

TALKING AVOCADOS



WINTER 2018

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Avocados Australia Limited

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We all make mistakes. If we make an error, please let us know so a correction can be made in the next issue.

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Cover: Malaysia meeting, regional meetings

Chairman's Perspective

The Australian avocado industry continues to push forward with a variety of research and extension activities that will help improve our industry from behind the farm gate to the retail shelves.

This work is driven by investments from you, the grower, together with Australian Government contributions, to our levy system.

As an industry, our current goals are outlined in the Avocado Strategic Investment Plan 2017-2021:

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

I encourage you to read the R&D section of this edition of *Talking Avocados* because there are projects in place to help you meet or exceed all of these goals by 2021.

At the Regional Meetings held across the country this year (pages 20 and also 41), we heard about the work that was done to provide suggestions for how we at the farm and

packhouse can better store and transport our avocados, and more work has been done to help the retail section of our supply chain prevent squeezing and improve displays to increase sales and customer satisfaction.

As an industry, the imperative is ensuring that we put a quality piece of fruit in the hands of every consumer, every time if we can. Production continues to increase and we need to make sure that we improve the quality of our production as this happens.

We continue to make sure consumers are reminded about the health and versatility of avocados at every turn (check out the latest on the industry's marketing on pages 28 - 32 it's up to us as industry members to make sure they also always associate avocado with quality.

Jim Kochi

Jim Kochi, Chairman, Avocados Australia Limited



Annual General Meeting 2018

All members will be sent a detailed notice in due course.

Date: 2 November 2018

Time: 1.00pm to 2.00pm

Place: Brisbane Markets Ltd

Training Room 2

Martin Taylor Drive off 385 Sherwood Road

Rocklea QLD 4106

Please RSVP for catering purposes.

More information: admin@avocado.org.au

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CEO's Report



Export market development

As more and more avocado trees come on-line, it's vital that as an industry, we develop markets for our high-quality fruit. This was clearly highlighted in July when we had the largest volume of Australian fruit ever consigned in a single week: 376,000 trays. While this isn't the highest total ever consigned (including New Zealand supply), it is clearly a sign of things to come for our domestic production.

This is why our export strategy is so important. As part of this strategy, Avocados Australia has been working with key exporters (Sunfresh, The Avolution and the Avocado Export

Company) into the Malaysian, Hong Kong and Singaporean markets since 2015 via the Australian Government Department of Agriculture and Water Resource's Package Assisting Small Exporters program (PASE). More on the program, including a recent event in Malaysia can be found on pages 13.

A major part of our export strategy is to open new markets, and very recently, we have successfully obtained market access to Japan for Australian avocados.

While the regions with Queensland fruit fly are not yet permitted to export to Japan, this is a major milestone in our market access program. For more information on this, see page 10.

Regional meetings

The recent round of regional meetings drew more than 400 avocado industry members, and we've received some very positive feedback.

We hope to have a new industry development and extension project up and running soon, pending Hort Innovation approval. If successful, there will be a full program of workshops and field days across every growing region during the three-year project.

You can read more about the regional meetings on pages (pages 20 and also 41).

ANVAS ACCREDITED NURSERIES

ANVAS accredited trees can be purchased from the following nurseries:

Anderson Horticulture Graham Anderson Duranbah Road Duranbah NSW Ph: 0438 390 441	Birdwood Nursery Liz Darmody 71-83 Blackall Range Rd Nambour Qld Ph: 07 5442 1611	Turkinje Nursery Peter & Pam Lavers 100 Henry Hannam Drive Walkamin Qld Ph: 0419 781 723
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New PR campaign

The Hort Innovation marketing team is encouraging the country to celebrate 25 years of the smashed avocado with the man regarded as the first to “smash avocado”, Aussie restaurateur, Bill Granger. Bill first put avocado on a piece of toast and served it at his café in Sydney’s Darlinghurst back in 1993. This launched brunch as we know it and sparked not only Australia’s great love affair with the versatile fruit, but the world’s. You can read more about this on page 32, along with an update on the new “Smash An Avo” campaign on pages 28-31.

OrchardInfo Tree Census closes 8 September

Tree counting time again! The 2018 *OrchardInfo* Tree Census is now open, and Avocados Australia is looking forward to another excellent response this year.

Our team will be standing by to answer any questions you may have about the tree census and the productivity survey, the details of which were emailed to each grower in early August.

All forms completed before midnight on Sunday, 8 September 2018 will go into the draw to win one of ten \$100 Visa gift cards*.

OrchardInfo contributes vital and valuable knowledge to our industry. It helps us prioritise everything from what research to advocate for on behalf of industry, to the domestic marketing effort, and developing export markets based on future predicted production.

Avocados Australia maintains this data on behalf of all avocado growers. The individual’s data remains entirely confidential; for reporting, data is aggregated to regional and national levels and only provided to those who contribute their data.

The *OrchardInfo* Tree Census report for 2018 will be sent to contributors later in the year.

* *Avocado orchard businesses submitting their completed tree census form and productivity survey by midnight on Sunday 8 September will be entered into the draw to win one of ten prizes of \$100 (pre-loaded Visa gift card). The winners of the prizes will be notified by phone, and announced in the next edition of Talking Avocados.*

Have you visited the BPR lately?

A host of new material has been added to the Best Practice Resource on the Avocados Australia website since the last edition of *Talking Avocados*.

The Export section has been updated with a range of new content, including information on making sure exporting is right for you and selecting a new export market.

In the BPR Library, you will find all of the AHR resources mentioned on Page 42 in the Education Materials section, and the various presentations from the 2018 regional meetings in the Event Proceedings section.

The BPR is an online one-stop-shop focusing on best practice to improve the quality of avocados provided to consumers. Visit www.avocado.org.au/best-practice-resource/ to log in, or, if you have forgotten your details, please contact Amanda at admin2@avocado.org.au.

John Tyas

John Tyas, CEO, Avocados Australia Limited

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

Around Australia

South Queensland Report

By Daryl Boardman,
Avocados Australia Director



Harvest is still happening in South Queensland and should continue through to October. I have to say, quality has been mixed with more fruitspotting bug damage than we've seen in recent years. We're not sure of the cause for that, as it could be a number of factors.

Yields have been average, but on the flipside, size has been very good (25s and larger); it's all been in that good supermarket size fruit.

The current dry weather may be a concern for next season. South Queensland trees are coming into flower so if people can't keep water up to offset the dry, it may impact on fruitset for the coming season. The trees will flower prolifically because they are stressed but they may not set fruit.

For those who are looking for a family day out, I see the Blackbutt Avocado Festival is on Saturday, 8 September. I'm not sure I can encourage people to be throwing their avocados around at home but the games at the festival could be a good chance.

More seriously, the Avocados Australia Annual General Meeting is being held in Brisbane on 2 November. A notice with full details will be sent to members in due course. Anyone who can attend in person will be welcome; this is a good chance to catch up with your Board members and hear about the activities of Avocados Australia on behalf of our growing industry.

Another important upcoming event is Asia Fruit Logistica, in Hong Kong. Avocados Australia will have a stand as part of Hort Innovation's Taste Australia pavilion. I will be attending the event under The Avolution banner. Attending this trade show is a good opportunity to see what's new and there's more and more benefit from attending. Australian avocado exports are growing; it's good to see exports from Queensland are continuing to increase, giving us a diversified market which we're going to need as we have expanding orchards and increased supply.

The key, however, will be quality. I encourage all growers to listen to any industry advice on quality parameters and Maximum Residue Limits (MRLs), especially for newer or emerging markets.

Sunshine Coast Report

By Robert Price, Avocados Australia Director



The Sunshine Coast has started picking and I understand that the Infocado report shows our region was supply up to 13% of the nation's avocados in the week of 20 July.

In the last edition of *Talking Avocados* I noted that the word coming in from north of the Sunshine Coast regarding fruit

quality was positive and I'm happy to say that's proven correct. It's important for the entire industry that we provide high-quality fruit for our consumers.

This region has a long history with the avocado, and on 11 May I was fortunate enough to celebrate a part of that history with Natures Fruit Company. Natures' story traces back to 1987 when 15 avocado growers from the Sunshine Coast hinterland rallied together work on marketing their fruit. The Sunshine Coast Fruit Marketing Co-operative Association Limited was registered in December of that year, and the first meeting of the co-operative was held in January of 1988, and packing started in March of that year.

This event reinforced for me the avocado industry's long history of progressive, innovative members, something we need to maintain into the future.

Central Queensland Report

By Eric Carney, Avocados Australia Director



As at mid-July, a majority of growers from Central Queensland have finished or are about to complete their harvest for the season. Virtually all growers saw an increase in size this season, with enough 14s and 16s and 18s around to be a challenge to sell. As always, weather plays a deciding part and



The Groves family from Groves Grown Tropical Fruit, Bungundarra, Central Queensland fielded a swathe of local, national and international calls as their first Avozilla harvest took place this winter. The Avozillas can be up to five times the size of a regular avocado and proved very popular with those who purchased during the short season.

Image: www.facebook.com/grovesgrowntropicalfruit/



Alvin joined the crew of Blue Lagoon Avocados in Bundaberg for this year's Bundy Winterfeast farmers markets. After helping out picking and packing the avocados, touring the town (and getting a haircut), Alvin as a complete social butterfly at the markets, touring the stands and checking out everything from macadamias to flowers to wine. You can see all of Alvin's CQ adventures via www.facebook.com/bluelagoonavocados/.

we can thank the rain during fruit fill last spring/summer for larger profile size.

Speaking of weather, by mid-July winter is definitely here with some days the minimum temps are below double digits. Many trees took the cooler weather back in June preceded by warmer weather as a mild winter and we see more than the usual amount of Hass and Shepard trees already setting fruit with the main flower still yet to come.

The region had a great turn out to the Regional Meeting held at Don's Fort packhouse where quality, specifically postharvest quality was discussed. Growers were updated on the latest findings with regards to cool chain management from farm to retail store as well as updated findings in regards to handling

fruit when picking. Also discussed was potential upcoming imports from South America and we had a chat with the local Workplace Health & Safety Queensland. Always great to talk to fellow growers, learn more and update the note book.

North Queensland Report

By Jim Kochi, Avocados Australia Director



Now that the North Queensland harvest season is over, it is a good time to reflect on the season past and to discuss what happened. In the first instance it's all about tray numbers to market. 2018 is the first time NQ has out-produced our nearest rival region, Central Queensland, with a record crop of about 4,185,000 tray equivalents (trays) compared to CQ's 2,074,000 trays, over the January-June period. For NQ this means that we produced not only a record crop, but it was also 31% more than the same period last year.

Now, since actions have consequences, one of the consequences was a lowering of price in the market but was that due to the volume in total or was it due to the volume at particular times that may have overwhelmed the market? The forecast for the NQ crop was 3,873,000 trays, meaning that we under forecasted and surprised the market. Or, possibly the market price drop could be due to the exceptionally high supply in March (1.17 million), April (900,000) and May (929,000), again under forecasted.



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Around Australia continued

These numbers are sourced from our industry's Infocado system and they are there to be used to keep the market informed and for us to discuss to help us understand how the market responds to the supply/demand principles.

The market can and will perform better if we all contribute more accurate forecast data so that the market can prepare and handle the volume. It is up to all of us to provide better numbers to the Infocado system so it can work better for us.

The fine mild winter we have experienced this flowering period hopefully will lead to a good fruit set for both Shepard and Hass. Some blocks seem to have flowered earlier than recent past years and possibly some split flowerings, so we have some challenges ahead of us for the 2019 season.

Tristate Report

By Kym Thiel, Avocados Australia Director

Cold and frosty conditions have existed over much of the Tristate during winter. It is a quiet time for avocado growers in this region with everybody preparing themselves for a less than average to average crop, which will be disappointing given where the market may end up.

We have, however, had a run of very good crops in recent years and to help make up for it fruit size and quality appears to be up if looking at the trees is any indication. As a result of the lower crops and significant volumes of fruit still in the marketplace from other regions, it looks like being a much later start for many growers with mid-September being the rough timing at this stage.

Dry conditions have existed over much of the Murray-Darling Basin – and the country as a whole – and therefore lease water prices are well above average for this time of year. Growing avocados in our region is not viable without healthy water allocations and those that try to be “tight” with water simply do not produce viable crops. Crop load and fruit quality both suffer.

Tree health is very good and most growers are expecting the flowering to be heavy and the trees to throw a heavy crop for 2019. Let's hope spring setting conditions are favourable and the winter dry breaks soon both locally and over the rest of the country.

Also, the South Australian Avocado Growers Association (SAAGA) annual general meeting was recently held in conjunction with the Avocados Australia Regional Meeting in Renmark. As the re-elected SAAGA president, I would like to remind members of SAAGA to pay their \$25 annual membership fee as soon as possible to the SAAGA account BSB 105 048 account number 039 958 840. Please use the reference *YourSurnameSAAGA*, for ease of identification.



Western Australia Report

By Dudley Mitchell, Avocados Australia Director

It would seem that Jim Kochi's lamentations in the last edition of *Talking Avocados* have proved to be accurate – poor quality and undisciplined marketing have caused prices to plummet. That these behaviours occur over the lowest demand period of the year is unbelievable and the consequences should serve as stark reminders to those areas whose crops are still to come. Quality is paramount while disciplined marketing ensures pricing stability – both are absolutely within our control as growers. If there is one thing that sets the avocado industry apart from other industries both globally and domestically it is that the whole value chain collaborates. If we lose this willingness to work together, our industry is doomed to fail.

For Western Australian growers, I would urge you to keep up-to-date with the latest post-harvest quality guidelines that can be found in the BPR on the Avocados Australia website. These were developed with your levies and provide a comprehensive guide to how to handle your produce from the field through the supply chain.

Remember what Milton Hershey of chocolate fame said: “Give them quality. That's the best kind of advertising!”

From a marketing point of view, the chains move the volume and the price is set on the open market. Aim to send the bulk of your volume through the chains, preferably using established routes so that we do not see the kind of senseless under-cutting that is happening now, and keep the terminal markets buoyant. Talk to your marketer, every day if necessary. Ask about volumes, when to start or stop picking and whether there are any quality problems. Timely feedback is essential for continual improvement. We have a wonderful product, let's not butcher it on the altar of mediocrity and complacency.

Good luck for the coming season!



Tamborine and Northern Rivers Report

By Tom Silver, Avocados Australia Director

It has been a later than normal start for the Northern New South Wales and Tamborine avocado harvest season, as growers wait for market conditions to improve. This is despite fruit maturities actually being more advanced this year than the average and many orchards already budding up heavily for next year's crop, meaning fruit should be coming off.

I expect a lot of growers have been disheartened by the weak domestic avocado market during the last few months.

Significant increases in production in the immediate future are going to mean that fruit quality is going to become even more



important than it already is. Quality, robust fruit is the only way to ensure that the consumer will continue to purchase repeatedly.

The need for strategic marketing and supply of product will also need to be improved. The market price will generally drop very quickly but take some time to build back up, therefore the need for a well-managed supply is paramount, the days of sending and hoping are over. Avocados Australia's Infocado program is our industry's tool to manage supply issues. The Infocado program, whilst still running, is undergoing a significant upgrade which will allow data to be entered more easily and accurately.

Weather conditions in our region started to dry out in mid-July after a prolonged period of overcast and wet days, thankfully with the absence of any major rain events as occurred in 2017. Temperatures have been above average and as I mentioned earlier, many orchards are budding up for a big flowering.

Central New South Wales Report

By Ian Tolson, Avocados Australia Director



The Central NSW regional meeting held at Stuarts Point was very well attended with 70 growers being advised of the results of the Applied Horticultural Research project, a general industry overview by John Tyas, then followed a presentation from Safe Work NSW on safe harvesting.

All presentations were very much appreciated by growers. It is always pleasing to see such a wonderful attendance at these information sessions. Thank you to John and staff for their efforts in co-ordinating speakers and presentations, a special thanks to the CWA ladies for the wonderful morning tea and lunch.

Harvesting in the local area has begun, at present (early July) five growers are in the thick of it, while the rest of the region will start getting on board over the next few weeks; busy times ahead.

Prices are below those for the same period last season. The increased plantings and projected increase in fruit volume over the coming years may see prices remain or even lower than these, however, good quality, premium grade fruit will return the best money, therefore it is in the growers' best interests to strive for the best possible quality fruit to be presented to consumers for consumption. Repeat purchase is the best way to grow consumption; there is no point in advertising the product, its benefits and uses if the consumer's only option on retailer's shelves is of an extremely poor standard.

Weather conditions are very unpredictable at the moment, temperatures are 25 degrees one day 16 degrees the next. Much needed rain fell at the beginning of July, halting harvest plans, but since then it has been sunny and very windy which has dried everything out and some growers are irrigating again.

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Japan opens for Australian avocados

Joy Tang, Avocados Australia

From May 2018, a new protocol for Hass avocado to Japan is in place to allow producers in regions free of Queensland fruit fly to access the Japanese market without a requirement to treat produce.

The summaries of changes and key points for the new protocol, as per the relevant Industry Advice Notice from the Australian Government Department of Agriculture and Water Resources (DAWR), are:

- Avocados must only be sourced from officially recognised areas free from Queensland fruit fly: Western Australia, Riverland (South Australia) and Tasmania
- Only fresh avocado (*Persea americana*) fruit of the Hass cultivar are permitted to be exported to Japan
- Only fresh avocado fruit meeting the “hard mature condition” can be packed for export to Japan
- Growers and packhouses intending to export avocado to Japan must be accredited by the Department of Agriculture and Water Resources prior to export.
- The MICoR case and protocol is available via <https://micor.agriculture.gov.au/Plants/Pages/default.aspx>.

The application for accreditation of orchards and packhouse for the export of avocado has recently closed and Avocados Australia will be progressing the applications with DAWR, with hopes the first trade can be facilitated to Japan in 2018.

Avocados Australia has been working with DAWR and industry members to achieve this important milestone which will set a successful precedent for gaining access to other potential markets.



Photograph by Alva Pratt on Unsplash

Japan at a glance

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, avocado imports have had an exponential increase, going from about AU\$156 million in 2012 to AU\$268 million in 2017, a 171% increase.

Total import volume was 60,635 tonnes in 2017, and Mexico accounts for more than 90% of the total, followed by Peru, US, New Zealand and Chile. Hass variety avocados account for 99% of Japan’s imports.

The market research conducted by Austrade Japan in 2017 identified that Japan’s spring and summer are the periods of peak demand, driven by the increased sale of salads. After a relative lull in autumn, demand for avocados picks-up again in December during the Christmas/New Year season. Japan produces a very small volume of Bacon and Hass avocados, with the harvest starting from November.

In Japan, avocados are colloquially referred to as ‘the butter of the forest’, because of their smooth buttery texture. While avocado is not part of the traditional diet, it has become part of the sushi repertoire thanks to the influence of the



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Japanese community in California and the evolution of the so-called 'Californian roll', which is a ura-maki style sushi roll with avocado, cucumber and crab (often tuna or salmon is substituted).

With the growth trend of consuming healthy and exotic products, now avocado is eaten as a Japanese breakfast dish, as a co-equal partner with natto (also known as Japan's Vegemite!) on top on a bowl of rice. Avocado slices are served as an accompaniment to yakitori (charcoal-grilled chicken-on-a-stick), and at home, avocado is a common ingredient in all kinds of salads. Japanese consumers have discovered that avocado goes particularly well with soya sauce and wasabi, but as a still relative "new" product available in the market, there are a sizable number of customers not very familiar with or confident in buying and using avocados.

Competition for Australia

Austrade market research highlights that Australian avocado exporters will face strong competition from Mexico and New Zealand when they enter the Japanese market. Year round, price is the key factor driving sales of imported avocados into Japan, but fruit quality and consistency, and reliability of supply are also crucial factors.

Australian exporters should focus on supplying:

- premium grade fruit of higher quality and dry matter content,
- consistency of supply and quality, and
- superior taste, instead of attempting to compete on price.

More information

You can contact Joy Tang on email via export@avocado.org.au or 07 3846 6566.

The Fresh Avocado Market report for Japan published by Austrade Japan is now available in BPR library in Avocado Australia website www.avocado.org.au/best-practice-resource/.

Acknowledgement

The Avocado Export Readiness and Market Access Project (AV17000) has been funded by Hort Innovation, using the avocado research and development levy and contributions from the Australian Government.



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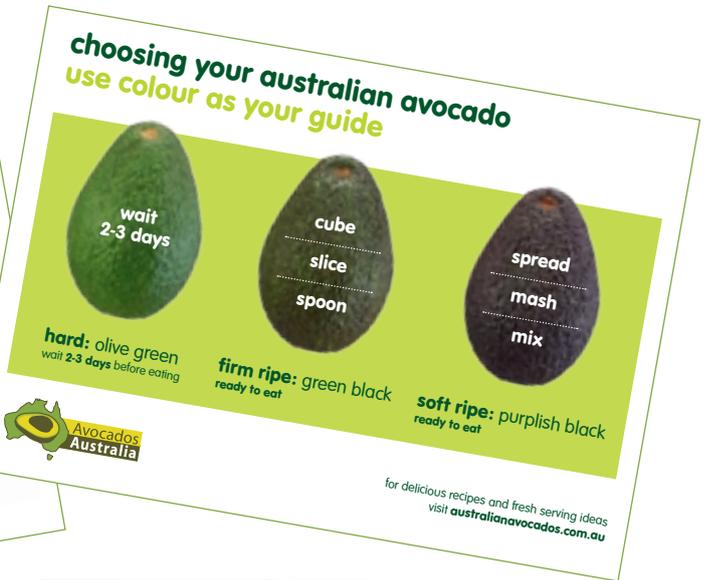
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Ripe and ready to eat – Malaysia, Hong Kong and Singapore

Jenny Margetts



The last three months of the 'Ripe & Ready' program, has seen a flurry of activity as this phase of export development comes to a close.

The 'Ripe & Ready' program has been managed by Avocados Australia and funded through the Australian Government Department of Agriculture and Water Resource's Package Assisting Small Exporters program (PASE), Sunfresh, The Avolution and the Avocado Export Company.

Avocados Australia has spread the export message to all growers that attended the May-June regional meetings, promoting quality as the key requirement to ensure our premium position in export markets.

In addition to this, new material has been developed to support 'Ripe & Ready' campaigns in export markets.

"Our consumer education and other materials have been updated to reflect the domestic market campaign," Avocados Australia CEO John Tyas said.



The Avolution's Antony Allen was part of the PASE project, promoting Australian Avocados in Hong Kong, Malaysia and Singapore

"The new design provides a fresher and more modern image of our avocados in export markets. The content of the material has been developed in conjunction

with our exporters and their supply chain partners and tailored for the different countries in which we have undertaken export development activities.

"In the last quarter we have also provided additional training in Singapore, as well as conducting training with staff of Aeon in Malaysia and Park 'n Shop and Wellcome in Hong Kong."

simple healthy recipes australian avocados

Pumpkin & avocado salad
cooking time 20 mins | serves 4

ingredients

- 1 large or 2 small avocados, seeded, peeled, sliced
- 500g pumpkin, seeded, peeled, cut into 2cm cubes
- Salt & pepper to taste
- 2 tablespoons olive or other salad oil
- 2-3 cups (500g) baby spinach or stem lettuce leaves
- 1 tablespoon lime juice or balsamic vinegar

method

- Preheat oven to 200°C. Place the pumpkin in an oven fry lined with baking paper and drizzle with half the oil.
- Season with salt and pepper. Bake in oven, turning occasionally, for 20 minutes or until golden brown and tender. Remove from oven. Place spinach and avocado in a large bowl. Add the pumpkin and drizzle with lime juice and remaining oil. Gently toss to combine. Serve immediately.

Guacamole
preparation time 5 mins | serves 6-8

ingredients

- 2 ripe avocados, halved, seeded, peeled
- 1 tablespoon lime juice
- 1 tablespoon fish sauce
- 2 tablespoons fresh coriander, finely chopped
- 2 tablespoons fresh mint, finely chopped

method

- Place the avocados, lime juice and fish sauce in a medium bowl.
- Use a fork to mash until smooth.
- Add the chopped coriander and mint and stir to combine.
- Taste and season with salt and pepper.
- Spoon into a serving bowl & garnish with extra coriander and mint leaves.
- Serve immediately with rice crackers or tortillas.

Your guide to australian avocados ripe & ready to use

australian avocados

how to choose ripe australian avocados

Hard avocados change colour as they ripen so colour is a good visual indication of ripeness without touching the fruit.

To test by touch, gently press the stem end of your avocado. If it's quite firm, it will be ready in a couple of days. If it's softening or soft, it's ready to eat.

healthy reasons to eat avocados

- Nutrient dense**
Avocados contain a range of vital nutrients needed for a healthy body.
- Rich in vitamins C & E**
Avocados contain antioxidant vitamins C & E.
- Contain good fats**
Rich in healthy monounsaturated fats.
- Full of fibre**
Avocados assist with maintaining a healthy digestive system.

hard: olive green
wait 2-3 days before eating

firm ripe: green black
ready to eat – perfect to
cube | slice | spoon

Not ready yet – keep fruit at room temperature to allow it to ripen. Once ripe, fruit can be stored in the refrigerator for up to 2 days.

add cubes to salad

slice & enjoy on toast

eat with a spoon

spread on a wrap

mash into guacamole

mix into a smoothie

for delicious recipes and fresh serving ideas visit australianavocados.com.au

Australian avocados impress in Malaysia and Singapore



Euro-Atlantic General Manager Adrian Ung (right) introduces nutritionist Alexandra Prabaharan, Western Australian avocado exporter Jennie Franceschi and Avocados Australia CEO John Tyas at a recent event in Malaysia. The team was in-country to present the benefits of ripe and ready avocado marketing at the retail level.

A fresh, modern image of Australian avocados is being promoted by key supply chain members in Malaysia and Singapore.

Avocados Australia Chief Executive Officer John Tyas said promoting high-quality Ripe & Ready avocados in key Asian markets was an important part of the country's longer term export goals.

Avocados Australia recently held an event in Malaysia, the culmination of a multi-year project to introduce ripe Australian avocados to retail shelves.

Mr Tyas said at the final event in Malaysia, hosted by Euro-Atlantic and featuring nutritionist and media personality Alexandra Prabaharan, reiterated the main messages of the project regarding the boost in sales from retailing ripe avocados, and the nutritional benefits of avocados.

The 'Ripe & Ready' program has been managed by Avocados Australia and funded through the Australian Government Department of Agriculture and Water Resource's Package Assisting Small Exporters program (PASE), Sunfresh, The Avolution and the Avocado Export Company.

"One of the challenges that we have had from the start of the program was the reluctance of retailers to offer a 'ripe' product for consumers," Mr Tyas said.



Avocados Australia CEO John Tyas in Malaysia discussing the retail training materials now available to the in-country supply chain via the PASE project.



The Euro-Atlantic team from Malaysia with Western Australian avocado exporter Jennie Franceschi and nutritionist Alexandra Prabaharan (centre front) at a recent event in Malaysia.

"This reluctance is typically driven by the additional cost and risk in providing this offering. However, we have been able to convince some key retailers that there is a benefit of additional sales, warranting the investment in managing a 'ripe' offering and we are now starting to see the benefits of the work undertaken to date.

"To support the development of the 'Ripe & Ready' program, Avocados Australia, with the Department of Agriculture & Fisheries Queensland and the exporters involved in the program, has been providing support and training to importers and retailers in key markets, as well as tailored information brochures for consumers."

Mr Tyas said this work was a key part of the industry's development, as domestic production continued to grow.

"However, competition from other countries is only increasing in our export markets and the requirement for servicing the market with the highest quality product is now greater than ever.

"This is why the entire Australian avocado supply chain is working to make sure we get export right, including a focus on high-quality fruit. It is so important for the prosperity of our industry as we move into a higher supply environment," Mr Tyas said.



Nutritionist and media personality Alexandra Prabaharan, reiterated the nutritional benefits of avocados at a recent PASE event in Malaysia.

International avocado brainstorming

Simon Newett, Department of Agriculture and Fisheries, Nambour, Queensland

The Avocado Brainstorming Conference was held during the last week of May in Tzaneen, Limpopo Province, South Africa.

Tzaneen is the epicentre of avocado growing in South Africa and home to well-known avocado companies including Westfalia Fruit (which incorporates Westfalia Technological Services), ZZ2 and Allesbeste Nursery. The conference generally takes place every four years, just before or after the World Avocado Congress but this time it was held a year earlier.

It was organised principally by Dr Mary Lu Arpaia from the University of California with support from the California Avocado Commission and local help from Zelda van Rooyen and other staff from Westfalia. Sponsorship was afforded from various sources including several Australian avocado companies (see below).

There were 78 attendees from 11 different countries including nine individuals from Australia. The theme was 'Towards a Sustainable Future' and there were two and a half days of conference and two days of field trips.

Topics during the conference were:

- Providing for the consumer: Health, safety, flavour
- New technology to improve avocado production
- Challenges to productivity: Diseases
- Challenges to productivity: How the tree regulates return bloom and crop load
- Where theory meets practice
- Challenges to productivity: Genetics, genomics and biotechnology
- Meeting the challenges of the future

The conference also attracted about 26 posters.

Allesbeste Nursery

Andre and Zander Ernst and their nursery manager Abram de Villiers hosted a tour of this progressive nursery that produces about 200,000 clonal avocado trees per year. Impressive was their attention to detail, openness with information and commitment to continual learning and development. Like Australia, South Africa has an accreditation scheme for its avocado nurseries and Allesbeste has always achieved the top (five star) rating.

Recent developments include the adoption of 'coco peat' as the sole ingredient (apart from some slow release fertiliser) of their potting mix. Coco peat is made from different grades of coir fibres (from coconut husks) and is imported in a fumigated state from Sri Lanka. Allesbeste regularly monitors the electrical conductivity of the potting mix in the bags and has found that the ideal range for growth is between 1.3 to 1.8 mS/cm.



Allesbeste is experimenting with growing Maluma® on vertical (shown here) and Tatura trellises.

The information and traceability of each tree is considered very important (for example so that elite trees and rootstocks can be identified down the track) and this is currently done with a manual system of plastic labels however Allesbeste is developing an electronic system which will entail permanently inserting a radio frequency identification (RFID) tag into each tree. This system will allow trees to be tracked through the nursery production process and into the field, it will also allow orchard maps to be electronically generated and for detailed information to be available on each tree.

Allesbeste produces 'micro clones' in small pots usually called 'forestry tubes' with a volume of about 300 mL. These trees are usually re-potted into seven litre bags to allow them to grow out and become more robust before planting out in the field. The advantage of the small pots is that large numbers can be transported very cheaply to other parts of South Africa and the world. Allesbeste has established 'satellite' nurseries in distant regions of South Africa where these micro-trees are sent to and upon arrival are then potted up into the larger bags and grown out.

The most common rootstocks being used in this nursery are Dusa, Bounty and Duke 7. It was surprising that Duke 7 was still being used but apparently, they do well in the colder production regions. Allesbeste is continually looking for superior rootstocks and has a two-year-old trial in the ground with 28 different lines. The average time to produce a clonal tree at Allesbeste is 17 months and they are sold for the equivalent of USD10 each.

Allesbeste trellising trials with Maluma® variety

The Maluma variety, selected in a warmer region north of Tzaneen, has a very upright, single leader growth habit. Allesbeste believes that this habit lends it to trellising so they are experimenting with both Tatura and vertical trellising at densities ranging from 1,250 to 2,500 trees per hectare. The underlying theory is that training branches horizontally along the wires will expose them to more light and result in more flower buds and therefore potentially more fruit.

Westfalia Estate rootstock breeding and selection

Westfalia now has the largest avocado 'footprint' in the world with operations in Chile, Peru, Colombia, Mexico, California and Portugal. They recently formed a partnership with Agricom in Chile. Westfalia also has large timber interests and grows and processes mangoes.

Westfalia has its own research team (Westfalia Technological Services) and amongst their projects is a programme to develop better rootstocks. One of their successes is the Dusa® clonal rootstock now used successfully in many different parts of the world. Much of the rootstock selection process revolves around screening for tolerance to Phytophthora root rot. The process of identifying, testing and releasing a new rootstock can take from 20 to 23 years.

Netting, rootstock and variety trials near Soekmekaar

Soekmekaar is a cooler area at 1,200m above sea level about an hour's drive north of Tzaneen where the Agrivet orchard provides Westfalia with sites for research. There, they have a trial testing six different fruiting varieties on five different rootstocks and another where Hass and Gem® are being tested on 11 different rootstocks. There is also a trial looking at the effectiveness of netting to reduce damage from wind rub and hail which both affect this growing area. In this 1.2 ha trial Gem® is being grown under 20% shade netting. The net has been up for two years and thus far has been effective although they have found that the trees grow taller.

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International avocado brainstorming continued



Netting trial at Soekemekaar for wind and hail showing hail release mechanism.

Netting trial near Tzaneen

There is another netting trial close to Tzaneen with 10ha of orchard being protected. There, Nick and Nelius Human are testing the performance of Hass, Maluma® and Carmen® under both 20% and 40% shade netting. Due to the large area under the net they are looking at ways to attract and keep honey bees within the structure. This includes planting basil at the row ends. Basil flowers for much of the year and provides a lot of nectar. As was found at Soekmekaar the avocados tend to grow taller under netting and a plant growth regulant is applied to reduce their growth.

ZZ2 farms at Mooketsi

ZZ2 currently has 1,000ha of avocados but has entered a rapid expansion phase to reach 2,300ha of avocado orchards. To achieve this, they are expanding their nursery to produce 250,000 trees per year and are planting between 200 and 300ha of orchard each year. ZZ2 has a 'nature farming' philosophy. This means that they try as far as possible to farm in harmony with natural processes but still use modern methods. For example, they produce 50,000 m³ of compost per year at Mooketsi for their tomato and avocado enterprises. They also make compost tea and apply it regularly through the fertigation system. ZZ2 find that both supplements improve soil health and



Two-year-old Gem® variety growing on cloned Dusa® at 6 x 3m spacing at Soekmekaar, note upright growth habit and pronounced planting mounds. (Photo courtesy of Neil Delroy.)

consequently the general health of their crops.

The ZZ2 canopy management system involves mechanical pruning in rotation so that both sides of the hedgerow and the top of the tree are mechanically pruned over a period of about five years (a maximum of one side or top per year). In addition, one major limb is removed per tree per year to create a 'window' to allow light into the canopy and water shoots are cut in half. Some hand spraying with PGRs is conducted on new flush.

Summary

The South African avocado industry is predominantly aimed at export and continues to expand through good leadership, innovation and research. The excellent tree health at all the orchards we visited was very noticeable, attributable at least in part to strict adherence to phosphorous acid application protocols, well drained soils, universal use of planting mounds and the widespread use of proven clonal rootstocks such as Dusa® and Bounty.

The small 'Avocado Brainstorming 2018' conference was an ideal opportunity to network, catch up on innovative research and find out about the latest nursery and orchard management practices.

A more detailed report will soon be available on the Avocados Australia Ltd Best Practice Resource.

Acknowledgments

The conference was sponsored by 21 different organisations including Australian companies Costa Avocado, Delroy Orchards, Jasper Farms, Simpson Farms, Southern Forest Avocados and West Pemberton Avocados. The Queensland Government supported Mr Newett's attendance through the Department of Agriculture and Fisheries.



The canopy management approach of ZZ2 gives trees a 'short back and sides' appearance, note the 'windows' into the canopy for light penetration. (Photo courtesy of Neil Delroy.)

Reduction of the acceptable soil chloride level for avocado in Australia

Bridie Carr and Simon Newett, Department of Agriculture and Fisheries, Nambour, Queensland

Until recently, it was recommended that a soil chloride level of less than 200mg/kg was “unlikely to affect avocado growth under average conditions”.

This level was arrived at a number of years ago by fertiliser company agronomists in conjunction with the Queensland and New South Wales Departments of Primary Industry. As with anything in science, recommendations are subject to change with the development of new technology, research and experience.

Recommended nutrient levels are based on what the crop needs (and can tolerate) so that growth and development is optimised. To manage these levels, it is essential that growers conduct regular soil, leaf and irrigation water tests, accompanied by observation for any toxicity or deficiency symptoms.

Avocado is particularly susceptible to chloride and toxicity is generally observed when leaf chloride levels reach 0.25%. Leaf symptoms appear initially as a tip burn which can then spread along the leaf edges (*refer to the photograph*) and eventually affect most of the leaf, in severe cases leading to leaf drop.

Observations have recently been reported in Australia where toxicity symptoms have been seen in avocado leaves when soil chloride levels have been less than 200mg/kg. This has prompted a review of the acceptable soil chloride level including consultation with avocado agronomists in New South Wales, Tristate, California and Chile where chloride is often a problem.



Chloride and salt burn symptoms commence with tip burn and can then extend along leaf edges.

The review recommended a reduction in the acceptable soil chloride guideline from 200 to 100mg/kg but the level shouldn't be taken in isolation. Chloride toxicity and the level at which it is induced also depends on a variety of other factors such as the quality of the irrigation water, the rootstock, soil type and types of fertilisers used.

All of these will contribute to the chloride level in the tree and should be monitored with management practices put in place to suit the situation. For example, chloride could be at an acceptable level in the soil but in conjunction with high chloride in the irrigation water could result in leaf burn.

- Irrigation water – chloride levels need to be monitored to ensure that they are below the recommended threshold. To put this in perspective if the chloride level in the water is at the threshold (80mg/kg) and you irrigate 12ML/ha/year then you are actually applying a massive 960kg of chloride per hectare per year! Longer irrigations will therefore be needed from time to time to flush accumulated chloride from the root zone. For example, the protocol of one agronomist in Chile is to apply an irrigation every month that is three times longer than normal.
- Rootstocks differ in their salt (chloride and sodium) tolerance. Avocados on Mexican rootstocks are more susceptible than those on West Indian rootstocks. Most of the avocado industry in Israel is based on West Indian rootstocks because their water quality is poor.
- Soil type – avocados growing in a soil with high cation exchange capacity (CEC) and high water holding capacity (WHC) will have greater exposure to chlorides that are present.
- Fertilisers such as muriate of potash contain high levels of chloride and should be avoided. Some other products such as natural gypsum, manures (eg cattle feedlot) and composts can also be high in chlorides so it is important to test them to see if they are safe to use.

General guidelines for avocado in Australia

Soil chloride	Leaf chloride	Irrigation water chloride
<100mg/kg (new level)	<0.25%	<80mg/L

Acknowledgement

The authors would like to thank Graeme Thomas for prompting this review.

Infocado and OrchardInfo: a case study in industry collaboration

Sue Plunkett-Cole, Avocados Australia

Avocado Australia's data team members, Sue Plunkett-Cole and Amanda Madden, recently attended the Hort Connections session "How can I make better decision using data?" and were pleased to realise how strongly positioned the avocado industry is with our collaborative data collection and reporting.

Not only do we have more than a decade of industry data and reports, but also, our growers, packers and traders maintain strong participation in the data programs. Maintaining excellent participation takes considerable time and effort, but the return is well worth it with quality data available for data-driven decision making.

It was clear from the session that many similar industries struggle to achieve the participation required to run a data program. We feel fortunate that our participants have experienced firsthand the benefits of our data program for many years, which creates a "virtuous cycle" of participation.

It is certainly a boon that the avocado industry sees the advantages of this collaborative effort. Nevertheless, there can be no resting on laurels, and as many of you are aware, our team works tirelessly and with boundless enthusiasm to ensure that everyone can participate to their best advantage.

The data program began under the stewardship of then CEO, Antony Allen, who launched *Infocado* and *OrchardInfo* in 2005. His work in getting industry members to work together was instrumental, as the success of this program is built on the collaboration of our participants, and their willingness to regularly contribute their data. From the outset, the assurance of data confidentiality and de-identification was also vital to building the collaborative environment, and is still the cornerstone of all reporting from the systems today.

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.

Over the years, the data program has undergone continuous improvement, and is supported by Hort Innovation via levy funding (as below). Current CEO, John Tyas, has implemented several improvements, including the employment of a full-time Data Analyst, and a refresh of the data capture and reporting process.

These strategies have already seen success with the increased participation in the simplified *OrchardInfo* activities last year, and the development of comprehensive annual statistics reporting, published on the website. Later this year, the streamlined data capture process will be released, and the data team look forward to onboarding all participants in the coming months.

More information

To find avocado industry statistics and reports, visit www.avocado.org.au/news-publications/statistics/ and www.avocado.org.au/our-programs/supply-chain-data/.

For more information on the avocado industry data program, please contact Sue Plunkett-Cole 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 Horticulture Innovation Australia Limited using the avocado industry research and development levy and funds from the Australian Government.

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Avocados Australia's Sue Plunkett-Cole and John Tyas at the Brisbane Markets.

Australian domestic production rises 16.7%

Sue Plunkett-Cole, Avocados Australia

Another successful financial year for the Australian avocado industry has come to a close, with final dispatch volume for 2017-2018 at 14 million trays and 2018-2019 forecast estimates currently sitting at very similar levels.

Avocados Australia CEO John Tyas said the avocado supply from April to June 2018 was 4.5 million trays.

"Australian fruit volumes were 25% higher than in the same quarter last year," Mr Tyas said.

"For the full financial year 2017-18, Australian avocado supply increased by 16.7% on last year to slightly more than 14 million trays," he said.

"However, overall market supply decreased by 1% to 15.8 million trays, due to the New Zealand supply almost halving on the previous year."

Mr Tyas said this increase in production was to be expected, as new plantings continued to come online across the country.

He said this would have clear implications for growers with a need to focus on quality to meet consumer expectations.

"Australians now consume 3.5kg of avocado per year, per person but if we want that to continue to grow, we need to be ensuring our customers are always able to pick up a high-quality piece of fruit," Mr Tyas said.

"Ensuring this will involve the entire supply chain - from the farm to the retail shelf. No one part of the industry can deliver consistent, high quality product, it's a team effort and we all have our roles."

Participants in Avocados Australia's *Infocado* program will have seen the details in the July quarterly *Infocado* report. The Avocados Australia *Facts at a Glance*, the high-level annual avocado industry statistics, for 2017-18 will be released on the industry website in September.

The annual tree census opens in August for 2018, growers will be emailed directly with details on how to participate. There was an excellent response last year, and contributors provided very positive feedback on the simplification of the forms

over the last two years, saying it is very quick and easy to contribute. The data from the tree census and the productivity survey are used in the OrchardInfo report which is distributed to contributors only, and is a key report used by AAL in industry planning activities.

More information

To find avocado industry statistics and reports, visit www.avocado.org.au/news-publications/statistics/ and www.avocado.org.au/our-programs/supply-chain-data/.

For more information on the avocado industry data program, please contact Avocados Australia on 07 3846 6566 or infocado@avocado.org.au.

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Regional meetings well received

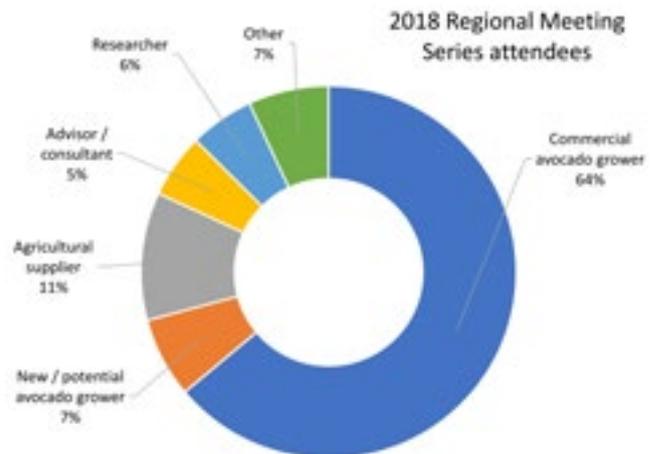
The regional meetings drew more than 400 avocado industry members to events held across the country in May and June.

The possibility of avocado imports, the progression on exports, supply chain improvements and workplace health and safety were all on the agenda.

Attendees received free copies of the Supply Chain Best Practice Guide, Fruit Quality Problem Solver and Checklists and Ripeness guide, developed by AHR. (More about those on page 41)

Avocados Australia CEO John Tyas said the new resources and project updates with regards to bruising were well received, as were presentations on improving retail quality management and supply chain quality improvements.

You can find copies of the presentations from the events, including industry and export updates, in the BPR Library, in the events category: www.avocado.org.au/best-practice-resource/library/.



A bulk of the 400+ attendees at the 2018 regional meeting series were commercial avocado growers, followed by agricultural suppliers, new or potential growers.



Avocados Australia Director Daryl Boardman with Tony Walsh, Malcolm Frick and John Tannock at the Southern Queensland regional meeting in May.



Charlie Colgan and Ilse Kaufmann at the Sunshine Coast regional meeting.



Barrie MacKay, James Howe, Tayla MacKay and Adam Goldwater in Mareeba in May.



Avocados Australia CEO John Tyas with Peter Austin at the Crows Nest, Q, event in May.



Right - Jarmille Poggioli, Primo Produce with the youngest attendee of the 2018 regional meetings: 11-week-old Zahli, at the Mareeba event.



Left - The regional meetings are an all-ages affair, with 15-month-old Tyla Whild, from Whild Avocados, in the West Australian audience.



Brent Chambers, from event host Sunfresh, with Chris Best at the Sunshine Coast regional meeting in May.



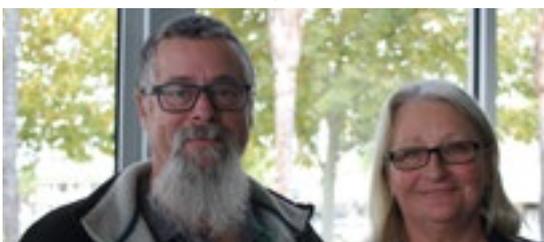
While in Western Australia, the Avocados Australia and AHR teams visited Jasper Farmers (from left): Dr Jenny Ekman (AHR), Adam Goldwater (AHR), Joy Tang (AAL), Jacinta Foley and Neil Delroy (Jasper Farms), Sue Plunkett-Cole (AAL), Jim Stone (Jasper Farms) and John Tyas (AAL).



Vin Farrell, VP & EA Farrell with Bernadette and Tim Backhouse, Backhouse Avos, at the West Australian event.



Avocados Australia Director Kym Thiel with Craig Wooldridge, EE Muir & Co at the Tristate event in May.



Dean and Esther Little at the Tristate meeting in Renmark on 21 May.



Natale Ravello and Charlie Borzi in Mareeba on 31 May.



Graeme Thomas, Colin Stumm and Ross Williams at the Central NSW event.



Peter Jones, Marjie Reynolds and Robyn MacIntosh at the Tristate regional meeting on 21 May.



Grant Wilson with host Lachlan Donovan at the Central Queensland regional meeting in June.



Avocados Australia Director John Walsh with John and Cassie Warren at the CQ regional meeting.



Joy Tang (Avocados Australia) with Allan Butcher at the event near Childers in June.



Among the big crowd in Central NSW were Devinder Khunkhun, Rodney Allan (WorkSafe NSW), Sue Williams, Paramjrt and Kirpal Khunkhun



Corrine Jasper (Hort Innovation) with David Reeve and Stuart Murray at Stuarts Point in June.



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Regional meetings continued



Sue Plunkett-Cole, Avocados Australia with Kirsty Fontanini and David Hargreaves in Bunbury, WA.



Tim Paltridge and Daniel Sutton at the West Australian event.



Peter Ward and Justin Loffler in Renmark for the Tristate regional meeting.



Karen Welch and Keyalah Hennessey at the Stuarts Point Community Hall.



Trevor and Nicole Radloff, from Ellerslie, New South Wales at the Tristate meeting.



Eric From with presenter Melinda Perkins, QDAF at the South Queensland update.



Joss and Neil Donovan with Dorian Pozzan, Sunfresh, at the Coolool event.



Tony Dugdell, Cameron Barritt and Lindsay Francis at the Sunshine Coast regional meeting.



Alan Boardman and Tony Clarke in Crows Nest, Queensland.



Carol Stevenson, Stephen Ashe, Michael Flynn and Bill Kereczko in Crows Nest.



Ian Tolson, Jake Binney and Josh and Douglas McMillan at Stuarts Point.

GreenTech spray system for avocado ADVERTORIAL

Chances are the next avocado or stone fruit you pick up at your local fruit and vegetable store could have been grown in Australia and protected through its growth cycle using a GreenTech spray system.

From Mareeba, North Queensland to Busselton, Western Australia, tree crop growers have turned to GreenTech to help solve their crop protection needs.

Since 1997, privately-owned manufacturing company GreenTech International Pty Ltd, based in South Australia, has established a global business as an authoritative manufacturer of chemical application technology for tree crops, including nurseries.

Queensland-based avocado growers Alvis and Noalene Brazzale said their 100 hectare avocado plantation (with about equal of mango trees), faced some unique challenges managing fruitspotting bugs and scale.

After critically evaluating a number of spray machines on the market, Alvis purchased a tall tree spray system from GreenTech, manufactured in Australia.

"The spray head technology was critical in our decision making process. With our climate and associated pests and diseases, we needed to ensure that the entire tree, including the very





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top of our 6.5 to 7 metre trees, could receive chemical application in the most efficient and cost-effective way," explains Alvis.

"GreenTech's tall tree sprayer with its unique design and electrical fan motors produces high air volume that is effective in applying chemicals to my trees. The power requirement to operate the fans is so low that I was also able to save on diesel fuel expenditure, while not having to worry about any potential hydraulic oil contamination to my crop."

Another happy customer is Neil Delroy, manager of Jaspers Farms near Busselton, Western Australia's largest avocado operation producing more than one million trays per year. Over the years, Jaspers Farms has purchased several GreenTech spray systems for applying fungicides to tall avocado trees.

"The GreenTech spray system is the best on the market as it produces high volume and medium air velocity and supports extended adjustable arms, so we can reach the tops of tall trees," Mr Delroy said.

"On top of the strength of the GreenTech product, it produces the right droplets for obtaining the best spray coverage with excellent cost savings and reliability.

"With such a significant investment in avocados having planted and developed a large farm, we need to protect our trees so we can keep producing the highest quality fruit to meet the high standards required by Australian consumers."

With over 2,000 GreenTech spray systems in operation globally, founder and managing director Benz Baek says demand for proven crop protection solutions has never been higher in all agriculture.

"Our SARDI & CSIRO tested electrical fan technology together with the robust design of our sprayers meet international standards, allowing us to deliver proven crop protection solutions tailor made for the requirements of our diverse client base."

"We must develop, manufacture, and deliver solutions that we know are of the highest quality. This must always be the guiding principle of our business," Benz says.

HARPS training underway

HARPS is rolling out a training course nation-wide to help producers meet HARPS requirements.

The first event was held in Western Australia in August, and at the time of printing three dates had been set in Queensland. Please visit <https://harpsonline.com.au/> or call 1300 852 219 or email harps@harpsonline.com.au for other dates. Avocados Australia is publishing these dates, as available, in the fortnightly *Guacamole*.

The course is particularly aimed at Tier 1 and 2 growers, suppliers, packers and wholesalers to the major grocery retailers, and covers the following:

- HARPS overview and general requirements;
- food safety and quality issues in the produce industry;
- legal requirements for food safety programs;
- four hazards (biological, chemical, physical, allergen) and their sources;
- three elements of a food safety program (facilities and equipment, HACCP and pre-requisite programs);
- food safety risk assessment and HACCP process; and
- HARPS elements in practice.

The course has been designed to reflect the immediate needs for producers to meet the HARPS requirements, using case studies and practical examples where possible. In addition, the course will include Food Safety Risk assessment and the HACCP process, which will qualify as 'HACCP refresher training' as stipulated under HARPS Section 5.2 (this will save needing to attend a separate HACCP Refresher course).

Attendees will be provided with a handbook with the slide presentation and provision for note taking as well as supporting documents for exercises and case studies (all to keep). The course will also provide example templates and pro-forma documents that attendees can use to adapt to their own specific activities (as requested during the Awareness Sessions).

The fee for the course is \$680 per person (plus GST). To ensure each attendee is able to get the most out of the training, the HARPS team would like to cap the number of attendees to 15 per daily session.

More information

Please visit <https://harpsonline.com.au/> or call 1300 852 219 or email harps@harpsonline.com.au.



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Freshcare offers food safety certification option

The Freshcare Supply Chain Standard (SC1) has been approved as a base scheme under HARPS (the Harmonised Australian Retailer Produce Scheme), enabling fresh produce supply chain businesses to now seek certification to the recently released standard.

Following the Freshcare HACCP-based model, the new Supply Chain Standard comprises of prescriptive compliance criteria for businesses operating throughout the fresh produce supply chain, including those dealing with packing and handling, storage and ripening, transport and distribution, and wholesale and brokerage.

The Freshcare Food Safety and Quality Standard (FSQ4) remains the appropriate standard for growers and grower-packers. FSQ4 is also approved as a base scheme under HARPS.

As with the other Freshcare standards, all businesses participating in SC1 must have at least one representative, with day-to-day operational involvement in the implementation and management of food safety and quality, complete approved Freshcare training to ensure a full understanding of the program requirements.

For SC1, the training will be delivered via the Freshcare eLearning platform (www.freshcare.com.au/training/elearning/).



Freshcare General Manager, Industry Development, Clare Hamilton-Bate said the release of the supply chain standard and associated training module was a long-awaited service for industry.

“For a business to be certified to the Freshcare Supply Chain Standard, they must complete this module, to ensure a consistency in understanding and a uniformity of implementation,” Ms Hamilton-Bate said.

“Delivering the module through an e-learning process provides easier access for business to undertake training and maintain compliance both cost-effectively and efficiently.”

The eLearning module was developed with the support of Fresh Markets Australia (FMA).

FMA Executive Officer Gail Woods said industry welcomed the development of the Supply Chain Standard and the eLearning module, and she encouraged businesses involved in fresh produce supply chain operations to consider this new training and certification option.

Ms Woods said FMA members received a 10% discount on eLearning course fees, providing further encouragement to take up the opportunity to implement the new standard and provide increasingly rigorous food safety and quality assurance to Australian fresh produce consumers.

To achieve certification, supply chain businesses must first undertake the Freshcare eLearning and then implement the system within their business operations. Once a business has the system fully implemented, they can schedule an audit with a Freshcare approved certification body, providing independent 3rd party verification of their compliance.

More information

For further information please contact Freshcare on 02 8039 9999 (1300 853 508) or elarning@freshcare.com.au.

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Hort Innovation Marketing update

Welcome to the Talking Avocado Autumn 2018 marketing update. The last quarter has been a pivotal period for Australian Avocados, with the launch of the new “Smash an Avo” campaign in April.

Following an extensive process, new creative and a new logo were developed, under the over-arching theme “Avocados make everything better – Smash an Avo”. We wanted to ensure we used media to our advantage with our new campaign, so we used high impact media formats such as television and Out of Home (OOH) initially, to establish visibility with a broad audience quickly. More details about this, as well as the rest of the avocados activity that has occurred, is below.

A second burst of activity starts this month (August) with in-store and online activity, and another round of television activity is planned for September.

Television

The Australian Avocados television campaign launched on 29 April, and was on screens nationwide for four weeks. The goal for this campaign was for 40% of our target audience (grocery buyers aged 25-54) to see the ad at least two times in this period. We achieved this goal in all metro and regional markets except for Sydney, where we were below the tolerance by 0.7%. During this period, the ad was in seven out of the top 10 most watched programs, including *The Voice* and *MasterChef*. We underpinned these key programming by appearing within consistently rating programs such as news, current affairs shows, *Family Feud* and *The Project*.

If you would like to view the ad, you can find it here - <https://bit.ly/2tzpFFt>



Still from TV Commercial (TVC)

Mumbrella ad of the month award

Each month, the marketing industry publication, **Mumbrella**, nominates a number of television ads that are up for ‘ad of the month’. For the month of May, they put forward the Australian Avocados ad as a nominee, up against Hahn, McDonalds and Ebay, with readers voting in a poll to determine the winner. The Australian Avocados ad resonated most, winning the title of ‘ad of the month’, which is an amazing achievement when considered the calibre (and marketing budgets) of the other nominees! Comments included that it was an “original advertisement which is really entertaining” saying it is nice to “see marketing hitting the mark”. Read the article here - <https://bit.ly/2xFq39V>.

Digital

In addition to the television activity, we also had eight weeks of digital activity that ran from 29 April to 23 June. We had standard video ads, six-second YouTube ads, and 15-second Spotify audio ads. All facets of our digital campaign achieved an above benchmark result during this period. We finished with an overall Completion rate and Viewability of 84% and 79% respectively for the video component. Spotify had an audio completion rate of 91% across 190,000+ impressions and impressively YouTube served 4,547,000+ impressions with a 92% completion rate and 95% Viewability score. This campaign has delivered well beyond its designated benchmarks through careful planning and optimisation of sites, and weighting to current events such as popular catch up television shows such as *My Kitchen Rules*, *Love Island* and *MasterChef*, as well as live events such as NRL which is now being broadcast live and free on the 9Now app.

Definition of some common digital terms are below.

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

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



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

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

OOH Retail

Out of Home (OOH) digital shopping centre screens are the last form of advertising to communicate to the shopper before the purchasing decision is made. This form of advertising reinforces the message in consumers' minds and helps to drive action before consumers enter the grocery store. The OOH activity included three pieces of creative featuring three different meal ideas being run on television screens located at select shopping centres across Australia to inspire consumers while grocery shopping.

Australian Avocados were on 786 screens nationwide from 29 April until 9 June, across both a variety of shopping centres (through Val Morgan Outdoor) and Westfield shopping centres.

The reach of this activity was huge; the Val Morgan outdoor activity reached 6,023,080 people an average of 10.5 times, while the Westfield activity reached 5,409,000 people an average of 10.5 times. The Westfield activity was targeted towards more affluent centres, while the Val Morgan activity uses class-leading real-time audience technology, which uses facial recognition software and audience metrics devices measuring those viewing content based on their age and gender, and can serve ads accordingly. This means that the ad was only shown when the majority of people walking by and viewing the ad were in our target demographic - pretty amazing technology!



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Hort Innovation Marketing update continued

OOH Gyms

To drive frequency, we extended our screen reach into both Anytime Fitness and Fitness First gyms. On average Anytime



Fitness members attend the gym 3.4 times a week, and spent an average of 80 minutes there. We had 260 Portrait Screens + 600 Landscape TVs reaching 726,643 unique gym users across June. As a

bonus, we also received a recipe in the June Anytime Fitness EDM which links directly through to the Australian Avocados consumer-facing website.

Across Fitness First gyms, we had 1,822 Landscape TVs, reaching 1,223,400 unique gym users across June. We also received bonus activity for this element; a full page ad in the July/August issue of Fitness First magazine and a one-page editorial piece on why avocados are a necessity not a luxury in your nutrition. As this activity is still ongoing, full results for the OOH gym activity will be reported on in the next edition of *Talking Avocados*.

Social Media

Social Media remains an integral part of the media mix. Remaining 'always on', it ensures avocados are top of mind year-round. Each month, we reach more than 500,000 consumers with avocado content. During the last few months, our new recipe content in particular has proved very popular; it's very encouraging to see consumers trialling avocados in ways they wouldn't have previously, such as the Avocado Cheesecake (below).

Posting recipe content from the Australian Avocados website, combined with the launch of the new campaign, has seen a huge

increase in visits to the website. There were more than 35,000 visits to the website in May alone, and increase of 29% from the previous highest month.



Sarah Leanne Made this last night - sooo yummy!



Wellbody Naturopathy by Tegan Barton Okay so this was amazing! My new favourite recipe by far. 🥰🥰🥰

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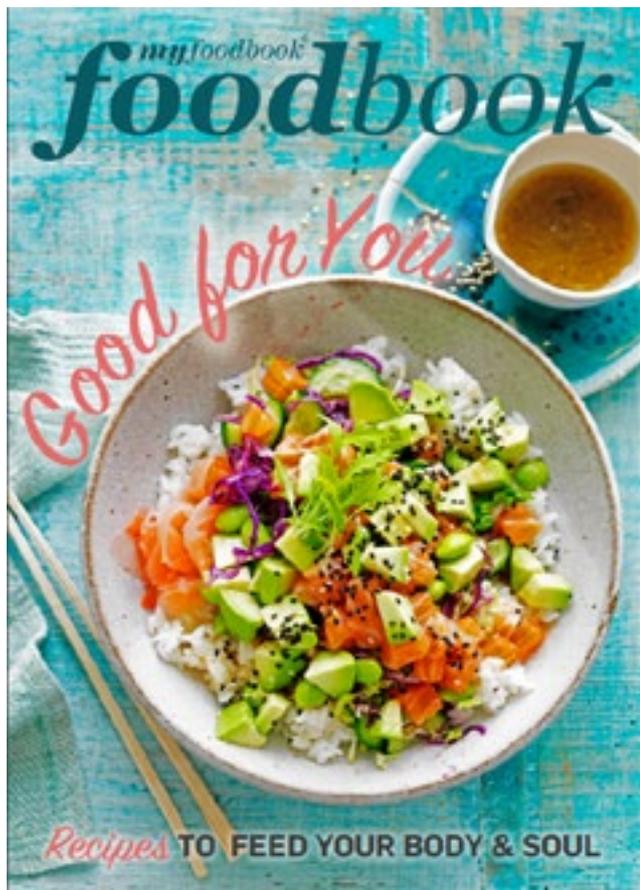
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Myfoodbook

The Australian Avocados subscription with Myfoodbook has been active since November 2017. In that time, Australian Avocado recipes have been viewed nearly 140,000 times. Video content has also been created and shared, with 38,600 views so far, with more video content to come! Avocado recipes have also been featured in the 'Good for you' foodbook, which has been downloaded over 11,000 times, and will be featured in the 'Around the World' foodbook launching in August. Find all the recipe content and cookbooks at www.myfoodbook.com.au.

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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25 year anniversary of the smashed avo

It's been 25 years since avocado toast first smashed its way into our lives, and now the man credited with starting the worldwide food phenomenon is back with a new twist on the popular dish.

Iconic Aussie restaurateur Bill Granger first put avocado on a piece of toast and served it at his café in Sydney's Darlinghurst back in 1993. Not only did he launch 'brunch' as we now know it, but he also sparked Australia's great love affair with the versatile fruit.

To help Australians celebrate the 25-year milestone, the 'father of smashed avo' has shared his fresh, new avocado go-to dish for 2018 – avocado and smashed cucumber salad with mirin and sesame.

"Avocados bring such a wonderful textural contrast to so many dishes. This salad was inspired by classic, simple Japanese summer salads and brings a new flavour to one of my favourite foods," said Granger.

"Avocados always take on so many flavours and here, soy, sesame and citrus are natural partners to balance the richness of the avocado. This dish is incredibly versatile, I love it."

It's Granger's go-to 'bring-a-plate' at barbecues and he also serves it up with poached or grilled chicken, fish, seafood or rice for dinner.

In 1993, Australians were just beginning to dabble with avocado. A decade later we were munching through an average 1.68kg a year, and today the average Australian eats a whopping 3.5kg of avocados each year – making us the biggest consumers of avocados per capita in the English-speaking world.

Fuelling Australia's passion for avocados is the fruit's health benefits. Avocados are nutrient dense and an excellent source of good fat, which

means they are an easy way to make any meal better.

Australian avocado growers have kept up with growing demand in the last two decades and now have planted more than 2 million avocado trees, more than tripling the size of the industry since 1998.

"Avocados are here to stay, the public's love for them just seems to keep going. You won't see another food so passionately talked about and eaten – people are even using them to propose now," said avocado grower and Avocados Australia Board Director, Tom Silver.

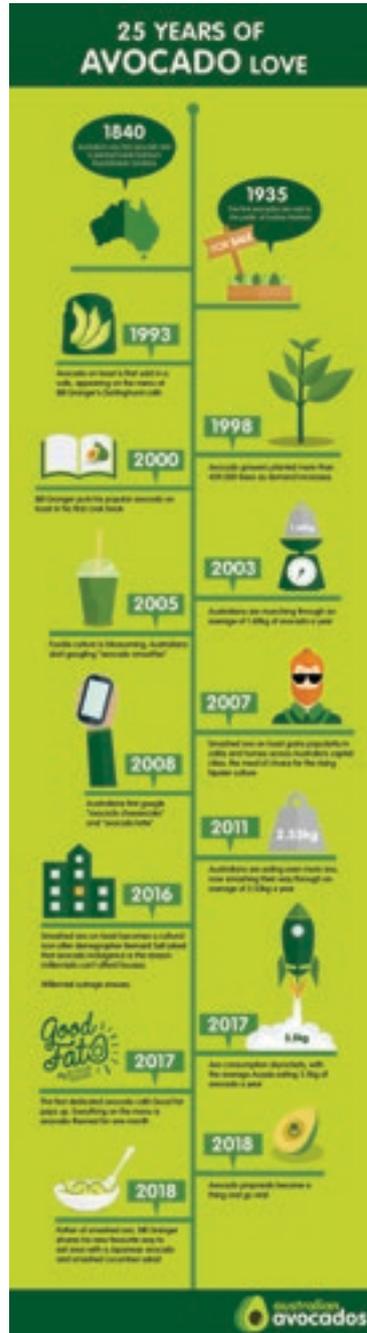
"Growers are planting new trees all the time. It takes three to four years for a newly planted avocado tree to bear fruit so as an industry we expect production to increase by around 50 per cent by 2025. That will be around 115,000 tonnes of avocados produced a year," he said.

Their popularity and versatility has seen them make their way onto café menus and home kitchens in everything from smoothies, pasta, sandwiches, salads, icecream, desserts, even coffee.

But for Bill Granger, who now has 18 restaurants worldwide and is in Sydney to open his new restaurant in Surry Hills, smashing an avo still has a special place in his heart.

"Avocado on toast was born because I was looking for something tasty to go with a bloody Mary at breakfast. I added it to the menu and it quickly became a favourite.

"Avocado on toast is still my go-to breakfast, with either salmon or poached eggs. It cannot be beaten," he said.



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Distributed By:



Greg Smith
National Product Manager
0429 797 643 gsmith@eem.com.au



Acknowledgement

The 25th anniversary of the smashed avocado was an initiative of the industry's marketing program. More on the marketing team's activities on pages 28-31.

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Beekeepers urged to adopt Code of Practice

Beekeepers nationally, commercial and hobby, are being urged to adopt the Australian Honey Bee Industry Biosecurity Code of Practice to keep their bees healthy and to safeguard honey bee and pollination dependent industries.

The benefits of bee pollination services dwarf the value of Australia’s honey production, which is itself worth more than \$100 million annually, along with sales of beeswax, queen and packaged bees.

“The aim of the National Bee Biosecurity Program and the associated Biosecurity Code of Practice is to ensure beekeepers have the awareness and knowledge to manage bee pests and diseases, and to detect exotic ones early,” Australian Honey Bee Industry Council (AHBIC) Chair Peter McDonald said.

“Established pests and diseases like American foulbrood, small hive beetle and chalkbrood are causing significant economic and social harm to the bee industry and this would be exacerbated by an incursion of an exotic pest like the varroa mite,” he said.

AHBIC worked with state governments, the Australian Government and Plant Health Australia to develop the National Bee Biosecurity Program and the Biosecurity Code of Practice. The honey bee industry contributes \$400,000 per year to the

program through levies.

In some states, legislation has been changed to assist with adoption of the Biosecurity Code of Practice, and bee biosecurity officers and apiary officers are found in each state to assist beekeepers.

“This new management system has been put in place to limit the impact of pests and diseases on the businesses of individual beekeepers, but also the broader industry and economy,” Plant Health Australia (PHA) Executive Director and CEO Greg Fraser said.

The Australian Honey Bee Industry Biosecurity Code of Practice requires the nation’s 1,500 commercial beekeepers, who have more than 50 hives each, and the 22,000 hobby beekeepers to use these best-practice biosecurity measures, including:

- register as a beekeeper
- report notifiable diseases
- control or eradicate pests and diseases, and manage weak hives
- maintain records of biosecurity related actions and observations



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- allow their operation to be assessed by bee biosecurity officers.
- commercial beekeepers with more than 50 hives also need to:
- demonstrate adequate knowledge to identify and manage bee pests and diseases
- undergo annual honey testing for American foulbrood disease
- provide a declaration that they operate and manage their bee hives in compliance with the Biosecurity Code of Practice.

More information

Australian Honey Bee Industry Biosecurity Code of Practice – <http://beeaware.org.au/code-of-practice/>

Australian Honey Bee Industry Council – <https://honeybee.org.au/>

National Bee Biosecurity Program – www.planthealthaustralia.com.au/national-programs/national-bee-biosecurity-program/

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Avocado trays in

MOYA finals

A "Retail Ready" avocado multi-pack earned Favco Fruit and Vegetable Company and Fresh Partners Australia a place as one of five finalists in the PMA-Produce Plus Marketer of the Year Award 2018.

The seventh annual award, announced at the 2018 Hort Connections, was one by the Lotatoes Potatoes campaign from T&G Global.

Each entry was assessed on how compelling the campaign was, its unique features, how appropriate the marketing tools were to the product and target audience, how well it was targeted at the particular market segment, and evidence of its success.

"Narrowing it down to just five finalists was no easy task for our panel of judges, who were amazed by the depth of entries we received again this year," explained Produce Plus editor Matthew Jones.

"It just goes to show the quality of marketers we have in our industry at the moment."

CEO of PMA Australia-New Zealand Darren Keating said it was great to see the hard work, creativity and strategy all of the finalists put into their marketing activities.

Favco's general manager – new business, Michael Burrow, told Produce Plus the aim of the 'Avocado Retail Ready Six-Pack' campaign, including the launch of a new value-added avocado multi-pack, was to make buying avocados "less of a mystery".

"The avocado six pack enables a select group of growers to have greater control of a percentage of their sales," Mr Burrow told the magazine.

"For the majority of the year the trays are packed on-farm, which means less handling damage when repacked."

Most of the fruit in the six packs is mature green at purchase. The line sells at selected retailers year-round and is packed by growers within Australia and New Zealand.



Avocado Strategic R&D Levy Investment Program

Overview

Research and Development

A vital component of ensuring the long-term future of the Australian avocado industry is research and development.

The industry has long invested in research and development programs to support the sustainable development of the industry. All commercial Australian avocado growers contribute funds towards avocado R&D through the national statutory levy.

Hort Innovation manages these funds, investing in projects addressing the industry's strategic priorities. The Australian Government also provides additional funding for avocado R&D through Hort Innovation.

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

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

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

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

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

Investments are aimed at addressing levy payer priorities as set out in the Avocado Strategic Investment Plan 2017-2021. The following projects over the last 12 months have been funded through four different mechanisms. There has also been additional funding secured over and above the levy funds through the successful application for Federal grants by Hort Innovation.

- avocado grower levies only (AV projects)
- 'multi industry' projects where the avocado industry levy jointly funds a project with one or more industries (MT projects)

- strategic industry investments are funded by Federal grants outside of the levy model (ST/AI projects)
- across industry (AH) projects are funded through all horticultural industry R&D programs including avocados. (AH projects are reported at the end of the article.)

AV projects funded through avocado levies

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

MT projects funded by avocado levies can be found below with the yellow shaded background

AH across industry projects can be found below with the blue shaded background

The following is a snapshot of the avocado program funded through Hort Innovation in 2017/18. The projects are reported on under the strategic investment plan objectives. Please note some projects meet more than one objective.

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

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

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

Acknowledgement

The projects presented in this summary are investments under a variety of Hort Innovation funds. Information for this summary has been drawn from a variety of sources, including the Hort Innovation Hortlink (more on page 71).

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

Avocado Industry and Market Data Capture and Analysis (AV16006)

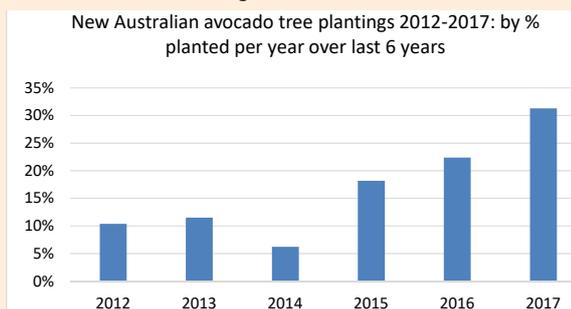
Service Provider Avocados Australia Limited (AAL)
Project Leader John Tyas
Start Date 21/04/2017
End Date 31/07/2020
Funding Type Hort Innovation Avocado Fund

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

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

In the 2017 OrchardInfo, reported in the Summer 2018 *Talking Avocados*, we reported that 200,000 extra trees were added to the national plantings in 2017, confirming a four year trend for increased tree planting across Australia.

The 2018 OrchardInfo tree count will close on 6 September. You can read more in the CEO’s report on Page 5 of this edition, and more about Infocado on Page 18.



Percentage of trees planted each year for the six years to 2017

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

Service Provider Coriolis Australia
Project Leader Virginia Wilkinson
Start Date 07/05/2018
End Date 10/08/2018
Funding Type Hort Innovation Avocado Fund

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

Understanding the Purchase Behaviour of Fresh Produce Consumers (MT13061)

Service Provider Nielsen
Project Leader Elisa King
Start Date 26/06/2014
End Date 31/03/2018
Funding Type Hort Innovation Avocado Fund

The market research carried out in this project included the use of Homescan Consumer Data, Woolworths Retail Scan Data, professional analysis of the data collected and reporting of industry trends and market development strategies associated with the insights gained. Retail Scan Data analysis and Homescan Consumer Data analysis was analysed in tandem by external experts to optimise their value.

Consumer Behavioural and Retail Data (MT17015)

Service Provider Nielsen
Project Leader Elisa King
Start Date 02/04/2018
End Date 31/03/2021
Funding Type Hort Innovation Avocado Fund

This project carries on from MT13061 and will provide avocado growers with quarterly access to market data, as to where their product sits compared to other products. The project will provide category reports, a comprehensive review and access to an online Harvest to Home dashboard.

Avocado Strategic R&D Levy Investment - Program Overview continued

Avocado Consumer Attitude and Behaviour Study (AV17002)

Service Provider	Quantum Market Research
Project Leader	Imogen Randell
Start Date	28/09/2017
End Date	30/11/2017
Funding Type	Hort Innovation Avocado Fund

The avocado's new marketing plan (more on that on pages 28-33 of this edition) has been underpinned by the market research carried out as part of this project.

The primary objective of the research was to understand avocado consumers in terms of the different types of consumer segments, their barriers and triggers to purchase, their purchasing behaviour, usage behaviour and a profile of who they are.

The research was also designed to provide input into the types of communication or activities which will increase consumption among each segment, to ensure consumer demand continues to increase in line with industry supply, without a detrimental impact on prices.

Stage 1 (a qualitative exploration) included both in-depth interviews and focus groups while Stage 2 (quantitative measurement) included an online survey.

The in-depth interviews were used to explore and unpack the attitudes of avocado buyers to construct a meaningful questionnaire to quantify the various segments.

You can read more about the results of this project in the Spring 2018 edition of *Talking Avocados* and the full report is available in the BPR Library (www.avocado.org.au/best-practice-resource/library/) in the Marketing Reports section.

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

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

Service Provider	Department of Agriculture and Fisheries Queensland
Project Leader	Daryl Joyce
Start Date	21/06/2016
End Date	31/10/2018
Funding Type	Hort Innovation Avocado Fund

This project was due for completion in May but has been extended to allow researchers to carry out further supply chain work. Beginning in 2016, this project is tackling the key issue of avocado bruising at the end of the supply chain, at both the retail and household level – where previous research suggests the majority of bruising occurs.

Previous research has established that the flesh bruising problem is mostly caused at the end of the avocado supply chain. It is generally recognised that measures to effectively eliminate this mechanical (ie, physical) damage issue are sorely needed. The project is:

- developing and testing tools and technologies to reduce handling by retailers and consumers, including tools for identifying ripeness
- documenting best practice to prevent fruit bruising at the retail level, producing information materials for use in retail education
- investigating any relationship between disease and flesh bruising
- reviewing and documenting contributing factors to fruit susceptibility to bruising.

With bruising affecting consumer decisions to repurchase, the ultimate goal is to improve consumer and retailer satisfaction, strengthening consumption of and demand for avocados.

Recent research has confirmed shoppers are major contributors to avocado bruising. In the project's studies of how consumers handle fruit, shoppers were found to apply compression forces typically ranging from three to 30 Newtons (N) to firm, ripe avocados when assessing ripeness. A 'slight' thumb compression of 10N applied to a firm-ripe fruit is enough to cause bruising, expressed within 48 hours at 20°C.

Researchers have been focusing on the laboratory assessment of non-destructive devices for measuring fruit firmness, and hence ripeness. Investigations have narrowed down to four 'best bet' devices, with all four found to be capable of distinguishing between different stages of ripeness for Shepard avocados, however, two of the devices ended up causing bruising of the relatively thin-skinned variety. At the time of writing, testing on Hass fruit had taken place during May 2018 and results were being analysed.

The devices being explored include:

- a prototype avocado decision aid tool based on a force-sensing resistor, that was developed under an earlier industry project (AV10019)
- the Sinclair Internal Quality Firmness Tester (iQFT), which is based on a low mass impact sensor
- a digital firmness tester which measures micro-deformation of the fruit
- the FruitFirm Meter which measures deceleration of a low mass impact 'hammer'.

The researchers have also been looking at the influence of impact damage at harvest on the development of rots at the retail level and other factors involved in declining fruit quality.

Reducing bruising in avocado

Melinda Perkins, Muhammad Mazhar, Daryl Joyce, Noel Ainsworth, Lindy Coates and Peter Hofman

As we near the end of the *Supply chain quality improvement – Technologies and practices to reduce bruising* (AV15009) project, it is timely to reflect on the findings to date and outline the research being undertaken in the final stages of the study.

Background

Recent surveys suggest that a large proportion of Australian avocado consumers are disappointed with the quality of the fruit that they receive. Encounters with flesh bruising are a major cause of consumer dissatisfaction.

This project was established to collate and evaluate current knowledge of factors that contribute to flesh bruising in avocado and to identify strategies to reduce it.

What we know about flesh bruising in avocado

A series of comprehensive literature reviews were conducted in the early stages of the project. The findings from these were communicated to industry via three *Talking Avocados* articles (details below), presentations at some recent Avocados Australia regional meetings, and a workshop at the Brisbane Markets (Figure 1).

Appropriate post-harvest temperature management was highlighted as a most important factor in controlling not only the expression of flesh bruising (Figure 2), but fruit quality in general.

The prompt cooling of Hass fruit to 5°C after harvest and minimising temperature fluctuations throughout the supply chain (except during ripening) are strongly recommended. The reviews also highlighted the following key points.

Flesh bruising arises when susceptible fruit are exposed to mechanical injury, including impact, compression and vibration. Susceptibility to bruising in avocado increases as fruit ripen and soften. To avoid bruising, softening fruit should not be exposed to drop heights of more than 10 cm. In fact, firm-ripe and soft-ripe fruit should be ‘handled like eggs’ and not dropped at all.

Freshly harvested fruit generally do not bruise if dropped. However, our research suggests that they become more prone to body rots upon ripening. A 30cm drop height at harvest versus



Figure 1. A workshop held at the Brisbane Markets in May allowed researchers to present project findings (top panels) and gain the perspectives of industry stakeholders via group discussions (bottom panels).

Good temperature management can reduce flesh bruising

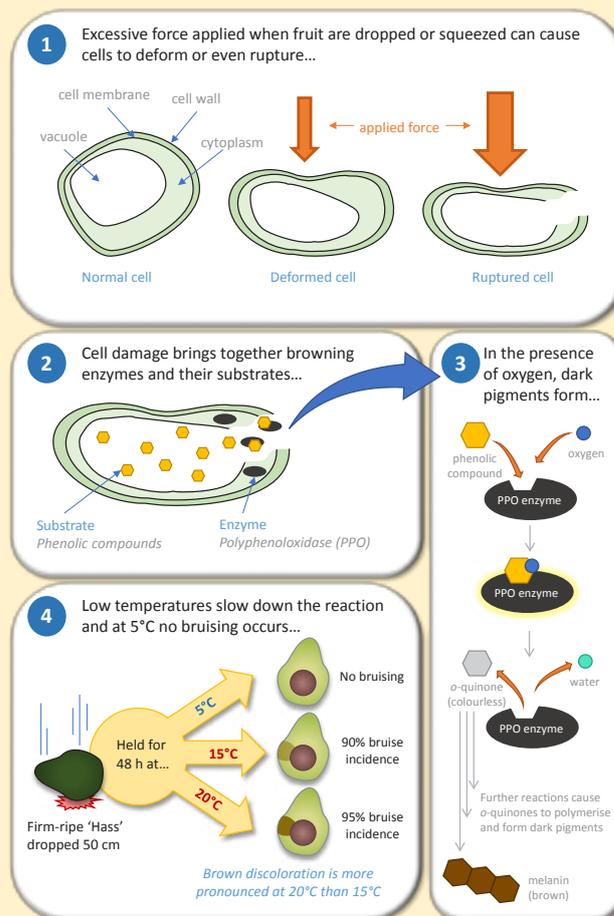


Figure 2

no impact at harvest caused increased body rots at the soft-ripe stage. More research is needed to quantify the relationship, but the initial findings do indicate that even hard mature green fruit require careful handling.

Hass fruit should be harvested when dry matter is above 23%, as increasing dry matter has been linked with lower bruise

Avocado Strategic R&D Levy Investment - Program Overview continued

susceptibility in this cultivar.

Passing fruit through the supply chain as quickly as possible is recommended because stored fruit are more susceptible to bruising upon ripening than un-stored fruit.

Squeezing of fruit by retail staff, shoppers and consumers is the predominant cause of flesh bruising. Possible solutions include educating these groups about appropriate handling techniques, arranging retail displays into relative ripeness categories (eg 'ripe and ready to eat now' or 'ready to eat in 2-3 days'), providing fruit in pre-packed formats (eg net bags, clam shells), and/or developing decision aid tools (DATs) that can be used to objectively determine fruit firmness (ripeness) in a non-bruising manner. Research by our team has shown that shoppers responded positively to a prototype DAT, indicating that such devices would be readily adopted by shoppers if made available.

Pre-harvest factors including tree nutrition, irrigation regime, rootstock cultivar, tree vigour, crop load and canopy management are known to affect avocado fruit quality in terms of ripening time, physiological disorders and/or post-harvest disease. These factors are highly likely to also affect bruise susceptibility, although there is next to no published research in this area.

Where to next?

During the next few months, the project team will monitor fruit quality through actual supply chains in the field and through simulated supply chain scenarios in the laboratory. The applied aim is to gain a better understanding of the quantitative extents to which some abovementioned factors, including post-harvest temperature and fruit dry matter at harvest, affect final fruit quality.

The focus will be on flesh bruising susceptibility, incidence and severity. However, body rot susceptibility, incidence and severity will also be carefully assessed. Crucially, the effect of impact injury at harvest on final fruit quality in terms of rots as well as bruising will be investigated. Fruit subjected to a controlled impact at the beginning of the supply chain will be compared and contrasted to fruit that receive no impact. In doing so, we aim to clearly demonstrate how careful handling at harvest can help deliver high quality fruit to consumers.

Want more information?

For more information, our previous Talking Avocado articles can be accessed online at www.avocado.org.au/news-publications/talking-avocados/feature-articles/:

- Factors affecting avocado flesh bruising susceptibility, Winter 2017 edition
- Best practice handling to reduce flesh bruising, Summer 2018 edition
- Does impact injury at harvest increase body rots at retail?, Autumn 2018 edition.

Acknowledgments

The Supply chain quality improvement – Technologies and practices to reduce bruising (AV15009) project is funded by Hort Innovation using the Hort Innovation Avocado research and development levy with co-investment from the Queensland Department of Agriculture and Fisheries, The University of Queensland, Avocados Australia and contributions from the Australian Government.



Supply Chain Quality Improvement – Cool Chain Best Practice Adoption (AV15010)

Service Provider	Applied Horticulture Research (AHR)
Project Leader	Gordon Rogers
Start Date	23/06/2016
End Date	31/05/2018
Funding Type	Hort Innovation Avocado Fund

This project aimed to motivate all supply chain members to reduce the amount of damaged fruit on retail displays. The guiding principle was that if supply chain members, including retailers, clearly understood the financial benefit of reducing the incidence of damaged fruit, this would motivate them to make the changes required. The project was designed to:

- increase the adoption of best-practice in cool-chain management and post-harvest handling across all sectors of the avocado supply chain, from orchard to retail
- help reduce the incidence of rots and other quality defects in avocados
- increase the awareness of factors that predispose fruit to quality defects across the supply chain.

In its course, the project produced four new guides and resources for the industry, which are available for download via the Best Practice Resource (BPR). They include:

- a detailed review of Australian and international research on pre- and post-harvest management factors affecting avocado quality
- *the Australian Avocado Supply Chain Best Practice Guide* – a concise guide for postharvest best practice from orchard to retail
- *the Avocado Fruit Quality Problem Solver Guide* – a postharvest guide focusing on fruit quality issues

- a series of risk-preventing checklists for each stage of the supply chain.

The resources were informed by delving into international and local research on managing avocado quality, along with industry consultation to understand how avocados are currently managed, and a series of studies involving Australian avocado businesses. The research involved 12 packhouses in five growing regions, examining impacts during harvest, sources of postharvest damage, and temperatures in supply chains from farm to retail. Key findings included:

- significant impacts can potentially occur when harvesting from mechanical work platforms if the bag is left at full extension – and restricting the bag around the middle and releasing fruit gradually should prevent damage.
- most impacts on packing lines were below damage thresholds, however, it was found that overloading fruit on the line and excessive brushing increased lenticel damage on Hass fruit.
- room cooling of bins of avocados is relatively slow, with large differences between the centre and outside of the bin – but these can be eliminated using forced-air cooling.
- fruit pulp temperature at dispatch was above 6°C in the majority of the supply chains monitored, and above 10°C in some.
- only one of the supply chains monitored maintained fruit temperature at 5°C during transport, with the majority averaging 8 to 12°C with significant variation occurring. In many cases, fruit temperature rose during transport, suggesting that truck cooling systems were inadequate to cope with heat generated by the avocado fruit.
- ripening temperatures were variable, with the best results gained when ripening rooms were equipped with forced-air systems for heating as well as cooling fruit.



Triggering adoption of post-harvest best practice

Adam Goldwater, AHR

The avocado industry's own data suggests that 20-25% of avocados have a bruise, rot or other internal defect before a consumer even takes it home. However, the fruit clearly didn't leave the packing shed with obvious problems.

The effects of rough handling or poor temperature management are often not apparent until much later, as the fruit begins to ripen. Everything that happens from flowering to packing, and even before, can affect postharvest quality.

Seven workshops held across the country have helped growers, packers, transporters and ripeners understand what can – and sometimes does – go wrong in supply chains. This has enabled them to identify improvements they can make in their own supply chains. Changes include reducing pick-to-pack times, checking packing lines for damaging impacts, monitoring supply chain temperatures and improving on-farm cooling systems.

The latest best practice recommendations across all stages of the supply chain from harvest, packhouse, transport, and ripening were presented. Key messages included:

- a new handheld NIR (near-infrared) device for measuring fruit dry matter (non-destructively) has recently been calibrated for use on avocados. In conjunction with accurate lab testing, this tool can help guide harvesting decisions
- significant impacts can occur when harvesting from mechanical work platforms if the bag is left at full extension; restricting the bag around the middle and releasing fruit gradually should help prevent damage
- post-harvest fungicides should be applied within 24 hours of harvest for best effect, especially if fruit were picked wet
- overloading fruit on the packing line and excessive brushing increases lenticel damage on Hass avocados
- delays between harvest and cooling can increase decay and disorders – *always* aim to pack and cool fruit within 24 hours of harvest
- if packing and cooling within 24 hours of harvest is *not possible*, then measure pulp temperature and precool fruit according to recommendations from the new best practice guide
- room cooling of bins of avocados is slow, with large differences between the centre and outside of the bin

Avocado Strategic R&D Levy Investment - Program Overview continued

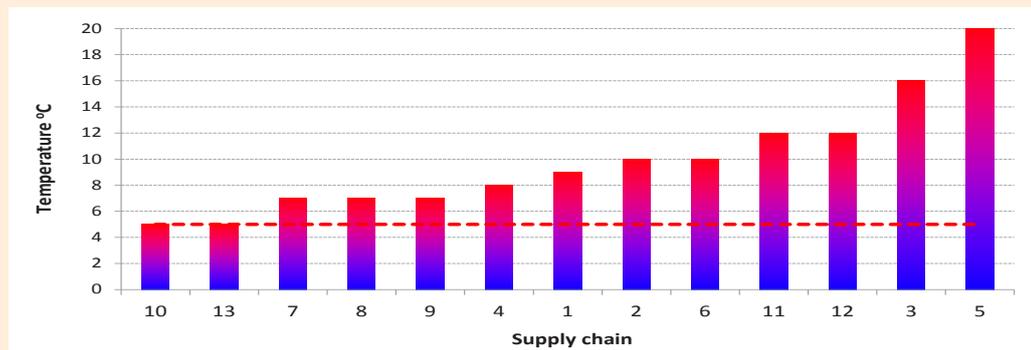


Figure 1: Pulp temperatures at dispatch from the packhouse: the red line indicates optimal temperature for Hass of 5°C

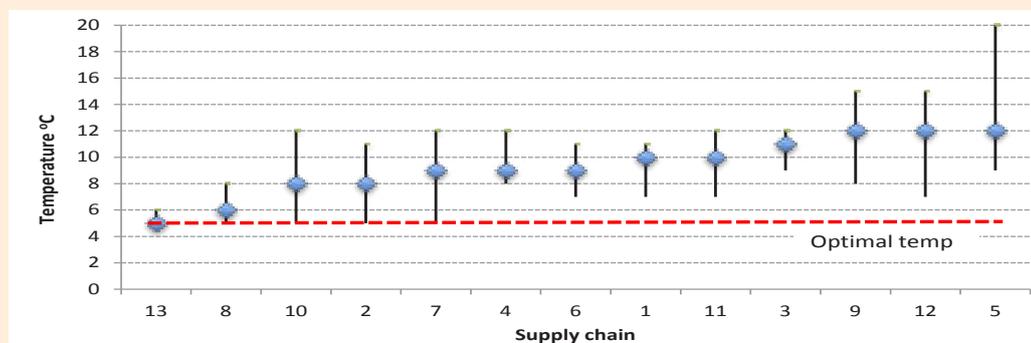


Figure 1: Average (◆), minimum and maximum air transport temperatures across 13 supply chains. The red line indicates the optimal temperature for Hass of 5°C.

- forced-air systems cool fruit quickly and efficiently, and avoid temperature gradients inside bins or packed pallets
- trucks do not cool fruit, so it is essential avocados are properly cooled before loading
- monitoring loads with temperature loggers is not only cheap insurance but also helps ripeners decide how to best manage the fruit
- storing avocados for more than two weeks before ripening increases risk of disease and internal defects
- ripening rooms should ideally be equipped with forced-air systems for warming and cooling fruit, as well as ethylene and CO₂ monitoring equipment.

Cool chain management is a key issue for Australian avocado supply chains

Studies across 13 supply chains from five major growing regions in Australia have identified poor temperature management, particularly during transport, as a key issue for the Australia avocado industry.

Fruit pulp temperature at dispatch was above 6°C in 11 of 13 supply chains monitored, and above 10°C in four supply chains. Truck refrigeration systems are designed to maintain temperature, not cool fruit, so avocados need to be close to

the target temperature (5°C for Hass or 7°C for green skin varieties) before dispatch.

This was clearly demonstrated by temperature logs recorded during transport, as only one of the 13 Hass supply chains monitored successfully maintained fruit temperature at 5°C. The majority averaged 8 to 12°C, often with significant variability. In many cases fruit temperature rose during transport, suggesting that the truck cooling system was unable to cope with heat generated by the avocado fruit.

Truck thermostats should be set on delivery air at 5°C for Hass or 7°C for green skin varieties. Adding a simple and inexpensive temperature logger to every load, and checking the data afterwards, can verify those temperatures are being maintained.

More information

Did you miss the 2018 Avocados Australia Regional Meetings? The full AHR presentation is available in the Library section (Event Proceedings) of the online Best Practice Resource.

Do you want printed copies of the new resources? Contact Adam Goldwater from Applied Horticultural Research at adam.goldwater@ahr.com.au or phone 02 8627 1040.

Do you want electronic copies of the new resources? These are available in the BPR, visit www.avocado.org.au/bpr-articles/whats-new-bpr/ for quick links. This includes all of the checklists as individual files (pre-harvest, harvest, packhouse, transport, ripening/wholesaler, distribution centre).

Acknowledgements

The *Cool Chain Best Practice Adoption Project* (AV15010) project is funded by Hort Innovation, using the Avocado industry levy and contributions from the Australian Government.



Supply Chain Quality Improvement – Retail and Consumer Education (AV15011)

Service Provider Produce Marketing Australia (PMA)

Project Leader John Baker

Start Date 12/07/2016

End Date 31/03/2018

Funding Type Hort Innovation Avocado Fund

The objective of this project was to deliver a reduction in the level of damaged avocado fruit at retail from the current ~20% of fruit with more than 10% damage, to no more than 10% of fruit with more than 10% damage within three years. This represents a value estimated at \$30 million gross value of production (GVP) per year.

The project began in 2016 and worked closely with retailers to deliver education, training programs and consumer-facing tools to reduce the percentage of damaged fruit available on shelves – helping boost the consumer experience with avocados at the retail level.

A key achievement of the project was the development of a high-impact, low-cost display and merchandising system for Hass avocados, involving:

- safely and correctly sorting avocados into ripe and unripe categories
- ensuring ripe fruit is consistently available
- using green and black coloured foam pads for display of avocados, with the colours used to separate the fruit into ripeness categories
- using header cards to identify stages of ripeness within the display, clearly indicating avocados to “Buy now, eat now” or to “Buy now, eat later”.

More than 150 stores were implementing the system by May 2018. Further uptake is also likely, as the benefits continue to be promoted through industry channels.

The other major project output was the online avocado training program for store-level staff, which was developed in consultation with retailers and will remain available into the future. The program, which can be completed in 30 minutes, incorporates five videos covering customers; ordering, receipt and storage; ripening; plus display and merchandising of avocados. Each section of the training also has a brief quiz to reinforce key points, and successful completion of the program enables participants to download an industry-endorsed certificate of recognition.

Back-room charts that reinforce key messages from the videos were also developed and distributed during the course of the project. These materials are available to any fruit retailer, via the “Retail” button at the top right of the www.avocado.org.au website.

Boosting avocado sales, reducing shrink

John Baker, Produce Marketing Australia

A new avocado retail merchandising approach, coupled with a practical on-line training program for retail staff, has resulted in a significant boost to avocado sales, as well as a decrease in damage and losses.

Based on consumer data, observations and retailer feedback, the new merchandising approach shows consumers are buying more avocados (a 30% increase per customer) and squeezing them less (a drop of 41% per avocado).

Background

Research has shown avocados in Australia have been held back from reaching their full market potential, due in part to practices at retail which are limiting consumer purchases. While avocados are normally a top five item in the fresh produce department, there is potential for them to be consistently a ‘top two’ produce item, potentially moving to number one, overtaking bananas.

As a result, a program was commissioned with Produce Marketing Australia (PMA) and Applied Horticultural Research (AHR) by the avocado industry and Hort Innovation to develop retail training programs, merchandising tools and consumer education resources to increase sales and reduce the percentage of avocados with internal damage from 20% (recorded from retail assessments in 2015) to less than 10% within three years.



Avocado Strategic R&D Levy Investment - Program Overview continued

The approach

The approach taken was to:

- undertake domestic and international data gathering, through desk research, consumer observations and consumer interviews
- identify a range of merchandising concepts and training approaches and present these to all major retail sectors (supermarkets and independent retailers)
- trial those concepts which retailers supported and believed had the best chance of success
- roll out the merchandising concepts and retail training on successful completion of testing.

As part of the data gathering, preliminary consumer research revealed 92% of consumers wanted avocados for use today or tomorrow (ie, ripe and ready to eat fruit); some fruit for later use was also wanted.

However, retailers have not been delivering on this requirement, with the added complication that fruit is being squeezed and damaged as consumers search for suitable ripe fruit.

In addition, research shows almost 40% of heavy avocado consumers use “consistent availability of ripe avocados” as one of their criteria to determine where to shop.

Up to eight merchandising concepts used in Australia and internationally were presented to all retail sectors, to assess their potential, acceptability and ease of understanding and implementation, before final selection. In addition, consumer observations of avocado shopping habits were undertaken, along with consumer interviews in a shopping environment.

Major sources of concepts included avocado marketers and retailers participating at the annual Produce Marketing Association convention and exposition in the United States and at Fruit Logistica in Berlin.

These sources were also used to identify approaches and potential content for the online retail training program, as well as the experience of Produce Marketing Australia.



Shooting practical footage for the avocado retail training program at Trims Fresh, Penrith in suburban Sydney.

Merchandising package

A combination of four merchandising concepts were eventually agreed, developed and successfully tested across a range of retail formats. These concepts were:

- use of coloured foam display pads, developed specifically for the campaign
- avocados displayed on the foam pads according to stages of ripeness
- ensuring consistent availability of ripe fruit, and
- “Buy Now, Eat Now” and “Buy Now, Eat Later” header cards.

The combined concepts were successfully trialled across a range of retail formats and locations, including regional centres where no face-to-face support was possible, to ensure the system could be easily understood and implemented throughout Australia. In-store trialling provided comprehensive data collection to measure success, as well as retailer feedback and ideas for improvement from store management and store staff.

Online training package

The agreed avocado on-line retail training program includes five short sections, containing extensive in-store footage covering: 1 Customers, 2 Ordering, Receiving & Storage, 3 Ripening, 4 Care & Handling, and 5 Display, Signage & Merchandising. Short quizzes at the end of each section have been included, to reinforce key messages. A downloadable industry-endorsed “Certificate of Completion” is issued on successful completion.

The program has been developed to be easily accessible via computer or portable devices, such as smart phones. Less than 30 minutes is required to complete the training.

Avocado Australia has agreed to provide access to the training via their website at www.avocados.org.au. Click the “Retail” button at the top right of the website homepage.

Results

The new merchandising package has been an outstanding success, measured by both consumer data, consumer observations and retailer feedback:

- consumers are buying more avocados and squeezing less (based on observations of almost 400 consumers)
- more consumers are buying avocados, and
- wastage is down significantly.

As the accompanying chart shows, there was a 30% increase in the fruit purchased per customer, a 16% increase in the number of consumers buying avocados, as well as 47% more consumers

buying two or more avocados. There was a corresponding reduction of 41% in the number of squeezes per fruit purchased and a 60% reduction in bruise volume.

Retailers report the merchandising system is simple for staff to implement and maintain. In addition, they noted customers returned unpurchased fruit to the correct side of the display.

Simplicity and low cost (around \$50) make the merchandising approach very attractive to a cross-section of retailers. Over 150 stores were successfully implementing the merchandising concepts at the end of June 2018, with at least another 150 stores planning to do so within three months.

The avocado retail training program has received strong support from a range of retailers. Independent retailers involved in testing the merchandising concepts are already using the training for their staff. In the Metcash IGA network a store staff competition has been implemented, with support from Hort Innovation, to encourage uptake of the training and merchandising. Costco has encouraged staff to complete the training. Coles has adapted most of the merchandising and training concepts to suit their particular requirements.

As David Scally, Regional Manager for Ritchies Supa IGA, and a trial participant said: "The merchandising concepts work, it is the way to go." Ritchies subsequently rolled out the merchandising system to all their Queensland stores, prior to total implementation across all their 70 stores.

Acknowledgements

The *Retailer Point of Purchase Improvements (AV15011)* project is an investment under the Hort Innovation Avocado Fund.



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

Trade Facilitation (MT15029)

Service Provider	Hort Innovation
Project Leader	Jenny Van de Meeberg
Start Date	07/03/2016
End Date	31/12/2019
Funding Type	Hort Innovation Avocado Fund

Hort Innovation, in order to deliver on its constitutional responsibilities regarding trade, requires an administrative project to enable in-bound and out-bound trade related delegations necessary to secure and maintain market access. This Trade Facilitation project will provide Hort Innovation with a suitable administrative vehicle to facilitate these activities. These activities will fulfil Hort Innovation's three constitutional objects regarding trade, namely: market access (including new access, improvement and maintenance), market development and in-market promotion/consumer demand. This project acts as a fundamental vehicle to facilitate activities in support of these objectives.

the power of sorted avocado displays

Store-level best practice

1. Sorted displays
2. Ripe fruit consistently available
3. Coloured stages of ripeness foam pads
4. Header cards

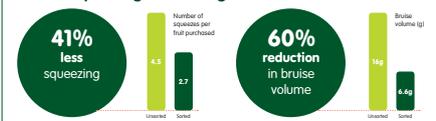


Benefits

Increased sales



Reduced squeezing and damage



Easy to setup and maintain

- Simple for staff to implement
- Consumers return unpurchased fruit to correct side of display



Avocado Strategic R&D Levy Investment - Program Overview continued

Horticultural Trade Data and Intelligence Reporting (MT16010 & MT16011)

Service Provider	Euromonitor International Ltd
Project Leader	Tim Foulds
Start Date	10/03/2017
End Date	14/02/2018
Funding Type	Hort Innovation Avocado Fund

This project was wrapped up early. The goal was to provide Australia’s horticultural industry with a strategic program of trade performance information to support increasing productivity, farm gate value and global competitiveness.

The two available reports (for Quarter 1 and Quarter 2 of 2017) are available in the Market Data section of the Library in the Best Practice Resource.

www.avocado.org.au/best-practice-resource/library/

Avocado export readiness and market access (AV17000)

Service Provider	Avocados Australia
Project Leader	John Tyas
Start Date	01/11/2018
End Date	20/10/2020
Funding Type	Hort Innovation Avocado Fund

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

Already, the project has employed an Export Coordinator and Avocados Australia is working with the Australian Government Department of Agriculture and Water Resources on export applications to both Thailand and Japan (see Page 10).

Specific project activities will include updating of the industry’s Best Practice Resource export module and export strategy; supporting export protocol training for participating orchards and packhouses ahead of each season; implementing an export registration and audit process; providing input into other export-related initiatives; and more.

Avocado presence at key international trade events

Service Provider	Hort Innovation
Project Leader	Julie Willis
Start Date	This is an ongoing project
Funding Type	Hort Innovation Avocado Fund

The avocado industry has a presence at key international trade shows – Asia Fruit Logistic in Hong Kong and the China Fruit & Vegetable Fair in Beijing – via ongoing Hort Innovation projects. Most recently, these activities occur under the Taste Australia banner.

Asia Fruit Logistica is Asia’s largest horticultural trade show, drawing 11,000 attendees from 74 countries in 2017.

China FVF is the only official comprehensive produce trade event in mainland China. This convention offers a platform where policy makers from China, embassy representatives from major produce trade nations, professional associations and industry executive get together, share information, exhibit new products, meet clients, social network, discuss solutions and make deals.

Developed by Hort Innovation with industry and after off-shore stakeholders reviewed the brand, Taste Australia encompasses trade show attendance, in-store promotions and seminars for buyers, media and influencers to spread the message about Australia’s quality produce.

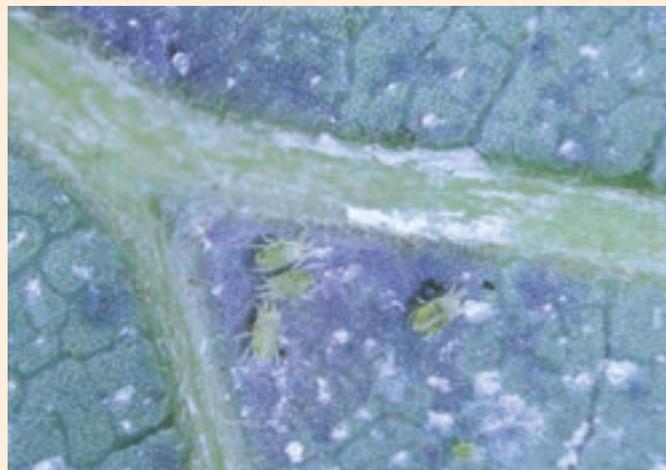
Objective 4: By 2021, productivity (marketable yield per hectare) has improved by 15 per cent on average without increased production costs per kilogram

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

Service Provider Western Australian Agricultural Authority (Department of Agriculture and Food Western Australia)
Project Leader Stewart Learmonth
Start Date 01/07/2016
End Date 01/07/2018
Funding Type Hort Innovation Avocado Fund

This project is investigating the six-spotted mite, an exotic insect pest occurring in avocado orchards in the lower south-west of Western Australia. It is clarifying the pest status of the mite in avocado orchards and investigating its management, with a focus on the role of mite predators and, potentially, miticides. The project is also set to develop guidelines for growers to protect crops, monitor orchards and take action.

Six-spotted mite (SSM) is an accidentally introduced pest mite from Central America and can be distinguished from other pest mites by the presence of at least three dark spots on each side of its body. It occurs in avocado orchards in eastern Australia but is not considered a pest there. SSM was first recorded in Western Australia (WA) in 1986 but it was not until spring 2014 that severe defoliation in avocado orchards occurred.



Six-spotted mite can be distinguished from other pest mites such as two-spotted mite by the presence of at least three dark spots on each side of its body.

The extent of SSM as a pest in WA seems to be restricted to orchards only in the lower south-west around Pemberton. Avocados grown just to the north in the Manjimup area, which are infested with the mite, have not suffered defoliation. The mite has yet to be recorded in avocado orchards in the Albany and Busselton regions, or further north around Perth. Project members provided an update to the industry in the last edition of *Talking Avocados* (Autumn 2018).

This project, which ended in Jun 2018, sought to clarify the pest status of six-spotted mite in avocado orchards, and the management of the pest. The management aspect will involve a primary focus of monitoring for the pest and beneficials, the role of predatory mites with in-season releases of two exotic species, and whether these predators are self-sustaining. Guidelines will be extended to growers on basic orchard practices to resist mite attack, monitoring for the pest and predatory mites, and using the predatory mites. Final outcomes will be extended when available.

Achieving More Consistent Yields of Quality Fruit in the Australian Avocado Industry (AV14000)

Service Provider Department of Agriculture and Fisheries Queensland
Project Leader Simon Newett
Start Date 01/11/2014
End Date 31/12/2017
Funding Type Hort Innovation Avocado Fund

With irregular bearing identified as a key issue in the Australian avocado industry, this three-year project was established in 2015 to provide growers with the knowledge required to implement practices for more consistent high yields of good-quality avocados from year to year. It had a strong focus on delivering workshops and resources to growers.

The project ran 42 workshops across eight Australian growing regions, with more than 2,600 growers attending. More than 100 participants were surveyed after the workshops:

- 80% of growers surveyed said they had made changes to their businesses as a result of the events
- more than 50% reported that they had reduced the amount of irregular and alternate bearing on their orchards as a result of the project
- 91% also said they now have a better understanding of the flowering and fruit-set process.

Participants were also asked to estimate the financial benefit of the project to their business. For the 100 respondents who attempted to answer this question, the value reached \$7.1 million.

Avocado Strategic R&D Levy Investment - Program Overview continued

As well as workshops, the project delivered:

- Avo Alert emails – monthly reminders sent to all growers, specific to each major production region, providing prompts about the orchard activities that should be considered in that particular month and the month ahead
- video resources, also available from the BPR
- a review of orchard nutrition practices, conducted with growers across the country and resulting in an update of the industry’s plant nutrition guidelines, available from the BPR
- content for other channels, such as regular articles for *Talking Avocados*.

There was a research component to the project too. Members of the project team and 28 growers participated in the collection of observations on flowering and fruit set – mainly during the 2015 and 2016 flowering seasons – on 28 orchards across the country, while data loggers were used at these sites to record temperature and humidity.

The data was analysed and the results presented to growers at the workshops and via the BPR, to educate about this complex but critical stage of fruit production and help in the implementation of practices to improve fruit set and retention.

Full details are available in the project’s final report, which has been uploaded to the BPR in the R&D section of the Library. You can also read more in the Summer 2018 edition of *Talking Avocados*.



More than 2,600 grower attendees at 42 workshops held across eight Australian avocado growing regions during the three-year project.

Avocado industry capacity building – Western Australia (AV17006)

Service Provider	Department of Primary Industries and Regional Development, Western Australia
Project Leader	Rohan Prince
Start Date	30/06/2018
End Date	31/05/2021
Funding Type	Hort Innovation Avocado Fund

This project supports the role and activities of a Western Australia Avocado Research Officer, to help develop the capacity and productivity of the state’s avocado industry. The (yet to appointed) officer will deliver best practice management information to growers and other industry participants in Western Australia, support national development activities within the region (such as forums and workshops), and help address identified orchard productivity issues in the state through research activities.

Investigating Tree Mortality During Early Field Establishment (AV14012)

Service Provider	The University of Queensland
Project Leader	Elizabeth Dann
Start Date	01/08/2014
End Date	31/05/2018
Funding Type	Hort Innovation Avocado Fund

Beginning in 2015, this project is looking into fungal root rots caused by species of the Nectriaceae family, which can infect and cause destruction of roots of plants in the nursery. The work is increasing the industry’s understanding of diseases causing tree deaths after out-planting, and providing practical management procedures for nurseries and growers to improve tree establishment and health in avocado orchards. This project is winding down, and close to completion.

One of the project’s areas of research has been the evaluation of cover cropping and/or mulching with biofumigant species within the brassica family – an avenue not previously investigated in avocado production systems. The idea is that these biofumigants could be used as pre-planting treatments to suppress rot-causing pathogens already in the orchard soil, helping to protect new, young transplants.

Most recently, the researchers have looked at the effect, under field conditions, of using brassica biofumigants as fresh mulch for reducing two important black root rot pathogens, *Calonectria illicicola* and *Dactylonectria macrodidyma*.

- Biofumigant products Caliente, Mustclean and Nemfix were all found to be effective in significantly reducing the viability of *Dactylonectria macrodidyma* at three days post incorporation.
- Caliente was found to best reduce the frequency of *Dactylonectria macrodidyma* fungal growth over time during the trial.
- There was no significant suppression of *Calonectria illicicola* by any of the biofumigants tested.
- The research suggests time has an effect on the efficacy of brassica species on fungal suppression, and that regular incorporation of brassica biofumigants into orchard soils may reduce pre-existing *Dactylonectria inoculum* and potentially improve mortality of young orchard transplants.

The project has also developed a rapid identification test for *Dactylonectria macrodidyma* and *Calonectria illicicola*. It is expected that the test – a ‘loop-mediated isothermal amplification’ or ‘LAMP’ diagnostic – will be made available to the Avocado Nursery Voluntary Accreditation Scheme (ANVAS), the Nursery Industry Accreditation Scheme (NIAS), and to pathology labs for the broader industry.

Other continuing work in the project includes assessing avocado rootstocks for susceptibility to root rot disease, and the evaluation of root rot management and treatment measures for growers and nursery operators.

Improving avocado orchard productivity through disease management (AV16007)

Service Provider	The University of Queensland & Murdoch University
Project Leader	Elizabeth Dann & Giles Hardy
Start Date	9/11/2017
End Date	05/11/2021
Funding Type	Hort Innovation Avocado Fund

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

The dedicated Phytophthora component involves the work of a Murdoch University team, whose work includes a closer look at phosphite treatments, including the issue of residues, potential for Phytophthora pathogens to develop tolerance, alternatives and more.

In its initial months, this investment has been working to establish a range of trial work, including a field investigation

looking at the use of pre-plant biofumigation to tackle disease. The researchers note that brassica biofumigants are quick growing and frequently used in the vegetable industry to break nematode and soilborne disease cycles, and add organic matter to soil. In late May, sowing with two biofumigants took place (Caliente and BQ Mulch), after the trees were cleared from the trial area. Avocado seedlings or grafted plants are set to be sown into the plot, and will be assessed for mortality or other symptoms of Phytophthora decline in the ensuing months.

Planning is also underway for larger field trials to be conducted over the project’s course, assessing different amendments or treatments on tree health, yield and fruit quality.

Meanwhile, glasshouse trials have begun, looking at the suppression of Nectriaceae fungi post-infection using a range of fungicides. These trials will assess effects on plant and root growth and root necrosis after inoculation with *Calonectria illicicola* and *Dactylonectria macrodidyma*, and subsequent fungicide drench.

Finally, in relation to phosphite treatments for Phytophthora, the researchers have been looking at fruit at commercial maturity for phosphorous acid residues – with a number of growers submitting fruit for assessment. Initial results on residues are to be reported back to participating growers, and more widely to industry, so that a clear picture of optimal time for application of phosphonate sprays and injections can be determined.

In the Murdoch University component of the work, sampling is underway to look at phosphite tolerance in *Phytophthora cinnamomi* and more.

Avocado industry biosecurity capacity building (AV16010)

Service Provider	The University of Queensland
Project Leader	Andrew Geering
Start Date	6/11/2017
End Date	05/11/2021
Funding Type	Hort Innovation Avocado Fund

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

Avocado Strategic R&D Levy Investment - Program Overview continued

Safeguarding Australia's avocados

Researchers are working with the Australian avocado industry to safeguard one of the nation's favourite fruits for years to come.

Funded by Hort Innovation – and being delivered by the University of Queensland State-Government-supported research institute, the Queensland Alliance for Agriculture and Food Innovation (QAAFI) – the work targets both existing and emerging avocado disease threats.

Hort Innovation chief executive John Lloyd said Australian avocados have never been more popular with domestic consumption tripling during the past 20 years from 30,000 tonnes to 90,000 tonnes.

"There is no arguing avocados are everywhere, on café menus, on television, in pop culture...there is even an avocado emoji," he said.

"What this research aims to do is protect a fruit that Australians are highly affectionate about, for decades to come."

QAAFI horticultural scientist Dr Liz Dann said the orchard disease management component was about improving yields and fruit quality and building capacity to deal with biosecurity issues.

As part of the project, Dr Dann will work with industry to help prevent the spread of any avocado disease outbreaks in nurseries and orchards around Australia.

"My work has a strong field component," Dr Dann said. "I am constantly reviewing the disease management practices, and trialling new products or approaches for reducing the impact of the many diseases which affect avocados."

While Dr Dann's focus is the management of existing diseases of avocado orchards such as Phytophthora Root Rot, her colleague, Dr Andrew Geering's focus is on developing diagnostic tests to protect the industry against new threats.

"Sometimes the biosecurity threats are well understood but others seem to pop out of the blue," Dr Geering said.

"A good example of a pest that was not previously on anyone's radar is the fungal disease Laurel wilt, which is spread by the tiny Redbay ambrosia beetle and is now decimating the avocado industry in Florida.

"As soon as the beetle bores into the trunk of an avocado tree and introduces the fungus, the whole tree just collapses within a month.

"There is no resistance. We don't have the beetle in Australia yet – but it is vital we have good diagnostic tests for a wide range of pests and pathogens."

Dr Dann said all diseases are manageable. "We just need the tools and the capacity to maintain current biosecurity processes, and to meet emerging challenges."

Acknowledgements



Queensland Alliance for Agriculture and Food Innovation (QAAFI) researchers Dr Liz Dann and Dr Andrew Geering. Photograph: QAAFI, The University of Queensland.

Maximising yield and reducing seasonal variation (AV16005)

Service Provider	CSIRO
Project Leader	Harley Smith
Start Date	31/5/2017
End Date	31/12/2020
Funding Type	Hort Innovation Avocado Fund

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

As the project team report, fruit tree production is dependent upon mechanisms regulated by the nutrient status of the tree, as well as environmental cues. However, production is significantly limited by the fact that vegetative shoot growth coincides with fruit development, which results in resource competition for the carbohydrates, other nutrients and hormones necessary for maintaining growth.

This competition impacts on the early stages of fruit development, as shoot growth diverts resources, resulting in fruit growth cessation followed by abscission – a key event that limits avocado production.

The project has begun looking at relevant knowledge and knowledge gaps in this area, working with international experts and bringing together information from model plant systems and existing industry research to delve into how reproduction events are regulated (including pollination, fertilisation, fruit set and fruit abscission) and what the physiological mechanisms of resource competition and fruit growth cessation are.

This information is what is needed to allow key intervention points to be identified, to in turn develop effective management tools to limit abscission and enhance growth and development.

Field trials are upcoming, including those looking at factors affecting timing and degree of fruit abscission including pruning and fertilisation treatments.

The project will also be developing tools and systems to address the physiological basis of high productivity. It will begin using a rootstock trial to look at the role of rootstock-scion interactions in regulating yield, and will look to develop a method to manipulate stored carbohydrates to better understand the role of carbohydrates in resource competition.

Enhanced National Bee Surveillance Program 2016-2021 (MT16005)

Service Provider	Plant Health Australia
Project Leader	Jenny Shanks
Start Date	12/12/2016
End Date	12/12/2021
Funding Type	Hort Frontiers Pollination Fund

Now part of the Hort Frontiers Pollination Fund (including the avocado R&D levy), this multi-industry investment is delivering a nationally coordinated bee-pest surveillance program to help safeguard honey-bee and pollinator-dependent industries in Australia. It builds upon the previous National Bee Pest Surveillance Program (MT12011), and includes upgrading sentinel hive arrays, strengthening relationships with surveillance operators, the introduction of new elements such as Asian hornet screening and more. The surveillance is designed to enable the early detection of high-priority pest incursions that can impact on honey bees, providing the best opportunity for successful pest eradication. The avocado industry is one of several contributors to the project's work.

The project team recently visited a number of the surveillance program's sites. This included meeting with the Commonwealth Operational Science Services at Tullamarine Airport to discuss swarm capture and the risks at sea and airports with cargo and trade, and with AgVic Apiary Officers at ports in Melbourne and Geelong to inspect sentinel hives and catch boxes. There were also lessons on 'bee-lining' (following bees back to their nest) with AgVic Apiary Officers and the Bee Biosecurity Officer for Victoria. Finally, the Beekeepers Association of the ACT discussed implementation of the program in the Canberra region. These visits and activities allow contact with state-based apiary biosecurity officers and volunteer beekeepers who are familiar with the port environment and conditions, the location of hives, and have experience with handling honey bees. They are also a chance for apiary officers to provide feedback and informal progress reports on their work to Plant Health Australia, and to strengthen the relationships between people working in the program.



Avocado Strategic R&D Levy Investment - Program Overview continued

Underpinning projects

National Avocado Industry Communications Program (AV15002)

Service Provider Avocados Australia Limited

Project Leader John Tyas

Start Date 02/11/2015

End Date 02/11/2018

Funding Type Hort Innovation Avocado Fund

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

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

The National Avocado Industry Communications Program strives to inform and engage all stakeholders ranging from growers, suppliers, exporters and importers, wholesalers, retailers, decision-makers from government and non-government organisations, the media and the general public.

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

This project was reviewed in 2018, via Independent mid-term review of the avocado communication program (AV17003). Recommendations from this review are being implemented.

Industry Annual Reports & Industry Advice and Grower Consultation

Service Provider Hort Innovation

Project Leader Corrine Jasper

Start Date ongoing

Funding Type Hort Innovation Avocado Fund

Hort Innovation has ongoing projects to fund the advisory mechanism under Hort Innovation. This includes the strategic investment advisory panel (SIAP) and attendance by growers

at meetings to provide advice on strategic R&D investment and marketing investment through individual project committees, such as evaluation panels and other meetings. It includes the strategic investment advisory panel flights, accommodation and attendance and also evaluation panel time and attendance and input into various project steering committees by growers and industry stakeholders as needed.

In addition, Hort Innovation produces and Industry Annual Report, available at <https://horticulture.com.au/grower-focus/avocado/>.

Multi-scale monitoring tools for managing Australian Tree Crops: Industry meets innovation (ST15016)

Service Provider Hort Innovation

Project Leader Andrew Robson

Start Date 20/08/2015

End Date 16/05/2018

Funding Type Rural R&D for Profit Grants Programme

The Multi-scale monitoring tools for managing Australian Tree Crops: Industry meets innovation is an overarching project, funded via a grant awarded to Hort Innovation in May 2015 as part of the Rural R&D for Profit programme from the Australian Government. The purpose of this grant was to fund a collaborative research and development (R&D) project to support continued innovation in Australia's primary industries.

Among the achievements of this project were:

- a new online tool to enable quicker and more targeted biosecurity and disaster planning and responses, the Australian Tree Crop Rapid Response Map - <https://bit.ly/2OKORBO>
- research into the potential of using high resolution satellite imagery and targeted ground sampling to determine yield and fruit size variability - www.mdpi.com/2072-4292/9/12/1223/htm.

This project involves funding from the Australian Government Department of Agriculture and Water Resources' Rural R&D for Profit program and was delivered with support from Hort Innovation and coordinated by the University of New England. The success of the project can be attributed to the multi-disciplinary team from industry, research/academia and government, including The University of Queensland

University of Sydney, Central Queensland University, Agtrix Pty Ltd, the Queensland Department of Agriculture and Fisheries, Queensland Department of Science, Information Technology and Innovation, Simpson Farms Pty Ltd, Avocados Australia, Australian Macadamia Society and Australian Mango Industry Association.

Transforming subtropical/tropical tree crop productivity (AI13004)

Service Provider Queensland Department of Agriculture and Fisheries Queensland

Project Leader John Wilkie

Start Date 20/11/2013

End Date 01/12/2018

Funding Type Horticulture Transformational Industry Fund

This project is investigating the potential for orchard intensification in tropical orchard production systems. The goal: small trees, high productivity. Trial blocks for trial crops including mango, avocado and macadamia are established in Queensland and northern New South Wales.

This program has the potential to transform the commercial productivity of subtropical and tropical tree crops. There are aspects of the methodology that offer the application of cutting edge science to Australian horticultural tree crop industries, in particular research into areas of molecular genetic regulation of floral initiation and tree architecture. Other aspects of the methodology, such as portions of the applied physiological and horticultural experimentation and germplasm evaluation offer the potential for significant improvements in understanding and productivity when applied to avocados, mangoes and macadamias. The integration of the program components into a unified and ordered approach is this program's greatest strength and is probably unique for subtropical and tropical tree crops

The Key Research Components (KRCs) are: vigour management, architecture, canopy light relations, and crop load.

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

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Producing better fruit by innovation

Rootstocks for high density planting: trial update

Helen Hofman, Queensland Department of Agriculture and Fisheries

As part of the Small Tree High Productivity Initiative, we are evaluating a range of rootstocks that are commercially available in Australia to see how they perform in a high-density planting of Hass.

In Phase One of this trial, established in May 2016, we planted Hass on nine different rootstocks: 181, Ashdot, Bounty, BW2, Dusa, Latas, Reed, Velvick and Zutano. In Phase Two, planted in January 2018, we are comparing Hass on a range of clonally-propagated rootstocks (A10, Reed, Velvick, Zutano and Dusa) as well as Velvick seedling rootstocks.

In addition, we have included Gem on Zutano rootstocks and Maluma on Velvick rootstocks following reports of success in using these scions in high density plantings overseas.

The trees are planted at the Bundaberg Research Facility in Central Queensland at a two-metre spacing with 4.5 metres between the rows, with 12 replicates of each rootstock. The trees are tied to a single upright three-metre high trellis and pruned to a single central leader. We are aiming for a good distribution of strong, horizontal branches in a 'Christmas tree' shape, maximising the light received by the whole canopy.

In May 2018, we harvested the first crop from the Phase One rootstocks. Yield and other key characteristics are shown in Table 1. On average, we harvested 3.5kg per tree, that is, 3.9 tonnes per hectare. Yield per tree was, as expected for a



Phase 1 of the rootstock trial in May 2018, with Technical Officer Carola Parfitt

first crop, highly variable and there were no consistent yield differences between the rootstocks. The variations we recorded in flowering intensity and timing (reported in the Summer 2018 issue) had little effect on final yield. Dusa, Bounty and Latas flowered slightly earlier, and Dusa and Latas more intensively, than those on other rootstocks. Trees grafted on Velvick were the latest to flower. The only difference in yield efficiency between rootstocks was that yield per cubic metre of canopy at flowering was higher for Ashdot than for any of the other rootstocks.

Our experience with canopy shading and branch death in the Small Tree-High Productivity Initiative's Planting Systems Trial (see Page 68) prompted us to take a different approach to pruning in this rootstock trial. We are pruning far more frequently and are much 'stricter' in keeping trees to their space and shape, particularly removing growth from the 'shoulders' which shade the lower part of the canopies. We have pruned the trees to the same canopy size with pruning in winter, after

Table 1: Key characteristics of Hass on various rootstocks, Bundaberg Research Facility, 2018

	Rootstock CSA (May 2018) (cm ²)	Scion CSA (May 2018) (cm ²)	Scion/rootstock CSA ratio (May 2018) (cm ²)	Yield per tree (kg)	Yield efficiency (kg/m ³ of winter canopy)	No. of pruning cuts >10mm dia
Zutano (s)	84 d	65 ab	0.79 a	4.1 ns	0.68 a	20 bc
BW2 (s)	75 cd	66 ab	0.87 ab	3.2 ns	0.53 a	22 c
181 (s)	75 cd	70 bc	0.95 bcd	3.1 ns	0.43 a	20 bc
Ashdot (s)	69 bc	66 ab	0.99 cd	4.4 ns	1.20 b	13 a
M2 (Dusa) (c)	54 a	60 a	1.13 e	4.7 ns	0.73 a	19 bc
M1 (Latas) (c)	71 c	71 bc	1.02 de	3.6 ns	0.60 a	20 bc
Velvick (s)	83 d	77 c	0.94 bcd	4.3 ns	0.67 a	21 bc
130 (Reed) (s)	75 cd	67 ab	0.89 abc	2.7 ns	0.69 a	16 ab
Bounty (c)	59 ab	59 a	1.03 de	3.9 ns	0.73 a	15 ab
<i>Pvalue</i>	<i><.001</i>	<i>0.01</i>	<i><.001</i>	<i>0.312</i>	<i>0.013</i>	<i>0.045</i>

Seedling rootstock (s)
Clonal rootstock (c)

CSA cross-sectional area. Means within the one column followed by the same letter or by 'ns' are not significantly different at the 95% confidence level. P values <0.05 indicate > 95% confidence that rootstock differences are significant.

the spring flush and after the summer flushes. Of the rootstocks, the trees on Ashdot have required less pruning than trees grafted on most of the other rootstocks.

There are some differences in rootstock and scion cross-sectional areas (CSAs) of the trunks, which are of interest in light of the high scion/rootstock CSA ratio evident in the Ashdot rootstocks measured in the Small Tree-High Productivity Initiative Planting Systems Trial (see Page 68). A scion/rootstock ratio that is >1 suggests the root system is growing more slowly than the above-ground structure, and may mean the tree is slightly stressed and/or the supply of hormones produced in the roots is reduced.

In the Phase One trial, Ashdot rootstocks are, to date, not showing the same trend. Dusa, and to a slightly lesser extent Latas and Bounty, rootstocks have smaller rootstock CSAs and higher scion/rootstock ratios. These differences can disappear as the trees mature, so we will continue monitoring.

More information

We will report in future issues on whether any of these characteristics change or continue and lead to differences in yield, and whether our pruning strategy helps us to better manage canopy vigour, branch structure and the light environment of the trees. Also, as Phase Two plantings start producing, we'll provide an update on how these are performing. Growers are welcome to visit the trial site at the Bundaberg Research Facility.

Please contact Helen Hofman at Helen.Hofman@daf.qld.gov.au.

Acknowledgements

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A key element of this initiative has been co-funded by Hort Innovation – using the across horticulture levy, contributions from QDAF and funding from the Australian Government – through the Hort Innovation project *Transforming tropical/subtropical tree crop productivity* (AI13004). We are especially grateful to Hort Innovation and the various associated industries and horticultural businesses for their support for this initiative.



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

Service Provider	Nursery & Garden Industry Australia
Project Leader	John McDonald
Start Date	30/08/2017
End Date	30/08/2018
Funding Type	Hort Innovation Avocado Fund

The long-running Avocado Nursery Voluntary Accreditation Scheme (ANVAS) was reviewed as part of a previous levy-funded project, and this new investment is now intended to implement the recommendations from this work - updating and improving the scheme and its guidelines to ensure they are best placed to protect the industry's productivity and profitability, aligning with new technologies and emergent pathogens. This includes transitioning the ANVAS nursery production requirements into the Nursery Industry Accreditation Scheme Australia (NIASA). At the time of writing, the project team had completed a set of final draft guidelines as an 'Avocado High Health Production' appendix to NIASA for final consultation.

ANVAS supports sound nursery practices, the use of virus-tested and registered sources of seed and budwood, and the exclusion of soil-borne plant pathogens and roots diseases. Participation in the scheme has been voluntary, with any nursery operator that meets ANVAS requirements able to apply for accreditation.

Avocados Australia will provide updates as they become available.

Review of national biosecurity plans (MT17003)

Service Provider	Plant Health Australia
Project Leader	Rodney Turner
Start Date	10/11/2017
End Date	30/11/2020
Funding Type	Hort Innovation Avocado Fund

This project is for and funded by both the avocado and mango industries. It is responsible for reviewing and updating the industries' biosecurity plans – top-level documents that identify high-priority endemic and exotic pests, diseases and weeds, along with the risk mitigation activities required to reduce their biosecurity threat, and surveillance and diagnostic activities. They provide a strategic framework for industry and government to work together to improve preparedness for and response to these potential threats.

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

Avocado Strategic R&D Levy Investment - Program Overview continued

Research and Development

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

Service Provider Peracto
 Project leader Jodie Pedrana
 Start Date 27/04/2018
 End Date 30/11/2020
 Funding Type Hort Innovation Avocado Fund

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

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

Avocado industry minor use program (AV16002)

Service Provider Hort Innovation
 Project leader Jodie Pedrana
 End Date ongoing
 Funding Type Hort Innovation Avocado Fund

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

All current minor use permits for the industry are searchable at portal.apvma.gov.au/permits.

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Across Industry R&D program

Prior to the establishment of the Hort Frontiers initiative with its broad range of co-investors, levy industries contributed to 'across-horticulture' projects to address issues facing horticulture as a whole. Below are the remaining legacy investments from this particular across-horticulture funding stream, some of which are winding down and some that will be continued under different funding models at their conclusion.

More information

For further details on specific projects, we encourage you to contact Corrine Jasper on corrine.jasper@horticulture.com.au.



Project No	Title	Project Start	Project Completion	Organisation
AH11011	Horticulture funding of the CRC for Plant Biosecurity	30/06/2012	30/05/2018	CRC For National Plant Biosecurity
AH13027	Plant protection: Regulatory support and co-ordination - Continuation of AH09003	31/05/2014	01/07/2018	AKC Consulting Pty Ltd
AH13033	Investing in Youth Successful Scholarship Applicant	27/06/2014	31/05/2018	AgriFutures Australia
AH15001	Horticulture Statistics Handbook 2015-2018: find these handbooks via https://horticulture.com.au	07/12/2015	20/12/2018	Hort Innovation
AH15002	National Fruit Fly Strategy Council – Phase 2	03/11/2015	01/10/2018	Plant Health Australia

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Research and Development

Ongoing rootstock trial Tristate region

Dr Liz Dann, University of Queensland

This article summarises the growth and yield parameters of trees in the ongoing rootstock trial in the Tristate region, at Waikerie, South Australia, measured in September 2017.

The data for 2013-2016 is presented in *Talking Avocados*, Volume 28, Issue 1, Pages 30-34, or check out the Best Practice Resource! Login, select Library, Event Proceedings, then scroll down to Study Group – Tristate – Meeting 6, and open the last file, Tristate Rootstock Trial Update - Liz Dann (QAAFI).

The rootstock trial in the Riverland region of South Australia, was planted in early October 2012 as a final activity of Dr Tony Whaley's project *Rootstock Improvement for the Australian Avocado Industry* (AV08000). It was planted six years later than the other rootstock trials due to the extended drought in the area and the lack of water for irrigation from the Murray River. *Table 1* lists the rootstocks planted in the trial, and provides some comment on each.

Nine seedling rootstocks were chosen for this experiment. Following advice from local growers no pure Mexican race material was chosen for testing at this site due to past experience with high salinity in irrigation water (Mexican race varieties have the greatest susceptibility to salinity). All rootstocks were grafted with Hass.

Tree height, canopy diameter, yield (kg) and number of fruit per tree were recorded for all trial trees in September 2017. Edranol polliniser trees were included in the trial design, to determine whether yields of nearby Hass trees were affected (increased) by cross-pollination with a "B" type flowering variety.

However, annual observations from 2013-2017 confirm that Edranol flowers some weeks earlier than Hass at this site, and is

thus not likely to be having an effect on pollination success and resulting yields.

Tree height in 2017 had increased by 35-79cm over the 2016 measurements. Trees on Zutano, Reed and Velvick rootstock were the tallest and had the greatest canopy diameter (*Table 2*). Canopy volume of trees on these rootstocks (16.8-18.2 m³) was also significantly greater than those of TT and A10 (less than 12.1 m³). In fact, the canopy volume of these three rootstocks nearly doubled in the 12 months since September 2016.

Tree yield in 2017 was phenomenal! In 2016 there was less than one bin harvested from the trial (366kg), but the 85 trees in 2017 yielded 6.44 tonnes, or 14 bins! This converts to approximately 18.2t/ha. Yield and fruit numbers per tree were not significantly different among rootstocks (due to large tree-to-tree variability even within each rootstock), however, A8 had an average yield per tree of 94kg, then Velvick at 83kg, Zutano, Reed, SHSR02 and A10 with yields between 72kg and 79kg per tree and AA1, Ashdot and TT with much lower yields (*Table 2*). (The highest yielding trees in 2016 were on A8, A10, AA1 and Zutano rootstock.)

There were significant differences amongst rootstocks for average fruit weight (*Table 2*). Fruit weight was greatest at approximately 250g per piece for A8, Velvick, Zutano and Reed, the highest yielding trees. The lightest fruit was 207g per piece from TT rootstock, with between 220g and 235g per piece for the other four rootstocks.

Yield efficiency (YE) is the kilograms of fruit harvested in September 2017 per volume of canopy measured in September 2016, since it was the previous year's growth which drove flowering and fruit set in spring 2016. There were significant differences in YE amongst rootstocks (*Table 2*). YE from TT

Table 1. Seedling rootstocks used in the Riverland avocado rootstock experiment planted at Waikerie on 3 October 2012. All rootstocks were propagated to Hass. At least 10 replicates of each rootstock (except Reed where there were eight trees) were planted in a randomised block design. (Reproduced from AV08000 Final Report)

Rootstock	Horticultural race	Comments
AA1	Guatemalan	AA1 An Anderson's nursery rootstock currently untested in the rootstock project.
A8	Guatemalan	An Anderson's nursery rootstock with good performance at some sites in the rootstock project.
A10	Guatemalan/ Mexican	An Anderson's nursery rootstock with good performance at some sites in the rootstock project.
Ashdot	West Indian	A Birdwood nursery rootstock (from Israel) with dwarfing characteristics and high yield efficiency.
Reed	Guatemalan	Reed is used extensively as a rootstock in Western Australia. Good production at some sites in the rootstock project.
SHSR02	Guatemalan	Consistently amongst the top yield rootstocks at sites across the rootstock project. Has good resistance to Phytophthora root rot.
TT	West Indian	An unknown rootstock with strong West Indian characteristics. Should have good salt tolerance.
Velvick	West Indian/ Guatemalan	Currently the most widely used rootstock in Australia. Consistently amongst the top yield rootstocks at sites across the rootstock project.
Zutano	Guatemalan/ Mexican	Currently the main rootstock used in the Riverland and New Zealand. Good performance at some sites in the rootstock project.

Table 2. Growth and yield of Hass trees grafted to different rootstocks recorded in September 2017, nearly five years after planting at Waikerie, South Australia.

Rootstock	n	Height (cm)	Canopy diam (cm)	Canopy volume (m ³)	n	Yield (kg/tree)	Fruit size (g)	Yield Eff.
AA1	10	326 cd	388 abc	13.7 bc	9	65.7	222 cd	7.63 d
A8	6	364 abc	381 abc	14.2 abc	8	94.0	248 abc	11.1 b
A10	11	334 c	352 cd	12.1 c	11	72.5	231 bcd	10.9 b
Ashdot	3	322 bcd	366 abcd	11.9 abcd	3	57.9	230 abcd	10.4 bcd
Reed	6	392 ab	414 ab	17.8 ab	6	76.4	251 abc	8.20 bcd
SHSR02	12	350 bc	373 bc	13.1 bc	12	76.2	237 abc	10.3 bcd
TT	7	273 d	303 d	6.97 d	7	53.3	207 d	14.7 a
Velvick	20	380 ab	419 a	18.2 a	19	82.8	255 a	8.27 cd
Zutano	10	400 a	398 abc	16.8 ab	10	78.6	248 ab	9.65 bcd

n= number of replicate trees. Discrepancy in tree numbers for height and yield is due to missing data, eg. missed measuring or picked accidentally by farm staff when nearby commercial trees were picked.

Within each column, means followed by the same letter are not significantly different $P < 0.05$

Yield efficiency is the kg of fruit per m³ of the canopy volume measured in 2016

rootstock was significantly higher than that from all other rootstocks. A8, A10, Ashdot and SHSR02 had YE greater than 10kg fruit/m³. Reed, Velvick and Zutano had YE of approximately 8-10.

Unfortunately, crop load for 2018 looks very light, and trees have grown substantially without a crop to retard growth. Therefore, both yield and YE in 2018 will be low.

Acknowledgements

This trial was initiated under AV08000, and data collection was supported by the *Avocado rootstock assessment and*

improvement -Interim project (AV13018 - 2013-2015), the South Australian Avocado Growers Association (2016) and the *Maximising yield and reducing seasonal variation* project (AV16005). I thank Kym and Craig Thiel for their collaboration, and Chuck and Ken for their help with harvesting the trial in 2017. Thanks also to Dr Harley Smith for bringing a team of research staff to help with the picking and data collection.



Participants at the Tristate Study Group meeting, held 30 March 2017 (photo courtesy Simon Newett, Queensland DAF).

Growers believe non-bee insects are important pollinators

By Brad Howlett¹, Megan Gee¹, Mike Garratt²

The results of an online survey from 43 Australian avocado growers found that most believe non-bee pollinators such as flies, beetles, moths or butterflies play an important role in the pollination of their avocado orchards.

The survey aimed to understand grower knowledge of pollinators within their crops. The findings will later be compared with those from growers of a range of crops from around the world. This information is important to better understand more broadly the role of pollinator diversity across crops in different growing regions, where and how growers learn about their pollinators, and what further information growers would like to help to improve pollination.

The role of bee and non-bee pollinators

A recent scientific study funded by Hort Innovation and Plant & Food Australia on avocado pollination in the Sunraysia region of Australia found non-bee insects, particularly flies and beetles, to be more important pollinators across orchards than honey bees.

In some orchards honey bees and other bee species were completely absent during orchard surveys, demonstrating that non-bee pollination can be critical for crop yields. However, it is unknown whether this is the same for other regions across Australia, or whether growers consider non-bee pollinators as important. Here are some findings from a recent online questionnaire posted to growers.

Honey bees

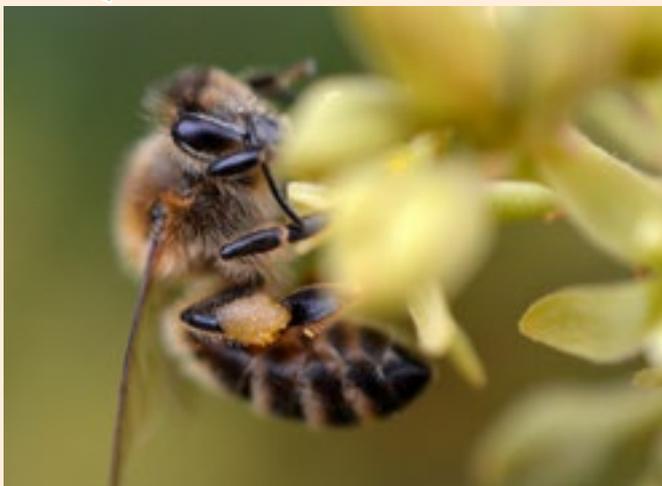


Figure 1. Many Australian growers place managed honey bee hives in their avocado orchards for pollination.

Honey bees (Figure 1) are the most commonly used managed pollinator by growers of avocado. Of the growers that responded to the question on whether they used managed honey bees for pollination, 24 indicated they did, compared with 15 who did not. Just under half the growers thought that honey bees were very important pollinators, while just five believed they were either minor pollinators or did not play a role in pollination (Figure 2).

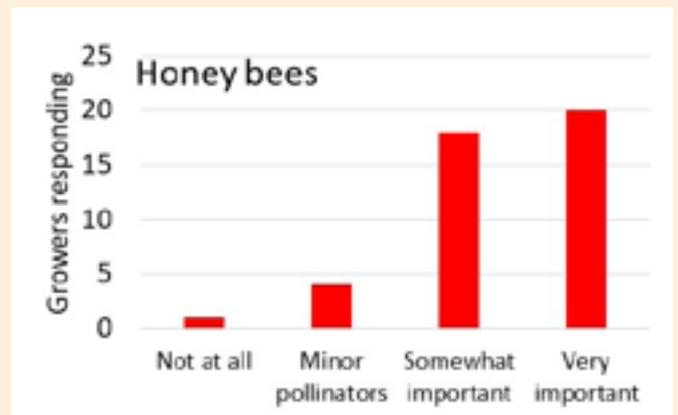


Figure 2. Most Australian growers surveyed believed honey bees play a somewhat important or very important role in pollinating their avocado orchards.

Native bees

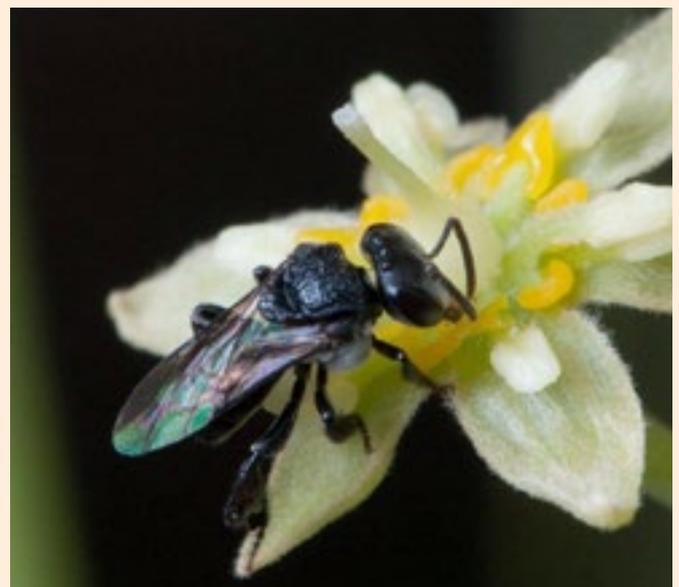


Figure 3. Native bees such as this stingless bee may play a useful role in the pollination of avocado in some Australian orchards. Photograph: Brian Cutting, Plant & Food Research.

Australia has a diverse array of native bee species, including solitary ground nesting species such as *Leioproctus*, *Lasioglossum* and blue banded bees, as well as social species such as stingless bees (Figure 3). In the Sunraysia region, native bees were rarely seen visiting flowers of avocado, but stingless bees were found to visit orchards near Bundaberg and therefore could provide pollination in some locations. Most growers believed native bees play a somewhat or very important role in the pollination of their orchards (Figure 4).

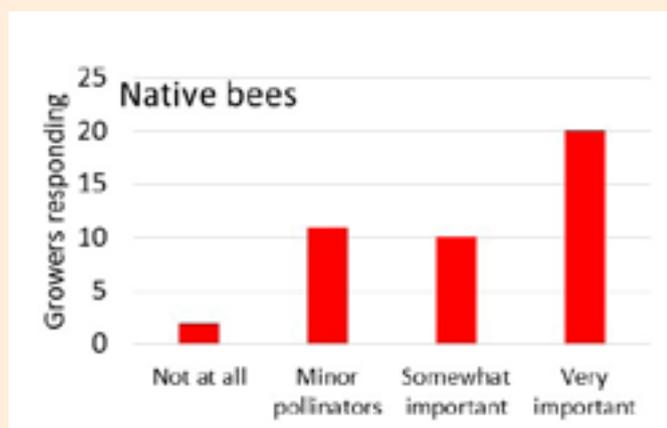


Figure 4. Many Australian growers surveyed ranked native bees as somewhat important or very important pollinators in their avocado orchards.

Flies

Scientists were surprised by the key role that flies (Figure 5) can play in the pollination of avocado orchards in the Sunraysia region, but this result may not be so surprising to Australian growers. All but one of 42 growers who ranked the importance of flies believed they play some role in pollination. Moreover, 24 growers believed them to be very important pollinators (Figure 6). Growers commented that hover flies and blow flies were common fly pollinators. This is in agreement with the scientists' findings from Sunraysia (Figure 6).



Figure 5. Brown blow flies, along with other flies, can be important avocado pollinators. Photograph: Brian Cutting, Plant & Food Research.

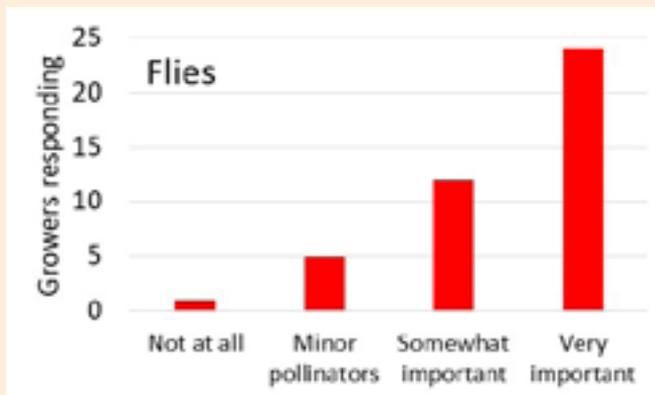


Figure 6. Most Australian avocado growers surveyed ranked flies as important pollinators in their orchards.

Beetles



Figure 7. Beetles such as lady beetles are proven pollinators of avocado. Photograph: Brian Cutting, Plant & Food Research.

Although many growers considered beetles (Figure 7) to play a role in pollination, overall more growers thought they played less of a role in the pollination of their orchards than flies and bees (Figure 8 - next page). Scientists have demonstrated that beetles are capable pollinators in Australia; however, similar to the results of this survey, the importance of their role varied widely between orchards.

Growers believe non-bee insects are important pollinators continued

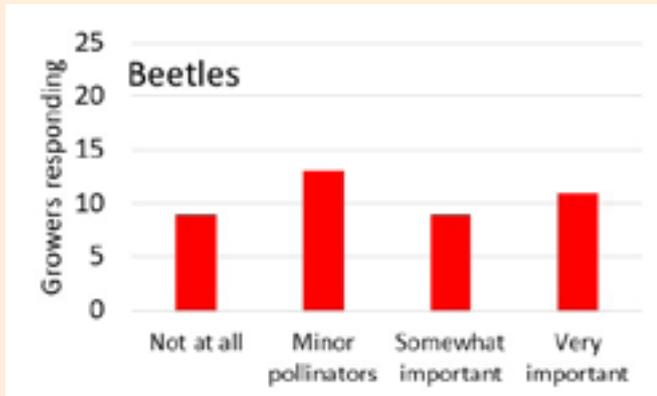


Figure 8. Although Australian growers surveyed generally ranked beetles as less important avocado pollinators than bees and flies, they were still often considered to play some role in pollination.

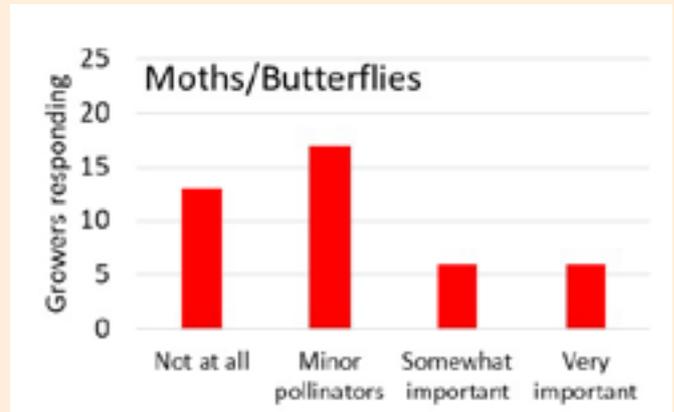


Figure 10. Some Australian growers surveyed thought moths and butterflies play a role as avocado pollinators, but generally they were regarded as less important pollinators than bees, flies and beetles.

Butterflies and Moths

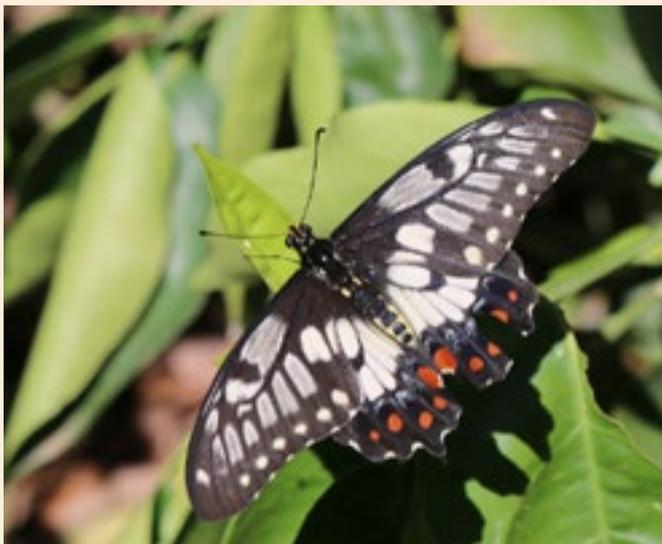


Figure 9. Little is known about the role of butterflies and moths as pollinators of avocado. Some Australian growers surveyed think they may play a role. Photograph: Victoria Potdevin, University of New England.

Although butterflies (Figure 9) can be important pollinators of some plants, scientists did not find evidence that they provided significant pollination to avocado orchards in Sunraysia. Moths may play a role as pollinators of avocado at night, but this has not been well studied. Overall, growers considered butterflies and moths to be less important in the pollination of their orchards although many thought that they play a role (Figure 10).

Other pollinators

The only other insect growers mentioned as avocado pollinators were ants (Figure 11). Two growers believed ants to be very important pollinators, and a further two considered them as somewhat important.



Figure 11. Some Australian avocado growers believe ants can play a role in the pollination of their crops. Photograph: Victoria Potdevin, University of New England.

How do growers know about non-bee pollinators?

Growers indicated that most of their awareness of non-bee pollinators has come through their own observations, with 37 growers indicating that they have seen these insects on their flowers. Ten growers had developed awareness through grower workshops, nine through discussion with other growers, seven through farm advisors/agronomists, seven through growers' magazines or pamphlets, seven through scientific publications or discussion with scientists, and just one through media such as internet, radio or television. These findings suggest the need

for further extension of existing scientific knowledge to growers, particularly about the efficiency of pollinators.

What further knowledge would growers like?

The findings from the questionnaire highlighted that many growers pay attention to what is pollinating their orchards. The findings reflect the limited scientific studies that have demonstrated the important but sometimes variable roles of non-bee insects as pollinators of avocado in Australia.

Many growers have indicated they would like verification that non-bee pollinators actually pollinate their avocado trees. Scientists have recently quantified the effectiveness of specific flies, such as blow flies and hover flies, and of lady beetles in Sunraysia orchards. Their ability to pollinate was found to vary between species, but some were of similar efficiency to honey bees. A brochure on how growers can improve their pollination in avocado orchards, including a summary of the efficiency of common fly and beetle pollinators, can be found at: <http://beeaware.org.au/wp-content/uploads/2018/03/Avocado-pollination-brochure.pdf>.

Several growers also indicated that they would like further information on management strategies to boost non-bee pollinator numbers. Techniques to manage non-bee insects remain poorly developed; however, scientists have begun focusing on the potential management of hover flies that feed on decaying vegetation in water. The larvae of these hoverflies are known as rat tailed maggots, and in some locations can be found in very large numbers. A drawback of increasing the numbers of these flies can be that you may also get mosquito larvae in the watery solution. Other common hoverflies that visit avocado flowers feed on aphids associated with grass. It could be beneficial for growers to observe whether large populations are present on grass in or around their orchards. If so, it may be best to avoid mowing during flowering, to minimise impact on their pollination.

Blow flies may be easy to rear on animal protein, but some species may be problematic to sheep (causing fly-strike) or a nuisance within houses.

Some growers have mentioned that native bush can help to support non-bee pollinators, and overseas research suggests this is often the case. However, one grower cautioned that some non-bee insects can also damage avocado fruit.

Non-bee pollinators are particularly vulnerable to pesticide applications during flowering. Unlike bees, which retreat to their hives/nests later in the day, non-bee insects are more likely to shelter within the trees. Avoiding the use of pesticide application during flowering will limit the loss of non-bee pollinators within the orchard.

More research is needed on how to effectively manage all pollinators of crops including avocado. We would like to continue to work with growers in the future to establish the most practical and effective pollinator management strategies for increasing pollination and crop yield and quality.

More information

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Breeding Varroa-resistant bees

Injecting a natural type of bacteria called *Wolbachia* into the abdomen of honey bees could help to solve a leading cause of honey bee deaths worldwide.

Dr Emily Remnant from the University of Sydney has spent the past 12 months investigating immunisation of honey bees against virulent viruses spread by the Varroa mite.

Varroa is recognised as the world's most damaging honey bee pest. While currently not established in Australia, it poses a huge threat to the international bee keeping industry and the global food supply chain, with the commercial value of honey bee pollination valued between \$200-\$500 billion per annum.

Currently there are no formal strategies in place to protect bees against viruses, but a recent series of trials undertaken by Dr Remnant and her Sydney based research team has shown promising results.

"The aim of my research was to improve honey bee health by developing and enabling a novel method to increase honey bee resistance to viruses using a natural bacterial symbiont, *Wolbachia*," Dr Remnant said.

"The *Wolbachia* method has been shown to reduce virus levels in other insects and is currently used to reduce transmission of the dengue fever virus in mosquitos, which requires the development of *Wolbachia* positive embryos.

"After multiple unsuccessful attempts to inject *Wolbachia* directly into embryos, a complex technique trialled during my fellowship in New Zealand, I developed and implemented an alternative method of injecting *Wolbachia* into honey bee queen abdomens."

Dr Remnant received the Minister

Varroa detection at the Port of Melbourne

Agriculture Victoria and the Australian Government Department of Agriculture and Water Resources (DAWR) are responding to a detection of varroa mite at the Port of Melbourne.

The detection which was made as a ship arrived at the port in late June and was immediately investigated and treated by DAWR.

Acting Chief Plant Health Officer Nigel Ainsworth said Agriculture Victoria was currently undertaking precautionary surveillance of bee hives within a two-kilometre radius of the detection to confirm that it has not spread beyond the Port.

"If you have unregistered hives or are aware of a feral hive and think it is in the surveillance zone, please call our team on (03) 9217 4166 so we can arrange an inspection," Dr Ainsworth said.

Speaking to *The Weekly Times*, Dr Ainsworth said the captain of the vessel noticed bees on board before they arrived in Australia, and notified the Australian Maritime Safety Authority before the ship reached port.

Dr Ainsworth told the newspaper bees were found in a crate that was secured and treated.

"The weather in Melbourne (was) very cold and overcast so it's extremely unlikely the bees went anywhere at all. They were extremely sluggish and lethargic."

Australian Honeybee Industry Council representatives have been consulted in relation to the detection and are working closely with Agriculture Victoria and DAWR.

Surveillance activities include the testing of established sentinel hives, the establishment of new sentinel hives and floral sweep netting which is being undertaken in the port precinct and the adjoining parkland.

Laboratory results from the established sentinel hives have so far been negative for varroa mite.



Dr Emily Remnant, recipient of the Minister for Agriculture and Water Resources Award and AgriFutures Australia sponsored 2017 Science and Innovation Award for Young People in Agriculture, Fisheries and Forestry, with Dr Dave Alden, former AgriFutures Australia General Manager, Research and Innovation.

for Agriculture and Water Resources Award in addition to the AgriFutures Australia sponsored 2017 Science and Innovation Award for Young People in Agriculture, Fisheries and Forestry, for her research in this area

"The two Awards allowed me to establish a microinjection setup in my own lab, with specific equipment and honey bee laying cages from the US and New Zealand, to begin lab trials," Dr Remnant said.

"The initial queen injection protocols showed good results and with continued testing to generate sufficient samples for sequencing and virus testing, I am hopeful that more good things will come."

Generating *Wolbachia*-positive honey bees is critical to the next stage of Dr Remnant's research, as this will determine whether this process can reduce virus levels in honey bees, and contribute to a new way of enabling virus protection in honey bees.

In addition to this, Dr Remnant explains that there is significant potential for the Australian bee keeping industry to play a key role in breeding and exporting virus resistant bees overseas.

"If *Wolbachia* provides honey bees with virus resistance, this knowledge may lead to the breeding of virus resistant honey bees in Australia, before Varroa potentially becomes established.

"Our existing practices in the queen breeding industry are perfectly compatible with enabling the *Wolbachia* technology to be rolled out, including the opportunity to export virus resistant queens to countries already affected by Varroa and associated viruses.



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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

Bioprospecting of mycorrhizal fungi

Columbia (2017): Inoculation and root colonisation of avocado plants with arbuscular mycorrhizal fungi (AMF) has been shown to help the absorption of water and nutrients. Potentially, the use of AMF can be part of a broader management strategy to improve overall productivity. This research is aiming to identify AMF specific for avocado varieties in Colombia, which could improve sustainable crop management practices.

Response of avocados to alkaline water

Spain (2018): Avocado is considered a salt-sensitive species, but the effect of alkaline water on avocados has not been sufficiently studied. Three irrigation schedules were applied, with different salt treatments (alkali salt (NaHCO₃) and neutral salt (NaCl)) to six different avocado rootstocks. Biomass reduction was observed in both salt treatments, and especially in the roots under the alkali stress. Alkali stress also had greater impact on the photosynthetic capacity of the plant.

LiDAR for canopy monitoring

Chile (2018): A ground-based mechatronic LiDAR system and associated algorithms was tested in avocados. The portable system was shown to be accurate, efficient when estimating porosity and crown surface, and can offer growers a useful tool for crop monitoring and decision making.

Pests and diseases

Antifungal biological control of fusarium dieback and phytophthora root rot

Mexico (2018): Research into the use of biocontrol agents (bacteria) to control Fusarium dieback (FD) and Phytophthora root rot (PRR), has been conducted. FD is an emerging disease triggered by fungi associated with two ambrosia beetle species (*Euwallacea fornicatus* species complex), while PRR is caused by *Phytophthora cinnamomi*. The bacteria, sourced from avocado orchards in California, showed a range of inhibitory activity.

Postharvest

Biological control of postharvest anthracnose disease

Mexico (2018): Anthracnose is a fungal disease caused by

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Colletotrichum species. A preventative treatment using a biological control agent (derived from *Bacillus*) reduced severity and incidence of anthracnose disease on harvested avocado fruit. This research provides a possible new approach to management of this disease.

Reducing post-harvest food losses through innovative collaboration

Netherlands (2018): A study of Mexican and Columbian avocado supply chains into the Netherlands identified effective partnerships as the backbone of innovative collaboration, and the largest contributor to the reduction of postharvest losses. They functioned as catalysts of trust, communication, cooperation and innovation, in addition to contributing to reducing structural inefficiencies along food supply chains.

Health

Avocados increase availability of carotenoids

France (2018): Fruits and vegetables are, by far, our main source of carotenoids. The bio-availability of carotenoids can be inhibited by interactions with some compounds in vegetables e.g. fibres and phytosterols. Conversely, the triglycerides in avocados have been shown to improve the bio-accessibility of carotenoids. Understanding these interactions allows dietary

recommendations to be made or food processing or culinary methods used that improve the bioavailability of carotenoids and associated well-established health effects.

Avocado leaves - a source of polyphenolic compounds

Brazil (2017): Avocado leaves were shown to possess diverse polyphenolic compounds with robust antioxidant activity. The research showed that precise control of drying temperature was an important for maintaining high levels of these compounds and associated antioxidant activity.

Effects of avocado on cardiovascular disease

USA (2017): A review to verify the effects of avocado consumption on cardiovascular diseases (CVDs) risk factors showed that the consumption of avocados has a beneficial effect on CVDs prevention, which can be attributed to its monounsaturated fatty acids content, especially oleic fatty acid. However, there was no consensus in the research reviewed as to the amount of avocado needed to confer such benefits.

More information

If you would like more details on any of the snapshots, please contact Jenny Margetts, P2P Business Solutions, at jmargetts@bigpond.com or 0418 215 276.

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

Small Tree High Productivity project update

Helen Hofman and John Wilkie, Queensland Department of Agriculture and Fisheries

The Avocado Planting Systems Trial, Bundaberg

The avocado planting systems trial in Bundaberg, Central Queensland planted in 2014, is a key activity of the Small Tree High Productivity Initiative. This trial synthesises strategies to manage vigour, maximise light interception and distribution, optimise tree architecture and increase crop loads. The trial compares Hass on two rootstocks, Ashdot and Velvick, in three different planting density/tree-training systems: a conventional or low density planting at 9 x 5m (222 trees per hectare) with minimal pruning to date; a medium density planting at 6 x 3m (556 trees per hectare), pruned to a central leader to approximate a cone shape to improve canopy light distribution; and a high density planting at 4.5 x 2m (1,111 trees per hectare), trained and pruned onto a trellis, also with a single central leader. The trees are now around 4.5 to 5 metres high (*Table 1*). Both the medium and high-density trees are 'filling' their planting space, but the low density trees are not as yet.

Effects of planting densities and tree training to date

We have now harvested three crops from these trees. *Figure 1* shows the yields per tree for the three different densities and the two rootstocks from 2016 to 2018, and *Figure 2* shows yields per hectare. On a per tree basis, yields are substantially higher for the low-density trees, reflecting the larger canopy size and the full irradiation of the canopy peripheries. On a per hectare basis, there was no difference between yields for all three planting densities (around 13 tonnes/ha).



High density Velvick



Medium density Velvick

This result is disappointing: by this stage of orchard life we had hypothesised that the more light-efficient tree shapes in the high and medium densities would be delivering higher yields. On a cumulative yield basis over three years, the high densities have the advantage to date, due to their early high yield, with a total of 28.5 tonnes per hectare compared to 21.6 tonnes per hectare for the low-density planting and 23.3 tonnes per hectare for the medium density planting (although $P=0.066$, that is, the data is variable so our confidence that these means are truly different does not meet the 95% confidence standard).

In future years, the low-density plantings are likely to become less efficient as the canopies crowd and the inside of the canopies become less productive. Nevertheless, it is clear that the systems we have established for the high and medium density trees are unlikely to match the performance of other high-density systems established internationally, which are reporting 20 to 30 tonnes per hectare at similar or higher planting densities. So why the difference and what needs to change?

Branching and flowering terminals

The medium and high-density trees are smaller in volume (*Table 1*) and have a simpler structure and thus fewer fruiting sites or flowering terminals (*Table 2*). However, on a per hectare basis, the increased planting density means the number of flowering terminals is about 80% higher for the medium and high-density plantings compared to conventional plantings, so this simplified structure is not the main problem.

Nevertheless, as the trees grow older, the simpler structure may be a disadvantage in terms of branch death and renewal. On average, 16.6% of our sample branches (12 per tree, on five trees per density/rootstock combination) died over the growing season. Some of this death is due to the avocado's natural habit of sacrificing smaller branches that are shaded and/or did not set fruit; but at least 50% of branch death could be attributed to attack by scolytid beetles and subsequent fungal infection. Because tree structure in the high and medium density systems is much simpler, relying on branches radiating from a single central trunk, the lost branches in the higher densities had a greater impact on fruit load than those planted at low density. The percentage of fruit in spring on branches that later died in

the low-density plots was 4%, in the medium-density plots 6%, and the high-density plots 15%.

Fruit set and summer drop

Even when excluding branches that subsequently died, fruit set is much lower and summer fruit drop is much higher on the medium and high-density trees than in the conventional planting (Table 2). The reasons for this, are as yet, unclear. We have begun work to establish the effects of light distribution on flowering intensity and fruit set in each of the planting densities. Our preliminary work shows light levels affect flowering intensity, timing of floral expansion and anthesis and vegetative growth, but in the work we have done to date there is no clear relationship between light levels and fruit set or retention.

It is possible, if planting systems maintain high levels of light interception and within-canopy light distribution, that one of the more important determinants of final yield is overall canopy volume or leaf area. Note that yield efficiencies this year, while higher for the low-density treatment which still has the advantage in terms of full canopy illumination, were similar for the medium and high densities (Table 1). Factors such as root restriction may also be coming into play.



Low density Velvick

Table 1: Average canopy dimensions and yield efficiency in the planting systems trial May 2018

	Rootstock CSA ¹ (cm ²)	Scion CSA ¹ (cm ²)	Ratio of rootstock/scion CSAs ¹	Tree height (m)	Canopy volume per tree (m ³)	Canopy volume (m ³ /ha)	Yield efficiency 2018 harvest (kg/m ³)
Density treatment							
Conventional	318 b	339 c	0.94 ns	4.8 ns	65.5 c	13630 a	1.01 ns
Medium density	203 a	204 b	0.98 ns	4.8 ns	37.4 b	16554 b	0.82 ns
High density	155 a	149 a	1.04 ns	4.9 ns	20.1 a	16483 b	0.78 ns
Rootstock treatment							
Ashdot	197 a	220 ns	0.92 a	4.6 a	37.0 a	14437 a	1.10b
Velvick	254 b	241 ns	1.06 b	5.1 b	45.0 b	16675 b	0.68a

Means within the one column and group followed by the same letter (a, b or c) or 'ns' are not significantly different at the 95% confidence level.¹CSA - cross sectional area

Table 2: Planting Systems Trial flowering and fruit set for each planting density 2017-18

	Flowering terminals per cm ² of branch cross sectional area	Estimated flowering terminals per tree ¹	Estimated flowering terminals per ha ¹	% of flowering terminals that set fruit in spring	% summer drop	% of flowering terminals that set and retained fruit until harvest
Conventional	5.2 ns	2124 c	472,000 a	24% b	25% ns	17% c
Medium density	5.0 ns	1519 b	844,000 b	20% b	29% ns	13% b
High density	5.2 ns	792 a	880,000 b	14% a	46% ns	8% a
P value	0.727	<.001	<.001	0.008	0.097	<.001

Based on counts on 12 branches on sample trees (five trees per density/rootstock combination). Fruit set and drop data excludes branches that died in whole or part over the growing season.

Means within a column followed by the same letter (a, b or c) or 'ns' are not significantly different at the 95% confidence level. P values <0.05 indicate > 95% confidence that density differences are significant.

¹ Based on the base cross sectional area of all branches on sample trees

Lessons learnt

So what do we need to do differently? Our practice of pruning branches off cleanly at the junction with the trunk was successful in reducing unwanted regrowth, but we now recognise we need to leave the bases of these branches to reshoot and provide replacement branches for those that die. We are following this new approach in the rootstock trial (see report in this edition on page 54). We are also planning to trial 'bowl' or 'vase' tree shapes in a medium density planting which may better maintain branching complexity as well as improve light distribution inside the canopy. Our plan is to prune more frequently to reduce shading, to see if this helps in summer fruit retention. We are continuing trials on the use of plant growth regulators to induce branching, enhance flowering intensity and reduce regrowth in the tops.

Small Tree High Productivity project update continued

Rootstock effects

The Planting Systems Trial includes trees on the rootstocks Velvick, a vigorous rootstock commonly used in central Queensland orchards, and Ashdot, an Israeli rootstock which has shown smaller canopy sizes and superior yield efficiency in early years in a previous Queensland trial.

The two rootstocks in the trial are showing significant differences. Ashdot on average has a smaller canopy, 90% of the Velvick height on average and 82% of Velvick canopy volume (Table 1). For yield this year, Ashdot outperformed the Velvick rootstock at a ratio of 1.4 to 1 on a per tree and per hectare basis (Figures 1 and 2). Because of the smaller tree size, this meant that yield efficiency was 1.6 times that of Velvick. On average, the ratio of rootstock to scion cross-sectional area is smaller for Ashdot (Table 1). Ashdot trees also set more fruit on determinate inflorescences (those without a vegetative shoot emerging from the tip): 63% of spring-set fruit compared to 46% of spring-set

fruit on Velvick. These two characteristics – smaller rootstock and determinate flowering pattern – may be related: slight stress or reduced production of cytokinins in the roots are two possible hypotheses to explain the more determinate flowering pattern. The larger proportion of determinate inflorescences contributes to better early fruit set as there is less competition on determinate inflorescences between fruit and vegetative growth. Fewer vegetative spring shoots may also contribute to the smaller tree canopy of the trees on Ashdot.

More information

Growers who would like to see the trial in Bundaberg and share experiences in high density plantings are most welcome! Please contact Helen Hofman (Helen.Hofman@daf.qld.gov.au).

Acknowledgements

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A key element of this initiative has been co-funded by Hort Innovation – using the across horticulture levy, contributions from QDAF and funding from the Australian Government – through the Hort Innovation project *Transforming tropical/subtropical tree crop productivity* (AI13004). We are especially grateful to Hort Innovation and the various associated industries and horticultural businesses for their support for this initiative.

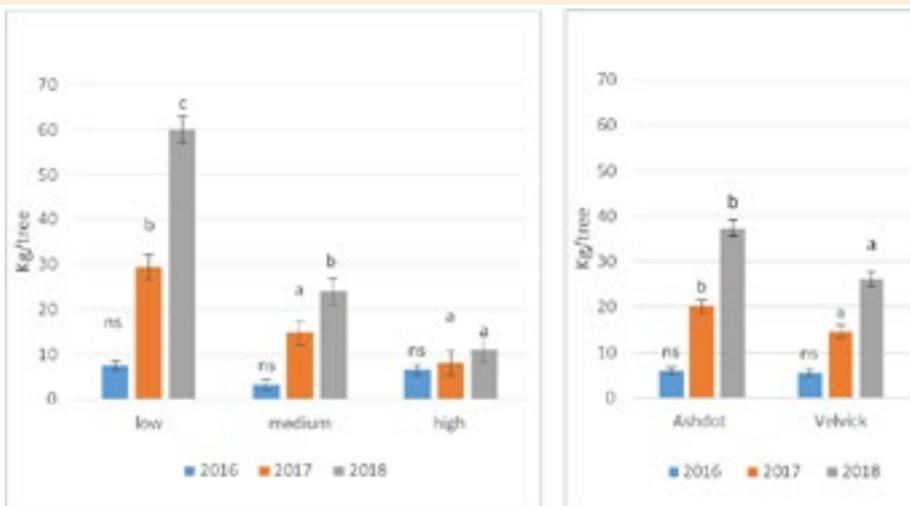


Figure 1: Yield per tree 2016 to 2018 (a) (left) by density/training systems and (b) (right) by rootstock. Means within the same year marked by the same letter (a, b or c) or 'ns' are not significantly different at the 95% confidence level. Error bars indicate + and – the standard error of the means.

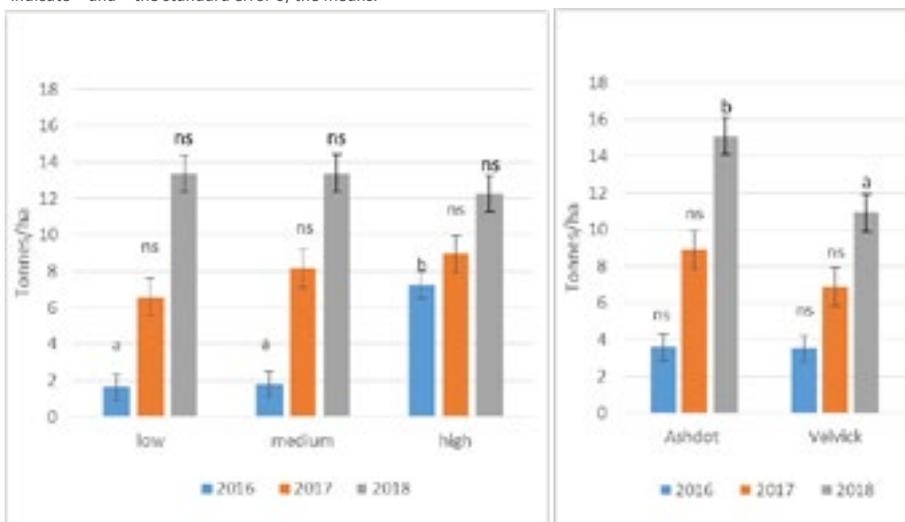


Figure 2: Yield per hectare 2016 to 2018 (a) (left) by density/training systems and (b) (right) by rootstock. Means within the same year marked by the same letter (a or b) or 'ns' are not significantly different at the 95% confidence level. Error bars indicate + and – the standard error of the means.

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News from Around the World

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Mr Avocado expands China operation

Mr Avocado is setting up its first domestic avocado production base in China.

According to *Asia Fruit*, the plantation in China’s Yunnan province will cover more than 6,000 hectares and be managed by Yunnan Avocado Agriculture Development Co Ltd.

Mr Avocado told the *Produce Report* (12 June 2018) that the farm was expected to start producing fruit in 2022, with an output capacity “reaching 100,000 tons”.

“Avocados originating from the farm will be distributed in China under the Mr Avocado brand and under the Mission Produce brand for export markets,” says *Asia Fruit*.

“Presently, China’s supply of avocados is almost completely dependent on imports. Consumption of the fruit had been rising extremely quickly in recent years, and demand is expected to continue growing. Domestically produced avocados have the advantage of being closer to the consumer market, thus greatly cutting the transit time, prolonging the selling season, and helping taste and freshness.”

Since its reveal in 2016, Mr Avocado, the joint venture between Mission Produce, Lantao International and Pagoda, has experienced tremendous growth, according to *Asia Fruit* (30 July 2018).

“The company is now building a new avocado ripening centre in Southern China to complement the service of its Shanghai facility,” *Asia Fruit* reports.

“Growing domestic fruit is yet another step for Mr Avocado to solidify its leading position in the market.”

Mr Avocado Assistant Chairman Liu Mosu told *Asia Fruit* that the YAAD had successfully imported rootstocks from North America.

“The company will set up its own nurseries to produce planting materials in the future,” *Asia Fruit* reported.

“Chinese-grown avocados could be a game changer not only for the vast domestic market, but also its neighbouring markets in Asia. Mr Avocado believes the Chinese supply will have an advantage in distance and price when exporting to other Asian countries, strengthening Mission’s global supply.”



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News from Around the World continued

World Avocado Month

Sales of avocados continue to soar all across Europe with 510 million kilograms consumed in 2017.

According to the World Avocado Organization (WAO), Europe is the world's fastest growing market for avocados. For 2018, WAO expects Europe to consume even close to 600 million kilograms. To celebrate Europe's love affair with the world's favourite super fruit, a series of partnerships, events and offers were held across Europe during World Avocado Month in June.

"The growth of avocados is on a rapid trajectory in Europe, having grown phenomenally in the last five years alone," WAO Chief Executive Officer Xavier Equihua said.

"Yet there is still an abundance of uses for avocados which people have only scratched the surface of. I'm excited to see how Europe's love of avocados will develop as they make these discoveries in the near future."

In the United Kingdom, events included vegan nights and retailer, restaurant and food company partnerships. For example, Tesco tempted consumers with some innovative avo-BBQ combinations. The supermarket hosted a roadshow, which visited 100 stores in 100 days, serving All-American Avodogs and Avoburgers, all from the WAO cookbook, the first ever e-cookbook dedicated to avocados.



Avocado Month display in a Carrefour centre, France

In Paris – the epicentre of avocado consumption in Europe – a cocktail reception was held on the rooftop of the Publicis. Guests included French and international journalists, avocado producers, ambassadors and French retailers. During the event, the Champs-Élysées was lit with a gigantic custom art installation composed of thousands of LED avocado green lights displaying the logo of *Avocado – The fruit of Life* in honour of France’s love for avocados.

Custom activities were also held in Spain, Amsterdam, Germany (the country with the highest avocado consumption growth rate in Europe) and Norway.

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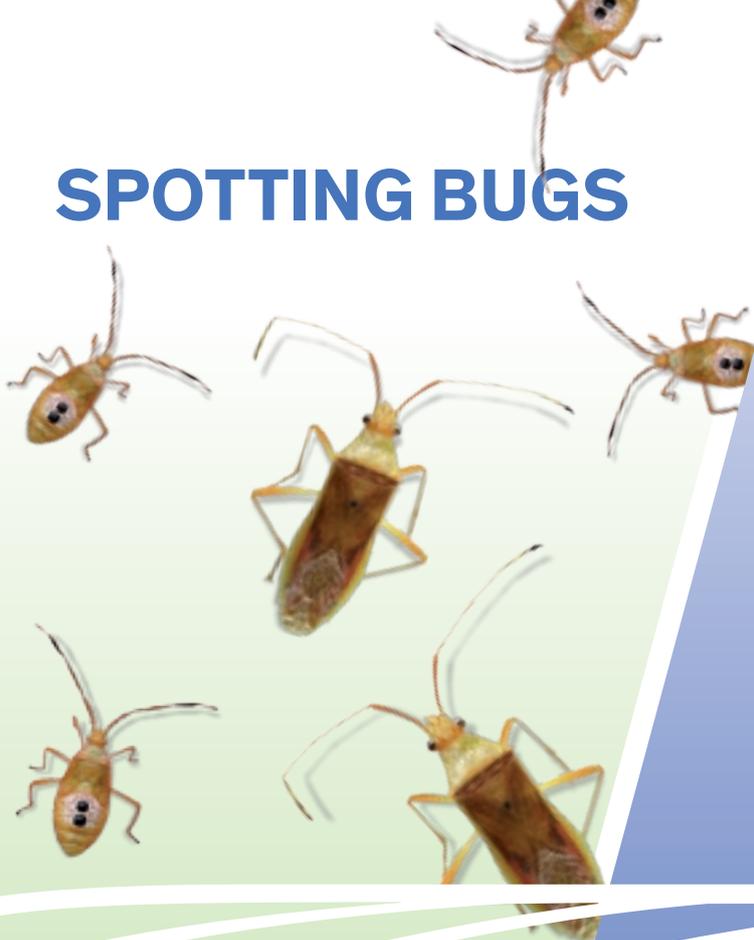
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