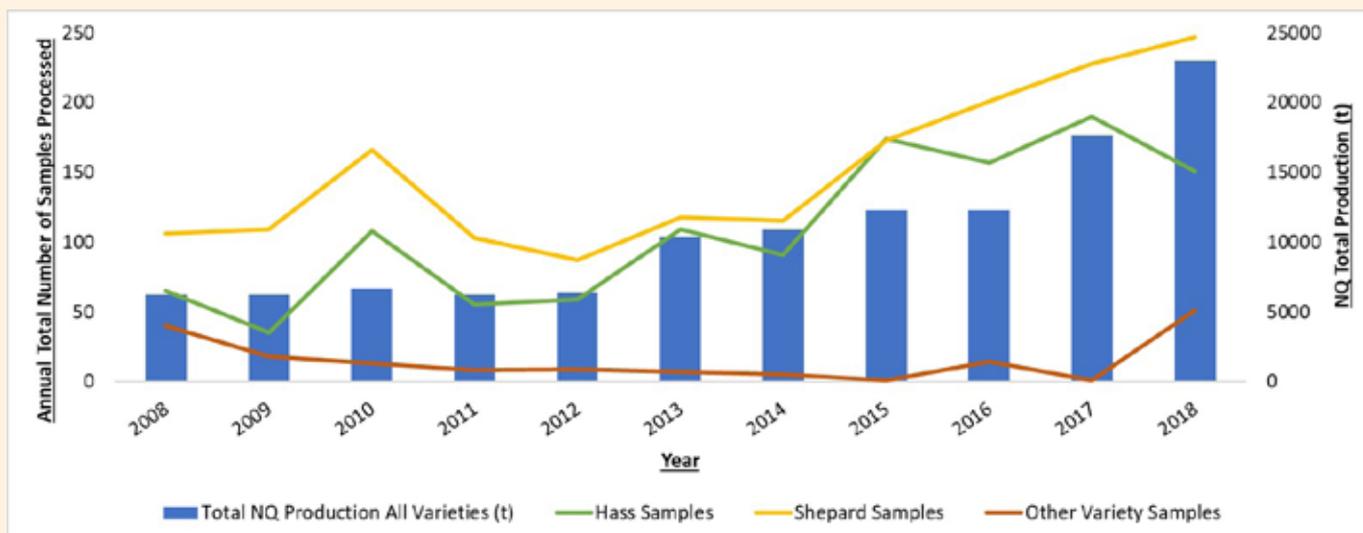


Figure 3. Annual total number of samples processed (Hass, Shepard & Other varieties) and NQ Total Production (t) between 2008 and 2018. Production values sourced from Hort Innovation, 2017 and Avocados Australia, 2018

utilisation of this service by the North Queensland avocado growers is evident, as these figures include almost every avocado producer in the region.

In 2017, North Queensland was Australia’s fastest growing avocado region (31% of all new avocado plantings), and is one of the largest avocado producing regions in Queensland (Figure 3). It is anticipated that the number of DM% sample submissions will also continue to increase as production increases.

Varieties

Based on total area, north Queensland’s variety profile is

unique to other Australian growing regions, comprising 53% Shepard (highest in Australia), 41% Hass (lowest in Australia) and 6% of other variety types. This pattern is proportional to the samples submitted through the Mareeba Research Facility where historically there has been more Shepard samples than Hass submitted in any given year, except 2015 (Figure 3). Over the past 18 years the service has processed 4,000 samples; 52% Shepard samples, 40% Hass samples and 8% other variety samples. There is economic incentive to harvest as early as possible to meet high value periods, and many growers avidly participate in the DM% testing service to assist with their determination of accurate harvest times.

North Queensland growers support avocado maturity testing continued

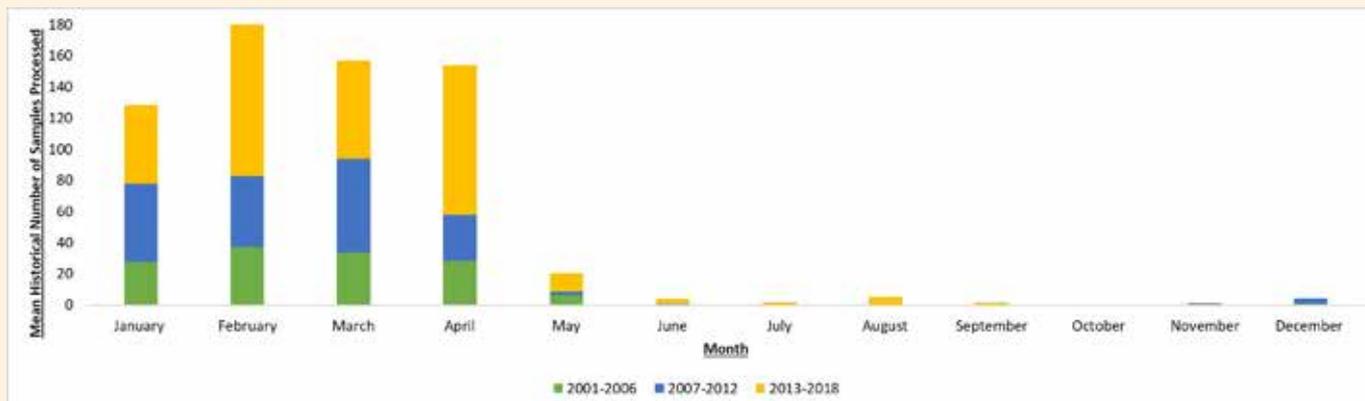


Figure 4. Historical mean number of samples processed monthly between 2001-2006, 2007-2012, 2013-2018

Seasonality

The DM% testing service is available all year round, however, it is most popular in the lead up to and during peak harvest season between January to May (Figure 4). Shepard fruit are usually submitted between Jan – March and Hass fruit between March – May. In past years the testing service was not required after May, however in recent years small volumes of samples have been submitted through to October. These have included late Hass, as well as Sharwil, Carmen and other varieties.

Conclusion

The destructive DM% test is a simple and accurate guide for assessing avocado maturity. The long-standing service provided by DAF at the Mareeba Research Facility has assisted North Queensland growers with orchard management decisions for decades. Advances in Near Infra-Red technology, may eventually replace destructive DM% methods for avocados, however, in the meantime the Mareeba Research Facility will continue this service to support the expanding north Queensland avocado industry. Officers are expecting another record season in 2019.

Mareeba DAF dry matter testing details

Five fruit are required per sample. Each sample should be representative of the fruit intended for picking. Collect the sample in the morning of testing. Store the sample in a plastic bag (or sealed container) and keep cool prior to delivery to DAF Mareeba (B block, 28 Peters St, ph:4017 0700) after 8:30am and before noon on *Tuesdays only*. It is recommended that samples are delivered to DAF as soon as possible after collection. Sample variety identification must be recorded. Cash, cheque, EFTPOS or credit card payment options are available. Invoices cannot be issued. Cost per sample is \$25. Test results are forwarded the following afternoon.

More information

Queensland Department of Agriculture and Fisheries Graduate Development Horticulturist Ebony Faichney, Mareeba, ebony.faichney@daf.qld.gov.au.



Phosphite: is it a suitable long-term treatment for *Phytophthora*

cinnamomi in avocado?

Kay Howard, Treena Burgess, Bill Dunstan and Giles Hardy, The Centre for *Phytophthora* Science and Management

The problem

Phytophthora root rot is most commonly caused by the soil-borne pathogen, *Phytophthora cinnamomi*, which has a host range of greater than 5,000 plant species worldwide.

P. cinnamomi generally occurs in areas of higher rainfall but can be found anywhere in horticultural production as irrigation provides conditions that favour this pathogen. It spreads and infects in wet soils. Stress (eg drought, waterlogging, nutrient deficiencies, heat etc) and/or damage to plants makes them more susceptible to disease.

P. cinnamomi has a complex lifecycle (Figure 1) and it is attracted to the feeder roots, where they infect the root and cause root rot. This greatly disrupts uptake and distribution of water and nutrients, which depletes the plant's store of carbohydrates (see Symptoms box).

Avocado is sensitive to water logging, and flooding exacerbates the effects of root rot because *P. cinnamomi* can quickly produce swimming spores (zoospores) which can rapidly infect new roots in water-logged soil (Figure 1). However, normal watering of

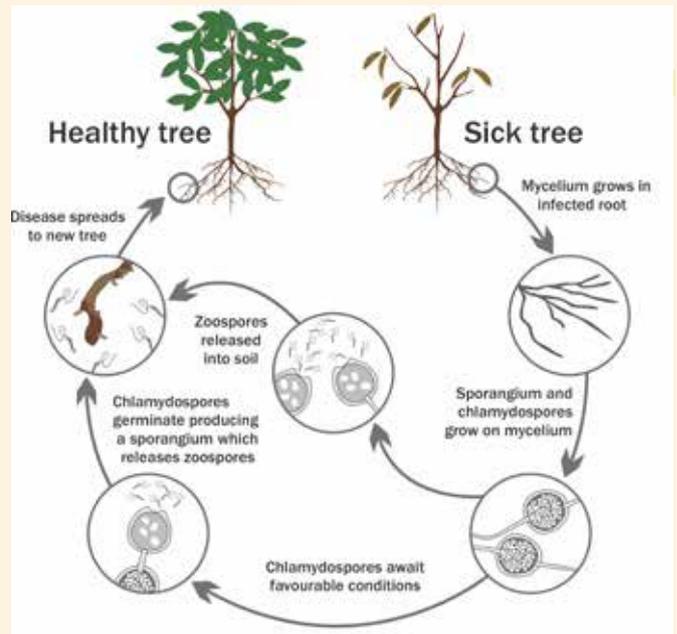


Figure 1 – *Phytophthora cinnamomi* disease cycle. This illustrates how the pathogen and diseases it causes can spread within and between trees. Free water in the soil allows the motile (mobile) stage to travel distances in the soil to gain access to roots.

Adapted from: Rudman T (2005). Interim *Phytophthora cinnamomi* Management Guidelines. Nature Conservation Report 05/7, Biodiversity Conservation Branch, Department of Primary Industries, Water and Environment, Hobart.

Symptoms

In healthy trees there should be many white feeder roots. Infected feeder roots first look water-soaked and then become brown to black and brittle (arrows). This image shows an infected tree with some new growth (white feeder roots) that occurs to replace losses, but these roots are also vulnerable to infection. When infected, the disruption of water uptake may result in the tree showing signs of drought or water-logging.

An infected tree with active disease will require high root production to stay alive and depending on when it became infected may be stunted compared to healthy trees. This image shows an infected tree (L) compared to a healthy tree (R). The canopy of the infected tree is thin and the leaves are showing some chlorosis (yellowing) of the leaves.

As the infection progresses, infected trees exhibit canopy decline with chlorosis (yellowing) of leaves that often wilt and may have necrotic (dried and brown) tips. This image shows severely diseased trees (foreground) with chlorosis of the leaves, a thin canopy and stunting, compared to healthy trees (background). As the pathogen extends into the trunk of the tree cankers can be seen as the pathogen kills the outer layers (phloem/nutrient transport system) and causes splits and secretions in the outer bark.



Phosphite continued

avocado orchards provides ideal conditions for infection to occur. Due to reduced water uptake by diseased roots, the root zone becomes water soaked, continuing to create better conditions for the pathogen.

Phytophthora was first found in avocados in the 1920s, and *P. cinnamomi* is the major limiting factor for production in Australia, South Africa, and California, and has destroyed production in many areas in Latin America. It was estimated that root rot costs the Australian industry approximately \$10 million/year (2015), while California reported losses of \$30-40 million/year (2012). Due to irrigation of orchards in all Australian states (Mediterranean, semi-tropical and tropical regions), conditions are always conducive to disease. *P. cinnamomi* is present in most Australian avocado orchards, and the current areas with favourable environmental conditions for this pathogen coincide with horticultural areas of Australia (Figure 2).

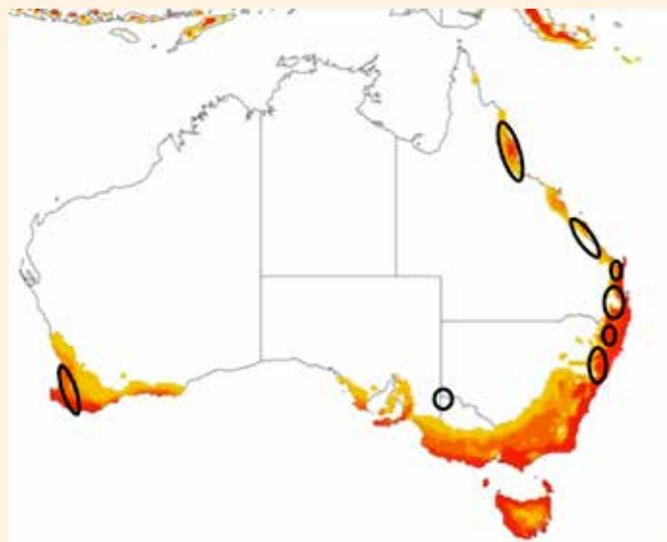


Figure 2 – A CLIMEX model showing the climatic suitability for *Phytophthora cinnamomi* in Australia (see Burgess et al. 2016). The darker the colour the more suitable the climate. The dark circles indicate the main growing regions for avocado.

Phosphite (phosphonate)... and how it works

Worldwide, phosphite is used to protect horticultural crops against *P. cinnamomi*, and native plant communities in Australia, the US, and Europe. It has a simple chemical structure and is relatively safe to use due to low toxicity to mammals, and it is broken down to phosphate quickly in the soil by bacteria.

There is confusion on which terminology to use, with the terms 'phosphite' and 'phosphonate' used interchangeably. However, the term phosphonate covers a broad family of organic molecules related to phosphorus. A variety of phosphonates

occur naturally, and many commercial products contain phosphonates including glyphosate herbicides. Consequently, phosphite is the most appropriate term to use. Solid phosphorous acid added to water forms phosphonic acid with an equilibrium established where phosphonic acid is predominant.

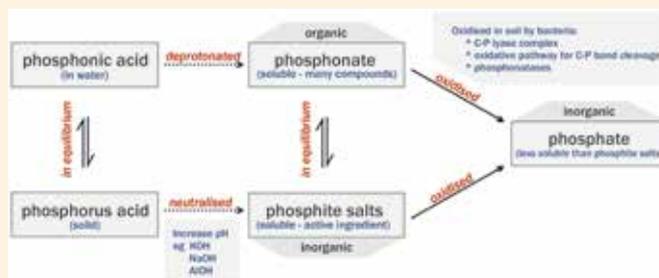


Figure 3 – Relationship between of phosphite and phosphonate

Figure 3 shows the way that salts of phosphite are produced – these are the active ingredient of commercial preparations used to control *Phytophthora* – they have fungicidal properties. Both phosphorous and phosphonic acids are too acidic to use on plants so the solution is neutralised (increase the pH) by the addition of a base (eg potassium, sodium or aluminium hydroxides) which produces a soluble inorganic phosphite salt. This remains in equilibrium with the soluble phosphonates. Both of these products can be degraded (oxidised) by bacteria to form phosphate.

Worldwide, the avocado industry mainly relies on the application of phosphite to manage disease caused by *P. cinnamomi*. Without treatment infected trees usually die. Phosphite-based treatments have been used on avocado since the 1970s. The use of phosphite provides good results in the greenhouse and under orchard conditions by rapidly protecting roots from *P. cinnamomi* infection and allowing recovery of affected avocado trees.

Phosphite moves around the tree in both the xylem and the phloem, and is the only fungicide known to do this. The concentration of phosphite in plant tissues is directly related to its application rate. In the phloem, phosphite moves in association with products of photosynthesis, in a source-sink relationship, to areas undergoing rapid growth such as the roots and shoots (and fruit, if applied at the incorrect time – search “Optimizing phosphonate use” or look for the AV11011 project report in the Best Practice Resource Library (R&D reports), www.avocado.org.au/best-practice-resource/). Within the host tree, phosphite directly inhibits pathogen growth, and protects indirectly by stimulating host defence responses which inhibit pathogen growth.

Within the plant, direct action occurs as the pathogen readily takes up phosphite, which results in the accumulation of toxic compounds inhibiting enzyme activity and altering gene regulation. Phosphite has also been shown to inhibit zoospore release, reducing the spread of the pathogen.

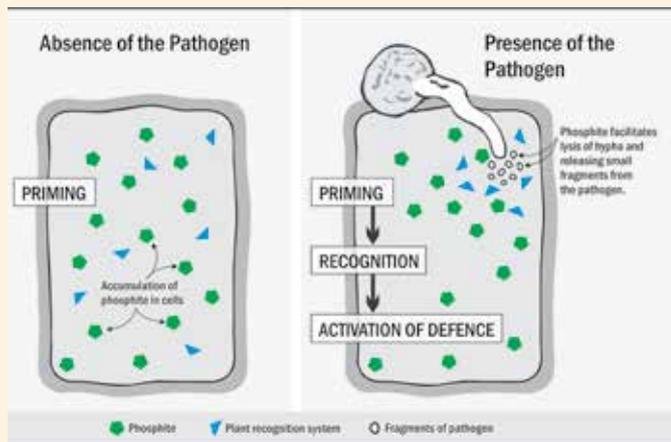


Figure 4 – How phosphite works within the host cells. In the absence of the pathogen, cell defences are primed by phosphite. When the pathogen is present, the direct action of phosphite results in toxic accumulation within the pathogen hypha, resulting in lysis (bursting). Small parts of the hyphae are recognised by the primed cell defence system and an active (indirect) defence reaction stops further spread of the pathogen. Treatment with phosphite allows a rapid response to infection by the pathogen.

Adapted from: Dalio RJD, Feischmann F, Humez M, Osswald W 2014 Phosphite protects *Fagus sylvatica* seedlings towards *Phytophthora plurivora* via local toxicity, priming and facilitation of pathogen recognition. *PLoS One* 9(1):e87860 doi:10.1371/journal.pone.0087860

For indirect action, phosphite induces a strong and rapid defence response in plants challenged by the pathogen as it “primes” the plant’s recognition system. These defence responses occur within hours, and induced defence genes stop pathogen spread in the host (Figure 4). A close relationship exists between the amount of phosphite at an invasion site and the level of plant defence gene expression.

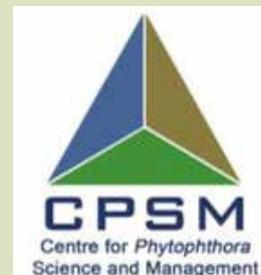
Phosphite...and what we know

Much of the research on the use of phosphite has been in native plant species and communities, and in other agricultural crops and horticultural species, on *P. cinnamomi* and other *Phytophthora* species. Fortunately, much of this information is transferable as long as there is a strong understanding of plant (host), pathogen, environment (conditions) and time.

In native plants, horticulture, and forestry, the CPSM has extensively investigated the use of phosphite, covering many different aspects of the effect and efficacy of this component of an integrated management system. We have looked at the rates and timing of application, and application mode (soil drench, foliar, bark, injection, and slow-release capsule implants) while considering tissue types (micro- and macro-features of leaf and

CPSM

The Centre for *Phytophthora* Science and Management (CPSM www.cpsm-phytophthora.org) established in 2003 at Murdoch University, has presented a cohesive research effort against the threat posed by *P. cinnamomi*. Researchers have 35+ years of multidisciplinary experience working on the biology, ecology, pathology, epidemiology, genetics and management of *Phytophthora* diseases in natural and managed landscapes (including plant production nurseries). CPSM has had more than 30 PhD projects and has over 150 peer review publications on *Phytophthora* and/or phosphite.



Current project:

Improving avocado orchard productivity through disease management (AV16007) 2017-2020

Head of the project, *Professor Giles Hardy* is an expert in plant pathology with an emphasis on the biology, ecology, pathology and control of pathogens in Australian natural and managed ecosystems, particularly *Phytophthora* diseases.



Associate Professor *Treena Burgess* has extensive experience on the taxonomy and genetics of *Phytophthora* and other pathogens. Treena’s studies using metabarcoding of environmental DNA has highlighted just how widespread *Phytophthora* is within Australia.



Dr *Bill Dunstan* is a passionate ecologist who has worked tirelessly for over a decade to find a means to stop the spread and possibly eradicate the devastating pathogen *P. cinnamomi*.



Phosphite is it a suitable long-term treatment for *Phytophthora* continued

bark surfaces), and environmental conditions such as soil type, season and weather. The uptake and distribution, phytotoxicity and sensitivity, both within and between species and genera, to phosphite has been investigated while determining the amount of control of *Phytophthora* in infected plants (in susceptible and tolerant species) in the laboratory, the glasshouse, and the field, and what effect it has upon zoospores and other agents of spread and survival. Models have been created to investigate phosphite's stimulation of plants' biochemical defence mechanisms. We have also considered the effect of phosphite application in conjunction with fire, flood and drought events, on plant reproduction success and the symbiotic relationships between plants and mycorrhizal fungi. We have pioneered and trialed many techniques and tested them against methods devised by other researchers to ensure the best practices are used, as well as studying differences that occur between glasshouse and field trials.

Phosphite...what about tolerance?

There has been a lot of speculation, and some evidence, that isolates of *Phytophthora* exposed to long-term phosphite use can become tolerant to phosphite.

In 1994, *P. cinnamomi* isolates collected from South African

orchards with prolonged phosphite treatment history tended to be more tolerant to phosphite compared to isolates from untreated trees via direct action tests on solid media.

Our laboratory has looked at the sensitivity of *P. cinnamomi* isolates to phosphite (in 2001 and 2008). In the first study, sensitivity on solid media (direct action) 9% of isolates were rated as tolerant. In the second study, using a model system with lupin seedlings (testing both direct and indirect action of phosphite), isolates from a few avocado orchards with a long history of phosphite use showed that they most likely had an increased tolerance to phosphite in comparison with isolates that had less exposure to phosphite. These isolates were able to colonise more roots of phosphite-treated plants than sensitive isolates from areas with no phosphite treatment. We noted that phosphite tolerant isolates are more likely to be isolated from unhealthy trees.

In New Zealand, avocado orchards have been injecting phosphite for up to 45 years. Studies based on assays (testing the direct effect) published in 2018 showed tolerance of *P. cinnamomi* isolates to phosphite was associated with orchards that had >15 years of phosphite application.

For the current Hort Innovation project, *Improving avocado orchard productivity through disease management (AV16007)*, we collected isolates of *P. cinnamomi* from Western Australia and Queensland avocado groves with different phosphite



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application histories. We found more tolerant isolates in orchards with regular phosphite application, while the most sensitive were isolated from areas where phosphite was not used. We have screened over 100 *P. cinnamomi* isolates on solid media. Measurement of the direct effect of phosphite on the pathogen showed tolerant isolates would require 3-5 times more phosphite for the same effect on growth as isolates from areas where phosphite had not been used.

Now, CPSM has extensive glasshouse trials on phosphite-treated avocado saplings. Using five (5) sensitive and 25 tolerant isolates of *P. cinnamomi*, we aim to determine if there are differences in pathogenicity (ability to cause disease) between these groups of isolates. This experiment will examine the direct and indirect effect of phosphite, and will give an indication of the level of risk to the industry from long-term phosphite use. A thorough survey of orchards will be undertaken if we can demonstrate that there is tolerance to phosphite developing, to investigate the risk in different areas and conditions.

Is widespread resistance/ tolerance to phosphite possible?

The potential tolerance of *P. cinnamomi* to phosphite is analogous to the resistance of bacteria to antibiotics. There are horticultural examples where phosphite use has led to a high level of resistance from increased genetic diversity of the pathogen resulting in severe disease. This is because phosphite is fungistatic only (does not kill), so using it allows trees to survive, while the pathogen also survives, and continues to grow and produce spores if conditions are suitable. The evidence is the recovery of the pathogen from plants years after phosphite has contained the disease. Prolonged use of phosphite selects for the development of tolerance in *P. cinnamomi*.

It has been shown that phosphite tolerant isolates from avocado have increased the potential to cause disease in a model plant in the laboratory, and more recently resistance to phosphite in citrus by *Phytophthora* has been reported.

In the natural environment where *phosphate* is limiting, treatments are most effective in limiting pathogen growth. This is due to a phosphate starvation response resulting in the plant having a strong uptake of phosphite into the plant. However, in avocado orchards, not only is *phosphate* plentiful, soil conditions and water availability can be more favourable to disease. This selective pressure in orchards may allow the resistant mutants to become predominant in the microbial population.

Resistance (a high level of tolerance) in *Phytophthora* is usually the result of a simple mutation. Usually resistant mutants require 10x the dose of phosphite of the parent strains to inhibit their growth, and without this, they are more competitive in the environment. We cannot increase doses of phosphite by

this amount without causing phytotoxic effects in the plants, so there is concern that in the future phosphite would no longer be effective in controlling *P. cinnamomi* in avocado orchards.

Conclusion...what to do now?

So, is phosphite suitable long-term treatment for *Phytophthora cinnamomi* in avocado? The answer is yes, but there may need to be some adjustments made to how it is used. For now, continue to use phosphite – it is an effective management tool for controlling *P. cinnamomi* when it is applied regularly and as part of an integrated management system.

Follow the Best Practice Resource articles to understand when to apply, and the levels required to protect.

Always remember that phosphite is fungistatic and its effect is temporary. When present in the plant it indirectly and directly **controls** the pathogen but does not kill it. In the soil, it offers very little direct control or reduction of pathogen load.

The correct concentration in the roots will reduce the chance of new infections occurring.

Maintain the best plant health and use stringent orchard management; more information on how to achieve this can be found in the Best Practice Resource.



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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.

Production

Effect of honey bee density on pollination and fruit set of avocado

Colombia (2018): This research, carried out in the municipality of Popayán, Colombia, aimed to determine the effect of honeybee density on pollination and fruit set of the Hass avocado. The results obtained show an increase of honey bee density per tree, pollination rate, pollination efficiency, percentage fruit set, percentage fruit set final, number of fruits per tree and total fruit weight per tree when six and four bee hives/ha are introduced in the avocado crop. Three avocado orchards were selected, each one with an area of one hectare and trees with an age of six years. The treatments were: (1) four hives/ha, (2) six hives/ha, and (3) control without hives. Treatments of six and four hives/ha presented significant differences with respect to the control, with a honey bee density per tree of 7.72, 6.04 and 2.72, pollination rate of 60, 55 and 50%, pollination efficiency of 7.57, 6.04 and 5.98 grains of pollen per stigma, 6.11, 4.13 and 3.54% fruit set initial, 0.058, 0.048 and 0.028% fruit set final, 231, 212 and 137 of fruits per tree, 46.2, 38.2 and 21.6kg fruit per tree, respectively.

Prediction models of the floral development of the Mendez avocado

Mexico (2018): The availability of prediction models provides an opportunity to forecast important events of avocado flower development. The objective of this research was to

develop models of prediction, generation in temperature, floral development in Mendez avocado. The investigation was carried out in two commercial orchards of the company Agro Gonzalez in the south of the state of Jalisco, Mexico. In each orchard 10 trees were selected and in each of them 30 shoots were labelled at the beginning of each vegetative flow (FV) of winter (February 2014 and 2015) and summer (August 2014 and 2015). From each marked tree an apical bud was collected monthly or biweekly as the anthesis date approached. Cold days (DF) were calculated and accumulated for each sampling period of years, denominating them accumulated cold days (DFA). Through the regressions, the temperatures associated with the floral development were identified and mathematical prediction models developed. Subsequently, the ability to predict the floral development of the best prediction models for all FV in 2014 against the same FV in 2015 and vice versa was evaluated. After verification of the difference between years, a regression model was developed for each FV by integrating the information of the years into a single data set. The floral development of apical buds of the winter and summer FV was associated with temperatures ≤ 17 (126 DFA) and $\leq 15^{\circ}\text{C}$ (138 DFA), respectively, and could be modelled mathematically.

Application of genomic tools to avocado breeding

United States (2019): Traditional tree breeding programs face the challenges of long generation time and significant expense in land and personnel resources. Avocado selection and breeding can be more efficient and less expensive through the development of molecular markers for the estimation of germplasm genetic diversity, marker-assisted selection (MAS), and creation of linkage maps. This article describes the development of the first set of avocado genetic markers based on single-nucleotide polymorphism (SNP) variation in



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expressed genes. RNA sequencing was used both to build a reference transcriptome from Hass, the most widely grown avocado cultivar worldwide, and to identify SNPs by alignment of RNA sequences from the mapping population parents to the Hass transcriptome. This study provides a new genomic tool for the avocado community that can be used to assess the genetic diversity of avocado germplasm worldwide and to optimise avocado breeding and selection programs by complementing traditional breeding methods with molecular approaches, thus increasing the efficiency of avocado genetic improvement.

Post-harvest

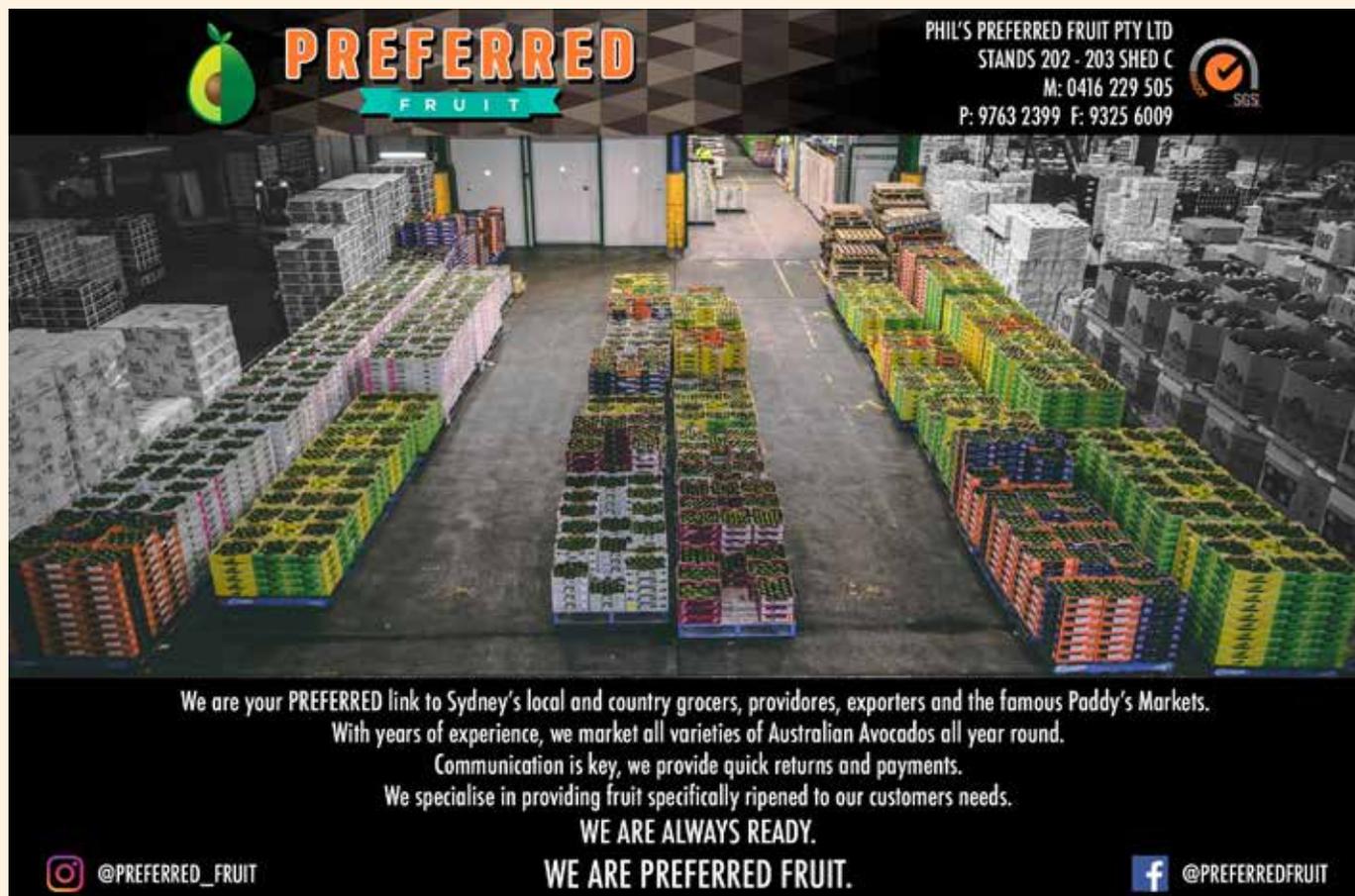
Effects of chitosan treatment on avocado post-harvest diseases

South Africa (2019): Stem-end rot (*Lasiodiplodia theobromae*) and anthracnose (*Colletotrichum gloeosporioides*) are major post-harvest diseases in avocado, causing severe post-harvest losses throughout the supply chain. One of the strategies to reduce development of such decay agents is the application of resistance inducers (eg chitosan), capable of reducing fungal growth and inducing resistance in fruit tissues. The influence of chitosan treatment (1% or 1.5% w/v) was investigated on decay incidence, gene expression of phenylalanine ammonia-lyase (*PAL*), chitinase (*CHI*) and lipoxygenase (*LOX*) and

antioxidant enzyme activity [superoxide dismutase (*SOD*) and catalase (*CAT*)] in (i) drop-inoculated (without wounding) or (ii) artificially infected (with wounding) avocado (cv. Hass) with *L. theobromae* or *C. gloeosporioides* pathogens and also in (iii) naturally infected (natural inoculum) avocado. Fruit were dipped in 1% or 1.5% w/v chitosan dissolved in water for three (3) minutes, followed by storage for 14 days and 28 days respectively at 7.5°C, and thereafter for five (5) days at 18°C to simulate market shelf conditions. Chitosan at 1.5% significantly reduced the incidence of stem-end rot and anthracnose in both inoculated and naturally infected avocados. The up-regulation of *PAL* and down-regulation of *LOX* genes moderately allowed higher epicatechin contents (90 mg kg⁻¹ FW) in the exocarp, which could have contributed to improved anthracnose control. The up-regulation of *CHI* genes and higher *SOD* activity could have contributed to control of stem-end rot. Chitosan solution (1.5%) retained moderate levels of C7 sugars and firmness up to five-day shelf life. The control of stem-end rot and anthracnose of avocados obtained with 1.5% chitosan can be ascribed to a combination of its antifungal and eliciting properties.

Maturity, storage and ripening effects on anti-fungal compounds Hass skin

New Zealand (2018): Fruit rots are a major risk to the quality of avocado fruit in international trade. For New Zealand-grown



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Snapshot International Avocado Research Update continued

Hass fruit, rots become increasingly problematic later in the harvest season. In this paper, results are presented from an investigation of the effect of fruit maturity, storage and ripening on the concentration of the antifungal compound persin and compounds associated with its metabolism in the fruit skin of New Zealand grown Hass. The persin concentration decreased markedly during maturation, with a ~30% decrease in total persin (the combined persin and persenone-A), from ~600 mg kg⁻¹ at the early harvest to ~400 mg kg⁻¹ at the late harvest, approximately four (4) months later. The concentration also decreased during storage and ripening, although the degree of change was dependent on the concentration present at harvest. Irrespective of harvest maturity or storage, the concentration of persin in the skin of ripe fruit did not decline below ~200 mg kg⁻¹. The epicatechin concentration declined by ~17% and catechin by ~50% between the early and late harvests. The total (epi)-catechin (the combined epicatechin and catechin monomers, epicatechin dimer B2, and (epi)-catechin oligomers) concentration declined by ~20% between the early and late harvests, from ~15.4 g kg⁻¹ to 12.5 g kg⁻¹. The changes with storage and/or ripening were of a smaller magnitude than the change with maturation. Also, the total (epi)-catechins concentration tended to increase slightly during storage. The

findings are discussed in the context of the risk of rots in late season New Zealand-grown Hass fruit based on previously described associations between changes in skin composition with fruit rot development.

Pests & Diseases

A remote sensing technique for detecting laurel wilt disease in avocado

United States (2019): Early and accurate disease detection is essential for implementing timely disease management practices. Current disease detection tactics are labour intensive, expensive, require a level of expertise in pest identification, and, may result in subjective disease identification. In this paper, an automated early disease detection technique for avocado trees is presented and evaluated. This remote sensing technique can detect the laurel wilt (Lw) disease, and differentiate it from healthy trees (H), trees infected by phytophthora root rot (PRR), and trees with iron (Fe) and nitrogen (N) deficiencies. Detection of Lw disease in avocado trees, in early stage, is very difficult, because it has similar symptoms with other stress factors such

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as nutrient deficiency, salt damage, phytophthora root rot, etc. The neural network multilayer perceptron classification method with a 6 bands Tetracam was able to successfully detect Lw with an accuracy of 99% in asymptomatic (early) stage. Hence, low-cost remote technique can be utilised to differentiate healthy and unhealthy plants.

Market research

Avocados and Chinese cuisine

Australia (2018): This paper presents the results of qualitative research undertaken in Singapore with consumers from various Asian ethnic backgrounds, with emphasis on Chinese-ethnic consumers. The study found that although avocados are gaining popularity in Asian markets consumption is still relatively low, with only a small portion of consumers purchasing them regularly. The study concludes greater awareness of the different uses of avocados is needed to increase consumption, and more consumer information is required to dispel any confusion about the health attributes of the fruit. Avocados are not popular with Chinese consumers, as most find it hard to integrate the fruit in Chinese cooking. Furthermore, as avocados are known as 'butter fruit' in Chinese, there are misconceptions as to the negative health aspects of the fruit.

The Australian avocado industry is taking active steps to gain market access to the expanding Asian consumer market. As the phytosanitary protocol development process is time consuming, costly and resource intensive, the industry needs to ensure that such investment translates into trade success. Understanding consumer's attitudes and interaction with avocados in the first step to plan market development activities and ensure export success.

More information

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



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Unlocking avocado DNA

Australian scientists are embarking on a five-year \$13.3 million tree DNA project that will make it easier to develop fruit and nut trees resistant to drought and disease, including avocado.

Delivered through Hort Innovation under the Hort Frontiers strategic partnership initiative, this five-year project will develop a breeders genomic toolkit for tree breeders and researchers to better understand how genes control traits that are valuable to Australian growers – such as tree size, yield, disease resistance, and tree maturity.

The research will be conducted by the Queensland Alliance for Agriculture and Food Innovation (QAAFI) embedded within the University of Queensland (UQ) and the Queensland University of Technology (QUT).

The project aims to build a complete DNA map that will visualise the genetic make-up and variability of the nation's five leading tree crops, avocado, mango, macadamia, almond and citrus, representing 80% of the total volume of horticultural tree crop production in Australia. Together, these five crops accounted for around 56% of horticultural tree crop revenue in 2017.

Hort Innovation Chief Executive Officer Matt Brand said while currently profitable, the horticultural tree industry faced challenges that stemmed from plant diseases, slow production and climatic changes.

"Plant production is, by definition, a slow and timely process. This project will break down the genetic code of our five leading tree crop varieties to assess ways to develop more resilient trees that can withstand the changes expected in the coming years," Mr Brand said.

QAAFI Director Professor Robert Henry said the long generation time of tree crop production made it difficult for plant breeders and physiologists to rapidly develop new plant varieties in response to pest and disease outbreaks, changing climate or evolving consumer preferences.

"So in the case of crops like avocado, there has been some work in the past and we have low-quality data on their genomes, but what this project will do is bring that up to a modern standard



Professor Roger Hellens will lead QUT's involvement in the Hort Frontiers project.

by applying the very latest technologies to producing a high-quality genomics platform," Professor Henry said.

He said this would underpin understanding the biology of avocado and extending that how avocado could be produced more efficiently and at a better quality.

"Despite its popularity and cult-like status in some countries, there is currently only a limited amount of information available on the avocado genome."

Professor Roger Hellens, who will lead QUT's involvement, said while scientists had discovered a lot about humans' DNA and the DNA of field crops such as wheat and rice, tree crops were still a "bit of a mystery".

"In addition to creating opportunities for more adaptable, higher-yielding tree crops, this research combined with advances in robotics and digital agriculture, could really pave the way for the orchard of the future," Professor Hellens said.

More information

More information on the *National tree genomic program* (AS1700) can be found at www.horticulture.com.au.



Professor Robert Henry, Director Queensland Alliance for Agriculture and Food Innovation at the University of Queensland.

News from Around the World

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

Mexico focusses on yield

Mexican Hass avocado production is forecast at 1.9 million metric tons (MMT) or more for marketing year (MY) 2018/2019, however, plantings have slowed.

According to a recent USDA Foreign Agricultural Service Global Agricultural Information Network (GAIN) report released in late November 2018, overall production is expected to be good as weather conditions have been optimal thus far.

"Sources indicate that the implementation of phytosanitary pest-control programs has helped boost production," the GAIN report said.

"Exports for MY 2018/19 are forecast to be close to 1MMT."

The report says production estimates for MY 2017/18 are at about 2MMT, based on official estimates.

"According to producers, avocado trees had an alternate-bearing high crop and good rainfall," the report said.

It also notes that the Mexican Avocado Association of Producers and Export Packers (APEAM) is working with producers in Michoacán, the largest production region, to invest in technological improvements to ensure avocados are free of pests and chemical or biological residues, thus improving the quality of the fruit.

"According to sources, costs of production in Michoacán vary from about \$81,000 pesos/ha (US\$4,308/ha) using basic technology to about \$110,000 pesos/ha (US\$5,851/ha) with advanced technology that includes machinery and irrigation systems," the report said.

"The depreciation of the peso against the dollar keeps increasing these costs. Yields vary from eight to 10 metric tons per hectare (MT/ha) or more depending on the level of technology used."

New planting

The GAIN report said the area planted to avocados was not expected to grow as strongly as in the past, as growers instead increased the area in a more orderly way and to increase yields using better cultivation methods and techniques.

"Total area planted for avocados for MY 2017/18 is estimated at 231,028ha; area planted in MY 2016/17 is estimated at 218,492ha. The area in Michoacán increased almost 5% from MY 2016/17 to MY 2017/18, a slower growth compared to previous years.

New areas pest free

In other news from the Mexican government, four regions in Michoacán and two in Nayarit have been declared free of the large avocado borer (*Heilipus lauri*), the small avocado borer

(*Conotrachelus aguacatae* and *C. perseae*) and of the avocado seed moth (*Stenoma catenifer*).

In all regions, the declarations came after technicians from the National Service of Health, Food Safety and Quality (SENASICA) verified the absence of the pests based, however, growers will have to carry out various management steps to ensure the pests don't return.

If control actions are not carried out on the avocado, these pests cause damage to the fruit when the larvae feed on the pulp and the stone.

www.fas.usda.gov/data/mexico-avocado-annual-3

New Zealand estimates NZ\$130 million in avocado exports

New Zealand's primary industry exports are forecast to increase by 3.8% for the year ending June 2019 to \$44.3 billion, according to the New Zealand Ministry for Primary Industries (MPI) *Situation and Outlook for Primary Industries* (SOPI) report.

As at December 2018, avocado exports from New Zealand to Australia were well underway for the current season, with mid-range yields expected, following last season's low yielding crop. The forecast value for the year ending June 2019 is NZ\$130 million.

While Australia is the destination for 85% of New Zealand's avocado exports on average, newly opened access to China provides additional opportunities.

The SOPI report acknowledges Australia's increasing domestic production, "which could start to put pressure on the market for New Zealand fruit, although domestic consumption there has seen similarly strong growth".

New Zealand horticulture also expects to benefit from the Comprehensive Progressive Trans Pacific Partnership (CPTPP), which came into force on 30 December 2018. The CPTPP is a new free trade agreement (FTA) between Australia, Brunei Darussalam, Canada, Chile, Japan, Malaysia, Mexico, Peru, New Zealand, Singapore and Vietnam.

New Zealand Horticulture Export Authority CEO Simon Hegarty said it would provide for instant elimination of tariffs for many products and more rapid reductions in others in Japan.

"With tariffs amounting to almost \$45m in 2018, the removal of tariffs on trade with Japan will provide an estimated benefit of NZ\$37m from the start date," Mr Hegarty said.

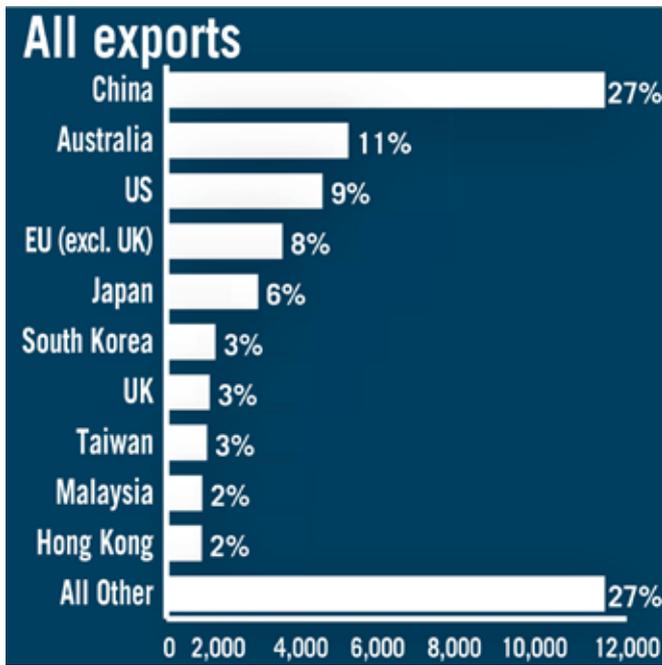
According to the New Zealand Ministry of Foreign Affairs and Trade, Japan eliminated tariffs on avocados once the agreement went into force. As a member of the CPTPP, referred to as TPP-11 in Australia, tariffs on Australian horticulture will also be eliminated.

Outside of the CPTPP, the recently released *New Zealand*

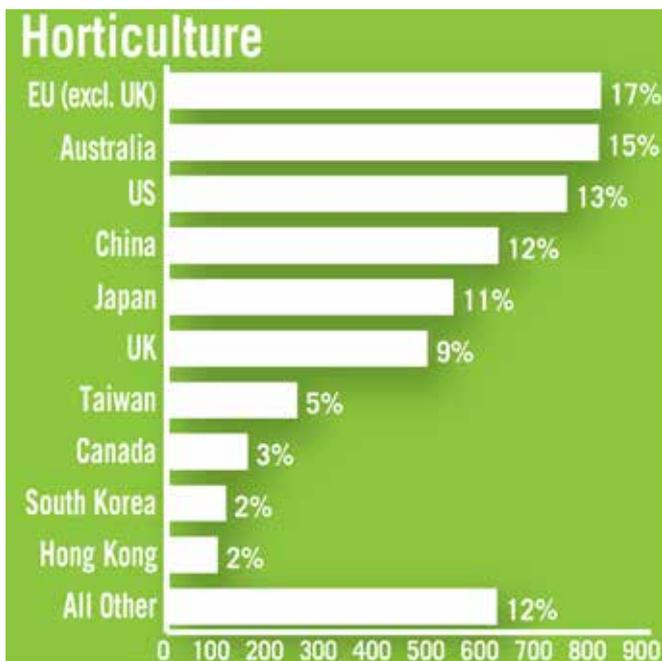
Horticulture – Barriers to Our Export Trade report, released in December 2018, shows encouraging growth for New Zealand in the Indian avocado market.

“The volume and value of apple and avocado exports to India in 2018 has basically doubled since 2016 and significant growth has occurred in kiwifruit exports over this period too,” the report said.

bit.ly/TA294NZ



Top markets (\$NZ millions, year ended June 2018)



Top markets (\$NZ millions, year ended June 2018)



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News from Around the World continued

Trans-Tasman alliance to stamp out threats to national biosecurity

A joint initiative to combat threats to Australian plant biosecurity was announced in late 2018.

Cemented by a Memorandum of Understanding between Australia and New Zealand, the Trans-Tasman collaborative, led by Australia's Plant Biosecurity Research Initiative (PBRI) and New Zealand's Better Border Biosecurity (B3NZ), will focus on biosecurity Research, Development and Extension efforts at pre-border, border and post-border stages.

The initiative aims to build capacity to support the future of plant biosecurity through education and training, and will establish professional development opportunities for postgraduate and post-doctoral students across the two countries.

Hort Innovation CEO Matt Brand said Australia and New Zealand both pride themselves on their unique natural environment, high-quality produce and trusted international reputation.

"And both Australia and New Zealand share a common goal of wanting to maintain this reputation and impede the destructive impact that the threat of pest and disease can have on our horticultural industries," he said.

"Through Hort Innovation's involvement in the PBRI, we are helping to drive a new era in Australian biosecurity research.

"Our role as a Research and Development Corporation is to invest in, manage and evaluate research and other activities that deliver impact for our producers and the broader community.

"This project is of national and international importance because not only are we at the forefront - working together across plant production systems to stamp out threats before they can establish and take root, we are also working with New Zealand industries and government to protect our growers from biosecurity threats to promote greater efficiencies across our R&D investments."

B3NZ Chair James Buwalda said Trans-Tasman connections would be facilitated between key elements of the biosecurity research, development and extension systems.

Hort Innovation

Avocado partners with Michelin in France

After the successful collaboration between the World Avocado Organization (WAO) and the 2019 Michelin Guide Revelation for Great Britain and Ireland, the avocado will now join the Michelin Guide for the prestigious 2019 Michelin Revelation in France.

Regarded as the Oscars of the food world, the hotly anticipated Michelin Revelation awards stars to fine dining establishments in recognition of quality cuisine.

Avocados are the first fresh produce product to be invited to collaborate with the Michelin Guide in its 110-year history; the partnership highlights the ever-growing popularity of the superfood across Europe.

"We are very proud to continue our collaboration with the Michelin Guide," WAO President & CEO Xavier Equihua said.

"The revelation of the stars is the most important gastronomic event of the year in France. Numerous star chefs feature the avocado in their creative dishes and we want to further enhance its versatile uses and flavours in the world of gastronomy."

Food stylist Colette Dike, FoodDeco, will create the first ever edible Michelin Star sculpture made entirely from fresh avocados.

A special edition of the 2019 Michelin Guide for France will also be created to celebrate the collaboration.

"The guide's cover will fuse the traditional red of the iconic Michelin Guide with the green of the avocado," Mr Equihua said.

"In honour of the event we are also creating a special edition cookbook dedicated to cooking with avocados – a first of its kind."

The cookbook is available to download: <https://online.fliphtml5.com/rlyl/ikpb/>.

In 2018, Europe and the UK consumed close to 650 million kilograms of avocados, a 35% increase over 2017. The UK, after France is the second largest market for avocados in Europe and continuing to grow in double digits' year on year with sales up 26% in the last 12 months alone.

France has been Europe's number one consumer of avocados for more than 20 years and the avocado has been a French food staple since the 1960s. It is widely considered as one of the most popular superfoods, with almost 159,500 tons consumed in France in 2018 (+30% VS 2017).

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Peru expanding production

By the end of 2019, Peru will have 33,000 hectares of Hass avocado planted, Daniel Bustamente from the Hass Avocado Producers Association of Peru (Prohass) has told Peruvian newspaper Gestion.

Mr Bustamente said the 2,000ha added this year represented a US\$50 million investment for the industry, spread over three years, and not including the price of the land.

At the end of 2018, the export of Peruvian Hass avocado was 335 thousand tons, which represented some US\$600 million, Gestion reported.

“In 2017, the Hass avocado had exceptionally high prices in the international market, so shipments in 2018, having a lower price, showed a lower growth of the total amount, despite the large increase in tons exported,” he told the paper.

“While the total export volume increased by 43% year-on-year, the invoiced amount only grew by 20% over the previous year (2017).”

Mr Bustamente told the paper it was unlikely there would be a significant increase in exports during 2019, perhaps 5-10%, given last year’s bumper production.

The cultivation of Hass avocado takes four years until the harvest can begin. Every year there is an increase of the

hectares of cultivation of this fruit in Peru, which is currently the second largest exporter of Hass avocados in the world, only after Mexico.

Gestion says only 1% of the avocado produced in Peru is destined for the domestic market, due to the small local demand. Fresh fruit exports make up 90% of national production, with some frozen product also exported.

Earlier in January, the Peruvian Association of Exporters (APEX), told Gestion avocado exports had increased 22.7% between January and November 2018, compared to the previous year.

However, they received lower prices in the European market because of significant supplies from a number of other exporting nations. Exports to China rose significantly with the industry carrying out in-country promotions to boost consumption. For Peru, the value of the Chinese market has grown from about US\$100,000 in 2015 to \$13.8 million in 2017.



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