

AUSTRALIAN

Citrus News

SPRING 2020



Harvest labour shortage looms

P 5-7



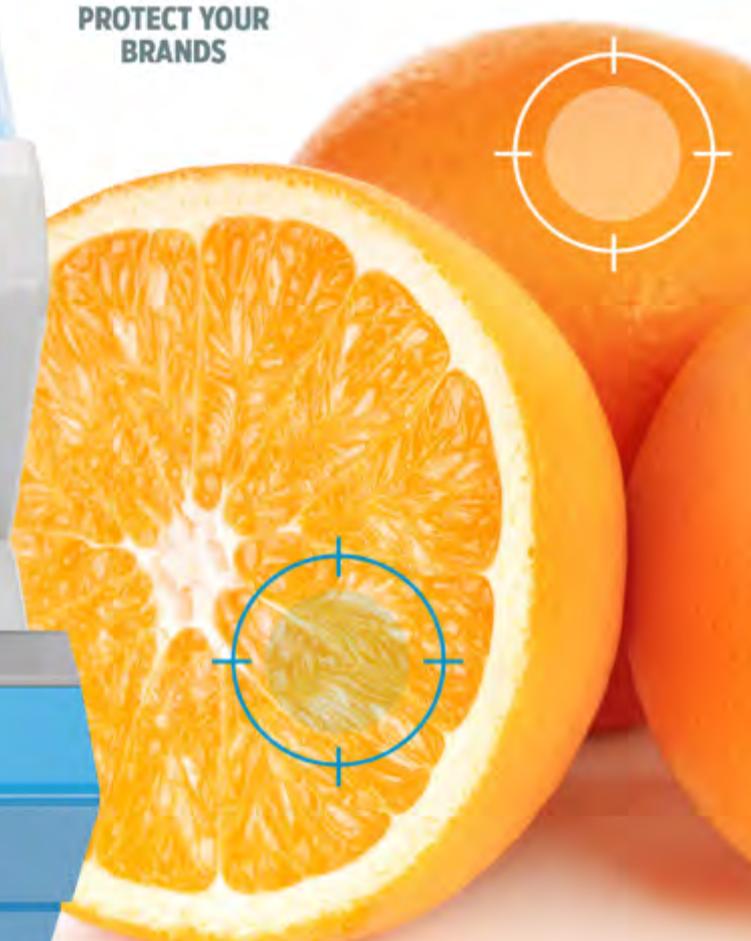
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 94 Lemon Avenue Mildura Vic 3502
 PO Box 10336, Mildura Vic 3502 Australia
 T: (03) 5023 6333
 F: (03) 5023 3877
 E: admin@citrusaustralia.com.au

www.citrusaustralia.com.au

MANAGING EDITOR

Stephen Cooke
 Industry Engagement Manager
 Citrus Australia Limited

M: 0427 124 437
 E: stephen.cooke@citrusaustralia.com.au

ADVERTISING

Shay Linder-Auricht
 Citrus Australia Limited

M: 0428 929 576
 E: shay@citrusaustralia.com.au

DESIGN & LAYOUT

Clare De Luca
 Fresh Republic

M: 0413 563 654
 E: clare@freshrepublic.com.au



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Cover image: Working Holiday Maker, Tom Hubrechts, Belgium, at Nutrano.

OUR CORPORATE PARTNERS





As 2020 draws to a close our work representing industry continues

I'd like to acknowledge every grower for the additional work and effort required this year due to COVID-19.

Additional safety requirements were made at your own time and expense, and national and state border closures also caused great stress for many.

It was a commendable effort to complete the harvest and I'm glad there was appropriate recognition of our great product through strong domestic and export sales.

The work in representing our members and our industry continues for the Citrus Australia team, too.

On top of dealing with industry and government on securing labour for next year's harvest (you can read more on pages 5-7), our small team is working hard for its members on a wide range of issues and continues to shape the industry one day at a time.

Since our last issue, we have:

- Continued our work on gaining a 4 Star Rating for fresh juice under the Health Star Rating System. This has involved meetings with Federal and State Ministers and stating the industry's case through the media.

This work has led to the Forum on Food Regulation requesting further information before making a decision.

- Prepared a synopsis of the extensive ACCC interim report on the Murray-Darling Basin water markets inquiry for our members and canvassed them for their views. This input was added to our official industry response.
- Represented industry interests during the diplomatic dispute between our government and China.
- Completed a submission to the National Agricultural Workforce Strategy. Member views were included in the submission.
- Leant our voice to Queensland growers in the lead-up to their state election. These growers will be adversely affected by their state government's decision to reduce the capacity of Paradise Dam. We will continue to represent them following the Labor win.
- Completed a successful traceability trial (read pages 8-9), which will help protect Australian exports.

We will keep a watching brief on issues in China and report to you as they come to hand.

There has been too much investment by you the grower and packers for us to simply lay down and listen to the government rhetoric that we need to diversify.

We will advocate for a diplomatic solution which saves face but does not alter our country's principles.

Diversification has long been our mantra throughout and we will work to assist industry to make this happen as seamlessly as possible.

The issue of available workforce for the next few seasons is far from resolved and we will continue to advocate for solutions on industry's behalf.

It is the financial support of Citrus Australia members which enables us to do this work and achieve these results for all growers.

I thank our members for their support and also ask you if you are not a member to consider supporting our dedicated team, who work hard for you and achieve significant results like this. ●

Thanks to our new members in 2020

Amaroo Farms Pty Ltd

Byron Bay Lemonade

Camera Group

Carlo Di Salvo

Core Fresh Farms

Creation Mildura Pty Ltd

Diacio Fresh Trading

Goldsun Orchards

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Monduran Farms

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You can find out more about memberships by contacting Kerry Thompson on 0448 213 330.

NATHAN HANCOCK

Chief Executive Officer,
Citrus Australia



Planning for next season must begin now

All growers should assess now how they plan to get sufficient workers for the 2021 harvest.

“We all recognise that we rely on seasonal workers of some type to manage the peak harvest period. Due to COVID-19 the numbers are all down in terms of available staff, and will continue to fall,” Citrus Australia CEO Nathan Hancock said.

“In a given year there’s typically 12,000 islanders employed through the Seasonal Worker Programme working across all of agriculture, currently there’s 6000 and falling as countries repatriate their citizens.

“It’s backpackers that concern me the most because we don’t know when border restrictions will be lifted, when airlines will return, when flights will be affordable and when people will return to countries like Australia for long holiday periods – if they will at all.”

“Add to that time another 12 months, as most backpackers work in hospitality before transitioning to agriculture to earn their second year visa – we’re now conservatively looking at the 2022 season before backpacker numbers might start to lift.”

Key points

- ❖ SWP, backpacker numbers falling
- ❖ Political inertia causing delays
- ❖ Two-year shortage likely

Hort Innovation commissioned Ernst & Young to conduct an analysis of the looming shortfall.

It found in October, there were 85,691 backpackers left in Australia, compared with the 135,263 here at the same time last year, and it’s estimated travellers are leaving at a rate of about 1000 per week.

The report showed anywhere from 47,000 to 64,480 short-term harvest roles would be needed in Australia over summer.

Nathan said these figures illustrated why growers had to plan now.

“Each time we put the call out, we encourage growers to respond by sharing information on the number of workers required, and when they are required even if it is next year,



Roslyne Jack and Merelyne Kalwatman, Vanuatu

so we can maintain pressure on the government, explain your situation and seek solutions.”

Despite the Prime Minister declaring the programme should be restarted a total of just 477 Pacific Islander workers have arrived into Queensland and the Northern Territory since October under the Federal Government’s Seasonal Worker Programme.

Initially Citrus Australia worked hard to lobby each state government to officially ‘opt in’ to the planning and logistics of bringing new workers into the country.

“We spoke with and wrote to the relevant departments in each state governments, advising them of the importance of administering these schemes, and we have repeatedly supplied the necessary data on required worker numbers in each citrus region.

“We’re pleased that they all eventually opted in, unfortunately at state level their just isn’t the political will or there’s an over correction to bureaucratic process that is slowing the important work of having SWP arrive.

“In essence we need a clear, affordable quarantine pathway that we can advise approved employers to take when they apply for workers through the schemes, unfortunately this has been a very slow process with most departments.”



Saraya Bowlzer-Harrison, Great Britain



From the previous page

The three models we have seen operate or are considered preferred by governments are:

- Hotel quarantine; expensive and compromised by the cap on overseas arrivals
- NT detention centre; extremely expensive and requires further internal chartered flights
- On farm quarantine; less expensive however becoming bogged down in bureaucracy

“So far, Pacific Island workers have entered Queensland using on farm quarantine, a second flight from Tonga is due around the time of printing.

The Northern Territory has let two flights in but has ‘gone to ground’ when it comes to other flights for their own growers.

Western Australia and Tasmania are yet to confirm pathways. The South Australian government has developed a ‘medi-hotel’ approach and is well advanced.

In Victoria, the government is exploring a pathway through the NT but this has not advanced.

“Unfortunately for those in NSW the prospect of any resolution on a feasible pathway being made swiftly are not looking good despite our and other PIBs best efforts to get them to engage,” Nathan said.

Nathan said federal and state governments are looking at risk stratification as a longer-term strategy, where Australia could form ‘travel bubbles’ with other countries that have strong records in suppressing COVID-19.

“A Pacific Bubble is attractive, as in theory it would preclude the need for on farm quarantine, however National Cabinet have sidelined any advancement of this idea until at least the new year.

“The take home message here is that it is extremely likely that the 2021 harvest is going to be difficult due to lack of harvest labour – help us tell that story to the government because at the moment there’s not the political will to get this happening.” ●

Contact **Kerry Thompson** at kerry.thompson@citrusaustralia.com.au or **0448 213 330**.

Here to help members navigate seasonal worker options

State governments have launched programs – some more helpful than others - to address the seasonal worker shortage and COVID-19 safety requirements.

For example, the Victorian Government has allocated funding targeted at more ‘COVIDSafe’ accommodation, grants for farmers to meet new health and safety requirements, and the employment of Seasonal Workforce Coordinators and Engagement Officers to link employees and employers.

The Queensland Government is has offered payments of up to \$1500 to subsidise transport and accommodation, for people who want to move from the city to regional areas. However, there is only enough funding for 466 people.

The Federal Government allocated funding in the recent budget for Australians, as well as WHM and international students, to relocate. There are also incentives for those on Youth Allowance and Abstudy.

“Policies that provide funds for relocation will not come close to filling the sheer numbers required by our citrus businesses and are unlikely to attract those with the resilience to stay on the job for any length of time,” Nathan Hancock said.

“Citrus Australia will continue to advocate for programs that facilitate the arrival of Seasonal Workers from the Pacific Islands, and retention of backpackers on the Working Holiday Maker visa.”

Some state governments have launched websites aimed at matching unemployed Australians with available work, effectively duplicating the Federal Government’s National Harvest Guide.

Citrus Australia recommends growers should contact their contractor as soon as possible to discuss worker options, and when you will require staff next year.

“Your contractor may tell you they will be right, they’ll have the staff, well I’d be digging a bit deeper to understand

how. In previous years contractors could move staff between regions to meet demand, this year there simply aren’t the core group of workers available to move anywhere.

“Added to this, as the economy fires back up, there will be pressure from the hospitality and tourism sector who are also critically short of staff.”

We advise growers to start advertising for workers now. This counts as labour market testing if you plan to apply for SWP workers. Retain the data for Citrus Australia to use as evidence of applications for when we speak to government departments.

“We also encourage citrus businesses to conduct exit interviews from staff, particularly Australian’s as to why they quit so as to gather evidence for government on why workers leave.”

Despite the shortage of workers, all businesses will need to ensure their workers are legal. It is important you do your best to ensure the staff you employ have the right to work, begin with a 100 points of ID type check and use VEVO on the Home Affairs website. MADEC provide all workers with a card, which certifies that they have undertaken basic training and have all legal documents. FarmReady Hub have a similar program.

Citrus Australia members have access to a range of resources developed by Citrus Australia and members can contact Kerry Thompson to assist with inquiries on government programs and pathways to access workers under the Seasonal Worker Programme and Pacific Island Scheme. This assistance is not available to non-members. ●

To become a member, you can visit the membership section of our website or call **Kerry on 0448 213 330**.

Promoting our satisfied workers

Vicki Byrne from Ireland received more from her time at Nutrano this season than she initially thought. Vicki worked in the orchard at Nutrano last season, and as a quality control analyst this season.

“At first I was quite nervous because it’s so different, it’s something I’ve never done before, but I’ve loved it, it’s been such a great experience,” she said.

“Everyone works so well as a team so it’s nice to come in every day. It’s a great atmosphere and everyone’s so helpful. We’re away from family so it’s nice to come in and feel like you’re part of a family.

“All my friends I’ve made over here are from regional Victoria. I’ve made friends for life. It’s a great experience and I recommend it to anyone that comes out to Australia.”

Citrus Australia will be promoting stories like those of Vicki and the other workers you see on these pages over summer and into next year.

The campaign through social and traditional media will explain the reality of harvest work to those considering it – yes, it can be hard work but there are significant benefits. It will promote the industry and negate negative stories based on poor employers.

We will also keep promoting the need for Government to implement

a national employer register, which would help weed out the unscrupulous employers that damage the industry.

Thanks to Tania Chapman at Nutrano for her help in facilitating our first profiles. ●

If you have a good news story regarding labour we would love to feature it. Contact **Stephen Cooke** on **0427 124 437**.



Vicki Byrne, Ireland



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Traceability trial a “game changer” for citrus industry

A \$200,000 trial of traceability technology for citrus exports has seen more than 400,000kg of premium fruit traced and verified from Mildura orchards through to international retail markets.

A partnership between Agriculture Victoria and Citrus Australia, and funded by the Victorian Government, the pilot traced fruit from Nu Leaf I.P. orchards in Mildura, through the Mildura Fruit Company packhouse, and on to international consumers.

The pilot, which has now concluded, used ‘digital fingerprint’ labelling developed by Laava ID and blockchain technology provided by Trust Provenance.

Fruit was scanned at over 50 retail and wholesale locations by overseas consumers, allowing them to verify that the fruit is a genuine Victorian product and to view the journey from “tree to table”.

The Australian citrus industry produces more than 750,000 tonnes of citrus each year, and last year eclipsed the \$500 million mark in exports.

Citrus Australia CEO Nathan Hancock said the decision to lead the program that would improve traceability in horticulture supply chains was borne out of necessity.

Key points

- ❖ 400,000kg fruit traced
- ❖ Scanned at 50 overseas locations
- ❖ Any pack house can use

“The scope and audacity of IP theft cost individual citrus businesses and the wider citrus industry millions of dollars every year,” Nathan said.

“Our industry relies on its quality and the safety of the product we produce here in Australia. We have a premium product in our export markets and we need to be able to prove to our end supplier the origin of our product.”

Nu Leaf IP General Manager, Matthew Cottrell, one of the partners in the project, said growers invest significant time and resources planting premium varieties such as Tang-gold, a high value seedless mandarin variety.

“By using the digital fingerprint labelling on our packaging and our blockchain, it will help us protect our brands and also will allow the customer to directly access proof of origin and also the features of our fruit,” Matthew said.

“For consumers, it also helps give confidence that they are buying a premium variety with the features they desire.

“This technology is providing benefits throughout the supply chain, from legitimising plantings and fruit through to the protection of brands.”

Mildura Fruit Company sources fruit from about 140 growers in the Murray Valley region surrounding Mildura, with up to 85% of this exported to about 30 countries.

“In a typical season we will pack about 90 million kilos of fruit. It’s very important to understand where that fruit comes from and where it goes,” MFC General Manager, Perry Hill, said.

“This trial supplemented our existing systems, enabling us to track various packed items through to the end consumer.

“This technology will enable us to satisfy our customers that product they are receiving is coming from a reliable source.”

Laava ID uses advanced computer vision technology developed in collaboration with CSIRO to produce a unique ‘fingerprint’ that can be scanned by any smartphone.

Unlike barcodes or QR codes which have been used in the past, Laava’s Smart Fingerprint technology is much



Harvest at Nu Leaf IP orchards.

Continued page 10



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harder to impersonate or replicate (a technique known as ‘spoofing’) and much more secure, making it more resistant to counterfeiting.

Laava ID CEO Gavin Ger said the trial proved that the unique Fingerprint technology could integrate with existing systems, in this case, MFC.

“Any pack house of any fruit can apply this solution,” Gavin said. “It’s a game changer.”

The project adds further value by providing consumers with additional information.

“By scanning the Laava Smart Fingerprint with their mobile phone, consumers can authenticate the products that they buy, learn more about their products, and engage deeper with the brands that made them,” he said.

Trust Provenance has built an integrity system that allows multiple data points to be linked into the one data platform.

Trust Provenance CEO Andrew Grant said the benefits of blockchain in traceability is that any data point that is stored on the blockchain cannot be changed.

“Bringing all these data sets together on the one platform also enables a number of business efficiencies and ultimately that brings a fresher and better quality product through to the consumer, who will have confidence they’re buying authentic Australian grown produce,” he said.

“In this project, we’re integrating data points from the grower, the pack shed, the logistics company, the food safety certification body and from data loggers which have got GPS and temperature data points throughout the journey.”

Citrus Australia remains focused on finding ways for industry to engage in advancing traceability.

Nathan is a founding member of the National GS1 Traceability Advisory Group and is looking for ways to build on the work achieved in the trial. ●

By scanning the Laava Smart Fingerprint with their mobile phone, consumers can authenticate the products that they buy, learn more about their products, and engage deeper with the brands that made them.



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High density plantings, intensive orchards to be tested

The economics of citrus intensification will be tested as part of a new horticulture industry project.

The research will also have an eye to the future, looking to uncover citrus types or varieties better suited to high density plantings as well as practical tips to improve the profitability of existing intensive orchards.

Dave Monks, research horticulturist with NSW DPI, is leading the project, which will build on established information, on behalf of the citrus industry.

He said this was part of a national drive for orchard intensification, in a bid to capture more sunshine and deliver quicker returns on investment across the horticulture sector.

“The primary reason is to generate more yield, because there’s more capture of sunshine,” he said.

“But there’s a delicate balance because we have to determine if it is profitable to simply try and capture all of the incoming solar radiation.

Key points

- ❖ Trial types best suited for high density
- ❖ Improve profitability of existing orchards
- ❖ Potential to reduce OHS issues

“Our current understanding of managing citrus orchards won’t simply overlay on a higher density planting. There is a financial cost to planting more trees and a gap in our understanding of managing high intensity plantings.”

Dr Monks said some growers had already invested in higher density plantings with mixed results.

Value will be determined by revaluating blocks established during the past 20 years with the dwarfing viroid, as well as planting a new block of navel oranges and inoculating them with newly isolated viroids which haven’t been available to the public.

Cost reductions and efficiency gains are expected due to the smaller size of the tree.

Some of these gains, such as a decreased occupational health and safety risk and simpler pruning, are harder to quantify than others such as decreased fertigation costs, according to Dr Monks.

“It is very reasonable to keep in the back of our minds, that citrus already converts a lot of sunshine into profit,” he said.



Barnfield Navels injected with a dwarf virus on Brett Hullah’s orchard.



Brett Hullah has 2.5ha of high-density plantings on his Coomealla, NSW, and is contributing to the project.

“If we, in any way, reduce the tonnage off a hectare, we need to have an equal or even slightly higher decrease in the cost of inputs because you have to recover the cost of planting the trees.”

This information will be conveyed via a financial tool available to growers. Dr Monks said it would be ideal for those considering planting an orchard.

For growers wanting best practice advice on an established high-density planting, the project will also research the most efficient and cost-effective way to prune these blocks to return them to productivity.

This information will be conveyed via case studies and field days at demonstration trials on growers’ properties.

The final part of the project will involve examining the shape and regrowth habit of 400 different citrus varieties to find those best suited to high density plantings; research that may be used by plant breeders.

“For example, the ability to flower in a low-light environment or conversion of minimal sunshine into fruit or return bearing on the same part of the tree year on year,” Dr Monks said.

.....

Brett Hullah is part owner and farm manager of Grandview Orchards at Coomealla, NSW and one of the businesses involved in the project.

His orchard includes 2.5 ha of high-density plantings, with trees including a viroid to limit their size.

Brett’s keen to learn how to better manage the tree size and regrowth after pruning.

“They are a bit of an interesting tree because when you prune, they can regenerate in some areas the same as a normal tree, but it seems to be a little delayed,” he said.

“Pruning the tree, we try and regenerate it but, for the ones with the viroid, we are just not sure if we are pruning the best way to get the best result.”

The project is funded by Hort Innovation, will take five years, and includes up to five grower collaborating properties and five NSW DPI staff. ●

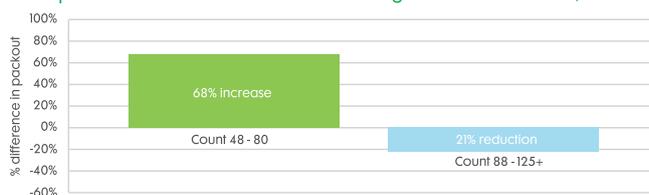


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Farm expansion part of Bob and Merveen's forward focus

There's no doubting Bob Sjollema's forward focus.

Every aspect of his NSW citrus business is geared towards the future.

From planting new and early navel varieties, to increasing the scale and maximising on-farm margins through quality improvements and cost reductions.

These plans underpin what Bob and wife Merveen believe will be a sustainable citrus operation.

Talking to Bob, it's clear what drives his cautious approach and unrelenting concentration on risk management.

"Five or six years ago I was going to sell this farm," he said. "At the time, they said you'd probably get more for it if you pulled all the citrus out...a vacant farm was worth more than a citrus farm. It was pretty ordinary."

The farm Bob referred to is a 20-hectare citrus block at Hanwood about 3km from Griffith in NSW, purchased 25 years ago.

Key points

- ❖ Focus on early and mid navels
- ❖ Increased returns forecast
- ❖ Farm value has improved

He and Merveen still own that property and recently added another 20ha to their business.

The Sjollemas may not have sold their farm during that tough time for the citrus industry, but this experience continues to shape their business decisions.

One example includes focusing on fresh fruit and navel varieties at their new farm.

A third of the new 20ha will be planted with Cara Cara navels, another third with Washington navels and the final portion will be divided between the new early navel varieties FJ and M7.

"I found over the years the early varieties always do very well in the market, the Cara Caras seem to be a good export orange with demand through Asia and particularly China," Bob said.

"I think the Australian market will pick-up a lot more on it too. Washingtons have always been the best navel, it crops well, grows well – and to a decent size – and they are good to look after. We have avoided the late season (varieties) because they don't seem to crop very well, they crop very irregularly."

The original farm – which is adjacent to the new block – is also dominated by navels.

About two thirds is a mix of Cara Caras, Washingtons and later summer navels such as Lanes. One third is Valencias.

The move away from Valencias was two-pronged.

Bob's initial concern surrounded future prices for juicing and discussions about changing the health status of



Bob Sjollema's orchard in Hanwood, NSW.

juice. Secondly, he wanted to set up his property for a potential sale.

“The fact is, I’m getting on in my life, in a few years we might want to sell it and I think everyone is looking for navel farms, not Valencia farms,” Bob said.

“The reason I went up to 100 acres (40ha) is because some of the people who really want to chase citrus farming will want 100 acres (40ha) of navels.”

The decision also makes economic sense. Bob said growing navels wasn’t much more expensive than Valencias but the margin was “double or triple the amount” even with slightly reduced yields.

The reward for quality in the navel market was also attractive for Bob.

Quality improvements and cost reductions – thanks to increasing the scale of the business – is where Bob believes he can maximise margins.

“The quality has been reasonably okay, but my fruit probably has not been as good a quality as it needs to be, but it is getting there,” Bob said. “I think as I get younger trees in it is certainly getting better and better. I still have some old trees in that need to come out.”

Now running 40ha, Bob will look to employ consultants to provide advice to help with issues such as quality and additional employees to better manage the workload.

“When you try and do everything yourself you are always behind,” he said.

This isn’t the first time Bob and Merveen have operated two farms, so they were well aware of the synergies and cost savings. This time won’t be any different.

“We don’t need to have two trucks, we don’t need to get any more equipment, all the equipment is the same,” he said.

“The cost of running a second farm is minimal compared to running one farm. Apart from water and fertiliser, everything is cheaper. Registrations are cheaper – they are spread over two farms – and you might need the tractor more often, but the cost is spread over two farms.”



Merveen and Bob Sjollema with border collie, Alley.

The economic gains don’t end there.

Bob anticipates attracting and retaining labour for picking will be easier, as the season will be extended, thanks to the young trees on the new farm.

One drip irrigation system will be used across both properties, representing a huge cost saving as only one pump will be required.

“The pump is often half the cost of the irrigation system and this way we can have one pump system and that lends itself to cheaper electricity when I put solar power on down the track,” Bob said. “That will be a big saving and that way we only need one control system and one fertigation system.”

The installation of an automated fertigation system will also save time and money. Previously, fertiliser was purchased premixed – sometimes a more costly exercise – or mixed manually on-farm.

Despite owning their irrigation water entitlements and being able to provide sufficient water to their trees, Bob said some trees felt the brunt of recent drought years.

Bob said in September that he was “cautiously optimistic” about the coming season. In September, he was anticipating a “heavy flowering” but this had been teamed with plenty of growth and it “remained to be seen if we set a heavy crop or not”. ●

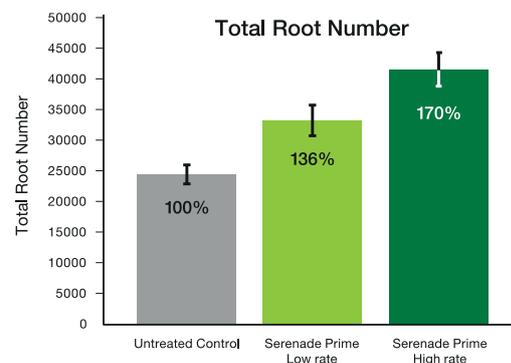
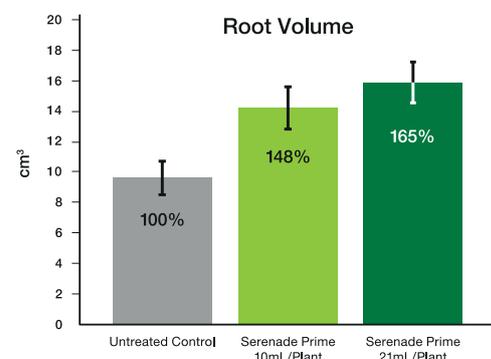
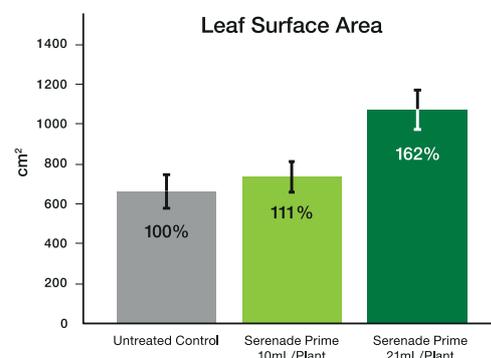


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KCT applications open

The Citrus Tree Census has become an important industry document, capturing the plantings data of the national industry and guiding businesses in their planning.

“The yearly online census has proven to be extremely popular, the summary reports are prized possessions and we receive enquiry about them all year round,” Citrus Australia CEO Nathan Hancock said.

Citrus growers who send fruit to KCT pack houses for export to protocol markets are able to register now for the 2021 season, via Citrus Australia’s on-line system.

“The first step of the KCT application is to update or confirm your tree census record” he added.

KCT orchard applications close COB 18 December 2020; growers are notified via Citrus Australia’s Tree Census emails.

At time of printing, 79 sheds have registered this season, and more than

300 grower applications have been received.

To complete the Citrus Tree Census and receive an orchard application email, growers are required to:

1. make any necessary changes to the Citrus Tree Census on-line form
2. enter ‘YES’ in the relevant box, if intending to export fruit from one or more blocks to Korea, China, Thailand
3. save the on-line form.

This triggers the KCT orchard registration email with a link and instructions on how to complete the on-line KCT orchard application.

Property maps must be uploaded onto the application immediately after saving the form; this ensures

crop monitors have the necessary information to perform crop monitoring activities.

Nathan said up-to-date records as a result of growers updating their tree census provides additional benefits to industry.

“This information is a vital tool for forecasting and for advocacy work with government as it helps us confidently state our value to the national economy.”

.....

For information regarding KCT orchard registrations please email registrations@citrusaustralia.com.au or contact Nicole Zerveas, Citrus Australia on 0499 044 111.

Freshcare has updated the Food Safety & Quality Standard to FSQ4.2

Existing Freshcare businesses should note that Freshcare has updated the Food Safety & Quality Standard for growers and packers.

The new Standard FSQ4.2 includes changes implemented to meet the requirements of the GFSI v2020 benchmark criteria. The Harmonised Australian Retailer Produce Scheme (HARPS) Standard version 1.0 remains unchanged.

Participating businesses are required to transition over to FSQ4.2 for audits occurring from 3 May 2021.

Citrus Australia is planning workshops in 2021 to explain the changes (covid19 permitting).

The changes in summary include:

- Freshcare Rules now found in Section 1 of the FSQ4.2 Standard.
- Freshcare Rules now provide guidance on Unannounced Audits; and the Two-Part Audit Process.
- Greater emphasis and focus on Food Safety Culture.

- Updates to M3 Training and development, requiring annual reviews of workers’ training needs.
- Updates to F13 Product identification and traceability, requiring dispatch records to be maintained and a test of traceability.
- Updated M4 Internal Audit Report Form.

Also notable is the update to the farm chemical user competencies.

- The following national competencies (or validated equivalent) must be included in all farm chemical user training qualifications:
- AHCCHM306 - Prepare and apply chemicals to control pest, weeds and diseases (supersedes AHCCHM303).
- AHCCHM304 Transport and store chemicals. ●

What forms have changed from FSQ4.1 to FSQ4.2?

- Form – M1 Property map checklist (new)
- Form – M1 Organisational chart (new)
- Form – M3 Training record – internal FSQ (updated)
- Form – M4 Internal audit report (updated)
- Form – F13 Harvest, packing and dispatch record (updated)
- Form – F13 Traceability test record (new)

.....

For further information about the new FSQ4.2 Standard go to: <https://www.freshcare.com.au/standards/fsq4-2/>



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Improving northern biosecurity through cross-sector collaboration

The vital job of keeping damaging exotic pests and diseases out of Australia has been bolstered with the implementation of the Tropical Plant Industries Biosecurity Surveillance Strategy (TPIBSS).

Beginning last July, the strategy focuses on building greater cooperation and collaboration across all sectors to assist in strengthening northern Australia's biosecurity systems for broadacre agriculture and horticulture.



Trevor Dunmall, Plant Biosecurity Northern Australia Industry Liaison Manager.

Plant Biosecurity Northern Australia Industry Liaison Manager, Trevor Dunmall, said this strategy was vital to keep pace with the increasing challenges posed by exotic pests and diseases.

"Up until 2020 the amount of freight and passenger movements into Australia was increasing every year," he said.

"Added to this is the increasing spread of exotic pests throughout the world, and the increasing area under crops in northern Australia. With these changes, there comes greater risk of exotic pests and diseases entering and establishing in Australia."

The citrus industry hasn't been immune to biosecurity threats with citrus canker entering the Northern Territory just two years ago.

Key points

- ❖ Building cross-sector collaboration
- ❖ Identifying shared priorities
- ❖ Improved data utilisation

Keeping the destructive citrus disease Huanglongbing (HLB) out of Australia is a high priority after it threatened the viability of citrus industries throughout the world.

Five months into the strategy, Mr Dunmall said the benefits of working together were already emerging.

"Independent of the strategy people were already improving collaboration and the strategy has been developed to build on and reinforce collaboration," he said.

The TPIBSS and other recently developed biosecurity strategies will provide direction and guidance for improving biosecurity across Australia.

This improvement would come through a shared approach to identifying priorities, improved data utilization, greater collaboration across government, industry and the community and a shared commitment to address barriers to improving Australia's biosecurity system.

For citrus growers, Mr Dunmall said this work should provide them with reassurance.

"It should give them the confidence that Citrus Australia and governments around Australia are working collectively to protect their businesses from exotic pests and disease," he said. ●

Dogs join frontline to detect citrus canker

Man's best friend will work on the biosecurity frontline to protect the Australian citrus industry, in a national first trial.

Just when you thought it wasn't possible to love dogs anymore, the canines will be trained early next year to sniff-out the destructive citrus canker disease.

But unlike their counterparts in the US, Australia's detection dogs must learn their craft with an artificial lure.

Alex Fulton, citrus canker project scientist with the Northern Territory Department of Industry, Tourism and Trade Biosecurity and Animal Welfare, said to her knowledge it was the first time an artificial lure for a plant bacterial disease was created in Australia and there were many benefits.

"The good thing about an artificial lure is you can replicate it time after time, it can be made to a consistent formula," she said.

"With live infected plant material, you can't be certain of exactly replicating that same one each time or delivering the same quantities of chemicals."

An artificial lure is also preferred because of the ability to:

- upscale and mass-produce scent lures
- limit the occurrence of 'interfering odours' from infected plant material
- imprint and train detector dogs in the absence of the disease or availability of the pathogen

It also allows for field trials without any risk of spread of the disease or potential harm to a detector dog.

Creating the lure took about six months and included experiments to identify the compounds and chemicals, as well as time for chemists from the Charles Darwin University College of Engineering, IT and Environment to blend it into a liquid for application.

The volatile organic compound (VOC) emissions, crucial to replicate the odour of citrus canker, were collected through three experiments including live plants infected with disease, bacteria growth and from individually infected leaves.

Key points

- ❖ Artificial lure created
- ❖ Dogs trained next year
- ❖ Dogs detect quicker than humans

The results from the experiments then inform the chemical composition of the scent blend, with formulation currently underway.

The plan is to incorporate the liquid formulation on a cotton cloth, or cotton wool, which will absorb the odour with limited background odour.

A procurement process has commenced to source two detector dogs and a handler for proof of concept imprint trials. Several agencies have been approached to gauge their interest and capacity for supply. A tender process will then be conducted to offer a fair and open process to all interested parties.



Dogs like this Browsing Ant detector dog, that travels to the NT from Queensland to do surveillance for this invasive species, will be trained to detect citrus canker.

Labradors are often the preferred breed, due to their focus, versatility, steady temperament and strong hunt and retrieve drive.

However, other breeds may be suitable with Springer Spaniels used in NSW to detect Hawkweed, and Belgian Malinois used in the US to detect citrus greening disease, according to Alex.

"We have a four to six-week time frame to imprint the dogs," Alex said. "The first trial will be pure odour identification, where the handler consistently gives the dog the target odour, so they associate the target odour with a reward."

The following steps include introducing "non-target" odours and blind testing, to ensure the dogs don't pick-up on any subconscious behaviour of their handlers which might indicate the location of the lure. The final trial includes placing lures outside for the dogs to identify the odour with the competing winds and other smells.

Funded by the Australian Government, Alex said the advantage of using detector dogs is that they can detect the disease earlier than humans can (before symptoms are visible), and cover a larger area in orchard settings.

As the citrus canker eradication program draws to a close in the Northern Territory, Alex said the detector dogs could provide ongoing assurance to citrus growers that the disease is absent and remains so.

In addition, trained dogs would enable a quick response if citrus canker returned.

"Depending on which way we go, if we get another incursion of citrus canker, we'll have the knowledge and skills to rapidly imprint and deploy a dog and delimit the area of infestation quickly," she said. ●



New test method to reduce risk to citrus

New genetic sequencing technology has the potential to improve screening of imported plant material for viruses and other pathogens, researchers say.

Scientists in the early stages of a Hort Innovation-funded project are streamlining the diagnostic process by developing a test that detects all known viruses in a single assay.

The project began in mid 2019 and is due to run until late 2022, supported by levy-based funding from the citrus, potato, table grape, berry (*Rubus* species) and nursery industries.

“The technical word for it is ‘high-throughput sequencing’ or, for short, HTS,” says Queensland University of Technology (QUT) Associate Professor Roberto Barrero Gumiel, who is leading this work.

Roberto says his team’s use of high-throughput sequencing has

Key points

- ❖ New genetic sequencing technology
- ❖ Could slash quarantine time
- ❖ Farm gate tech also tested

enabled it to compare two types of HTS technology to determine which method best locates viruses.

“In the initial study we used reference plants that were known to be infected with a specific virus. We tested the

new methods to see whether they were able to detect the viruses that we knew were present in those plants.

“So far, with a small number of samples we have been able to find all known viruses so now we are preparing to sequence another 300 plants over the coming months.”

Roberto’s team uses computer analysis to process its huge volumes of data.

“We use what’s called a ‘bioinformatics pipeline’, combining ‘biology’ with ‘information technology’ to detect viruses and viroids.

“The other activity we’re progressing in partnership with Agriculture Victoria, led by Dr Fiona Constable,



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New methods of detecting pathogens in plant material – both imported and on-farm – are being evaluated in a research project co-funded by five horticultural industries including citrus.

Photos: Robin Eichner, DAWE

is testing the ability of a range of HTS approaches to find bacterial pathogens, including commercial portable HTS technology.

“This can be potentially be used in the lab but may have further application at the farm gate for outbreaks that occur domestically. If we don’t know what the causative agent might be, then this technology can assess whether it is a virus or not.

“It’s a small device that does not require significant infrastructure, it’s always able to read very rich genetic information and the way that information is stored is like a chain of letters. Basically, it can read up to a million individual letters.

“The Agriculture Victoria team is testing the portable HTS technology for its applicability to routine testing of culturable bacteria and developing other HTS methods for detecting non-culturable bacteria directly in host tissues.”

Non-culturable bacteria include the biggest threats to the Australian citrus industry, such as the agents that

cause huanglongbing (HLB) and citrus variegated chlorosis.

Roberto says his team is working closely with the citrus industry to respond to its needs.

“Citrus is really keen to keep some of the existing protocols so this new technology will be one more tool the industry can use to inspect and scrutinise material that’s being brought into Australia,” he says.

Having the opportunity to tap into new markets by bringing in novel or improved germplasm is paramount for domestic plant industries. But, as Dr Nerida Donovan, citrus pathologist with the NSW Department of Primary Industries, says, “There are a number of serious diseases that could be contained within the imported material that could devastate our industry.

“To reduce the risk, new-variety imports are tested for citrus diseases and disease-causing agents are

removed by micro-grafting tiny shoot tips (0.1-0.2mm) onto a rootstock.

“It is a highly skilled process that is a balancing act between the tip being small enough so that no disease particles are present and large enough for the grafted tip to survive – it is a numbers game. The tiny plant then needs to grow large enough to provide material for testing to see if the disease agents have been eliminated.

“Current measures for testing and treatment of imported varieties take some time but they are essential to safeguard the industry from disease.

“Improved screening of imported plant material with HTS will potentially reduce the risk even further once the technology has been optimised. I’ll be watching the progress of this project with great interest.”

Roberto says his team – comprising QUT; the federal Department of Agriculture, Water and Environment; Agriculture Victoria; and the New Zealand Ministry of Primary Industry – aims to run a face-to-face end-user workshop in Melbourne once COVID-19 restrictions are eased – “hopefully in 2021”. ●

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Granulation: too much water too soon?

A belief that overwatering contributes to granulation in Imperial mandarins is at the core of Helen Hofman’s current research.

Helen, a senior horticulturist with Queensland Department of Agriculture and Fisheries (DAF), has been examining the influence of irrigation “for a couple of years” and has recently expanded her work by establishing new trials thanks to an investment from the Hort Innovation Citrus Fund.

“This project – which is due to run until August 2023 – is definitely industry-initiated, which is good because it means everyone’s motivated,” Helen said.

“It’s not clearly understood what causes granulation and how the whole process in the tree works but this research focuses very much on farm management practices rather than any academic investigation of the problem.

Key points

- ❖ Testing overwatering impact on granulation
- ❖ Investigating flush competition
- ❖ Industry driven research

“My hypothesis is that it’s related to water potential in the juice cells.

“Essentially we’re looking at managing the water status in the tree, which is mostly irrigation; nutrition, which is mostly nitrogen; and the effects of flush.

“The flush aspect is about better understanding the competition between flush growth and fruit quality and whether we can manipulate that.”

Helen says irrigation is her team’s main area of investigation.

“Growers had been reducing their nitrogen levels to try to get earlier fruit but that had had a detrimental effect on fruit quality so they needed to go back to applying the recommended amount of nitrogen.”

“We’re doing some further work on it but that’s pretty well established

GRANULATION 1

Variation in the severity of granulation is examined in samples taken as part of Helen Hofman’s field research.



GRANULATION 2

Trials examining the influence of irrigation, nutrition and flush on Imperial mandarin granulation are under way on commercial properties in Queensland.



and hopefully most growers are doing that now.

“Irrigation is the big one we’re focusing on.

“It’s counter-intuitive to growers. They’re getting dry fruit so they think they need more water but all our early work suggests that less water is better: that overwatering is contributing to granulation.

“As a result, our trials are about reducing irrigation, mostly in the first stage of fruit development.

“We’re looking at how much to reduce it by – that’s not yet entirely clear – and how long to reduce it for, because our previous work has shown early fruit development is the key time. “However, we’ve had some success with reducing irrigation right through to the end of January, which is quite late in fruit development.”

Helen is overseeing seven trials on four properties around Gin Gin and Mundubbera in the North and Central Burnett growing regions respectively.

“One trial’s looking at both irrigation and nitrogen,” she said.

“We’re looking at different rates of nitrogen; it’s a long-term thing so it’s showing some interesting effects on flush and flowering.

“We’re trying to better understand the relationships on the timing and the extent of flush. The strategies we’re looking at to try to influence this are plant growth regulators – sprays of growth-reducing chemicals – and whether when growers prune has an effect.”

Helen said the irrigation aspect needs “a fair amount of work”.

“The issue is that every farm is different – different soils, different weather conditions and variability even within the one block – so it’s quite difficult to be prescriptive by saying ‘Give them this much water’, but the aim of the project is to produce some guidelines that will help.” ●

Initial work in this project was funded by the Queensland Department of Agriculture and Fisheries (DAF), Carter and Spencer Pty Ltd, Seven Fields Operations Pty Ltd (Nutrano) and the Mundubbera Fruit Growers Association Inc.

Since April 2020 funding has been provided by DAF and Hort Innovation using the citrus levy and funding from the Australian Government (Project CT 19005).

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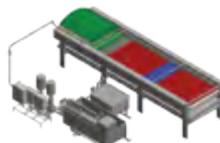
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Genomic analysis pinpointing desirable tree traits

Mapping the DNA of Australian citrus species is under way as the first step in giving local plant breeders access to the world's most modern database of citrus genetics.

In a multi-phase project, Professor Robert Henry, director of the Queensland Alliance for Agriculture and Food Innovation at The University of Queensland, is leading a team that's examining both budwood and rootstock phenotypes.

"Firstly, we're looking at the DNA of these species and sequencing the genome so we have the basic genetic information as a platform on which to conduct the rest of the project," Robert said.

"The second component relates that basic DNA evidence to the function genes and identifies which control things like flowering, for example, and the third looks at how to deploy that in breeding for those traits.



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

"We're producing a 'reference genome': a high-quality, accurate genetic sequence for all of the species in the major groups within citrus.

"Then we do re-sequencing: a less detailed analysis to see how each individual differs from that reference plant."

Robert said once the phenotype data has been collected, it is analysed to pinpoint which genes control commercially desirable characteristics.

"The impact of this genomics work is on the genetics of the trees: everything from architecture to flowering time and so forth.

Key points

- ❖ Mapping citrus DNA
- ❖ Genome sequencing first step
- ❖ Pinpoint commercially desirable traits

"We like trees to be more precocious and come into production earlier – that's important when you're changing to new varieties.

"People will continue to want to plant more smaller trees closer together to get more production per unit area and to get greater efficiency with nutrients and spraying and water use.

"On my team I have a number of PhD students who are identifying the genes and providing a genetic map of each variety that's then available to the people who are trying to quantitatively explain how the genes influence those traits.

"It can be data-intense but it also requires a lot of thinking to try to solve some of the bigger analysis challenges.

"We're working in each case primarily with breeders, because the implementation of what we do will be through plant breeding.

"We're able to sequence all the germplasm breeders use; we're producing a DNA sequence for every tree they're likely to use as a parent. We can look at the relationships between them and see which ones are closely related to others.

"All of that guides breeders as to whether they're crossing two things that are related or that are a long way apart.

"Sequencing of the citrus samples in this project is just starting but it will move very quickly from this point, taking advantage of what we've learned with the other species that are also part of this: mango, macadamia, avocado and almond."

Robert said decreasing costs have made this work possible.

"The underlying technology is advancing at quite a rate," he says.

"If we could go back five years this would have been too expensive to do. The costs come down as the technology improves.

"In the future it's going to be cheaper and cheaper so it'll become incredibly routine, we think, within the next 5-10 years."

Robert said increases in computer capacity have been crucial to facilitating research on such a scale.

"We need to be able to process a lot of data to make sense of all this so it's the computing as much as anything that's advanced this whole area of molecular biology. We can collect terabits of data per day – hundreds of millions of letters of genetic code in each individual.

"These are amounts of information we wouldn't have been able to store in the past, let alone analyse."

One of the practical by-products of the project will be a set of 'genetic fingerprints' for some of Australia's highest-value tree crops.

"There are a lot of crops where it's quite hard to tell one from another just by appearance yet the performance can be quite significantly different." ●

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Predicting chilling injury before your fruit leaves the shed

Being able to predict chilling damage could be a powerful decision making tool for Australian lemon growers wanting to export to overseas markets.

New research from the Queensland Department of Agriculture and Fisheries suggests there is potential for Near Infra-Red (NIR) cameras to grade out fruit unable to withstand export handling.

Queensland lemon shipments to Asian markets are required to follow in-transit cold disinfestation protocols. Protocols vary between countries, but typically involve prolonged cold storage in-transit of 14-21 days at 1-3.1°C.

While the fruit generally tolerate these conditions, skin damage consistent with chilling injury is occasionally encountered and results in significant economic and reputational loss.

Chilling injury is typically characterised by pitting and sunken lesions on the surface of the fruit following exposure to low, non-freezing temperatures (**Figure 1**).

Previous research has shown that sensitivity to chilling damage can differ between farms, seasons and varieties; however, it remains unpredictable and difficult to manage.

Dr Hung Duong's latest work found hyperspectral imaging can detect and predict chilling injury in lemons before it is visible to the human eye.

Key points

- ❖ Hyperspectral imaging can identify 70% of chilling injury in lemons
- ❖ A new predictive tool would help differentiate fruit suitable for export
- ❖ Would help maintain quality export standards

Scanners correctly predicted chilling injury on 70% of fruit after de-greening and cold storage. This technology could allow fruit of lower robustness be graded out and sent to the

domestic market only where it is not subjected to chilling temperatures during transport.

Seeded and seedless eureka lemons were collected from Widem Farming in Dimbulah, and subject to conditions to mimic an export supply chain.

Two de-greening treatments were used; 2.6 or 18.5ppm ethylene gas at 20.4°C or 28.9°C for 5 days.

Higher ethylene concentrations and temperatures were applied to simulate suboptimal practice known to increase the risk of subsequent chilling.

De-greened fruit were stored at 1.9°C for 5 weeks to stimulate sea freight to export markets. This was followed by 10 days storage at 20°C to

Continued page 30

Figure 1:

Typical chilling injury symptoms include sunken dark lesions versus non chilling fruit



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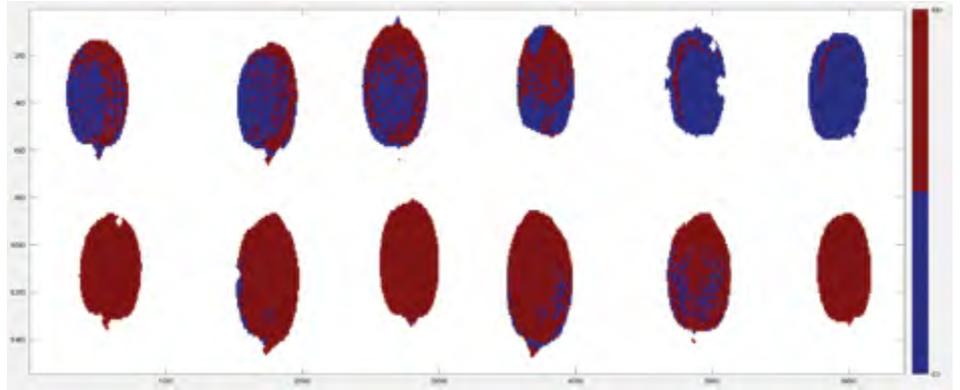
assess chilling damage under typical retail display conditions.

Fruit were scanned within 3 hours of harvest, after de-greening and after cold storage using three different hyperspectral devices (Bruker Matrix-F, Pika NIR 320 and Pika XC2) at wavelengths of 830-2500 nm, 900-1700 nm and 400-1000 nm, respectively. Various statistical models were applied to the data in order to analyse results (**Figure 2**).

“Chilling injury is hands down the number one challenge for me in exporting my lemons,” Wim VanNiekerk, Director of Widem Farming in Dimbulah, North Queensland, said.

“Being able to grade out fruit with higher risk of chilling injury is a huge business advantage, as well as limiting the chances of any quality disputes and unhappy clients when my product arrives overseas.”

Figure 2: An example of the model predicting chilling injury. Brown pixels predict no chilling damage, blue pixels show where chilling damage is likely to occur.



Similar technology has been used in cucumber, green bell pepper and apples to correctly identify skin defects before symptoms are visible.

More research with lemons is required to refine the modelling before practical adoption of the technique is explored. Nonetheless, the results in lemons so far are promising and have great potential to assist the expanding Australian lemon industry. ●

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For more information contact Hung Duong at hung.duong@daf.qld.gov.au



Wim VanNiekerk, Widem Farming, Dimbulah, North Queensland, participated in the project.



De-greening best practice tip

Lemons should be de-greened with no more than 5 parts per million (ppm) ethylene at 20-24°C for 3-5 days

Fruit de-greened at higher than recommended temperatures and ethylene concentrations are more subject to chilling injury when cold stored for export.

- **Hung Duong**, Research Horticulturist, DAF, Qld

SILVAN'S AVO JET TALL TREE SPRAYER

Silvan Australia released its new Avo Jet auxiliary spray unit in 2017 designed for targeted spraying in medium to tall trees such as citrus, avocados, mangoes and macadamias and its popularity is continuing to grow.

A key feature is the hydraulically driven fan that delivers a high velocity air stream into the top of the canopy. When combined with Silvan's patented Radak conveyor, the Avo Jet provides complete tree coverage.

The Avo Jet is fitted with four adjustable cannon jet nozzles per side assisted by five air outlets to direct the chemical into the top of the tree which can be difficult to reach and is often the area where pest and disease pressure is at its highest.

When fully extended for spraying, the Avo Jet stands five metres above the ground and is mounted to a hydraulically controlled frame which can be conveniently lowered from the tractor cab for road transport and storage. The Avo Jet can be fitted to any Silvan 4000L orchard sprayer in conjunction with the Radak conveyor.

Silvan Australia's spraying product specialist David Carr says that his company's long experience and leadership in spraying equipment and accessories

confirms that it is important to adapt to the changing needs of farmers.

"We are regularly talking to farmers about the challenges they face in managing pests and disease".

"The development of the Avo Jet was a direct response to listening to the needs of fruit growers for a product that directs chemical into the top of tall trees and compliments the proven Silvan Radak conveyor" Mr Carr says.

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The Silvan Avo Jet auxiliary sprayer compliments the Silvan Radak conveyor to obtain effective spray penetration tall trees such as avocados, mangoes and macadamias.

Standing five metres above the ground, the Avo Jet has a hydraulically controlled frame to lower the spray head for road transport and storage.



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Controlling vigour a rootstock breeding priority

New rootstocks able to curb tree vigour, tolerate salinity and resist disease are in development based on material from one of the world’s most comprehensive collections of citrus germplasm.

“We’re working at the moment on disease resistance and managing tree size better,” Malcolm Smith, Queensland Department of Agriculture and Fisheries (DAF), said.

“We have a pretty good handle on how we can introduce disease resistance into rootstocks effectively and we’ve also looked at compatibility with some of our important varieties.

“One of the newer challenges in a project started just over 12 months ago is controlling vigour.”

Malcolm said the current focus is on export-quality citrus – “mostly mandarins”.

“That’s been a significant shift,” he said.

“Most of our earlier work was with Imperials because they have so many problems with things like granulation and compatibility; we did a lot on that.

Key points

- ❖ Disease resistance, vigour a priority
- ❖ Export mandarin focus
- ❖ One rootstock increases fruiting

“Now, however, we’re working on the varieties that go into China, Thailand and Japan every year.”

Malcolm said the project’s aim is to “provide growers with rootstocks that are innovative and unique and that out-perform existing material as well as address a number of production issues”.

“Some we’ve screened for salinity will be in a new trial we’ll plant in October in the field.

“The material has been sent to the Elizabeth Macarthur Agricultural Institute in Sydney to confirm that it’s resistant to tristeza virus and soon it will be available for evaluation on growers’ properties in southern Australia.

“A big emphasis is on testing in different parts of the country, because salinity is a major problem in some areas but not much of one in others.

“With the particular group of rootstocks we specifically bred for salt tolerance we were very keen to get it into NSW as quickly as possible and

More than 150 different rootstocks are being evaluated in a new trial that is due for field planting in November 2020. Many of these rootstocks have been screened for salt tolerance and are in NSW being virus-tested before entering the southern evaluation.

Nine-year-old Imperial on rootstocks with vastly different graft union compatibility. The rootstock on the left shows considerable promise and is likely to be released in the next few years while that on the right is a promising rootstock from the California breeding program that is clearly unsuitable for Imperial mandarin.



get its virus freedom confirmed, which [plant pathologist] Nerida Donovan [at the NSW Department of Primary Industries] was able to do for us.”

Malcolm said having access to not only imported but also native citrus germplasm is an invaluable advantage.

“Over the past 20 years we’ve put together one of the better collections in the world in terms of genetic diversity, and we have mature trees that flower and fruit every year.

“We’re still looking for a few things internationally but otherwise it’s pretty well complete.

“Now we’re making use of it to generate commercial rootstock.

“We’re also trying to use citrus relatives that other people aren’t using. That comes with its challenges but it also comes with a lot of opportunities.

“We’ve not just making the same crosses people have been making for a hundred years; we’re getting out there and doing some experimental things as well.

“One example is the Australian desert lime, which we’ve been able to hybridise with some other species.

“Once we get a hybrid, often that’s the most difficult step out of the way. Making subsequent hybrids after that becomes quite easy, so we have

some very useful parent material in our collection that’s going into the commercial rootstock breeding work.”

He said one source tree has yielded rootstock that increases fruiting.

“We have quite a young trial at Gayndah, Queensland, with a variety that’s very shy fruiting – it flowers really well but then doesn’t set. It’s only early days but the rootstock is outstanding in terms of boosting productivity.

“It’s quite exciting because we would never have expected to find that particular trait – and in fact we wouldn’t have expected to see the sort of improvement in yield from any rootstock.”

Malcolm said all new rootstocks from the DAF research station at Bundaberg are compared to overseas equivalents.

“It’s a way of benchmarking the usefulness of Australian-bred material against what’s available internationally,” he said.

“We also have molecular markers now for a couple of the traits that are quite tricky to breed for in rootstocks so we can incorporate those techniques

Continued page 34

Genetic diversity is a cornerstone of the Australian rootstock breeding program, aiming to capture unique traits that will benefit commercial growers.



‘Spoiled for choice’ an ideal future

Malcolm Smith said he foresees a future in which Australian growers will move from having one or two “favourite” rootstocks to using up to half a dozen at any point in time.

“We’re really looking to get to a situation where growers are almost spoiled for choice,” he said.

“We don’t want one or two stocks that do well on sandy soils or salty soils or waterlogged soils. We really need four or five stocks that will perform under those conditions, because that’s the sort of diversity you need in an industry where things can go wrong.

“In our breeding program we’re really looking to have a good suite of rootstocks that have all the traits growers want.

“I was in Argentina a couple of years ago and just for lemons they had 10-15 rootstocks that were widely used commercially.

“When you speak to a grower there and ask ‘What’s your favourite rootstock?’, thinking they’re going to name one, they’re not interested in a favourite; they want to have diversity so they’re quite happy to have five or six different rootstocks on their farm. That’s the ideal for them.

“That’s the sort of situation we need in Australia so growers are not just using Troyer or *trifoliata* or Cleopatra but have five or six different choices they can use.” ●



Malcolm Smith, Queensland Department of Agriculture and Fisheries (DAF).



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into our conventional breeding as well. That dovetails very nicely with what we're doing."

Malcolm said the rootstock project's newest trial features a variety from the National Citrus Scion Breeding Program.

"The two programs are now quite tightly linked together – our rootstock trials are looking for better stocks for our own Australian-bred varieties."

He said one rootstock in particular is "looking pretty promising".

"It's quite compatible with Imperial mandarins and we think it will be compatible with other scions.

"That's one we'll consider releasing in the next few years; we're already giving it out to some nurseries to try just a few hundred trees here and there.

"This new one will follow on the heels of Barkley – which we released two or three years ago – as one of our highly compatible rootstocks.

"Then we have a lot of other material at various stages, right back to experimental crosses with some wild relatives that probably don't even look like citrus to most people. They have some particularly useful traits

like resistance to huanglongbing – the major disease in the world at the moment."

Malcolm said rather than run a linear pipeline of breeding, he aims to have the rootstock program "keep leap-frogging itself".

"If we see something that looks particularly promising we'll try to get that through into a field trial as quickly as possible."

"People think of elements in a pipeline taking 20 years to reach the end.

"A lot of our material is getting there faster, because if we see something with potential that's when we get it straight out to nurseries and growers to trial.

"And, if it's promising, we don't wait until we have 10 years of data before we say 'Yeah, we're going to release this'." ●

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Minimising the development of off-flavours in mandarin exports

The development of off-flavours in mandarin fruit delivered to export markets can occasionally be an issue in some shipments. Article by John Golding, NSW DPI.

It is a difficult quality issue to manage as occurrences can vary from container to container, orchard to orchard and even year to year.

It is generally thought that off-flavours develop due to anaerobic stress i.e. stress caused by insufficient air (oxygen) within the fruit to maintain normal function.

This lack of oxygen results in the fruit producing naturally occurring off-flavours such as ethanol and acetaldehyde during storage.

The development of fruit off-flavours is affected by a number of postharvest factors. Andrew Macnish and his research team from Queensland DAF have done a lot of work looking at the role of waxes in reducing the diffusion rate of gases between the fruit and the air.

They showed that different waxes have different permeabilities to oxygen and carbon dioxide. As a result, carnauba-based waxes are recommended to minimise the likelihood of fruit experiencing anaerobic stress caused

by a lack of oxygen and/or high levels of carbon dioxide (CO₂).

While carnauba waxes allow greater gas exchange in the fruit than many other coatings, there still remains the potential for the development of off-flavours in fruit arriving in export markets due to anaerobic stress.

Another potential source of postharvest anaerobic stress and off-flavour development are low ventilation rates in shipping containers during export. All shipping containers have a vent to allow air exchange (**Images 1a, 1b**).

Low ventilation rates can reduce the amount of fresh air coming into the container to a point where a critical build-up of CO₂ and /or low oxygen levels are reached.

The current recommendations for the air exchange / ventilation rates for shipping Murcott mandarins are unclear, with different shipping companies recommending different ventilation rates which range from 4 to 25 cubic meters air exchange per hour (cbm/hr) for different citrus types.

The ideal ventilation rate should be high enough to prevent a build-up of CO₂ within the container, but not too high to reduce the impact on water loss from the fruit. Even with wax applications, high ventilation rates can cause excessive water loss from the fruit.

The aim of this trial was to investigate different container ventilation rates on fruit quality and the development of off-flavours in waxed and unwaxed Murcott mandarin fruit after a simulated export and shelf-life assessment.

In this experiment low-seeded Murcott mandarin fruit were sourced from a commercial exporter in Queensland where half the fruit were taken from the packingline before the waxer (i.e. unwaxed) and the other half the fruit for the experiment were waxed with 'Decco Carnauba Premium' wax (0.5L per tonne).

Fruit were then stored at NSW Department of Primary Industries at four different ventilation exchange treatments (5, 15, 25 and 35 cbm per hour) (**Images 2a, 2b**). Fruit were stored at 1 °C in these drums for a simulated cold treatment export treatment of 24 days.

After cold storage fruit were assessed for weight loss, fruit respiration and ethanol production, fruit firmness, TSS, TA and sensory quality. These quality attributes were measured (1) immediately upon removal from cold storage; (2) after an additional 3 days at 20 °C ; and, (3) after an additional 7 days at 20 °C.

As expected, lower ventilation rates resulted in higher levels of CO₂ within the storage drums of mandarin fruit, due to insufficient flushing away of the CO₂ generated by the stored fruit.



Images 1a: Export shipping container.



Image 1b: Vent which allows fresh air to come into the container.

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However, the levels of the off-flavours in the fruit associated with ethanol only occurred at the lowest ventilation rate (5 cbm). Other results were not as clear; the combination of treatments (ventilation rate, shelf-life time and

wax) were all found to have different effects on each other at different levels and times.

Consequently, it was difficult to draw any clear conclusions from this storage trial. In most cases though the results indicated longer shelf life resulted in greater water loss, higher respiration rates, higher internal CO₂, higher

ethanol levels and softer fruit. Waxed fruit had lower respiration rates and were firmer than unwaxed fruit.

The components of fruit quality associated with the development of off-flavours (such as internal CO₂ and ethanol levels) varied between the different ventilation, wax and shelf life treatments.



Images 2a: Sample drum of waxed Murcott mandarins with different levels of ventilation during cold storage.



Image 2b: Set up of different drums for ventilation storage trial.

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Consumer taste testing of mandarins from the different treatments at NSW DPI.

These lack of clear differences in the postharvest parameters associated with off flavours (internal CO₂ and ethanol levels) was also reflected in the lack of sensory differences detected between the different treatments by the untrained consumers.

No differences in off-flavours (aroma and taste), aroma, sweetness, acidity / sourness, flavour / taste, and overall liking, were detected between the ventilation treatments at each assessment time for either waxed or unwaxed fruit, indicating that the ventilation treatments did not negatively affect consumer acceptability.

The lack of clear differences between the different container ventilation rates and development of fruit off-flavours suggests that the current set points for the container ventilation tested in this trial were adequate.

But these conclusions are based on work conducted with a high humidity flow-through and in one season with fruit from one harvest time. More work should be done to test these results and give growers and exporters more confidence in using adequate ventilation settings for export shipping containers. ●

John Golding is Research Horticulturist with NSW DPI.

Hort Innovation
Strategic levy investment

CITRUS FUND

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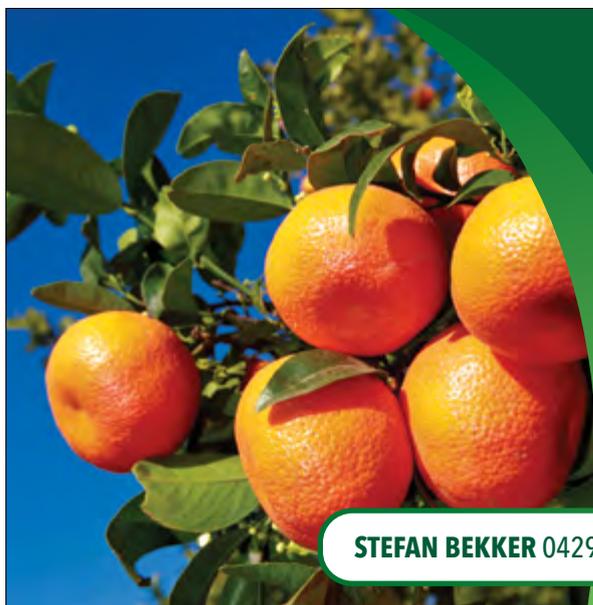
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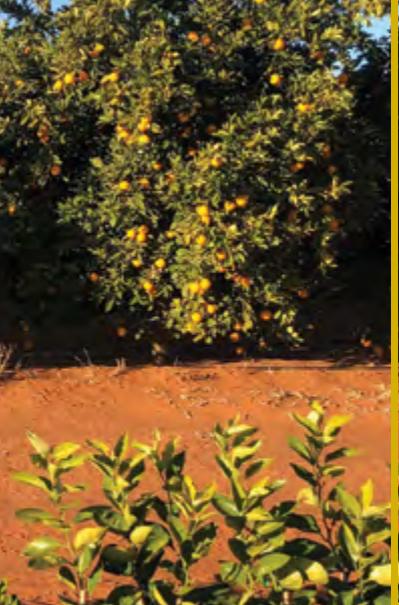


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