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AUSVEG WOULD LIKE TO THANK ITS LEAD STRATEGIC PARTNER

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Cover. A spray drone demonstration held in Gippsland, Victoria highlighted the benefits to growers for application of chemistries with minimal impact on soil. *See Page 141.* *Photo by Tom Bicknell.*

AUSVEG Hort Innovation

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Message from the AUSVEG Chair

Approaching mid-2024, the high levels of public, political and media interest in issues around the retail grocery sector have continued.

The fact many of this year's rolling retailer inquiries have been sparked by the consumer cost-of-living crisis means it's understandable some growers are sceptical about what, if any, results that improve their business viability will result.

That said, the heightened focus has shone a wider spotlight on issues our industry is facing.

The high costs of production and compliance, coupled with challenges securing sustainable farm gate prices, mean growers are struggling to the point that 37 per cent are considering walking away in the next 12 months – according to AUSVEG's latest Industry Sentiment Survey.

Yet while industry sentiment is at rock bottom, in my discussions with growers around the country, many can't remember a time when there has been so much public and political interest in aspects of our sector.

In its role as the lead advocate for the Australian vegetable, onion and potato industry, AUSVEG has sought to make the most of these opportunities to educate politicians and the public on the crucial contributions our industry makes to the nation, and the risks of not addressing our challenges.

In our submissions to, and appearances before, the various retailer inquiries underway – as well as in a range of other forums – we have continued to advocate for measures that will make a positive difference to growers.

There are some welcome signs. In the interim report of the Australian Food and Grocery Code review, we have seen our calls for a mandatory Code, making the complaints and arbitration system more independent and confidential, and measures to improve supermarket buyer behaviour embraced.

While the current suite of inquiries and reviews are well-intentioned, there is also a need to make sure recommendations are implemented effectively, and in ways that actually improve the situation for vegetable farming businesses. Once the glare of the political and media spotlight fades, we cannot be left with a situation where growers are worse off, with no meaningful recourse to improve their situation.

Just as we continue pushing for changes that will benefit vegetable growing businesses, we continue to warn against interventions that might overly distort free market dynamics, further disadvantaging vegetable growers and, ultimately, consumers.

Striking this balance requires ongoing engagement with the public, politicians and policymakers – not just on how grower-retailer relations can be improved, but also on the range of workforce, compliance, biosecurity and other issues we are facing.

During March, the AUSVEG Board visited Canberra for its first meeting of 2024. While in the nation's capital, AUSVEG Directors were also hosted by the Speaker of the House of Representatives, the Honourable Milton Dick MP, for an Australian Vegetable Growers showcase. The event brought some of Australia's leading growers together with politicians from across the political spectrum and key departmental figures, to discuss opportunities and challenges in our industry.

This has set a solid foundation for ongoing advocacy work to promote better understanding of the day to-day realities of operating a vegetable growing business.

There is still much work to do here. In recent weeks we have seen significant coverage of the government's plans to support Australian manufacturing, in the form of heavy interventionism.

While sovereign capability is crucial, particularly in the face of so much international turmoil, protecting Australia's food security must also be a priority.

For just a fraction of the cost of a speculative investment in unestablished and unproven industries – and in the short term, just a few legislative and policy adjustments that lighten the compliance and governance burden around issues like IR and the PALM Scheme – there are opportunities to support an established Australian vegetable industry with a proven track record of innovation and consumer need.

In finishing, I would also like to highlight the importance of, where possible, taking time to take stock, to get away from the farm, and catch up with colleagues grappling with many of the same issues you are.

To that end, Hort Connections 2024, is just a few short days away in Melbourne, from 3 to 5 June. In the current environment, coming together at events like Hort Connections – to network, celebrate success, and learn more about the latest innovations – is more important than ever.

I look forward to seeing you there.

Bill Bulmer
AUSVEG CHAIR

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The state of the sector, with the AUSVEG CEO

The multitude of challenges confronting the Australian vegetable industry have been the subject of significant discussion and consideration within our sector for some time.

However, in order for AUSVEG to most effectively advocate for positive changes that address the variety of issues vegetable, potato and onion growers are facing, evidence and data is invaluable.

When seeking that information – to truly paint a picture of the state of our sector – it is crucial to go straight to the source.

To that end, in early 2024, AUSVEG conducted an updated Industry Sentiment Survey, to provide a timely, evidence-based indication of how Australian growers are faring.

The previous iteration of this anonymous, confidential survey was only conducted in mid-2023. Yet, given the compounding pressures facing so many growers, and the heightened public and political interest in aspects of our industry – particularly, recently, the practices of the big supermarket retailers – it was crucial to source the most up-to date information.

An industry under strain

The latest survey results, across a range of small, medium and large-scale vegetable growing businesses, make for concerning reading.

The percentage of grower-respondents considering leaving the industry in the next 12 months had climbed to 37 per cent, up from 34 per cent last June.

Additionally, just four percent of respondents saw the future viability of their vegetable farming business as good or excellent, with 66 per cent indicating a poor or very poor outlook.

Input cost increases, poor retail pricing, increased labour costs, compliance and regulation, and a lack of operating certainty and profitability, were among the top issues contributing to this record low sentiment.

While these results may, and should, trigger alarm bells, this was not just an exercise in collecting concerns.

Evidence for change

The latest Industry Sentiment Survey data has already and will continue to be utilised across a suite of AUSVEG advocacy work, as part of efforts to improve the outlook for Australia's vegetable farming businesses.

The headline number of 37 per cent of growers considering walking away has already been widely cited across national media, and by influential industry and political figures, as a public indication of how tough the operating environment currently is.

Our advocacy has also extended beyond the headlines. The information gathered has informed AUSVEG's submissions and appearances before the series of political inquiries and reviews examining the behaviour and practices of the big supermarket retailers that have dominated early 2024.

Guided by direct feedback from growers, in our engagements with these various inquiries we have sought to promote changes and measures that will drive the most material improvement for vegetable farming businesses, without distorting the free market. These in turn have generated significant media, political and public interest.

The changes we have proposed on behalf of industry have predominantly focussed on the introduction of practical measures that provide greater certainty in grower dealings with retailers, address the power imbalance that is currently challenging so many fresh vegetable suppliers, and rein in some of the more questionable behaviours of the big supermarkets and their buyers.

By enhancing these representations with credible and current data and evidence from growers, we give ourselves the best chance of achieving the changes growers are telling us that they want to see.

This is also true of range of other policy issues AUSVEG is asking government to address on behalf of industry.

Workforce issues and shortages were identified in the Industry Sentiment Survey as another major ongoing challenge.

These include recent changes to the PALM scheme, which have rendered it practically unworkable for many, as well as the mounting compliance, red tape and wage cost burden making it unsustainable for many growers to continue operating.

Detailed insights and trends continue to inform our ongoing advocacy to politicians and government, as we seek fit-for-purpose solutions that recognise and address the specific workforce needs of the vegetable farming businesses that feed Australia.

Countering misconceptions

Utilising current and credible data is also key to counter misconceptions about the state of our sector.

Those looking to downplay the gravity of the situation may point to recent forecasts[1] from the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES), indicating the overall value of Australian horticulture is projected to nominally increase over each of the next two years, to almost $18 billion by 2024-25.

A deeper dive, however, reveals that a favourable outlook for some commodities within an extraordinarily diverse Australian horticulture sector, does not equal a rosy picture for all.

This is underscored by ABARES' observation that forecast growth reflects 'higher domestic production volumes, particularly for high value commodities such as almonds and table grapes, more than offsetting a fall in prices.'

The state of the sector, with the AUSVEG CEO

Price falls mean already borderline profitability will decline for many already-struggling growers. When looked at in real terms, the ABARES projections amount to an $83 million decline in 2024–25 compared to 2022–23. The picture is starker still for the vegetable sector specifically, where, based on the latest ABARES outlook, a decline of almost $350 million is forecast in real terms over that period.

Realising forecasts also requires growers to stay in the industry. Many tell us they won't. Or, as ABARES puts it: "Relatively higher energy, labour, fertiliser, and freight costs in 2023–24 and falling domestic fruit and vegetable prices are squeezing producer margins. In the short–term producers are expected to maintain production volumes due to the costs and risks involved with changing production decisions. However, over the medium term a persistent reduction in farm profits may lead to greater industry consolidation."

Boosting consumption

Other official statistics are also cause for concern. ABS data[2] released in April shows a 14-gram per day reduction in vegetable consumption across all Australians. This is on top of ABS data[3] from late 2023 showing Australians' vegetable consumption declined to the point that just 6.5 per cent of adults and 4.6 per cent of children are eating the recommended daily intake.

It has been very concerning to see the steady decline in vegetable consumption. The latest data is yet more evidence that coordinated efforts are needed to boost consumption. An increase of one serve per day per Australian could mean billions of extra serves consumed each year, billions of dollars in additional farmgate returns for growers, and reductions in the burden of preventable diseases on the Federal health budget.

AUSVEG understands the urgency around improving food literacy and increasing vegetable consumption. Along with Hort Innovation and other key industry stakeholders, we are continuing to work on the initiation of a long-term strategy, and coordinated, national behaviour change campaign to boost vegetable consumption.

Flow on implications

Approaching the second half of 2024, the evidence provides little doubt that the Australian vegetable industry is at a tipping point.

And while securing good data from growers on the ground is crucial, just as important is ensuring the implications of the information received are well understood.

To date, Australians have been fortunate to have access to an abundance of fresh vegetable products year-round. This is reflected in the fact that retail price spikes linked to temporary shortages of one commodity or another, due to extreme weather or other factors – regularly makes national news.

Twelve dollar lettuces, potato and hot chip shortages, and a lack of tinned beetroot, are just some recent examples.

In response to such shortages, industry has traditionally been able to reassure – pointing to Australia's natural strength in its counter-seasonal, national vegetable supply chain, and its ability to produce most fresh vegetables year-round. This has meant short-term reductions in localised supply have often been filled by production from other regions.

However, if the current sector-wide challenges are not addressed, and indications contained in the survey data play out, that may not remain the case.

At the extreme end of the equation, if more and more growers leave the industry, Australia risks becoming a net importer of fresh vegetable produce. In an era characterised by so much global uncertainty, volatility and conflict, that would not only be a national shame, but a risk to our food security and sovereignty.

This convergence of domestic and international factors highlights the critical nature of our collective efforts to educate the public, governments and policy makers, and to secure the improvements needed, through all avenues available to us.

The power of engagement

The validation within official data of on-the-ground experiences captured by the sentiment survey further highlights the importance of ensuring growers continue to engage with their peak body on the issues that are important to them.

AUSVEG thanks all who provided such valuable information to our latest survey.

While it can be confronting to reflect on the various challenges you are facing, and indeed your future in a sector that you have devoted much of your life to, please be assured that any and all information you provide is a contribution to ongoing efforts to improve our industry's fortunes.

I encourage all growers to engage in future surveys, as well as participate in the wide range of events and opportunities for networking and learning facilitated by AUSVEG, and the network of key partners within our industry.

A chance to catch up and reflect

One key opportunity for engagement is the fast-approaching Hort Connections 2024, which will be held at the Melbourne Convention and Exhibition Centre from 3 to 5 June.

With upward of 3,500 delegates anticipated at an event that has cemented its reputation as the centrepiece of the Australasian horticultural calendar, Hort Connections will provide plenty of opportunities, to catch up with colleagues, and learn more about the latest innovations, research and trends within our industry.

At a time when connection with colleagues – many confronting the same challenges as you – is more important than ever, I look forward to seeing you in Melbourne for what will be a timely and vital coming together of our industry.

Michael Coote
CEO, AUSVEG

FURTHER READING

1. ABARES report: agriculture.gov.au/abares/research-topics/agricultural-outlook
2. ABS media release: abs.gov.au/media-centre/media-releases/australians-consuming-fewer-vegetables-fruit-and-less-milk
3. ABS consumption figures: abs.gov.au/statistics/health/health-conditions-and-risks/dietary-behaviour/2022

2024 Preview

HORT CONNECTIONS 3-5 June 2024 Melbourne Convention Centre

INTERNATIONAL FRESH PRODUCE ASSOCIATION™ AUSVEG

It's time to start planning your schedule for Hort Connections 2024!

It's set to be an exciting few days. Here's just some of the things to look forward to:

Farm tours

The off-site tours are a must-attend event for any industry professional, affording you the opportunity to tour a range of properties and facilities depending on which you select. These include the Melbourne Market at Epping, as well as leading Victorian horticulture producers' farming operations.

There will be three farm tours this year: the Werribee Farm Tour, the Yarra Valley Farm Tour, and the Mornington Peninsula Farm Tour. To conclude the event, you will be chauffeured back to the Melbourne Convention and Exhibition Centre.

Annual Vegetable Industry Seminar

The Annual Vegetable Industry Seminar is a Hort Innovation Vegetable Levy-funded R&D seminar held each year to showcase emerging products and innovations in horticulture, as well as focusing on key areas for business and personal development of vegetable industry members.

Trade show speaker sessions

With an exciting line-up of trade show speakers and plenary sessions, the event will give delegates knowledge and advice for their business.

On Tuesday, attend sessions such as '*The Future of Agriculture: Microbiomes as Drivers of Soil and Plant Health*' presented by Dr Neil Wilson, Director of Research at Metagen; and '*Cultivating Leadership Excellence in Horticulture*' presented by Georgia Stormont, Sales & High Performing Teams Coach at Curious Georgia Coaching.

Dr Neil Wilson is a microbial ecologist with more than 20 years' research experience. Neil is passionate about communicating how the latest developments in the field of agricultural microbial ecology can help improve the sustainability of agri-ecosystems.

Georgia dedicates herself to the growth and development of emerging and existing leaders in the field. Her coaching philosophy, rooted in practical experiences, bridges the realms of horticulture and leadership.

The Women in Horticulture sessions will feature Brooke Hanson OLY OAM, Chief Motivation Officer at Lane 6 Australia. Brooke is an Olympic Gold and Silver Medalist who now empowers people to live a purpose-driven life by motivating individuals and inspiring organisations to achieve greatness. As a professional motivational keynote speaker, she has been transforming lives through energy management, mindfulness, and motivation, taking the importance of energy health performance to new levels.

Plenary sessions

On the final day, get set for a day of informative plenary sessions. Hear from Brett Fifield, CEO of Hort Innovation; Su McCluskey, Special Representative for Australian Agriculture and the Department of Agriculture, Fisheries and Forestry; Ben Hoodless, Managing Direction A-NZ at International Fresh Produce Association; and more.

Ms. McCluskey is a prominent voice promoting Australia's commitment to sustainable agriculture, to the multilateral system and to the principles that underpin global trade in agricultural goods and products. Ben has more than 20 years' experience working in A-NZ and South-East Asia for large multinational R&D companies. Ben has a global mindset, and is committed to delivering value for IFPA members, both in A-NZ and globally.

And of course, we can't forget the exciting opportunities for networking and celebration. Join us for the Perfection Fresh Breakfast and more than 200 trade show stalls. To wrap up the entire conference is the Hort Connections Gala Dinner where the Horticulture Awards for Excellence 2024 will be presented.

HORT CONNECTIONS HC MELBOURNE 2024

Register to attend Hort Connections at Horticulture's premiere conference and trade show hortconnections.com.au

Biggest challenges to Australia's vegetable industry

BY LUCY GREGG
GENERAL MANAGER, PUBLIC AFFAIRS AND COMMUNICATIONS, AUSVEG

In recent years it has become increasingly apparent that Australian vegetable, potato and onion growers are facing a livelihood-threatening set of challenges which also present serious implications for the nation's food security.

The recent AUSVEG Industry Sentiment Survey completed in early 2024, starkly illustrated the challenges and highlighted the increasing pressures confronting the vegetable, potato and onion sector.

In that survey, 37 per cent of grower respondents indicated they were considering leaving the industry in the next 12 months, up from 34 per cent in June 2023. Overall industry sentiment also dropped, with a mere four per cent of respondents seeing their future vegetable farming viability as good or excellent, and 66 per cent of respondents seeing their future vegetable farming viability as either poor or very poor *(Figure 1)*.

These numbers are frightening and should raise alarm bells with policy makers across the country. To truly appreciate the gravity of the situation, there is a need to address the overarching misconception that Australia has more than enough food to feed itself. Such misconceptions are often based on export data which shows Australian agricultural exports reached a record $80 billion in 2022-2023.[1]

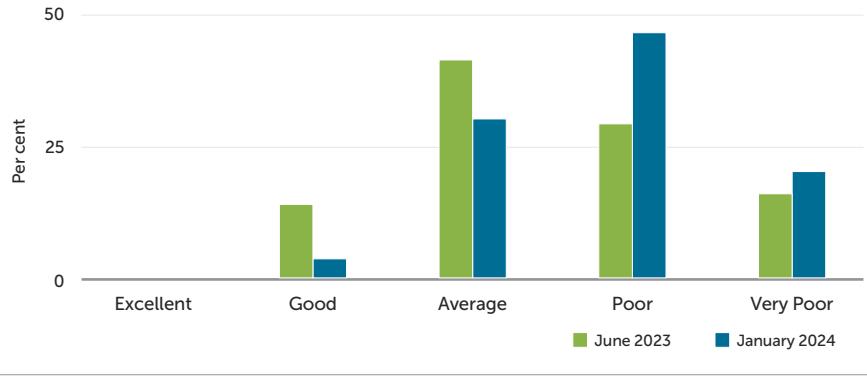
However, when it comes to vegetable production, 98 per cent of fresh vegetables purchased in Australia are grown in Australia, with fresh vegetable exports valued at $251 million[2], less than half a per cent of overall agricultural exports.

It's a simple and concerning equation – if 37 per cent of growers who produce 98 per cent of fresh vegetables in the country exit the industry, where do Australians get their fresh vegetables from, and at what price?

The reasons for growers considering exiting the industry are multi-faceted and variable. This is due to the diversity of crops Australia produces, the differences between widely dispersed growing regions, in addition to the complexities of state and regional issues that farming enterprises must deal with.

Nevertheless, universal themes are clearly identifiable. While these key challenges may come as no surprise to anyone involved in the industry, unless they are addressed with policy responses that support the industry's economic viability, protect fresh food supply, and lead to the adoption of an integrated, well-resourced national food security plan, then the threats to Australia's vegetable sector and food security will remain.

FIGURE 1 | AUSVEG INDUSTRY SENTIMENT SURVEY – FUTURE FARM VIABILITY



1. agriculture.gov.au/about/news/overview-aff-exports-2022-23
2. horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/australian-horticulture-statistics-handbook/

Below we consider some of the key issues confronting the sector:

Lack of an Integrated National Food Security Plan

How quickly we have all forgotten the shortages of grocery essentials during the COVID-19 pandemic. During the pandemic, our lack of sovereign capability saw a raft of initiatives focused on modern manufacturing, supply chain capability, and the lauding of our agricultural sector for feeding the nation, even when international supply chains were dramatically disrupted.

AUSVEG welcomed the release of the *Australian Food Story: Feeding the Nation and Beyond* report into national food security last November, and its comprehensive investigation into the vulnerability of Australian food supply systems. The Committee's recommendations reflected many key AUSVEG policy positions, particularly around developing a national food plan, and addressing key issues such as sovereign capability, labour shortages, vegetable consumption and biosecurity.

Of particular note was the recommendation to establish a Minister for Food, to provide an overarching mechanism to progress key priority issues relating to labour, migration, competition and environment, that are otherwise difficult to gain traction on, given they span multiple portfolios, and national, state and local jurisdictions. Four years on from the pandemic, it appears the angst over our capacity to the feed nation is all but forgotten. This is a shame because, given the current challenges confronting Australia's vegetable industry, there has never been a more important time to fund and act on the report's recommendations.

Workforce

Even prior to COVID-19 the agricultural sector and associated supply chains were facing chronic labour shortages, and the situation has not improved. In fact, many growers would state the situation has worsened. According to the recent Industry Sentiment Survey, 56 per cent of growers currently face workforce shortages, with 69 per cent saying they expect shortages to continue, and 16 per cent expecting them to worsen.

Shortages were being felt across the workforce in a range of full-time, part-time and casual roles, including skilled, semi-skilled and unskilled positions. Changes to the PALM Deed and Guidelines have had a significant impact on growers who utilised the scheme, with a 20 per cent drop in respondents participating since June 2023. Those who still engaged with the scheme expected to reduce PALM worker numbers by more than 30 percent.

Changes to overseas student visas, UK backpacker visa conditions, a 17 per cent increase in the minimum wage in recent years, and suite of industrial relations changes are additional burdens affecting growers' ability to source sufficient workers.

Vegetable growers are also an aging population, and the sector has continued to struggle to attract young talent, largely based on misconceptions of the industry. There is an urgent need to focus on changing perceptions, to help build a young talent pipeline, including highlighting job diversity, automation and science, working conditions (including wages), and career opportunities.

Compliance and regulation

The increasing burden of regulation and compliance is putting significant pressure on farming businesses. Family SMEs find it increasingly difficult to have the skills, knowledge and time to implement and manage some of the necessary requirements. Those businesses wishing to employ specialists (such as HR or Food Safety), or use service providers, also face difficulty in finding the skills in local communities or regions. Food safety and other assurance programs, OH&S, human resources/industrial relations, finance, and migration are just a few of the areas where grower enterprises require specialist skills on a daily basis.

Other activities such as new worker accommodation or packing sheds, water infrastructure, land clearing, all require a suite of permits and applications often at local, state and federal levels, that can be resource intensive for an SME. Not surprisingly, the recent AUSVEG Industry Sentiment Survey, indicated the burden of compliance and regulation was one of the most significant reasons for growers considering exiting the industry.

Economic viability

The relentless margin squeeze caused through escalating costs (both through inputs and labour) and reduced returns was the key issue for a vast majority of growers in the recent survey. The stifling economic environment was largely reflected in operational losses, with survey respondents saying lack of operating profit was prohibiting innovation, expansion and capital infrastructure upgrades.

The ongoing challenges are also contributing to growing tension between suppliers and supermarkets over how profitability and risk have been shared through the supply chain, following a period of soaring inflation and record profits for the grocers, versus plummeting returns for many producers.

Biodiversity and environment

Ongoing biosecurity incursions continue to create challenges for growers. The ability to effectively deal with pests and diseases is also hampered by an ever-declining range of appropriate and effective treatment options. Pests, such as Fall armyworm, are continuing to impact a broader range of vegetables, posing a real threat to Australian growers' ability to farm.

Environmental stewardship, and the evolving and varied forms this can take, may also contribute to significant additional costs to growers. This is despite the fact that growers have been consistently modifying their growing practices for decades, to minimise their environmental footprint to ensure generational longevity of the family farm.

Water

Water is one of the most contentious and challenging issues facing the agricultural sector in Australia, as governments seek to balance competing interests among various stakeholders, including farmers, environmental advocates, recreational water users, and urban populations. Striking a fair and equitable distribution of water resources amidst growing demand and limited supply requires navigating complex, multi-tiered political landscapes and negotiating conflicting priorities, even within agriculture.

Additionally, historical water rights systems often entrenched in regional disparities and outdated regulations further complicate policy formulation and implementation. Moreover, the impacts of climate change exacerbate these challenges by altering rainfall patterns and intensifying droughts, necessitating adaptive and resilient policy frameworks. Ensuring sustainability of the industry in light of Australia's evolving irrigation water policy environment will become increasingly challenging.

Climate

Global warming and its effects on agriculture present one of the biggest threats to Australia's food supply chains. Extreme weather events such as droughts, heatwaves, storms and floods are disrupting growing patterns with the prevalence of such events increasing.

The result will be greater volatility in availability of produce, and consequent reflections in price. Climate change was responsible for one third of food price inflation in the UK last year and estimates indicate that extreme weather events on global production could lead to a 20 per cent increase in food prices globally by 2050.[3]

Australia's diversified growing regions, covering a range of climatic conditions, do provide opportunities to source near year-round supply of most vegetable products. However, as growers exit the industry will areas of vegetable production become more intensive, potentially increasing the risk of regional crop 'wipe-outs' and product scarcity? And with these extreme weather events becoming more frequent, how do growers recoup the costs of rebuilding fences, infrastructure, and crop and machinery losses?

AUSVEG Industry Sentiment Survey

Top reasons for exiting the industry:

- Margin squeeze (increased labour costs and input costs and poor returns)
- Compliance and regulation
- Current business model not sustainable (including lack of succession planning, lack of operating profit, lack of capacity to innovate)
- Lack of workforce and appropriately skilled staff
- Crop losses due to weather events.

[3] *What are the 10 biggest threats to UK food security | The Grocer.* thegrocer.co.uk/supply-chain/food-security-the-10-biggest-threats-to-the-uk-supply-chain/689758.article

Supply chain issues equal greater costs for growers

BY TOM BICKNELL
SENIOR COMMUNICATIONS OFFICER, AUSVEG

Australian growers exist at the end and beginning of very long and complex supply chains. On the incoming side, agricultural inputs, most of them imported, travel tens of thousands of kilometres to reach growers.

Once those inputs have been used to grow vegetables, a delicate cold chain stretching hundreds or thousands of kilometres is required to transport that produce to primary domestic markets. For produce bound for export markets, those vegetables can travel tens of thousands of additional kilometres.

The vulnerability this creates for the horticulture industry has been brought into sharp focus in recent years as Australian and international supply chains were battered by major disruptions from extreme weather, labour shortages, industrial action, pandemic border closures, international conflicts, as well as biosecurity movement restrictions.

Severe flooding events can affect major road and rail arterials, leading to disruptions in the food supply chain that impact supermarkets, force growers to divert trucks loaded with produce via circuitous alternate routes, and delay delivery of urgent supplies such as packaging and farm inputs.

For growers, disruptions like these increase costs linked to both inbound and outbound aspects of the supply chain. With no means of passing these additional costs on to either domestic or international customers, they are another factor threatening the viability of many vegetable growing businesses, ultimately jeopardising Australia's food supply and security.

In 2023, a survey by the Global Coalition of Fresh Produce found that Australian fruit and vegetable growers had experienced an average 37 per cent increase in production and operating costs over the previous two years. That included a 107 per cent increase in fertilisers and 34 per cent increase in crop protection products and seeds.

In Australia, these agricultural inputs are largely imported following the erosion of domestic manufacturing.

Most of Australia's vegetable seeds are imported. All urea is now sourced overseas, mainly the Middle East, following the closure of IPL's Gibson Island plant in 2022, as are all potassium fertilisers. Two thirds of phosphorous fertilisers are imported. The situation is similar with pesticides.

The loss of domestic manufacturing capacity of these inputs has left growers further at the mercy of long, vulnerable and volatile supply chains.

On top of issues associated with imported inputs, growers are also faced with the intricacies of the outbound supply chain. Across the vast Australian continent, fresh produce will often travel thousands of kilometres from production to processing and onwards to retail shelves. Exported produce must travel similar distances to air and seaports before starting the even longer journey to markets around the world.

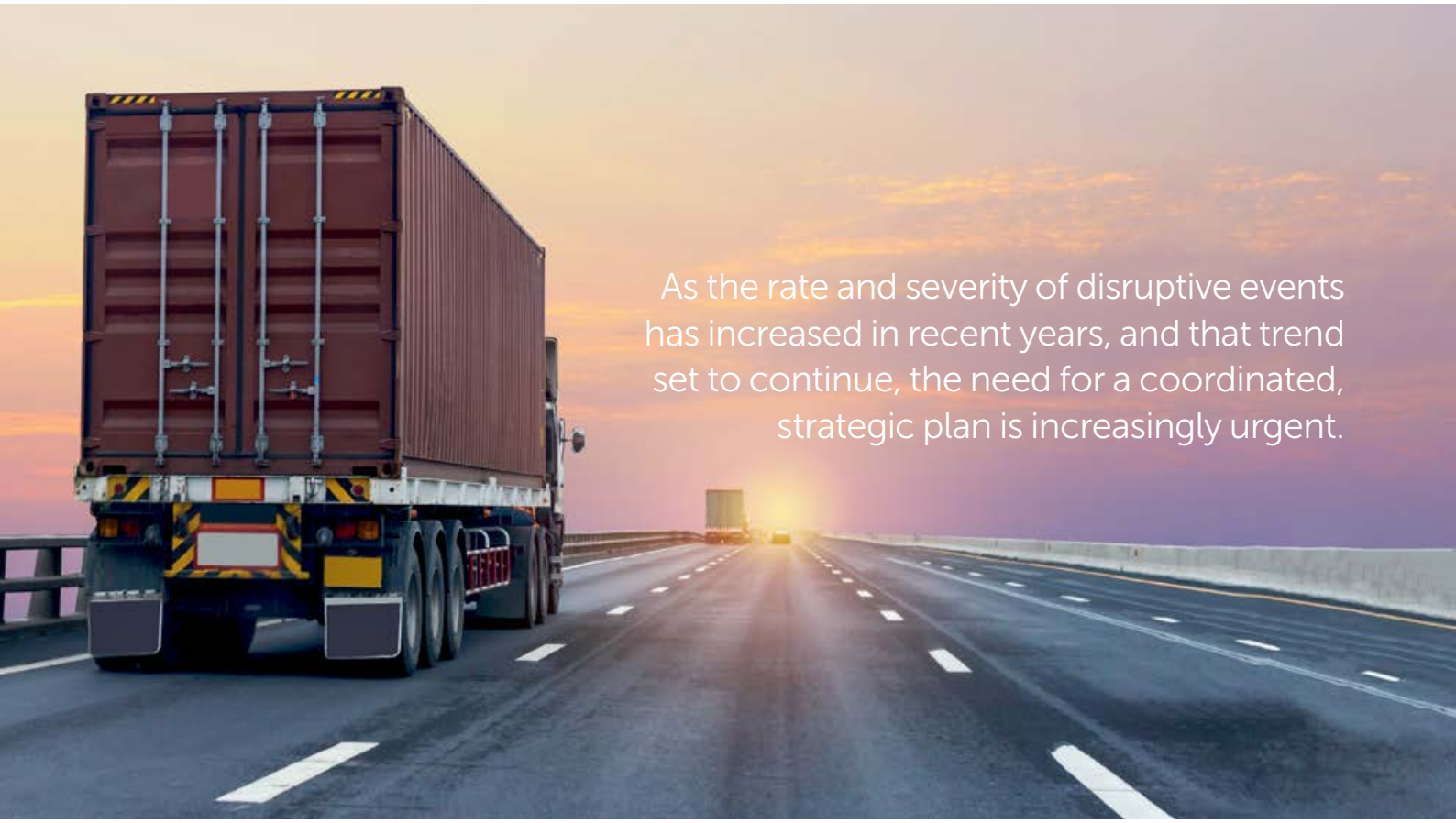
Australia's food logistics have always been particularly vulnerable by global standards. Our road network, for example, is ranked ninth by length by the CIA's World Factbook, but 157th by density, making for long, isolated transport links.

In the Global Coalition of Fresh Produce survey, Australian growers reported their shipping costs had increased 35 per cent in the two years to 2023. While inflationary pressures linked to ongoing disruptions and other factors have undoubtedly contributed to additional costs along the domestic supply chain – many of which growers have little option but to absorb themselves – the same is also true of export supply chains.

In January, port giant DP World Australia raised landside fees and charges at its container terminals in Melbourne, Sydney, Brisbane and Fremantle, in some instances as much as 52 per cent. The company was also hit by long-running industrial action that left containers sitting on docks for weeks.

For Australian exporters, both issues compounded international freight disruptions from conflict in the Red Sea, the Baltimore Bridge collapse and drought limiting capacity in the Panama Canal.

Our horticultural system is heavily dependent on a fast, reliable freight network, as are the tens of millions of people it feeds both internationally and in Australia. Without steps to improve efficiencies, national self-reliance, and supply chain resilience, growers will



continue to face challenges and additional costs, at a time when many continue to face a cost-of-production crisis that is threatening their business viability.

The Australian Government is currently undertaking a review of the National Freight and Supply Chain Strategy in response to these unprecedented disruptions.

The Strategy was launched in 2019 to improve the efficiency, effectiveness and reliability of Australian supply chains. The review aims to find gaps in the Strategy and bolster it against the increasingly challenging transport landscape, resulting in a refreshed Strategy and new five-year national action plan due to be released this year.

This review will no doubt address the expanding needs for maintenance and resilience of the physical freight network, which are critical components, but it must also look beyond that to address the structural challenges for Australian horticultural logistics.

As part of the National Freight and Supply Chain Strategy review, we urge the Government to look at ways to shorten the supply chains of agricultural inputs, particularly by encouraging domestic manufacturing capacity.

Improving domestic manufacturing of inputs is something AUSVEG has pushed for in its recent pre-budget submission to the Government.

The closer those inputs are produced to growers, the less Australia's food security is subject to an increasingly fragile freight system and tempestuous global politics.

In its submission to the Senate Select Committee's Inquiry on Supermarket Prices in February, AUSVEG also raised concerns about the increasing power of retailers along the supply chain through acquisitions or the establishment of new supply businesses that then force growers to use the retailer-owned business.

The challenge of reinforcing the freight links required to move produce from farm to fork is a separate problem again, requiring a rethinking of our road and rail network to include the resilience and backup capacity to handle extreme weather that is now a question of when, not if.

These are just some of the many existing and emerging issues linked to the supply chain, which are contributing to higher costs for growers – and which could impact future supplies of fresh vegetables in Australia if not addressed.

Despite countless reports and research in recent decades, Australia has so far failed to produce a nationally coordinated, cross-portfolio assessment of risks to its food supply chain, along with measures to mitigate those risks.

In a recent submission to the Senate Inquiry into Food and Beverage Manufacturing in Australia, AUSVEG emphasised the need for a National Food Supply Chain Resilience Plan.

In order to prepare and plan for disruptions, government and industry must work together to fully understand the complexities of our food system, how specific events might impact the various links in the food supply chain, and how these can be addressed.

As the rate and severity of disruptive events has increased in recent years, and that trend set to continue, the need for a coordinated, strategic plan is increasingly urgent.

John Deere's unprecedented commitment to HVC

BY JOHN DEERE PRODUCTION SYSTEM MANAGER, STEPH GERSEKOWSKI

In 2024-25, the High Value Crop (HVC) sector will reach a new record of $17.8 billion in its value of production, positioning it as the third largest agricultural industry in the nation. Horticulture is outpacing every other primary industry and, as global demand for food grows, its importance will only continue to rise.

At John Deere, we believe we are ideally placed to support growers by bringing the world's best precision agriculture technology to HVC.

Broadacre farming has reaped the benefits of technology and innovation over the past two to three decades, but horticulture has not enjoyed the same evolution, and this is now something we are committed to addressing. We want to start to bring HVC producers in line with their broadacre counterparts by applying and further developing tech already proven in the grains and cotton industries.

Unique challenges

At the same time, we understand and appreciate the unique challenges faced by our HVC customers in boosting the efficiency and productivity of their operations – be that limitations around machine form size, coverage under canopy or the range of implements available for specific crop types and farming practices.

We also know access to skilled labour is one of the greatest limitations to efficiency and productivity, particularly during periods when windows are tight such as spraying and harvest – and we're prioritising investment in automation to deliver solutions that are scalable depending on what workforce is available at any time. Autonomy can drive greater quality and consistency in job execution, increase profitability and improve farm safety.

Data management is another priority for the HVC sector, one we believe will become increasingly urgent over the coming years. For this reason, we are committed to connecting 100% of all John Deere small tractors as the first step in supporting greater documentation and traceability.

It is seldom we have a conversation with growers who do not speak about the growing pressure input costs are placing on production systems and we're working hard to deliver solutions that reduce overall costs of production for customers. Over the past two years, John Deere has introduced many solutions and technologies to address these significant, but not insurmountable, obstacles.

For example, the 5ML Tractor is specifically designed to meet the unique requirements of orchard and vineyard production, while precision ag technologies such as automated guidance system AutoTrac™, that were previously only placed on large agricultural machines, are now available in HVC equipment.

SmartApply™ can help growers achieve up to 93% less chemical runoff and up to an 87% reduction in airborne drift, while reducing chemical and water use by an average 50%. Additionally, our Joint Venture with GUSS is delivering spray units that bring together a sophisticated combination of GPS and light detection and ranging (LiDAR), vehicle sensors and software to navigate through rows autonomously.

From an overarching perspective, integration of tech and in-field monitoring with John Deere Operations Center™ means growers can access another level of insights and data analysis to support better documentation, traceability and data-informed management decisions.

This is an exciting and rewarding era, and we want to work side-by-side with growers to produce some of the best fruit, vegetables and wine in the world through uptake of technology we know can make an impactful contribution to industry and our farming communities.

You deserve to have the world's best tech powering your machine. We are listening and we are committed to High Value Crops.

Top. The John Deere 5ML Tractor is specifically designed to meet the unique requirements of orchard and vineyard production. **Above.** GUSS Automation is delivering spray units that bring together a combination of GPS and light detection and ranging (LiDAR), vehicle sensors and software to navigate through rows autonomously. **Inset.** Stephanie Gersekowski.

Find all your levy-funded R&D in one place

InfoVeg is the AUSVEG R&D resource database, housing hundreds of reports, tools and factsheets for vegetable growers, agronomists, researchers and industry in one convenient location.

Categorised by research, focus and vegetable, users of InfoVeg can search for information across many years and project iterations for a specific topic.

Need to find information on chemicals and pesticides, under pests and diseases for cucurbit?

Simply select from the search options and find all the information available in the database. A search by keyword or project code is also easily undertaken.

Information on levy-funded R&D projects isn't just available through the InfoVeg database. AUSVEG also covers R&D projects on video through our YouTube channel, and in our Vegalogue podcast.

Some of the latest projects uploaded this year to the InfoVeg database include:

- Economic contribution of Australian horticulture (MT21010)
- 10th International Spinach Conference 2023 (VG22010)
- Investigating soil pH and nutrition as possible factors influencing pink rot in potatoes – a pilot study (PT19000)
- Risk and crisis management planning for the onion industry (VN20001)
- Alternative disinfestation for market access for crops affected by tomato potato psyllid (VG17015)
- National Vegetable Protected Cropping Centre (VG17003).

Hort Innovation VEGETABLE FUND

This project has been funded by Hort Innovation, using the vegetable research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

To access the InfoVeg database, go to: ausveg.com.au/infoveg
You can listen to the Vegalogue podcast at: vegalogue.buzzsprout.com
And watch our R&D video series on AUSVEG's YouTube channel

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Ed Fagan joins AUSVEG Board

New South Wales vegetable grower Ed Fagan is no stranger to the intricacies of the industry, and advocating on its behalf.

AUSVEG welcomes Ed Fagan to the Board of Directors. Representing New South Wales, and filling the shoes of retiring Director Geoff Moar. Ed is a multi-generational grower from Cowra where the principal crop is beetroot.

In recent times, Ed has been at the coal face of the beetroot shortage, arising from the cyclone that devastated parts of New Zealand last year. As one of the few Australian growers of beetroot, demand has been intense in the past six months to meet the shortfall.

The family property, Mulyan, which was established in 1886, is within the Lachlan River catchment which has since become part of the Murray Darling Basin system. It was during the millennium drought in the early 2000s, when water became a contentious commodity that Ed joined the Lachlan Valley Water Board to advocate on behalf of farmers and be heard on water issues.

"With government making the decisions at a top level about where, how and who is using water in a system such as the Murray Darling Basin, I soon learned that changing the perceptions of politicians was vital.

"When many members of parliament believe that water is mostly for cotton and rice, it was essential to show that horticulture had water needs that were no less important. In my 20 years of advocating on water, I have learned a lot about how to work with government for appropriate change in horticulture."

For New South Wales, much of the vegetable processing of 30 years ago has disappeared, including the Edgell cannery in Cowra. Vegetable growers in the state are more likely to be small family holdings. Compared to Victoria and Queensland which have regional concentrations of growers, New South Wales growers are scattered across the state.

In the past 10 years, Ed has been involved with Hort Innovation as a member of the Strategic Investment Advisory Panel (SIAP) for vegetable growers.

The Fagan family have a history of advocacy. For Ed, participating on the AUSVEG Board is an opportunity to represent growers who have a similar farming ethos, ensuring their concerns are heard, and getting a return on their time, effort and investment.

"When you walk into a supermarket, the vast majority of the fresh fruit and veg is Australian grown. But when you walk into the canned and bottled section where our preserved beetroot sits, nearly all of it is imported. It would be great to see more of the processing done locally like it was in my father's time, so that the risks that Edgell and Golden Circle faced this season are reduced.

"The challenges that New South Wales growers have compared to those states who have concentrated areas of horticulture are a bit different, so I want to be sure that our needs and concerns are heard," said Ed.

"Issues such as workforce, market access, consumer education and prohibitive legislation that limits growers' ability to farm need a collective voice in parliament, and being on the Board will help give that perspective.

"As a smaller grower, I'm looking forward to bringing my experience of farming in New South Wales, and from business outside horticulture to the Board to give another point of view, and represent growers like me."

brassicas

Brassica varieties continue to evolve

Producing broccoli and cauliflower seeds for the Australian market is reliant on tried and tested varieties and determining what growers will need for the future.

The volume of broccoli and cauliflower production in Australia was more than 76,300 tonnes and 84,890 tonnes respectively in 2022-23.

With that level of production, the number of seeds required is significant. Not only to meet volume demands, but also to cater for year-round production across most states of Australia.

As with most vegetables, broccoli and cauliflower are not restricted to a few varieties, but hundreds to suit climate, growing season, and customer demand.

To meet those needs, the development of broccoli and cauliflower varieties aims to satisfy what the customer and retail environment prefers, in combination with the needs of the grower.

Pictured. Eliza Seymour shows the different varieties of cauliflower on trial in Werribee South.

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WITH ELIZA SEYMOUR HERE

"Globally there would be thousands of varieties of brassicas, but here in Australia there is likely to be more than 100 just in broccoli and cauliflower," said Bayer regional business manager, Eliza Seymour.

"Ultimately, the broccoli head that a customer purchases from their local grocery store in the Northern Territory needs to look the same as the one bought at a store in Tasmania. That means the development of varieties needs to provide consistent results for store specifications, but also handle different growing conditions across the country."

Developing a variety from concept through to commercialisation takes anywhere from seven to 10 years. During genetic development and field trials, consideration such as head size, colour, vigour, disease resistance and ease of harvest are all part of the final decision as to which will make it to market.

"Many growers are using varieties that are more than 10 years old, that are tried and tested, but many are happy to look at newer genetics that may offer added benefits on top of what they currently grow.

"For example, with cauliflower, the head can go yellow with sun exposure, so growers will use the leaf to cover the head to protect it and have done this practice for years. Some seed companies like Bayer are introducing new genetics that enable the cauliflower head to stay white even when it is exposed to UV light. The Curdivex® cauliflower range offers this brilliant-white trait. Part of my role is to demonstrate to growers that these new bright-white-gene varieties do not require sun protection but still produce the same results. Niche varieties such as orange or purple cauliflower come and go with customer demand. Broccoli has its own colour issues with a tendency to go purple due to the presence of anthocyanin pigments. Some retailers don't mind it, but others may reject it."

Field trials are an important part of grower acceptance. By the time trials are conducted in Australia, seed companies are confident that the variety will perform. For broccoli and cauliflower, Bayer will conduct a number of trials at different sites around the country, across the year.

Disease pressure and hardiness to weather conditions are important variables to trial. A variety that grows well in one location early in the season, may perform better later in the season in another region. Eliza says that the toughest season to prove a brassica is spring when weather conditions are at the most variable. A variety that performs exceptionally well in spring, will have fixed some headaches for most brassica growers.

Comparing 14 varieties of cauliflower in replica plots, Eliza will look for head size, height of the stalk (more so in broccoli), vigour of the plant's frame, whiteness of the head and tightness of the curd for cauliflower and disease resistance.

"The challenge for growers in Australia is that broccoli is sold to market agents and retailers based on head weight, whereas cauliflowers are sold by head count, with each cauli head roughly 1kg – or about six to a crate.

"Ultimately, we look for varieties that make it easy for the grower to plant, grow and harvest. If the variety needs a specific two-week window to plant, then it adds a level complexity to the planting schedule that the grower doesn't necessarily need or benefit from.

"One of the big focuses at the moment is stem height on broccoli. With many growers finding it difficult to find and train-up harvesting crew, the need for mechanical harvesting is on the rise, which means developing varieties that sit higher above the ground while maintaining the head weight that retailers specify."

From seed to seedling

The majority of growers will use seedlings grown from seed by vegetable nurseries. Depending on the time of year, a seedling can take up to eight weeks to grow to the size required for transplanting on farm. Once transplanted, these seedlings grow for an additional 11 – 22 weeks before reaching full maturity. If growers were to directly plant seeds in the field, this could mean more than 30 weeks where that piece of land is taken up by a Brassica crop.

Therefore, nurseries will provide hardy seedlings to the grower in regular cycles to allow the grower to transplant, harvest, prepare the soil and re-transplant.

Seeds are generally imported and fully certified to ensure good quality, high germination rates and Australian compliance. Forecasts for seed demand are completed two years in advance to ensure that seed companies are able to meet demand in the local market for certain varieties. Brassica seeds will hold their vigour for up to five years under controlled conditions but are tested every year to grade the quality and germination rates.

The seedling nursery provides an ideal environment for germination, and as the seedlings develop, they go through a hardening process to acclimatise to an open field system.

When the seedlings are received by the grower, they are transplanted directly into raised beds. Most will use a pre-emergent herbicide. Insecticides during the season are important to prevent damage to the growing head. Most growers use BTs to keep caterpillar populations to a minimum.

Fungicide programs are also essential to control fungal pathogens. In Brassica crops the main fungal issues include White Blister (*Albugo candida*) and downy mildew (*Hyaloperonospora parasitica*). *Verticillium* wilt and Club Root (*Plasmodiophora brassicae*) can also cause issues if the soil is not treated prior to crop establishment. Brassica growers in some areas of Australia can grow 12-months a year, and in that time establish and harvest three to four different crops. Over this 12-month period they will use varieties best suited to the seasonal conditions for optimum yields.

"Brassicas are very hardy plants. I am always amazed at how a broccoli crop can grow through the depths of a freezing Victorian winter, but also thrive in the humid Queensland summers. Varieties with a strong frame and good vigour will usually deal with adverse conditions much better than those without.

Ultimately Australian brassica growers are always aiming to grow a high-quality head that consumers will pick up in store and happily take home to their family for dinner. I am just really lucky to be able to help with that process on the genetics side."

Tasmania's broccoli and cauliflower is grown to high market standards

Tasmania's brassica harvest spans across the year for the fresh and processing markets. The agronomy to produce the best outcomes has a lot of similarities to mainland crops, as well as a few unique considerations.

Tasmania's broccoli and cauliflower growing regions are primarily along the northwest coast and inland to the south of Launceston. The coastal regions provide a milder environment and faster growing conditions, than inland.

Broccoli and cauliflower for fresh markets starts in early August for harvest commencing in December, through to March. Processor markets will start in January and finish in March, with harvest occurring from May through to July. Growth through the summer is typically 70-80 days, but through winter can be three to four months. Planting schedules are often three to four days apart to maintain regular market supply. Larger paddocks will be divided into different planting windows, often in the order of 3-5Ha per planting.

"In the summer when the plants grow quickly, it is important to make sure that the planting and harvesting schedule is maintained – if one planting is slower to grow and the window to market is missed it can be ploughed in," said agronomist Tim Walker of WalkerAg Consultancy.

For most growers, cauliflowers are grown to around 1kg per head, with 20-40 tonnes per hectare for the processors, while broccoli is based on weight and yields around 6-12 tonnes per hectare, but has a higher commercial value than cauliflower. To gain the yield, nutrients will be increased to meet plant demand.

"Strip till is the primary method over working the ground up and fertilising as it was done years ago. That method was able to do four rows at a time, plus fertiliser which led to a lot of soil compaction from the tractors.

"The advantage of strip till is that you can go into a wheat paddock or peas, where there is little trash left on the surface, strip till and top fertilise and take advantage of the nitrogen already in the soil from the peas."

For a cauliflower crop, Tim says that a tonne of fertiliser at a ratio of 6/15/13 for N, P and K plus trace elements is enough, while for broccoli 600kgs is sufficient. Tim prefers to do a top dressing of calcium nitrates to help the seedlings recover from transplanting shock.

Top. Tim Walker, agronomist amongst a crop of cauliflower.

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If weeds become a problem three to four weeks after transplanting, inter-row scarifying may be done in which case another top dressing of fertiliser is done to get into the brassica root zone. For many regions of Tasmania, the country can be quite steep and stony, so chemical control of weeds, radishes and volunteer potatoes can be the preferred method.

"Really, it is about timing for when a pre-emergent is used, particularly as they need to be washed in. If rain is forecast, great, otherwise you may need to irrigate. For the transplant, to lessen the shock on the seedling it is also better to plant into damp ground and give it another drink once it's planted. This summer has been pretty dry, so irrigation has been used more often to keep the plants perked up.

"Uniformity is important, as it saves on labour costs with hand harvesting. Ideally, a grower will only do one or two harvest passes, if it goes to three it starts to become uneconomical. That third pass might mean that the head size has blown out and no longer meets fresh or processed specifications.

"Getting the broccoli and cauliflower off to a good even start is a major part of the success of the final harvest."

Hand harvesting is a major cost in broccoli and cauliflower production so the move by some seed companies to develop varieties with a long stem and even height, that are more suited to machine harvesting is welcome.

Pest and diseases in Tasmanian brassicas

Tim runs an IPM program with his growers, particularly for cauliflower.

"The challenge with cauliflower is that you can't apply a pesticide at the start of the growth and leave it. Cabbage white moth can lay eggs under the leaves, so you need to time the insecticide application before the eggs mature and hatch. A fungicide as a precaution for mildew is also recommended. Using beneficials is quite important but needs to be present while the plant is quite small, so that as the cauli grows, you don't end up with a pest that becomes a contaminant."

A nemesis for the industry is slugs, snails and crane fly. Tim will perimeter bait around the field to keep slugs and snails under control, particularly as strip tilling into a wheat paddock and not working the ground can increase insect pressure on young brassica seedlings. Growers need to be mindful of the withholding periods for baits.

The crane fly maggot can quickly decimate a crop, as well as become a contaminant issue at harvest and stains the cauliflower curd.

"The beneficials that are most effective are ladybirds and spiders, so keeping them going to the end is great. Seeing the webs in the early morning dew across the crop is a welcome sight, because you know they are doing their job."

Diseases such as white blister, powdery mildew, Alternaria need to be prevented not cured according to Tim. Mixing up the active ingredients every couple of years, and not using the same one repeatedly means that the risk of developing resistance is low.

Follow the Ps of rotation

Many growers will undertake rotations across a five-to-six-year cycle with many different crops such as potatoes, carrots, onions, cereal, pyrethrum, poppies and peas.

As a rule, Tasmanian growers will have a minimum five-year rotation for brassicas. A positive outcome is that issues such as clubroot are rare, aided in part by the alkaline soils. When rotating into a potato crop, the pH will be altered to give a more acidic soil particularly to enable nutritional uptake. Poppies on the other hand need a pH of around 7.0 so lime is applied to redress the alkaline levels. A soil test every couple of years to assess the pH is recommended.

The optimum harvest conditions

"Tassie growers will stop watering ahead of harvest, so it is not too wet for pickers and equipment to get through the rows.

"With steep ground, a wet slippery row can be a safety risk, let alone covering the produce and crates with mud. Of course, if it rains it makes it tricky!"

Moisture for the cool room is welcome, as it aids in the cooling of the broccoli and extends the shelf life. Any more than 15 minutes from the field to the cool room, and the broccoli head will need to go onto ice in the truck for delivery to the cool room to maintain the freshness. Most produce will be moved to the markets the next day, but on average within two to three days. The cool room has high humidity to facilitate cooling, but also increases the risk of storage diseases.

For the processing market, cauliflowers will be harvested just as the leaves open, reducing the risk of 'sunburn' on the curd. The ratio of stem to head for broccoli to give a diameter between 90-160mm will determine when it is harvested.

"Hand harvesting broccoli and cauliflower is hard work. The growers and pickers in Tasmania have perfected the art to get the very best and freshest of our crops for the fresh and processed markets."

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COMMODITY PROFILE

Broccoli + baby broccoli

What the consumer is buying to the year ending November 2023

The most recent Harvest to Home figures by NielsenIQ shows that Broccoli (all – meaning broccoli and baby broccoli) was falling by 10.8% in terms of dollars ($), and growing quickly, at 19.7% in terms of volume (kg). Buying household percentage rose from 71% to 73%. The average dollar spend fell from $38.96 to $33.46. Broccoli rose in terms of average weight purchased (kg).

Major supermarkets constituted 76.5% in terms of dollar share of trade.

The Hort Statistics Handbook for year ending June 2023, showed that 76,316t of broccoli was grown in 2022/23, up on the previous year, with 3% going to export, 5% into processing and the remainder supplied as fresh.

Production

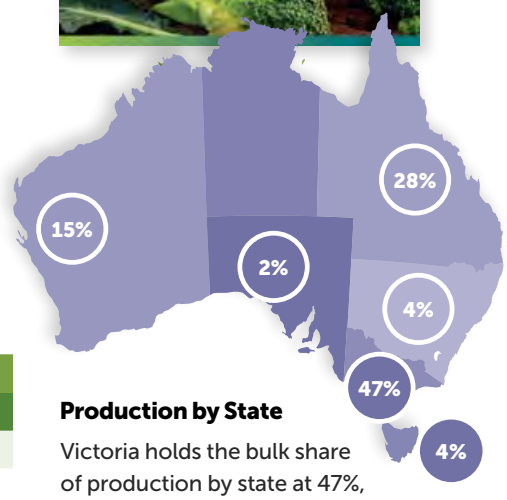
Year ending June	2021	2022		2023	
	VALUE	VALUE	VALUE % YOY	VALUE	% YOY
Production (t)	80,199	72,623	-9%	76,316	+5%
Production ($m)	$260.0	$293.8	+13%	$269.0	-8%
Fresh export (t)	3,680	2,546	-31%	2,215	-13%
Fresh export ($m)	$34.2	$38.6	+13%	$35.4	-8%
Fresh supply (t)	72,599	66,628	-8%	70,330	+6%
Fresh supply wholesale ($m)	$289.4	$331.4	+15%	$303.7	-8%
Retail supply (t)	65,247	59,854	-9%	63,338	+6%
Retail supply wholesale ($m)	$255.2	$292.8	+15%	$268.3	-8%
Food service supply (t)	7,172	6,774	-6%	6,992	+3%
Food service wholesale ($m)	$34.2	$38.6	+13%	$35.4	-8%

Exports January to December 2022–2023

Change in brassica exports to top 10 export destination

Destination	2022		2023		%▲ 2022–2023	
	AUD$	TONNES	AUD$	TONNES	AUD$	TONNES
Singapore	$6,256,908	1,102	$8,189,730	1,865	31%	69%
Hong Kong	$1,598,264	250	$1,334,152	212	-17%	-15%
Thailand	$1,150,194	177	$1,150,162	211	0%	19%
Malaysia	$810,849	118	$900,055	169	11%	43%
Philippines	$414,677	88	$666,522	192	61%	118%
New Caledonia	$164,570	52	$386,141	204	135%	292%
Vietnam	$415,334	56	$383,076	61	-8%	9%
Fiji	$286,584	33	$277,409	42	-3%	27%
Korea, South	$81,261	8	$239,215	39	194%	388%
Papua New Guinea	$180,813	33	$123,353	35	-32%	6%

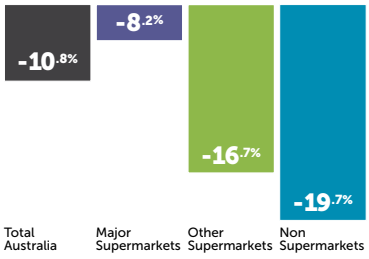
Source:Global Trade Atlas 2024.



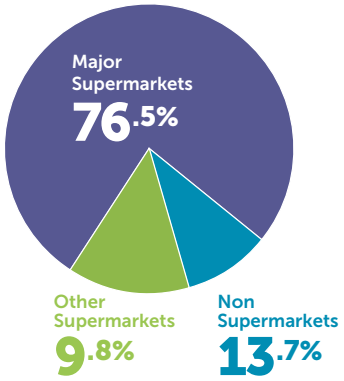
Production by State

Victoria holds the bulk share of production by state at 47%, followed by Queensland at 28%. Growing conditions around the country (excluding NT and FNQ) means that broccoli is available year round.

Retailer dollar ($) growth



Retailer dollar ($) share of trade



Source: NielsenIQ Homescan for the 52 weeks ending 05/11/2023 for the Australian market.

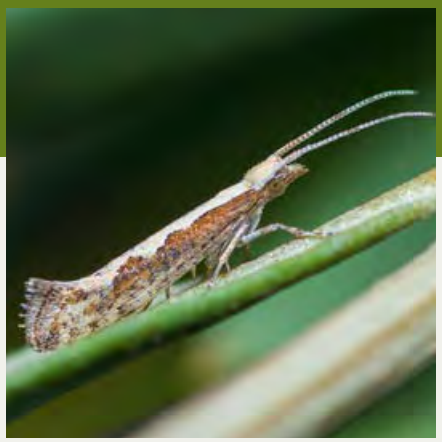
Hort Innovation

The *Australian Horticulture Statistics Handbook 2021-22 to 2023-24* project has been funded by Hort Innovation using multi-industry research and development levies and funds from the Australian Government.
Project Number: MT21006

Harvest to Home (MT21004) Consumer Behavioural Retail Data. This project has been funded by Hort Innovation, using the Australian Horticulture research and development levies, and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

brassicas

Pests



Diamondback moth

Plutella xylostella

DESCRIPTION

Diamondback moths are 10mm long. The male moth has three white diamond shape patterns vertically down its back, and is predominantly brown in colour. They are destructive in brassica and forage brassica crops.

EGGS

Pale yellow, oval eggs laid in clumps on leaves and stems. A female can lay more than 150 eggs in her lifetime.

GROWTH

First and second growth stages of the caterpillars are leaf miners inside the leaf, before feeding on the underside.

CONDITIONS

The lifecycle of the Diamondback moth is dependent on temperature. In southern regions it is about one month during summer. In winter the development is slower. In one year, the moth can complete six to seven life cycles. Eggs do not hatch below 8°C, insect survival is reduced at about 35°C

Thrips

Onion, western flower

Thrips tabaci, Frankliniella occidentalis

Thrip species are numerous, however onion and western flower are the most damaging in brassica crops. Identification is difficult due to their size.

DESCRIPTION

Nymph: Cream to yellowish, wingless and usually no longer than 1mm long.

Adult: Light to dark brown with thin bodies 1-2mm long with narrow, transparent wings.

DAMAGE

The adult and nymph stages feed by piercing the leaf surface and sucking the sap, causing the leaves to appear silvery and wither. Thrips are known to be a vector for Tomato Spotted Wilt Virus.

CONDITIONS

All brassica crops can be affected, especially during warm, dry weather. Onion thrips are common early summer, while western flower thrip is mid to late summer. Thrips prefer new shoots and hiding in the leaf axes of young seedlings.

Silverleaf white fly

Bemisia tabaci

DESCRIPTION

Eggs: Oblong, usually less than 0.2mm with a pointed end and laid in groups on the underside of the leaf.

Larva: First instar stage are flat, oval shaped, green-yellow in colour and quite mobile. Once they mature, the colour becomes orange-yellow and they thicken.

Adult: The adult is small (0.8-1.2mm long), with white waxy wings, held in a tent shape over the yellow body.

DAMAGE

Larvae and adults suck sap from the plant, stunting growth and reducing yield. Broccoli stalks can become bleached, and leaves develop silvery patches. While feeding, adults and nymphs excrete a honeydew, which encourages sooty mould growth.

CONDITIONS

Whiteflies can tolerate a wide temperature range for development (10-35°C). In warmer weather, the life cycle can be completed in 18-38 days. High populations can develop within three to four weeks.

brassicas
Pests


GREEN PEACH APHID

Aphids
Cabbage, green peach, turnip

Brevicoryne brassicae, Myzus persicae, Lipaphis erysimi

There are several aphid species that can be problematic in brassicas, including canola. Cabbage aphid is widely distributed in Australia and can be a vector for a number of plant viruses including cauliflower and turnip mosaic. Identification of aphids is easier in the non-winged form. Infestations can be a harvest contamination issue.

DESCRIPTION

Cabbage aphid: Grow to 3mm length, dull grey in colour with a black head. Nymphs are bright green, developing a grey, mealy appearance as the waxy coating develops.

Green peach aphid: Semi-translucent varying from yellow to green with dark red eyes as a nymph. The adult wingless adults have a patterned body and black heads.

Turnip aphid: Nymphs are yellow to olive in colour, and pear shaped. The wingless adult is 2-4mm long and greenish in colour.

DAMAGE

Cabbage aphid: Can form large colonies on the youngest leaves creating distortion and stunting. Severe cases cause yellowing, stunting and can be covered with honeydew excretion.

Green peach aphid: Cause leaf distortion through feeding. Large infestations can kill young plants.

Turnip aphid: Feeds on the flowers and the underside of leaves which can cause them to become curled and yellow.

CONDITIONS

Cabbage aphid: Peaks in spring and autumn with moderate temperatures.

Green peach aphid: Can over-winter in Prunus trees, to re-infest vegetables in spring.

Turnip aphid: peaks in spring and autumn in dry, moderate temperatures.

Fall armyworm
Spodoptera frugiperda

An increasingly problematic pest, Fall armyworm is found in maize, and detected in a range of crops.

DESCRIPTION

Eggs: Large clustered masses of up to 300 pale eggs, usually on the underside of the leaf, covered in a layer of hairs.

Caterpillar: Light green to brown with a dark head, becoming darker with maturity. Identified by a Y-shape on the head, and four dark spots on the last body segment.

Adult: Nocturnal, speckled brown moth 3-4cm, wings held flat across the body.

DAMAGE

Caterpillars chew on leaves and stems, leaving ragged holes. Resistant to many insecticides.

CONDITIONS

Prefers tropical to sub-tropical climates. Can occur year-round in northern regions, and late summer to autumn in the south. Strong flyers and can travel large distances.

For more information go to daf.engagementhub.com.au/fallarmyworm.


RED LEGGED EARTH MITE

Serpentine leafminer
Liriomyza brassicae

A major pest due to its wide host range and resistance to many insecticides.

DESCRIPTION

Larva: Initially transparent, becoming yellow to orange with maturity, about 3mm long.

Adult: A small black fly (<2.5mm long) with yellow markings on the head and body.

DAMAGE

Leaf miners create 'mines' in the leaf tissue, reducing the plant's ability to photo-synthesise and therefore affects growth. In severe cases the plant may wilt and die.

CONDITIONS

Prefers warm to mild, coastal climates. Spread is mainly attributable to movement of infected plant material.

Red legged earth mite
Halotydeus destructor

A major pest of broadleaf crops and pastures, including canola. There is increasing evidence of resistance to insecticides.

DESCRIPTION

Egg: Minute and orange, lays a single egg on lower stems or soil debris during winter to spring.

Nymph: Reddish pink, about 0.2mm with six legs.

Adult: Blue-black with eight bright red legs, generally feeds in groups.

DAMAGE

Tears plant leaves to release sap, resulting in large, whitish patches. Feeds in the morning or in overcast conditions.

CONDITIONS

RLEM can reproduce up to three times per season, mostly hatching in autumn to winter. Spends most of the time in the soil.

Tripod Farmers
blending quality and innovation

Tripod Farmers was established in 1990 at Bacchus Marsh, northwest of Melbourne. Today the business has grown to almost 400 ha over two locations but remains 100% Australian owned and family run. Run by the third generation of the Candeloro family and their sons Joseph, Frankie and Joseph Jnr Ruffo, now fourth generation growers. The five family members hold core roles across directorship to production, sales, transport, logistics, quality control and business development.

Frankie Ruffo is the Farm and Production Manager at Tripod Farmers and helps plan and oversee production including variety selection, crop protection program, fertiliser program and harvest scheduling.

"My grandparents introduced fancy lettuce and speciality vegetable lines to the Melbourne markets in the early 60s as F&M Candeloro Pty Ltd. By the early-90s Tripod Farmers saw increasing demand for leafy and fresh cut lettuce," said Mr Ruffo.

"They began expanding the business and we now grow a full range of leafy vegetables including spinach, salad mixes and wild rocket as well as baby cos leaves, full size and baby cos heads and coloured lettuce heads."

All of Tripod Farmers' produce is field-grown, mostly along river flats on sandy loam soil. All irrigation is fixed overhead, with water sourced from water catchments at Lake Glenmaggie and the Werribee River, as well as from privately owned bores.

Their product range includes 1.5 kg bulk salad leaf boxes for the food service industry, pre-packaged products under the supermarket brands and Leafy Patch brand products sold in independent supermarkets. Tripod Farmers sell to agents in the Melbourne, Adelaide, Sydney and Brisbane markets.

"We've got around 20 products in our salad range and that includes many different salad blends. Our most popular line is our salad mix, followed by baby spinach then baby cos," said Mr Ruffo.

"Production is 12 months a year, so every week we're seeding, planting, harvesting, packing and delivering products. It's a really challenging and rewarding work environment."

"Along with growing, we wash, pack and market all our own produce. We also do all our own intrastate transport and only outsource interstate transport."

Tripod Farmers have a purpose-built, state-of-the-art processing plant where produce is packed under a strict quality control and cool chain system to maintain shelf life, appearance and taste. Produce is transported straight from harvest to a temperature-controlled environment, washed in refrigerated tanks in the production line and packed immediately to maintain core temperature.

"We pride ourselves on providing quality produce to all our customers. We aim to supply the freshest and best products possible".

Demand for salad leaves is fairly consistent year-round with Tripod Farmers producing tonnes of produce each week.

"The farm is a fast-paced environment. In summer it could be less than a month between planting and harvest for our leafy varieties and in winter up to three months," said Mr Ruffo.

Variety selection is key to managing these seasonal differences and more than 50 different varieties of leafy vegetables are grown each season. Product development staff work with seed producers to trial new product lines.

"Innovation is a big part of our business and we're always trialling new lines and salad leaf blends to bring to market," said Mr Ruffo. "We're also increasing sustainability wherever we can – reducing labour and pesticide and herbicide use and increasing efficiency.

"We grow around six Syngenta varieties of spinach and lettuce that have good disease resistance which means we can use a bit less fungicide chemistry," said Mr Ruffo.

Tripod Farmers sustainability focus also extends to packaging, with biodegradable or recyclable punnets and bags as well as using technological innovations to reduce the environmental impacts of weed management.

"We recently invested in a LaserWeeder™, one of only 50 of its type in use in the world. It uses a camera to scan the field and AI [artificial intelligence] to tell the difference between the crop and weeds," said Mr Ruffo.

"We've been using the LaserWeeder* for around two and a half months now and its reducing labour and herbicide use."

From seeds sown in Bacchus Marsh over 35 years ago, Tripod Farmers has grown to one of Australia's biggest salad producers with a clear focus on quality, sustainability and innovation at every level. Their unique blend of knowledge, experience and passion yields produce that customers can rely on every day of the week.

Inset. Frank Candeloro loading cauliflowers into the truck for market in the 60s. **Above** Today, Farm and Production Manager, Frankie Ruffo, fourth generation at Tripod Farmers, inspecting lettuce.

Tripod Farmers is one of the venues on the Werribee/Bacchus Marsh bus tour as part of Hort Connections 2024. You can book your place on this tour via hortconnections.com.au. Syngenta has been a lead strategic partner with AUSVEG for the past 17 years and sponsor of the Syngenta Grower of the Year award.

FOR MORE INFORMATION
Visit syngenta.com.au and goodgrowthplan.com

brassicas
Diseases

Downy mildew
Hyaloperonospora parasitica

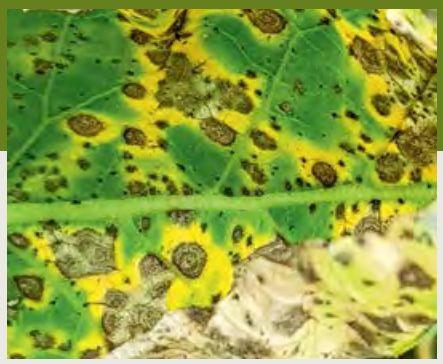
A fungus like organism that attacks the foliage, particularly in younger plants.

SYMPTOMS

On seedlings, powdery-white mass of spores on the underside of leaves, followed by black speckling and puckering on the upper surface. Leaves prematurely yellow and fall.

CONDITIONS

Prefers moist and cool temperatures. The disease can spread during storage but slows at temperatures below 5°C.



Alternaria leaf spot
Alternaria spp.

The disease can cause blackening of cauliflower curd as well as affecting the leaves in brassicas.

SYMPTOMS

Dark grey to black spreading spots with distinct margins and a yellow halo. The spores develop in the centre of the lesions. As the lesions age, they dry and become papery, leaving a 'shot hole' effect.

CONDITIONS

Moist conditions, specifically if the plant is stressed. Infection spreads above 10°C, during storage and transport.

Blackleg disease
Leptosphaeria maculans

Blackleg commonly affects the stems and leaves. Stem damage can lead to cankering and severing at the plant base.

SYMPTOMS

Lesions are brown with a purplish outline, distributed with pinhead dots. As the disease spreads, the stems develop sunken dry cankers near the base.

CONDITIONS

Predominantly carried over on crop residue but can also be present in seed. Once present in the crop it can be spread by irrigation and rainwater splash, wind, or farm machinery.

Clubroot
Plasmodiophora brassicae

Clubroot causes galls to form on the roots, which interfere with the uptake of water and nutrients. Under warm conditions, the plant may wilt. The fungus can remain in the soil for many years.

SYMPTOMS

Distortion and thickening of the roots.

CONDITIONS

Warm temperatures combined with wet, acidic (pH <7.0) soil.

Damping off
Pythium spp., Rhizoctonia solani

Damping off symptoms are similar across Pythium and Rhizoctonia and often grouped together, both are soil borne diseases.

SYMPTOMS

Pre-emergence damping off can cause brown, gelatinous rotting with the seed. If it germinates, the seedlings will be poor and stunted, yellowing and wilted and tend to fall over or collapse and die.

CONDITIONS

Wet soil. The fungi groups can survive in the soil for many years as resting spores or in plant trash. Seedling trays need to be sterilised before use.

Mosaic virus
Turnip mosaic virus, Cauliflower mosaic virus

Mosaic viruses in brassicas are generally spread by aphids. Cultural practices to control aphids is important to minimise crop damage.

SYMPTOMS

General mottling, mosaic or ring spots on leaves. Plants are stunted and young shoots can appear bunched and distorted.

CONDITIONS

Often spread by aphids, the population of insect vectors build up in weeds and move into crops during dry weather.

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VEGETABLES

brassicas
Beneficial Insects

Damsel bug
Nabis spp.

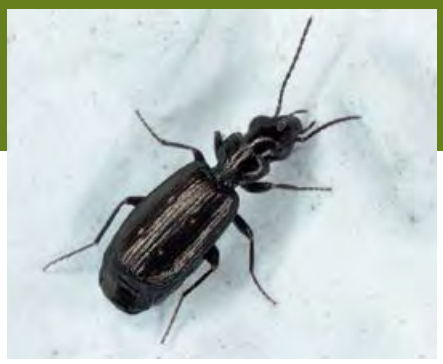
Damsel bug nymphs and adults are extremely aggressive predators on other insects, including aphids, leafhoppers and a number of caterpillars.

DESCRIPTION

Eggs: Whitish oval laid into plant tissue.

Nymph: Smaller version of the adult, and lacking wings.

Adult: Slender, light tan bug 8-12mm long with prominent mouthpart for feeding.



Ground beetle
Carabidae spp.

Both larvae and adult beetles are predatory on caterpillars, slugs, snails and other pests. Larvae often shelter in burrows, while adults forage in soil litter.

DESCRIPTION

Larva: Segmented grub with large head and prominent jaws.

Adult: Flattened black beetle, 8-12mm long with large eyes and ridged wing covers. Fast runners but rarely fly.

Hoverfly
Syrphidea spp.

Hoverflies usually appear in large numbers during spring and summer and are beneficial as pollinators and predators.

DESCRIPTION

Larva: Pale green to yellow, often with a dorsal strip, slug-like maggot up to 10mm long.

Adult: Similar in colouring to a wasp (black and yellow), however only one pair of wings.

LADYBIRD EGGS

Ladybird

A number of species of ladybirds are found in crops, and are active predators of aphids, thrips, moth eggs and mites.

DESCRIPTION

Eggs: Upright yellow eggs, laid in small clusters.

Larva: Black with coloured markings and a 'crocodile' like appearance.

Adult: round bodied, black with distinctive markings in red, yellow or orange.

Source: *Pests, diseases and disorders of brassica vegetables, a field identification guide,* Jenny Ekman (AHR), Len Tesoriero and Stuart Grigg. 2nd edition, March 2023

This project has been funded by Hort Innovation, using the vegetable research development levy and contributions from the Australian Government. Updating and republishing valuable

Project Number: VG12087

Hort Innovation VEGETABLE FUND

Adapting to a changing world

Amidst a changing world, characterised by evolving consumer behaviour and population pressures, innovations in vegetable breeding play a crucial role in ensuring the adaptability and sustainability of the fresh produce section.

World-leading vegetable seed company, Rijk Zwaan, tracks trends around the world to anticipate the needs of the chain. Global Manager of Chain and Retail, Jan Doldersum, discusses how developments in vegetable breeding can help the fresh produce section adapt.

Smaller households

More Australians are living solo than ever before. One out of every four households are occupied by one person, and the average households has shrunk to 2.5 people (Australian Institute of Family Studies, 2023). According to Rijk Zwaan's Jan Doldersum, we are already seeing this reflected on supermarket shelves with a trend towards smaller produce.

"Melon for instance, in the last five to 10 years, we've seen the ideal size decrease, and this is especially the case for watermelon. The preferable size for melons is relatively small; between one and two kilograms," Mr Doldersum said.

To achieve these sizes, vegetables aren't picked young but are bred to be smaller at maturity. Mr Doldersum:

"If you are a single or two persons in a household, you don't need a large cauliflower of 500g."

Rijk Zwaan has met this increasing interest by introducing a range of fridge friendly, smaller vegetables including a baby sugarloaf cabbage of 150-300 grams, a fun-sized stringless baby celery, and delicious personal sized watermelons, to name a few. Addressing these challenges requires a whole-of-chain approach that considers both sustainability and practicality. Plant breeding is the first in many steps that can have positive environmental impacts. These whole baby-sized, but big tasting products also have the potential to replace plastic wrapped cut pieces.

Increasing vegetable consumption, conveniently

Fresh snacks are a huge opportunity for Australia's health and for the vegetable industry.

"There has been a whole new category created for snacking vegetables, especially tomatoes, cucumbers, carrots and capsicums," Mr Doldersum observed.

Research from fresh food market analyst, FreshLogic and Hort Innovation has highlighted opportunities and challenges within the slowly growing snack segment.

Freshlogic's CEO, Martin Kneebone told AUSVEG, "All consumers are saying 'we would like more nutritious snacks'," but convenience and portability are crucial for success.

"We found that the sweet spot was a vegetable product that stayed whole and was able to travel through the supply chain in that form," Mr Kneebone said.

In the long run, smaller sized foods will be the way to go.

Direct-to-consumer disruption

It's anticipated that direct-to-consumer models will continue to expand. According to IBIS World, in Australia, the meal kit delivery market size has grown an average of 18.7% each year from 2018 to 2023 and is a new opportunity for fresh vegetables.

"Meal kits are a good choice for one or two person households, and companies are definitely sourcing smaller pieces including vegetables to fill those kits," Mr Doldersum said.

While there are some characteristics of smaller varieties that can be beneficial for growers, such as being quicker to mature and requiring less water, Mr Doldersum says.

"Much of the supply chain efforts are for more productive varieties, which often means bigger vegetables, but that's not always what consumers want. The challenge is to achieve higher value and higher sales and we have already seen huge success in meeting consumer demand with snack cucumbers and snack tomatoes. Retail outlets are aiming for smaller sized foods the long run. For sure, that will be of the main growth drivers for retailers and therefore for the fresh produce industry.

Above L-R. Unpackaged produce in the Netherlands, marketed as 'smaller vegetables for 2 people'.

FOR MORE INFORMATION
Visit rijkzwaan.com.au or contact info@rijkzwaan.com.au

Making the most of brassicas in cover crops

The brassica family can provide a positive role in cover crops. How, why and when it is utilised will determine the efficacy of the cover crop in rotation with a commercial crop.

Feature image. Detail of brassica from a mixed cover crop. **Above.** Kelvin Montagu discusses cover crops and termination.

The key to getting the most out of a cover crop is to ask what you want to achieve, how it will be terminated and what window of opportunity is available between commercial crops to plant it.

The fundamental principle of a cover crop is described in its name. It is a crop designed to cover the soil following a commercial crop. The cover crop provides protection from wind and rain soil erosion, builds soil health and structure ready for the next crop.

In southern climates, cover crops are generally planted in the winter, while in more tropical regions it is typically summer. The plants used in the cover crop will therefore be dependent on the region.

Three plant groups are commonly used for cover crops: grasses, legumes and brassicas.

Grasses such as oats, barley, sorghum and millets to improve soil structure and add biomass; legumes include peas, lablab and vetch to fix nitrogen, while brassicas such as mustards and oilseed radishes give excellent biofumigants for disease breaks between crops.

The choice of species needs to be carefully considered to give the benefits without creating pest and disease vectors from the cover crop to the cash crop.

Dr Kelvin Montagu, research scientist with Applied Horticulture Research has been studying the benefits that cover crops can bring for vegetable growers.

"Cover crops help protect the soil from extremes. Heavy rain will pound bare soil breaking down the surface soil structure and washing your valuable topsoil down the hill and worse, off-farm. A cover crop will protect the topsoil and reduce the amount washing away.

"Beyond that there are a number of benefits including building soil structure which is great for infiltration of rain and irrigation, water retention and aeration making it easier for working the soil. With increased soil health comes a lot of microbial activity that helps to reduce soil borne diseases like sclerotium and rhizoctonia.

"If there is a period between cash crops where the soil is fallow, there is an opportunity to plant a cover crop, even a six to eight week window is enough for a

Cover crop on display at Gatton AgTech.

general cover crop. If you are looking at a biofumigant or legume cover crop more time will be needed to get the most benefit out of these cover crops.

"It really depends on what you want to achieve from your cover crop. Is it to give an interval between different crops as a disease break? Do you want to add more biomass to improve your soil structure, or is the soil in need of organic nitrogen? Or perhaps a combination of all three.

"The second question that must be asked is how do you plan to terminate the cover crop? Will it be turned in, therefore needing time to decompose before the cash crop, or will it be cut and left as a mulch on the surface. The time frame needed for termination plus the growth time of the cover crop will determine how long you have for the cover crop between your cash crops."

A brassica biofumigant crop needs to be treated like a crop in its own right to gain the most benefit. The healthier the brassica, the more effective it will be as a cover crop.

Brassicas as a biofumigant cover crop

Brassicas can be used as a cover crop on their own, but it is important to note that using a brassica cover crop should not be in rotation with brassica vegetables as the pest and disease risk will be the same.

As a means of breaking the cycle of soilborne diseases, pests and weeds, the brassica family – mustards, radishes and rocket – produce compounds that suppress the effects through biofumigation. Studies undertaken by Queensland Department of Agriculture and Fisheries in the project *Optimising cover cropping for the Australian vegetable industry (VG16068)* showed that brassicas can be effective on basal rot (*Sclerotium rolfsii*); onion white rot (*Sclerotium cepivorum*); charcoal rot (*Macrophomina phaseolina*); white mould (*Sclerontinia sclerotorium*); rhizoctonia and verticillium wilt.

The researchers determined that the release of the active compound, glucosinolates is at its highest concentration when the plant is at 25 per cent flowering. The level of glucosinolate is dependent on the variety of plant.

For example, Caliente has low efficacy against charcoal rot during autumn to spring but is quite effective during the summer. Conversely, Nemfix is highly effective for basal rot during the winter/spring, but poor during summer and autumn.

Kelvin said it is important that if you are looking to use brassicas as a disease break, that it not be used in a mix to ensure the full potential. Using it in a mix, effectively dilutes the level of active compounds and may add to the problem.

"I had a leafy veg grower with problems with sclerotinia. He tried a biofumigant cover crop over winter prior to planting lettuce with good results. The process was repeated for a number of years with good results.

"After hearing about the effectiveness of cover crop mixes, he opted to give it a go. It was the worst lettuce crop in years. Effectively what had happened is that by adding a legume in the cover crop mix, he had added a source for sclerotinia to infect, and had not broken the disease cycle, but carried it over through the cover crop and into the lettuce.

"In addition, the biofumigant effect had been lessened as the brassica was only a portion of the cover crop mix. The message is to be careful about your mixes and be sure of what you want to achieve."

A brassica biofumigant crop needs to be treated like a crop in its own right to gain the most benefit. The healthier the brassica, the more effective it will be as a cover crop.

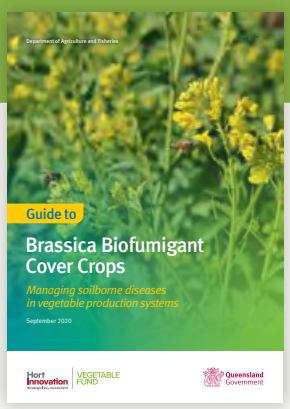
"If you are aiming to get the maximum benefit of a biofumigant Indian Mustards, Caliente and Rojo cultivars are particularly good, and will give 10-12 tonne dry matter to stimulate the soil biology. Once the bad guys are gone, the good guys come back pretty quickly."

Tillage radish, Black Jack and Terranova are deep rooted and ideal for soil structure. Kelvin says that for lettuce growers, where nitrogen will remain in the soil after harvest, these brassicas with their deep roots will draw down to the soil nitrogen, bringing it closer to the surface for shallow rooted leafy vegetables to utilise, and reduce nutrient runoff. Rocket is useful to manage nematodes, as it won't let them breed, driving the overall population down.

COVER CROPS

Cover crops are planted between commercial crops and incorporated back into the soil.

- Improve soil structure for water infiltration and soil porosity
- Prevent soil erosion from rain and wind
- Maintain or improve soil organic matter
- Legumes to fix nitrogen in the soil
- Increase soil microbial activity
- Retain nutrients that may have leached out of reach from vegetable root zones
- Brassicas provide a biofumigant to reduce the effects of soilborne pathogens, pests and weeds.



Top. Mark Schreurs with a tillage radish from a cover crop. **Above.** Cover of *Guide to Brassica Biofumigant Cover Crops*.

Brassicas germinate and grow quickly, crowding out weeds, Kelvin recommends a high seeding rate to increase that effect. The flow on effect of herbicides will need to be considered for subsequent vegetable crops.

"I would like to add, that a cover crop is often seen as another income stream by baling. The risk is that the tractor (or foraging livestock) will compact the soil, undoing the work of the cover crop.

"The income you may get from a cover crop is always going to be less than the saving you will gain from less nitrogen inputs, less diesel to work the ground, less labour to harvest and pack, plus greater yield returns.

"Work with the production system you have and see where there is a window of opportunity when the ground might otherwise have been fallow to put in a cover crop.

"Be clear about what you want to achieve and manage it accordingly and it will add value to your business in a relatively short period of time."

Terminating a cover crop

The success or failure of the cover crop incorporated into a production system is based on the termination. Poor termination can result in difficulties for the cash crop planting as a result of too much stubble, or the soil has not had time to process the biomass.

"Termination might be rolling and leave it as a brown mulch, or for brassica growers strip till is the best method. I have seen a number of growers strip till the cover crop while it is green, then plant the same day.

"If it has been a dry winter, and soil moisture is a concern, terminate early so that the moisture is still there for the cash crop, and retained courtesy of the mulch. If the rains do come, the soil is still protected, but has better infiltration rates. It is a useful management practice for banking soil moisture ahead of drier conditions."

The retention of soil moisture also aids in the decomposition of the biomass, as it provides a better environment for soil fungi. The fungi excrete proteins, which help to stabilise the soil surface and structure. Kelvin advises that the cover crop should not be left to get too woody unless you want the surface mulch to stick around for a long time. By terminating it when it is green and young, the rate of decomposition is faster, and the residue on the surface is less likely to interfere with vegetable crop establishment.

FIND OUT MORE

Guide to Brassica Biofumigant Cover Crops, by Queensland Department of Agriculture and Fisheries available from: ausveg.com.au/articles/a-guide-to-brassica-biofumigant-cover-crops

Applied Horticultural Research: ahr.com.au

SoilWealth ICP: soilwealth.com.au

VG16068 Optimising cover cropping for the Australian vegetable industry.

This project has been funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government.

Project Number: VG16068

Hort Innovation VEGETABLE FUND

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Mixed results inform cover crop success

In April 2024, the Devon Meadows farm of Victorian grower Peter Schreurs & Sons was hit with 60mm of rain overnight. The farm had had almost no runoff or erosion, which according to Darren and Mark Schreurs, is the result of many years of cover crops transforming the soil into a carbon-rich sponge.

As one of 14 trial sites for the *Optimising cover cropping for the Australian vegetable industry (VG16068)* project between 2018 and 2020, the Devon Meadows site was used to investigate cover crops and mycorrhizal fungi to benefit vegetable crops, in this case in leeks.

One of the key benefits of mycorrhizal fungi is to enable plants to draw more nutrients and water from the soil and increase plant tolerance to plants and diseases.

The initial results for the Schreurs leek crop were not profound. It is believed that the phosphorous rich nature of the Devon Meadows soil may have restricted the colonisation of the fungi, combined with the regular working of the soil for harvest and planting required by leeks, which disturbs the soil.

However, the benefits of using cover crops for soil health and successive leek crops have continued to improve in the four years since the trial.

"It was disappointing that the mycorrhizal fungi trial did not give the results hoped for, but the use of cover crops has energised the soil, so now we have a philosophy of keeping our soil covered with a cover crop to suit the time of year," said Darren Schreurs, who runs Peter Schreurs & Sons in partnership with his brothers Mark and Paul.

Mark Schreurs oversees the rotation of leeks to cover crops, using warm and cool cover crop mixes that suit the time of year. The aim is to minimise the time that soil is bare between leek crops. A detailed record is kept of the species used in the cover crops for rotation – some mixes may have only two or three species, some up to ten species depending on the needs of the soil.

In most cases a mix of cereals and grasses, legumes and brassicas will be used such as sorghum, sunflowers, vetch and tillage radish will be used. A flowering plant will be part of the mix to encourage pollinators.

Once the dominant species start to mature, Mark will roll and crimp and repeat the process two weeks later, to give other plants in the cover crop a chance to come through. By rolling and crimping the dominant species, a protective layer is in place on top of the soil to act as a mulch and reduce the risk of it going to seed.

As Darren pointed out, harvesting leeks requires that the soil be disturbed as the entire plant is removed. By planting a cover crop after harvest, the soil is given a chance to recover its biology and diversity.

The myriad benefits include an increase in pest and disease resilience; improved soil organic matter; improved nutrient uptake and water holding capacity.

As Mark explains it, the improvement in their soil's water-holding capacity since they started cover cropping has "added another good size dam" to the farm and the drainage is far better.

What was the research about

This investment, which ran from 2017 to 2020, supported Australian vegetable growers to effectively use cover crops to boost soil health and reap productivity benefits. Bringing together a consortium of research partners, it built on existing cover crop trial sites and established new ones to explore the how, why and when to best use cover crops across Australia's main vegetable growing regions.

Cover crops are one of the most useful tools for managing intensive vegetable growing soils. The integration of cover crops into vegetable production can improve soil health by building soil structure and condition, reducing erosion, adding nitrogen, improving nutrient recycling, and contributing to weed and soil-borne disease control.

The work explored cover crop species, cropping sequences, sowing windows and transition practices under a range of soil types, climates and crops, and delivered clear grower guidelines for using cover cropping that are specific to growing regions.

The field research generated new information on the use and agronomy of cover crops to manage soil structure, soil microbial communities, specific beneficial microbes, and soil-borne diseases under Australian conditions. The information was combined with practical industry knowledge and international research to deliver information on cover crops to the vegetable industry.

"When we did the trial, we were averaging 0.5 per cent organic matter, now it is closer to five per cent," said Mark.

The increase in beneficial insects across the farm has been noticeable, and Mark and Darren give nature time to combat pests and disease, rather than use chemistries. The ultimate aim is to drive chemistry use to a minimum.

"The biodiversity we get from the cover crops makes the whole farm that much more resilient. The field may look like it is sitting there doing nothing – and the temptation is to put another cash crop in – but the soil is taking in organic matter, building microbe numbers and nutrients ready for the next crop, not taking it away."

While there will always be trade-offs, with constant improvement and making the whole system more resilient, Mark and Darren want the farm to be better than when they arrived.

Top L-R. Darren Schreurs in the leek paddock. Cover crop. Mark Schreurs with tillage radish.

FIND OUT MORE

Visit Hort Innovation at horticulture.com.au
Optimising cover cropping for the Australian vegetable industry (VG16068).

This project was funded by Hort Innovation using the vegetable industry research and development levy and funds from the Australian Government.

Hort Innovation VEGETABLE FUND

Importance of soil carbon
under the microscope at Victorian demo site

At Tarwin in South Gippsland, Victoria, the Soil Wealth ICP team is demonstrating the use of cover crops to maintain soil carbon in a clay loam greenfield site, which is gradually being converted from pasture to a vegetable production system rotation (predominantly celery, spinach and leek).

Soil carbon, measured as the percentage of carbon contained within soil organic matter, plays a key role in soil health.

High organic carbon levels are associated with higher soil microbial populations, good nutrient holding capacity and improved nutritional cycling ability.

Vegetable growers can maintain or build soil carbon to improve soil health, crop resilience and productivity, and reduce greenhouse gas emissions.

The Tarwin trial applied compost and green cover crops including a buckwheat (*Faopyrum esculentum*) and vetch mix, and Japanese millet (*Echinochloa esculenta*) to maintain or improve soil organic carbon, provide weed competition, and improve nitrogen and phosphorus nutrient foraging, as the available nitrate and phosphorus levels in the soil are low.

Carl Larsen and Camilla Humphries from the Soil Wealth ICP team visited the Tarwin site in late March 2024 to check the cover crop termination, undertake labile carbon and soil chemistry tests, and investigate soil profile and structure pits across both the trial and control areas of the demonstration site.

Pre-trial testing

The soil tests taken at the commencement of the trial in June 2023 (across both the trial and control blocks) had high organic carbon levels ranging from 5.5-5.9 per cent.

Soil biology tests were also taken at the beginning of the trial to understand the microbial condition of the production system. Unsurprisingly the cultivated block, which has been subjected to deep ripping, bed forming and sub-surface drainage excavation, had a lower microbial biodiversity and a higher abundance of soil-borne pathogens including sclerotinia, verticillium and rhizoctonia compared to the adjacent pasture site yet to be developed.

The soil health rating, which considers the abundance of arbuscular mycorrhizal fungi, bacteria, fungi, mesofauna and protists, was highest for the non-cropped area. The limited disturbance to the soil in the non-cropped site compared to the cultivated site, could explain the high microbial population levels.

Measuring the impact of cover crops on labile carbon

Labile carbon is the carbon most readily available as a carbon and energy source to microorganisms.

While changes in practice may not demonstrate changes in total soil carbon, they may increase labile carbon, making it a better indicator of improved soil quality. Labile carbon is often a good 'leading indicator' of soil biological activity.

The labile carbon field test is useful for comparing management practices that influence organic carbon. These tests were taken across the different treatments within the trial and compared to the control area.

The relative results showed:

- **Very good labile carbon** in the areas with the warm season cover crops (Japanese millet and buckwheat-vetch mix) combined with minimum till *(Figure 1)*
- **Good labile carbon** in the areas with cover crops and cultivation, in both the trial and control that included grower standard cereal rye *(Figure 2)*
- **Poor-average labile** carbon in the areas with composting and cultivation, or minimum till, without cover crops *(Figure 3)*.

How do you know if your soil is healthy?

Soil health is the condition of the soil in relation to its inherent or potential capacity to sustain biological diversity, maintain environmental functions, and support healthy plants and animals.

A soil health status or soil condition can provide insights into a soil's capacity to fulfil all soil functions. This includes nutrient cycling, carbon storage and turnover, water maintenance, soil structure arrangement, regulation of aboveground diversity, biotic regulation, buffering and the transformation of potentially harmful elements and compounds.

Soil organic matter and soil organic carbon can indicate the physical, chemical and biological benefits associated with soil health.

Increasing organic matter inputs (crop residues, cover crops and composts) and reducing losses (cultivation and fallow) are key to maintaining soil carbon stores and improving soil health and productivity.

Where to next?

The terminated cover crops within the trial areas were strip-tilled ready for celery and leek transplants, which were the first cash crop.

The trial area will be returned to the standard cereal rye cover crop following the spinach cash crop.

The Soil Wealth ICP has useful resources for carbon storage in vegetable soils and related information at: soilwealth.com.au/2016/05/carbon-storage-in-vegetable-soils.

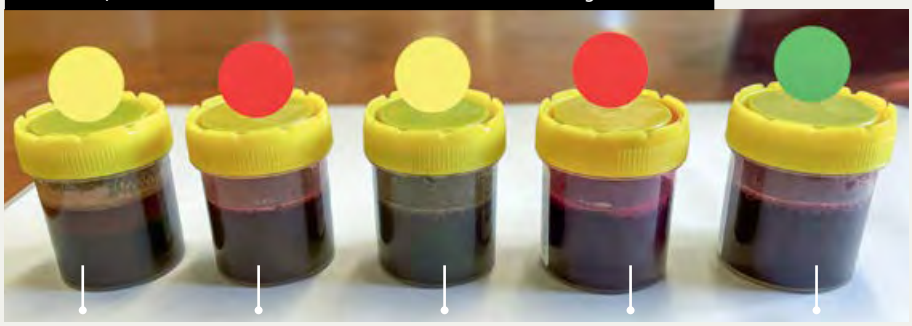
FIGURE 1 | Trial area treatments

FIGURE 2 | Comparison of rooting depths and soil structure

Japanese millet rooting depth 40-50cm

Buckwheat-vetch mix rooting depth 20-30cm

FIGURE 3 | Labile carbon field test results with soil health 'traffic light' indicators



Control = Good	TREATMENT 1 **Average**	TREATMENT 2 **Good**	TREATMENT 3 **Poor**	TREATMENT 4 **Very Good**
Cultivation Cereal rye Cover crop	Composting Minimum till	Cover crop Cultivation	Composting Cultivation	Cover crop Minimum till

FIND OUT MORE

For more information, please contact project leaders Dr Gordon Rogers on 02 8627 1040 or gordon@ahr.com.au and Dr Anne-Maree Boland on 03 9882 2670 or anne-mareeb@rmcg.com.au

This project has been funded by Hort Innovation using the vegetable and melon research and development levies and contributions from the Australian Government.

Project Number: MT22004

Hort Innovation VEGETABLE FUND Hort Innovation MELON FUND

The Soil Wealth ICP focuses on improving soil and crop health across the vegetable and melon industries by addressing growers' specific interests and regional issues, sharing knowledge and elevating sustainability.

Understanding how your levy works

It is Hort Innovation's job to work with industry to invest the vegetable, potato and onion R&D levies and Australian Government contributions into initiatives to help growers be as productive and profitable as possible, through the Hort Innovation Levy Funds.

Research and development (R&D) levies are payable on potatoes, vegetables and onions that are produced in Australia. These levies are collected by the Australian Government and then entrusted to Hort Innovation. It is then Hort Innovation's responsibility to work with industry to invest the levies – together with Australian Government funds into strategic R&D initiatives.

How are levy investment decisions made?

Investments specific to Hort Innovation are guided by the industry's Strategic Investment Plan (SIP) and Annual Investment Plan (AIP).

SIPs provide an overarching roadmap for industry to follow, and AIPs detail how levy dollars will be spent each year to achieve industry goals.

What is the Strategic Investment Plan?

The SIP is the roadmap that helps guide Hort Innovation's oversight and management of investment programs.

The SIP lays the foundation for decision making in levy investments and represents the balanced interests of the industry. The most important function of the SIP is to make sure that levy investment decisions align with industry priorities. In 2021, SIPs were refreshed to reflect the current needs of the respective industries. The refresh involved close consultation with growers, industry participants and the wider research community in each relevant sector.

The SIP details the industry's strategic goals centred around four outcome areas:

- industry supply, productivity and sustainability;
- demand creation;
- extension and capability;
- business insights.

Under each of those outcomes, there are industry specific strategies and key performance indicators that provide guidance on how industry will work towards achieving the outcomes.

Where a previous SIP is available, a performance report has been developed to demonstrate how investments delivered generated impact for growers.

The reports provide an overview of key achievements delivered through each levy investment, and how they relate to the industry's SIP outcomes and strategies. **While this performance report provides a five-year review of the vegetable SIP 2017-2021, going forward an annual performance report will be provided for the vegetable SIP 2022-2026.**

R&D LEVY RATES

Potatoes

48 cents PER TONNE

Unprocessed Potatoes

Vegetables

0.485%

of the gross sale value at the first point of sale

Onions R&D AT

$2.90 PER TONNE

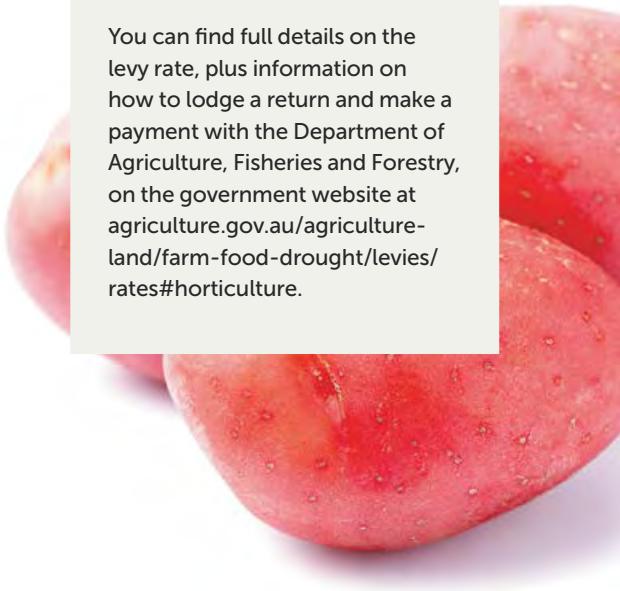
marketing at $1.00 per tonne

Hort Innovation POTATO – FRESH FUND

Hort Innovation VEGETABLE FUND

Hort Innovation ONION FUND

You can find full details on the levy rate, plus information on how to lodge a return and make a payment with the Department of Agriculture, Fisheries and Forestry, on the government website at agriculture.gov.au/agriculture-land/farm-food-drought/levies/rates#horticulture.



LEVY-FUNDED COMMUNICATIONS PROGRAMS

Australian potato industry communication and extension project (PT20000); *PotatoLink. National vegetable industry communications program* (VG22000)
Accelerating the adoption of best management practices for the Australian onion industry (VN21000)

Cultivating the next generation of agronomists

As two of Nutrien Ag Solutions' next generation of agronomists, Reece Heuir and Isaac Chizik work 3000 kilometres apart and in very different conditions.

Bother, however, both are making the most of the opportunity to learn – from farmers, colleagues and the pests and diseases that appear in the paddocks.

The grandson of sugar cane farmers in Queensland's Burdekin region, Reece took up a job as a crop monitor when on holidays from studying Sustainable Agriculture at university, which led to a position as a trainee agronomist in Nutrien's Ayr office.

Isaac came from an urban background in Victoria, where he completed a degree in Science at Monash University. He also completed three years of a medical degree before making a career change that still involved science and drew on his strong background in chemistry – leading him to working with Nutrien Ag Solutions in Wynyard, in Tasmania's key potato growing region.

Both have completed the company's two-year graduate agronomist program, which included two group visits a year to growing regions in other states.

Reece says it's been a big learning curve but rewarding work.

"The best thing about the job is making new connections with growers. Monitoring their paddocks and being able to show them what you actually found develops their trust," he said.

"I like knowing that I contributed toward growing a better crop. In a bad year, whether it's pricing or weather or markets, you feel disappointed. You want them to do well."

The arrival of Fall armyworm in the Burdekin in 2020 was a major challenge. Corn and sorghum growers were forced out of business and as a junior, Reece watched as his more experienced colleagues worked frantically to develop control programs.

"Our team had to work hard with research, trial and error to find ways to control Fall armyworm, and it's good to see people are growing those crops again. There were a lot of factors to take into consideration, including resistance management with the insecticides we were applying," Reece said.

"We're trained in all the new products coming to market – we're a big branch so it's easy to bring in new ideas and products and deal with problems that come up."

Through Nutrien's graduate agronomist program, he has enjoyed meeting his interstate colleagues on the company's twice-yearly training trips.

"As graduates we travelled to meet management, learn about the company and visit different farms across the country. We still have a big group chat where we can ask each other questions or share knowledge," he said.

In Tasmania, Isaac Chizik reports to Craig Dwyer, Nutrien Ag Solutions' business manager for the Wynyard branch, who service local potato farmers as well as growers of poppies, onions and some cereal crops. To be a successful agronomist, he said, requires the right attitude and application.

"Isaac has a real interest in the industry and a passion for communication, and he has the ability to pull out relevant information from technical data and deliver to the farmer what they need to hear," Craig said.

Growers value solid advice but they value relationships just as much.

"Isaac is very good at building those relationships, and that comes from being reliable and a good listener, as well as developing trust through being able to speak the growers' language.

"And timeliness – products need to be delivered even if it's 5pm on Friday. Guys who ring on Saturday know we will get them out of trouble and they value that."

A bonus for Isaac has been having access to senior agronomists, including one of 45 years' experience in the Wynyard office. While he's mentored by more experienced colleagues, Isaac brings his own skills to benefit the company.

"Obviously being younger is an advantage because he's really good in that digital space which is really taking off, things like variable rate spreading of fertiliser, carbon sequestration and sustainable farming practices. Isaac is all over that, which is a real value add for us.

"The way New Zealand farming and some areas in Australia have gone with restrictions on nitrogen use means we need to be ahead of the game, so if you're in that digital space and can map paddocks, it really takes it to the next level."

Both graduates would recommend a career as an agronomist with Nutrien Ag Solutions.

Reece said, "It's such a massive company with the ability to access agronomists all over Australia and that networking side is the best factor."

Above L-R. Reece Heuir, inspecting a chilli crop in North Queensland. Agronomist, Isaac Chizik in Tasmania, surveying a thriving fodder beet crop.

FOR MORE INFORMATION
Visit nutrienagsolutions.com.au.

	OUTCOME 1	OUTCOME 2	OUTCOME 3	OUTCOME 4
	Extension and capability	**Industry supply, productivity & sustainability**	**Demand creation**	**Business insights**
	To manage knowledge, relationships, systems and processes required to communicate effectively with internal and external stakeholders	To accelerate the application of production practices that optimise returns and reduce risk to growers	To maintain and strengthen consumer demand as the foundation for sustainable expansion of production and consumption in domestic and international markets	To deliver data and insights that is foundational to achieving success in the other three outcome areas of demand creation – supply, productivity and sustainability as well as extension and capability
POTATOES 	A change in knowledge, attitude, skills, aspiration (KASA) and practice for grower/industry profitability and sustainability through use of best practice and innovation. • Growers, value chain, media and governments being well informed on industry initiatives and achievements as a vital part of regional communities and networks. • Increased on-farm use of R&D outputs which will build a more resilient industry in addition to improved networks and cross-industry collaboration. • Proactive strategic and evidence-based decision making in businesses and for industry on investment, priorities and risk management.	Accelerating widespread use of existing and new R&D findings and proven management practices that will help growers to reduce the costs and impacts associated with pests, weeds and diseases. • Advances in productivity and biosecurity through a proactive and prepared industry. • New knowledge and understanding of sustainable production systems for Australian potato growers including precision inputs, management of salinity, enhanced soil health and improved water and nutrient use efficiency. • Proactively monitoring potential crop protection regulatory threats and having access to a broader suite of effective, socially acceptable and environmentally sound crop protection solutions.	Support product positioning with consistent quality, evidence of beneficial product nutrition attributes and responsible industry production practices. • Identify and prioritise export and domestic market niches where there is demand and growth potential for competitive supply of quality Australian fresh potatoes.	Achieving the outcome will involve reliable baseline data and analysis to provide insights and understand current and emerging trends. Key investments will support the provision of consumer knowledge and tracking, trade data and independent reviews to enable better decision-making process at industry level and individual businesses.
VEGETABLES 	A change in knowledge, attitude, skill, aspiration and practice for grower/industry profitability and sustainability through use of best practice and innovation • Maintaining and improving industry cohesiveness, with the majority of businesses and the industry supply chain actively engaged in implementation of this strategy; • Growers, supply chain, media and governments being well-informed on industry initiatives and achievements as a vital part of regional communities and networks; • Increased on-farm use of R&D outcomes that will build a stronger, more resilient industry – in addition to improved networks and cross-industry collaboration; • Proactive strategic and evidence-based decision making in businesses and for industry on investment, priorities and risk management.	New knowledge and understanding of sustainable production systems for Australian vegetable growers including enhanced soil health, improved water and nutrient use efficiency, precision inputs and labour use efficiency; • Responding to environmental change and climate variability; • Advances in biosecurity and the management of pests and diseases through a proactive and prepared industry; • Optimising the supply chain to improve quality and traceability, as well as reduce wastage and improve sustainability of vegetable production systems; • Improvements in protected cropping and intensive production technologies; • Proactively monitoring potential crop protection regulatory threats and having access to a broader suite of effective, socially acceptable and environmentally sound crop protection solution.	Grow the value of Australian vegetable exports by supporting industry to market premium products, targeting higher value market segments; • Articulate the value proposition for Australian vegetables and pursue more targeted market and channel growth opportunities; • Develop strong relationships across the supply chain with a shared goal to grow the category; • Enhance opportunities for value-adding and packaging; • Improve stakeholder engagement with the foodservice sector and the education of health benefits to consumers.	Achieving the outcome will involve reliable baseline data and analysis to provide insights and understanding of current and emerging trends. Key investments will support the provision of consumer knowledge and tracking, access to trade data, production statistics, forecasting and independent reviews to enable better decision making process at industry level and individual businesses.

ONIONS				
	Increasing knowledge, attitude, skills, aspiration (KASA) and practice for grower and industry profitability and sustainability through use of best practices and innovation • Maintaining and improving industry cohesiveness, with most businesses and the industry supply chain actively engaged • Growers, value chain, media and governments being well informed on industry initiatives and achievements as a vital part of regional communities and networks • Increased on-farm use of R&D outcomes which will build a stronger, more resilient industry, in addition to improved networks and cross-industry collaboration • Proactive strategic and evidence-based decision-making in businesses and for industry on investment, priorities and risk management.	Developing fit-for-purpose sustainable pest and disease management strategies • Biosecurity awareness and preparedness • Continuous improvement in soil health • Improved input management that reduces costs while maintaining yield and quality • Proactively monitoring potential crop protection regulatory threats and having access to a broader suite of effective, socially acceptable and environmentally sound crop protection solutions.	Broaden consumer awareness so that onions are more top of mind and purchased more frequently • Develop strong relationships across the supply chain with a shared goal to grow the category • Identify and prioritise domestic and international market niches (market segmentation) where there is demand and growth potential for competitive supply of quality Australian onions.	Achieving the outcome will involve reliable baseline data and analysis to provide insights and understand current and emerging trends. Key investments will support the provision of consumer knowledge and tracking, trade data, production statistics, and forecasting, benchmarking and independent reviews to enable better decision-making process at industry level and individual businesses.

What is the Annual Investment Plan?

While a SIP provides an oversight of investment over the next five years, the AIP explains how levy funds are going to be invested over a 12 month period.

AIPs are developed each year by Hort Innovation, informed by the SIP and industry consultation, and then discussed with the industry SIAP for feedback and prioritisation. Investment decisions will be guided by the industry SIP and prioritised based on potential industry impact, as well as availability of levy funds.

The AIP provides detailed information on:

- Funding availability
- How the industry is investing against their SIP outcomes
- Details on current investments across R&D.

Where do investment ideas come from?

There are many avenues that investment ideas come through – such as growers, delivery partners, previous projects, research networks, industry bodies, regional extension plans, and extension personnel. Before any ideas are progressed, Hort Innovation will investigate whether investment aligns with the SIP and whether investment is needed in this area.

How are investments prioritised?

To gain industry insights for strategic levy investments, Hort Innovation consults with growers through the industry Strategic Investment Advisory Panel (SIAP).

Hort Innovation develops draft investment recommendations based on investment ideas that are aligned to the SIP. Each recommendation includes high-level information on the aims of the project, outcomes, deliverables and budget.

The recommendations are then taken to the relevant advisory panel for feedback and prioritisation based on potential impact and available funding. Details of projects that will be progressing are then featured in the AIP. The SIAP consists of supply-chain stakeholders from the relevant industries, most of whom are levy-paying growers. Panels also include industry representative body representation and, where applicable, a lead agency representative from within the National Horticulture Research Network. The SIAP is in place to discuss investment ideas, in order to provide advice to Hort Innovation on potential levy investments. The advice they give is guided by the industry SIP. The SIAP provides a vital link between meeting the priorities of industry and helping Hort Innovation to make decisions on how, where and when investments need to be made.

How are investments progressed?

After the investment has been prioritised, it's then up to Hort Innovation to get the project up and running. This involves a tender process where the best delivery partner is chosen to undertake the project. Each delivery partner needs to submit regular milestones that report on their progress and at the end of each investment, a final report is produced that is made available to industry on what the project has achieved.

How to keep track of investments

Investments in the Hort Innovation Fresh Potato; Onion Fund and Vegetable Fund are detailed in the Your Investments page of Hort Innovation's website. Resources that are produced by the projects – such as fact sheets and guides – are also available through the Research reports and more page. Hort Innovation also sends alerts about project updates to its members.

Paying a levy doesn't automatically make you a Hort Innovation member, but signing up is free. The levy-funded communications programs, also provides regular information on levy-funded activity.

Grower input key to management of levy investments

Input by growers at multiple stages is central to Hort Innovation's management of vegetable, potato and onion levy investment.

The levy system set up in many Australian primary production industries is one of the key drivers of research, development and marketing in those sectors.

Australia's horticultural levies have been around for some time now. The potato levy, for instance, was introduced in 1991, the onion levy in 1994, and the vegetable levy in 1996.

The investment of those levies is overseen by Hort Innovation, the grower-owned, not-for-profit research and development corporation for Australian horticulture. Hort Innovation's annual investment in the vegetable industry is close to $15 million, nearly $1.3 million for onions, and $1.1 million for fresh and processed potatoes.

The primary production levy system that horticulture is part of is distinct to Australia, and *Australian Grower* magazine spoke with Andrew Francey, Hort Innovation's General Manager of Industry Service and Delivery, about how it gives Australia an edge against competitors on the international stage.

What does Hort Innovation do?

We're a grower owned organisation with 12,000 growers across 37 horticulture industries, and in the vegetable industry we cover around 4,000 growers nationally.

Our role is to invest in research and development, marketing and trade to build a prosperous and sustainable future for growers.

As an organisation, we're focused on ensuring we invest wisely based on growers' advice. Our key goal is growers' sustainability into the future, which means financial sustainability as much as it does land and people.

How does the agricultural levy system work?

At the request of each primary production industry, and indeed each horticulture industry, the Commonwealth Government collects levies on agricultural products to facilitate industry investment in strategic activities.

These levies are held and collected by the Commonwealth Government, and then entrusted to Hort Innovation for investment.

Is there legislation underpinning that process?

There is. Hort Innovation has a Statutory Funding Agreement with the Commonwealth. Our agreement outlines how we should conduct ourselves as a grower-owned body and sets expectations as to how we invest funds.

Most importantly, the key underlying principle of the legislation is for us to gain advice from growers and for the advice to be representative across all growers.

LISTEN TO OUR PODCAST INTERVIEW
WITH ANDREW FRANCEY HERE

Inset. Andrew Francey, Hort Innovation's General Manager of Industry Service and Delivery.

The levy system set up in many Australian primary production industries is one of the key drivers of research, development and marketing in those sectors.

How does Hort Innovation manage those funds and determine where they should be spent?

Talking to growers about where to spend their funds is a critical function within Hort Innovation. We do this in partnership with peak industry bodies like AUSVEG by bringing together growers to gain advice and develop five-year Strategic Investment Plans, and Annual Investment Plans that outline investment in projects which have been prioritised by growers.

This tells us where to invest based on the needs of growers.

How do you track that projects are running well?

We have an internal team of R&D experts who manage each project to ensure they're on track and hitting their milestones.

Many projects are advised through a project reference group, which is made up of industry representatives and growers. Many also have midterm reviews which independently assess the project's progress.

The Commonwealth also undertook an independent performance review of Hort Innovation last year, which noted improvements being made by Hort Innovation, particularly in the area of grower consultation.

What are some of the gains that you've seen in the vegetable, onion and potato industry as a result of levy investment?

We've seen some great gains. An example is the Soil Wealth Program, which has been running now for the last seven years. The program's success is evidenced by growers who have changed their practices over that time. With reducing tillage and introducing cover cropping, growers have seen increases in yield of 26 percent in some crops, lower labour and fuel costs, and better water holding and carbon capacity in their soils.

That's a good example of the right research invested in wisely, and over time showing real productivity and profitability benefit. They don't all have to be large investments like that project, but they do have to be relevant investments, and investments to make a difference.

A recent study by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) concluded that for every $1 spent in public agricultural research, nearly $8 is returned in benefit.

How can growers get involved in the process?

There are many ways that growers can be involved.

A simple way to get involved is the VegNET program, which is delivered in partnership with AUSVEG. Each vegetable and onion region in Australia hosts VegNET workshops, demonstrations, trial farms and grower community meetings. Engaging with your local VegNET Regional Development Officer is a great way to get involved.

You can also sign up to Hort Innovation communications on our website, or reach out to our dedicated Industry Service and Delivery Managers for vegetables, potatoes and onions, Mark Spees at mark.spees@horticulture.com.au and Jason Hingston at jason.hingston@horticulture.com.au.

Staying one step ahead of the trickiest threats

There's no need to remind any vegetable growers just how adaptable, resilient and destructive insect pests can be. And the spread of fungicide resistance in recent years has shown that fungal diseases can be just as tricky. Both insects and diseases have proved that they won't keep getting beaten by the same tactics year after year.

Fortunately, research and development companies like BASF are always working on new and better solutions to improve crop protection. That can mean overcoming shifts in sensitivity to older chemistry or being more targeted in ways that help beneficial insects get their work done and aren't associated with environmental harm.

The scientists and development teams at BASF have been on a hot streak for several years now and there's no sign of it ending.

"Over the last six years, BASF has launched seven products, so we've been able to equip the growers of vegetable crops with a new and improved crop protection option," says Serge Usatov, BASF horticulture portfolio manager. "Often that's been an entirely new product we've just brought to market, at other times it's a case of our development team completing all the necessary successful trials to add extra crops to the label. In 2024, we're launching new chemistry for use in various vegetable crops and then starting to work on registering at least one new option in lettuce."

For many vegetable growers, BASF's big new product for 2024 will be the most useful yet.

"We expect Cimegra® to quickly become the new first choice for controlling moths in brassicas and leafy vegetables," says Serge. "DBM is the most destructive pest of brassica crops and most local populations have developed resistance to the older insecticides growers used to rely on.

"Cimegra introduces a new active ingredient with the novel, broad-spectrum Group 30 mode of action, making it more effective than older insecticides that have struggled to control DBM. That will be the first reason growers give it a go. Then they'll find out what a great all-round package it is, with a whole lot of extra advantages: rapid knockdown, translaminar movement (single application, dual exposure as Cimegra moves to the underside of leaves) two-way control through both ingestion and contact, excellent residual control that lasts for up to three weeks, and a 1-day harvest withholding period and bonus activity on white cabbage butterflies."

Cimegra will strengthen insecticide rotations as part of a robust spray program and give growers extra confidence that they can consistently harvest large volumes of healthy vegetables regardless of insect pressure. Its launch follows the success of Versys® and Efficon® as next-generation insecticides.

"Versys is now very well established for aphid control in dozens of different crops," Serge says. "Efficon was only launched last year, so there are plenty of growers yet to discover just how powerful and useful it is. It complements Versys really well as part of aphid and whitefly control programs. It's been a big hit with the growers who have already tried it, so the word of mouth is very strong."

One new disease-control solution that BASF expect will be available to lettuce growers within the next year is Merivon, the co-formulated Group 7 and Group 11 fungicide already widely used in cucurbits and fruiting vegetables.

"The sensitivity of both insect populations and disease pathogens to different modes of action and specific active ingredients is constantly shifting," Serge concludes, "so we all have to be aware of emerging problems and on the lookout for even more effective and convenient solutions. We're proud that we've been able to keep adding new tools to producers' toolboxes and we appreciate the support we get from both agronomists and growers who recognise the vital importance of those innovations."

FOR MORE INFORMATION
Speak to your local BASF representative or visit crop-solutions.basf.com.au

The BASF crop protection team and Nunhems will be at the Hort Connections event 3-5 June. Come and see us and find out how Nunhems seed varieties and BASF crop protection can help you have your best season yet.

Minor Use Permits

The below minor use permits were recently issued by the Australian Pesticides and Veterinary Medicines Authority (APVMA). This information is circulated as part of Hort Innovation's Growing Innovation e-newsletter, which members and interested horticulture participants receive monthly. Sign up at horticulture.com.au/growers/become-a-member.

Permit ID	Description	Date Issued	Expiry Date	Permit Holder
PER14326 Version 5	Captan / leafy lettuce, cucumber, capsicum & chilli / grey mould	19 Dec 2013	31 Mar 2027	Hort Innovation
PER13901 Version 5	Glyphosate (shielded sprayer) / capsicums - snow peas - sugar snap peas / annual and perennial grass and broadleaf weeds	6 Apr 2013	31 Mar 2029	Hort Innovation
PER87563 Version 2	Warlock insecticide / brassica vegetables / liriomyza leaf miners	6 Jun 19	31 Mar 2029	Hort Innovation
PER83944 Version 4	Clothianidin / mango / fruit fly	27 Nov 2017	31 Mar 2026	Hort Innovation
PER14694 Version 4	Vectobac wg biological larvicide / protected cropping - capsicum, cucumber, eggplant, herbs, & lettuce	1 Jun 2014	31 Mar 2029	Hort Innovation
PER14695 Version 5	Metalaxyl-M / parsnips / pythium spp / phytophthora spp.	1 May 2014	31 Mar 2029	Hort Innovation
PER14457 Version 4	Alpha-cypermethrin / chicory, leeks, spring onions, shallots / redlegged earth mite, onion thrips	19 Mar 2014	31 Mar 2029	Hort Innovation
PER87631 Version 3	Coragen insecticide / spinach & silverbeet / cabbage leaf miner	21 Jun 2019	31 Mar 2029	Hort Innovation
PER87515 Version 2	VectoBac WG biological larvicide / mushrooms / fungus gnats / sciarids	15 Mar 2019	31 Mar 2029	Hort Innovation
PER14471 Version 4	Lambda-cyhalothrin / shallots & spring onions / various pests	30 May 2014	31 Mar 2029	Hort Innovation
PER80169 Version 4	Metribuzin / carrots / grass and broadleaf weeds	3 Mar 2015	31 Jan 2028	Hort Innovation

All efforts have been made to provide the most current, complete and accurate information on these permits, however you should always confirm all details on the APVMA **website at: portal.apvma.gov.au/permits.** Details of the conditions of use associated with these permits can also be found on the APVMA site.

You can also access the Non-Performance Reporting Form for Horticultural Pesticides at **horticulture.com.au.** This form should be completed when an adverse experience occurs as a result of using a permit. A 'non-performance' is an unintended or unexpected effect on plants, plant products, animals, human beings or the environment, including injury, sensitivity reactions or lack of efficacy associated with the use of an agricultural chemical product(s) when used according to label (or permit) directions.

Users are advised that while the pesticide can be applied legally under the APVMA minor use permit, there can be a significant delay until the MRL gazetted by the APVMA is adopted in the Australia New Zealand Food Standards Code. Until this occurs the MRL may not be recognised and a zero tolerance may be imposed for residues of the pesticide resulting from its use according to the APVMA permit.

Please be aware that in the absence of an MRL in the Food Standards Code, the use of the pesticide according to the permit may result in the suspension of the produce in the marketplace. Please check the FSANZ website or the **Australian Government ComLaw website:legislation.gov.au/Series/F2015L00468)** to confirm if there are MRL established by the Australia New Zealand Food Standards Code.

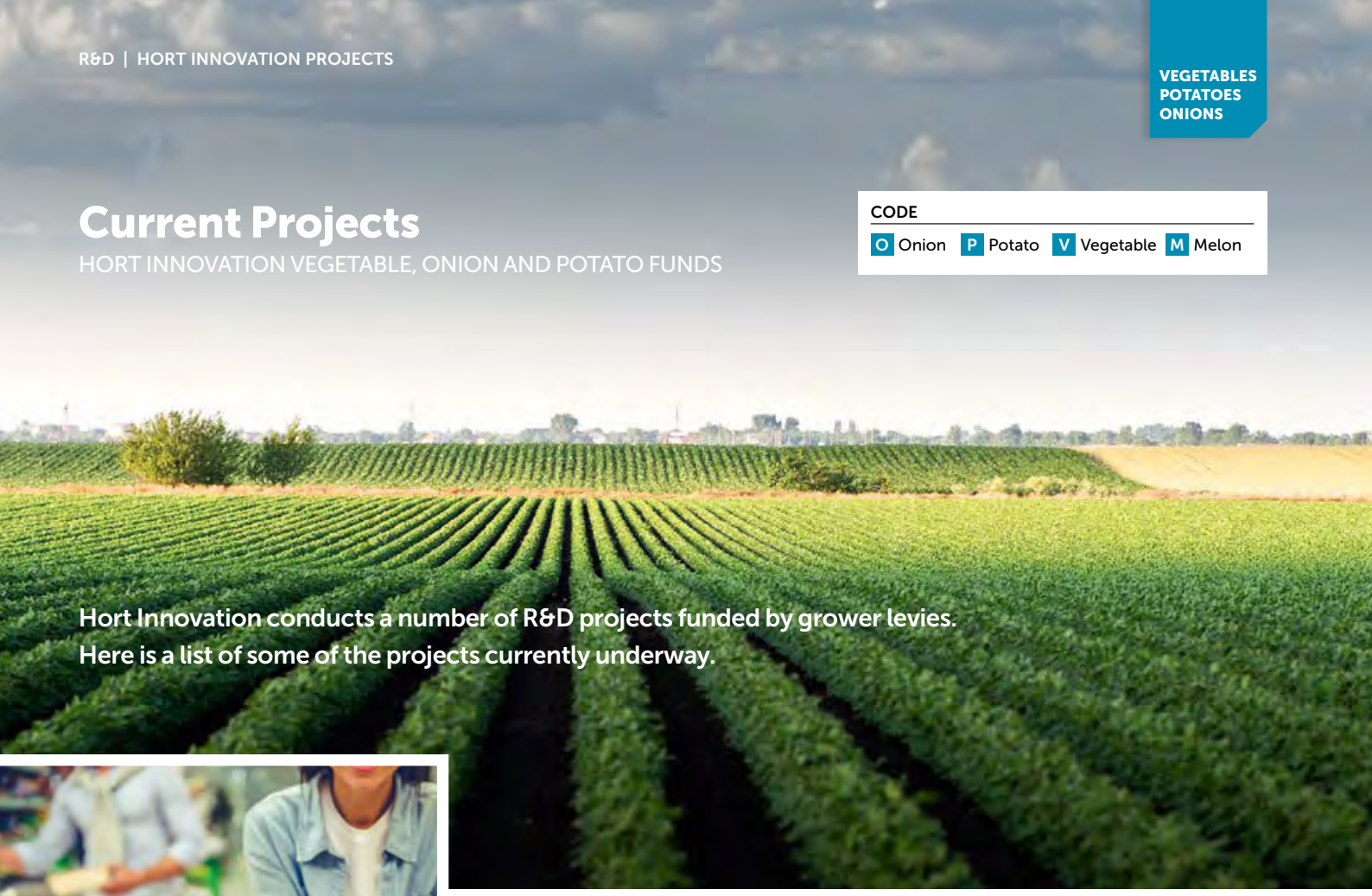
VEGETABLES
POTATOES
ONIONS

Current Projects

HORT INNOVATION VEGETABLE, ONION AND POTATO FUNDS

CODE

O Onion P Potato V Vegetable M Melon



Hort Innovation conducts a number of R&D projects funded by grower levies. Here is a list of some of the projects currently underway.

VO Consumer behavioural data program

MT21004

KEY RESEARCH PROVIDER: **NIELSEN**

This multi-industry investment is tasked with providing regular consumer behaviour data and insight reporting to a range of industries, through the Harvest to Home platform (*harvesttohome.net.au)*.

The platform has a dedicated dashboard for each commodity, making data and reporting easily accessible for industry participants.

The information is intended to assist growers and supply chain partners in decision-making for their businesses and, for the wider industry, the data and insights will be available to support strategic activities.

VOM Multi-industry export program

Vegetables, Onions and Melons

MT21009

KEY RESEARCH PROVIDER: **AUSVEG**

This investment provides international trade development support for Australian vegetable, onion and melon growers. The project is working to develop export markets, maintain viable export pathways, develop industry capability and achieve sustained export growth. This cross-industry collaboration is a first for the horticulture sector and will leverage the progress made under the *Vegetable industry export program (VG16061).*

The program focuses on building export capability and capacity in the vegetable, onion and melon industries, collating international market information for decision making as well as business development functions to uplift the ability of exporting growers to service a wider range of markets and channels and expand international trade opportunities in the future.

The export program comprises the following activities:

- Export skills & capability development
- Market planning & market entry
- Market engagement & trade facilitation
- Market intelligence & trade expansion
- Trade policy, protocol & risk management
- Communication & industry engagement
- Assistance, advice & resource development
- Export strategy implementation.

With differing export maturity of businesses across and within the vegetable, onion and melon industries, tailored approaches and pathways will be implemented.

Current Projects

HORT INNOVATION VEGETABLE, ONION AND POTATO FUNDS

VO Nuffield scholarships MT22003

KEY RESEARCH PROVIDER: **NUFFIELD AUSTRALIA**

The project supports Nuffield Scholarships from 2024–2029 from a variety of industries. In 2024 a rubus and onion scholarship have been supported and in 2025 a vegetable, avocado, mushroom and apple and pear Scholarship are being offered.

Nuffield Scholarships award primary producers with a life-changing scholarship to travel overseas and study an agricultural topic of choice to increase their knowledge, management, and leadership skills. It is a 14-week study program consisting of both group and individual travel. Completing a Nuffield Scholarship provides participants with a thirst for continued learning and equips them to be leaders in their industry and community.

VO National vegetable and onion benchmarking program MT22009

KEY RESEARCH PROVIDER: **PLANFARM**

This project is providing vegetable and onion growers with the ability to compare their businesses against national and regional benchmarking data. This will enable growers to track their own performance against industry averages and 'best in class' performance, providing the opportunity for positive practice change and farm business growth.

Each participating grower will directly have access to farm management consultants to discuss their performance, and industry as a whole will have access to five years of rigorous industry benchmark data.

This body of work has been completed to provide clear guidance for future work and funding to progress the Australian onions and adjacent industries in addressing the threat posed by processed imports with substantial evidence and practical recommendations. This work was completed by TGD on behalf of Hort Innovation and the Australian rubus sector, with support from numerous Growers, Processors, Manufacturers and Foodservice providers, and funded through the Onions research and development levies.

VOP Horticulture trade data MT22005

KEY RESEARCH PROVIDER: **IHS GLOBAL**

This investment provides Hort Innovation with a subscription to the Global Trade Atlas Database. Access to this trade data is used to validate export performance and assist with forming ongoing strategy and focus areas in the area of international trade. This information is shared with relevant industry bodies and delivery partners.

VOP Education and tools for canteen managers to increase vegetables in primary school canteens and vegetable consumption by children MT22006

KEY RESEARCH PROVIDER: **HEALTHY KIDS ASSOCIATION**

This project is engaging primary school canteens across Australia through a range of initiatives to boost the consumption of veggies at school and create long-term healthy eating habits.

Known as 'For the Love of Veg,' the project will develop practical tools and educational resources to increase vegetable inclusion in primary school canteen menus and increase vegetable consumption by children.

The program will draw on the networks and expertise the Canteen Consortium provides, which includes five leading-canteen associations and networks across Australia that can reach primary schools nationwide.

Current Projects

HORT INNOVATION VEGETABLE, ONION AND POTATO FUNDS

FEASIBILITY / SCOPING STUDY

VOP Surveillance and diagnostic framework for detecting soil-borne pathogens in vegetable industries

MT21016

KEY RESEARCH PROVIDER:
NSW DEPARTMENT OF PRIMARY INDUSTRIES

This multi-industry investment is examining the potential to develop a national surveillance and diagnostic framework for soilborne pathogens of melon, onion, potato, sweetpotato and vegetable crops.

The project team have three main areas of focus:

- Enhancing the biosecurity preparedness of the Australian vegetable sector by determining the best methods for soil sampling and diagnostics for the early detection of exotic soil-borne plant pathogens
- Determining the feasibility scope of developing a nationally consistent framework for soil surveillance and diagnostics
- Highlighting new areas for R&D investment by undertaking a foundational project and gap analysis in current knowledge of soil surveillance and diagnostics.
- Based on a thorough review of literature describing relevant technologies, and consultation with industry bodies, growers and government regulatory and scientific staff on practicality, application, cost effectiveness and appropriateness of outputs, the project team will determine the feasibility of a national framework, identify gaps and opportunities, and provide recommendations for future research direction.

VOP People development strategy for the vegetable, potato, onion, and banana industries

MT22002

KEY RESEARCH PROVIDER: **RMCG**

This project is about building a People Development Strategy to guide future investment in building capacity and capability within the vegetable, potato, onion, and banana industries.

Like many industries across Australia and particularly for the horticulture sector, the vegetable, potato, onion and banana industries are facing challenges in attracting, developing and retaining labour, skilled and specialist workers. While there has been investment into training and leadership initiatives, this has often been opportunistic and reactive. This project engaged with industry to design a coordinated, clear and well-thought through People Development Strategy (Strategy). This will assist in focussing both efforts and funds and ensure industries are able to respond to present challenges and establish future skills for a high functioning and innovative horticulture industry.

The development of the Strategy to guide investment in people aligns with the Strategic Investment Plans for the five levied industries of vegetables, fresh potatoes, processed potatoes, onions and bananas. The desired outcomes is improved capability and an innovative culture to maximise investments in productivity and demand.

The project involved a desktop review of national examples of strategies, initiatives and case studies from across horticulture and other industries. This provided the base for engagement with a Project Advisory Group and industry interviews to build the strategy. An advisor from the Global Leadership Foundation provided input into current best practice and contemporary language to create a thorough Strategy for Hort Innovation, industry peak bodies and individual organisations.

The Strategy and Implementation Plan was structured around an overarching Framework that takes into account Industry Context and Enabling factors necessary for successful implementation. From there four key strategies were developed based on the key skill needs identified through the desktop and engagement:

- Core skills and capabilities – maximise opportunities to develop and retain a diverse and collaborative workforce.
- Digital skills and capabilities – leverage information, technology and intelligence systems that enhance productivity and connectivity.
- Interpersonal and leadership skills and capabilities – recognise and develop emotionally healthy people and leaders at every level of industry.
- Collaborate and partner with people at local, regional and national levels to ensure business continuity and success.

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Current Projects

HORT INNOVATION VEGETABLE, ONION AND POTATO FUNDS

Root-knot disease caused by nematodes in guava.

VOP Industry preparedness for exotic root knot nematode *Meloidogyne enterolobii* MT22012

KEY RESEARCH PROVIDER: **CSIRO**

This research will use the latest advancements in molecular screening to provide a better understanding of root-knot nematodes occurring in Australia and develop an identification tool for these nematodes that will be more cost effective than methods presently available.

BACKGROUND

The recent identification of a new species of highly virulent plant parasite, the Guava Root-Knot Nematode (Meloidogyne enterolobii), in Australia means that there is a great need to improve root-knot nematode identification for trade, quarantine, and pest management purposes. Critically, it is not clear if M. enterolobii is a recent arrival to Australia, or if the species has been present for some time but has only just been recognised. Historic specimens lodged in Australian collections may hold the key to answering this question, but the information is locked to traditional methods of interrogation.

Guava root knot nematode was reported in Australia for the first time in late 2022, from the Darwin area of the Northern Territory. Since this initial discovery, further detections have been made in Queensland. Guava root knot nematode is a devastating plant parasite causing significant crop losses on a global scale. This nematode has a broad host range spanning 30 plant families, including many important food crops. Notably, guava root knot nematode is a resistance-breaking species, causing severe damage to crops with genetic resistance to other root-knot nematode species.

Consequently, this nematode is a significant biosecurity risk for multiple crops in Australia and is rated in the high to extreme risk categories on the biosecurity plans for multiple industries, for example onions, potatoes, sweetpotatoes, and other vegetables. The wide host range and resistance-breaking characteristics of guava root knot nematode facilitates rapid spread, and this species is very difficult to control. Preventing establishment of this species in production areas where it was previously not present is thus critically important.

METHODS

Identification of root-knot nematodes via morphological methods is time intensive, requires significant specialist expertise, and the fingerprint-like patterns present on the female body which are traditionally used to diagnose species are subject to human interpretive error. Molecular identification would be more accurate and high-throughput, however, nearly all historic material was preserved using formaldehyde-based solutions, which are generally thought to inhibit DNA extraction. This research project aims to improve root-knot nematode identification through a two-prong approach.

National Research Collections Australia (NRCA) is developing artificial intelligence-based image recognition for pests like Brown Marmorated Stink Bug and various weeds. This research project will develop a similar tool for rapid species-level identification of root-knot nematodes using images of perineal patterns, which are a fingerprint-like pattern of lines on the outside of adult females used for identification. The research team envision the tool as being able to provide a same-day, species-specific identification based on light-microscopy images of perineal patterns requiring minimal training to prepare. The results would thus be far quicker, cheaper, and easier than other identification methods available.

Despite the general assumption that DNA cannot be obtained from formalin-preserved material, a method doing just that has recently been pioneered by CSIRO. This research project will use this method to screen historic formalin preserved plant material for evidence of M. enterolobii infestation.

Current Projects

HORT INNOVATION VEGETABLE, ONION AND POTATO FUNDS

VOP National Bee Pest Surveillance Program: Transition program MT21008

KEY RESEARCH PROVIDER: **PLANT HEALTH AUSTRALIA**

This investment is delivering a national coordinated bee-pest surveillance program to help safeguard honey-bee and pollinator-dependent industries in Australia. The National Bee Surveillance Program was established in 2012, supported by the previous *National Bee Pest Surveillance Program (MT12011)* and *Enhanced National Bee Pest Surveillance Program (MT16005).*

The program will conduct surveillance for 13 pests that impact honey bees (mites and beetles), and pest bees that could either carry hitchhiking parasites or could themselves cause detrimental impacts to honeybees. The program activities include upgrading sentinel hive arrays, strengthening relationships with surveillance operators 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.

Several levy industries are contributors to the work, and the program is part of the Hort Frontiers Pollination Fund. Hort Frontiers is Hort Innovation's strategic partnership initiative, with more information available at hortfrontiers.com.au.

The importance of industry engagement

BY BOOMAROO NURSERIES

An industry is only as strong as the people who operate within it, and the networks they create. Fortunately for the Australian vegetable sector, we have incredible growers and suppliers, and our network of industry organisations is vibrant and strong. In this article we take a look at the importance of these industry bodies, and why Boomaroo Nurseries are so passionate about supporting them and the events they run.

The importance of industry organisations

From advocacy and advice through to organising social events, industry organisations play an important role in supporting the interests of their members. These bodies serve as conduits for knowledge exchange, while empowering growers and safeguarding their interests.

Additionally, having a group of people responsible for driving the interests of an entire industry in the political realm is crucial for the future viability and prosperity of any industry. In the case of vegetables, the future of the industry is critical for the population as a whole, not just the companies and people working in the industry.

Those in our industry are more than aware of the importance of vegetables and the hard-working people that grow them. Unfortunately, however, some members of the public do occasionally need reminding, and industry organisations play a key role in spruiking the great work of our farmers, as well as the companies that support them.

Vegetable cultivation is a tricky business, to say the least. Success hinges on a delicate balance of scientific understanding, traditional wisdom, and innovative techniques. Engaging with industry organisations, and other growers through industry events, provides growers with invaluable platforms for knowledge exchange. Through seminars, workshops and conferences, growers gain insights into the latest research findings, emerging trends, and best practices.

Publications like this one are also vital for members of industry to stay up to date with all of the latest product releases, news and views. I'm sure there are more than a few people reading this article who have a stack of recent editions of industry magazines on their desk.

Growing vegetables is more than just a vocation, it's a lifestyle. For many growers, the idea of a 9-5 workday is a fantasy. Spending hours on-farm, in-market or on the road leaves very little time for any sort of socialising. Interacting with industry colleagues in a social setting is not only good for the business, it's good for the soul. Building a network of like-minded people who you can lean on for advice or assistance when facing adversity is a no-brainer. With so many events on the calendar such as Hort Connections, gala and awards dinners, field days and farm visits, there are more than enough opportunities to come together and share a yarn with old friends and new.

The industry organisation landscape in Australia

We are extremely fortunate in this country to be represented by a vast network of hard-working industry groups from national, broad-ranging groups like AUSVEG all the way through to segment-specific organisations like Berries Australia and Melons Australia. There's even a body representing the interests of Lychee growers!

Many companies engage with more than one industry body. In the case of Boomaroo Nurseries, we are actively involved in many different groups including international bodies such as International Fresh Produce Association, national bodies such as AUSVEG and Australian Organic Limited, and state and regional bodies such as AUSVEG VIC, Queensland Fruit & Vegetable Growers, Lockyer Valley Growers, Granite Belt Growers Association, and even the Nursery & Garden Industry of Victoria due to our work in the ornamental horticulture space.

Boomaroo's commitment to industry bodies

In any industry sector, you will find a handful of companies that put industry engagement front of mind when conducting their ventures. Boomaroo are actively involved in a few different segments of horticulture and agriculture, and we feel strongly about the role we play in these spaces. Through our commitment to support key events such as Hort Connections and the VicVID and Lockyer Valley Growers Group Field Days, through to volunteering on industry boards, nobody could question our commitment to the growers of Australia.

It is vital that these industry organisations and events get the support of individuals and companies from around the industry. We love being involved, and we strongly recommend others actively engage with relevant groups around the country.

FOR MORE INFORMATION
Visit boomaroo.com

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Current Projects

HORT INNOVATION VEGETABLE, ONION AND POTATO FUNDS

VO VegNET 3.0
VG21000

KEY RESEARCH PROVIDER: **AUSVEG**

This investment is tasked with keeping Australian vegetable growers informed about current R&D activities, results and resources – supporting the adoption of industry best practice and bolstering vegetable productivity and profitability in key growing areas across the country.

The program is nationally coordinated by AUSVEG and delivered 'on-the ground' by regional development officers (RDOs) in key vegetable-growing regions who are responsible for developing and executing regional extension plans. This includes identifying each region's key priority issues and key regional resources and links - a critical step in ensuring growers receive assistance and information that meets their needs and will help them grow better crops and operate more efficient and profitable businesses.

VOP Annual Vegetable Industry Seminar 2022-2024
VG21003

KEY RESEARCH PROVIDER: **AUSVEG**

This project is delivering the Annual Vegetable Industry Seminars from 2022 to 2024 through a combination of in-person events, online webinars and video resources. All activities will be used to highlight outcomes from vegetable grower's levy investments.

As with previous investments, the in-person seminar will be run concurrently with Hort Connections while also providing access for those unable to attend in-person through digital platforms. This ensures the outputs from the project will cater to growers from around the country and from all backgrounds. The seminars and webinars will ultimately assist growers in increasing their profitability and efficiency by highlighting the latest global technology and innovations.

VO Soil wealth and integrated crop protection – phase 3
MT22004

KEY RESEARCH PROVIDER:
APPLIED HORTICULTURAL RESEARCH

The Soil Wealth and Integrated Crop Protection program assists melon and vegetable growers to improve the management of their soil and crop health, to drive their productivity, profitability and sustainability on-farm.

Building on the success of the previous investment *Soil Wealth and Integrated Crop Protection – phase 2 (VG16078),* the new project will focus on:

1. **Soil health, which underpins sustainable farming systems and the production of healthy crops.** Improving soil management practices will assist vegetable growers to have a more productive and resilient natural resource base with a focus on soil care, increasing organic material and improving grower margins.
2. **Crop health, driven by improved soil health and crop protection measures.** Improving crop protection management practices will assist vegetable growers to produce healthier and more profitable crops through managing insects, diseases and weeds to maintain healthy plants.
3. **Optimising inputs for healthy soils and crops, and profitable vegetable businesses.** Increasing skills in the effective use of nutrients, water, chemicals and other resources (e.g. plastic to minimise waste) will assist vegetable growers to maintain market advantage and demonstrate sustainability.
4. **Carbon and climate.** The climate influences what, when and how soil and crop health can be managed, including associated input use. Increasing awareness of changes in climate, both in extremes and longer-term averages, will be important for adapting production systems. Understanding the role of carbon will assist vegetable growers to remain profitable and sustainable into the future.

VO Learning from the past to amplify community vegetable education programs of the future
VG22003

KEY RESEARCH PROVIDER: **AGECON**

This project evaluated the impact of past initiatives to increase demand for vegetables so that a framework could be developed for industry to ensure the design and deliver of effective future programs.

CHALLENGE

The vegetable industry has delivered a range of levy funded initiatives seeking to increase consumer demand, motivated by the large share of the Australian population (>90 per cent) who are not consuming the recommended serves of vegetables per day. This 'consumption gap' represents a valuable opportunity for the Australian vegetable industry to realise additional demand and market growth.

Despite the broad range of investment activity seeking to increase vegetable consumption (e.g. product development, education, insights, best practice guidelines), population-level changes in actual consumption has not occurred, suggesting that the initiatives have generated a minimal observable impact.

Current Projects

HORT INNOVATION VEGETABLE AND ONION FUNDS

RESPONSE

This project sought to understand the delivery of previous initiatives seeking to increase vegetable consumption within Australia. This was informed by a literature review and stakeholder consultation process, culminating in a framework to guide future investment to increase consumer demand. The project drew on behaviour change theory to guide the evaluation and framework development approach and was delivered in three phases:

1. Literature review and mapping initiatives
2. Evaluation of levy and non-levy initiatives
3. Behaviour Change Framework to guide future investment.

BENEFIT

The literature review identified 100 initiatives that have been delivered (or are currently being delivered) primarily within a domestic setting over the last ten years, covering a range of cohorts and categories. The evaluation process was carried out on a sample of 10 initiatives, representing both levy and non-levy-funded initiatives. The key finding from the evaluation was that while initiatives were generally highly relevant to the target cohort and were supported by an appropriate strategic basis, the effectiveness of achieving sustained behaviour change and industry impact was significantly weaker. This was partly due to the absence of an implementation plan, which was required to engage stakeholders with the tools and resources developed on an ongoing basis.

Building on the literature review and evaluation insights, the project team developed a robust Behaviour Change Framework. This framework holds the potential to guide future vegetable R&D levy investment across five strategic pillars, in the context of the broader response levers and stakeholders that can complement and leverage levy-funded initiatives.

The Behaviour Change Framework provides Hort Innovation and relevant vegetable industry stakeholders with improved knowledge of the requirements to design and deliver levy investments that increase domestic vegetable demand and industry impact.

Milking the post-harvest window for almonds

In an almond crop, post-harvest is one of the most important times of the year for crop nutrition.

Almond growers and their advisers are encouraged to make the most of this opportunity by using soil and plant tissue test results to ensure adequate and balanced nutrition.

What is at stake?

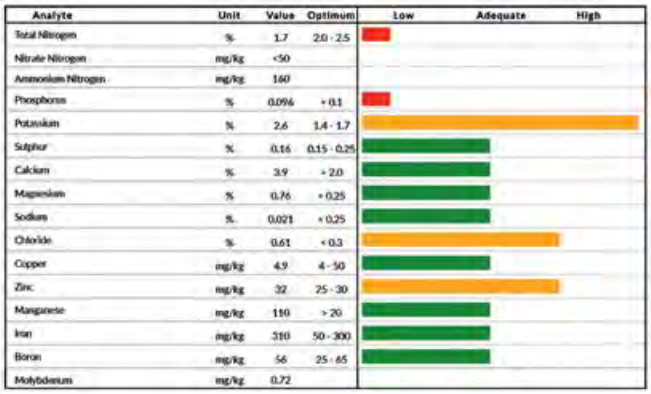
An adequate and balanced post-harvest fertiliser program gives trees a good start when it comes to the next crop.

Strengthening the trees will have a flow on effect when it comes to nut quality, size, and yield. The longer the tree's nutrient status remains at the low end or below the optimal range, especially during stages critical to yield, the greater the negative effects on yield, nut size, quality, and the following season's bloom.

Post-harvest tissue testing

Post-harvest tissue testing is a tool that can be used to enable growers to understand what nutrients may be missing. *Figure 1* shows the result from a test taken from an almond orchard in the Loxton area, following harvest. Based on these results, one can clearly see that both Nitrogen (N) and Phosphorus (P) are below the optimum levels.

FIGURE 1: POST-HARVEST TEST FROM ALMOND ORCHARD IN LOXTON



Fixing nutrient shortfalls

If your post-harvest tissue tests reveal an issue, liquid fertilisers can be an effective way to improve the nutrient status of your trees. In the EASY Liquids range, two nutrients of N and P can be balanced using N25 and Flowphos 15.

Nitrogen

There are four straight N-based product options:

- N24 (24% Urea)
- N25 is an Ammonium Nitrate (12.5% NH_4+ and 12.5% NO_3-)
- N26 (26% Urea)
- N42 (UAN – 10.5% NH_4+, 10.5% NO_3- and 21.5% Urea).

The ammonium form has a positive charge, allowing it to bind to the negatively charged soil colloids, hence reducing losses through leaching. The nitrate form is freely available and moves readily with the soil water to the root system. Ammonium is converted to the nitrate form via micro-organisms in the soil. Having N in the ammonium form, allows N to be banked and used over a longer period. Having N in the nitrate form is particularly useful in the cooler months.

TABLE 1: NITROGEN OPTIONS AVAILABLE FROM EASY LIQUIDS.

PRODUCT	TOTAL N	AMMONIUM	NITRATE	UREA
N24	24			24
N25	25	12.5	12.5	
N26	26			26
N42	42.5	10.5	10.5	21.5

Phosphorus

P is vital for root development, flower initiation and energy transport within plants. P is a structural constituent of essential biomolecules involved in energy metabolism, such as adenosine triphosphate (ATP) and pyrophosphate (PPi), and in the formation of key macromolecules such as nucleic acids and phospholipids. Hence, P is integral to nearly all major metabolic processes in plants (Scheerer *et al.* 2019).

The form of phosphate being used in an Almond crop is important. Products such as Flowphos 15 contain soluble orthophosphate, which contain one phosphate group. This is the only form of plant available P that roots can directly assimilate from the soil (Stigter and Plaxton, 2015).

Storage of polyphosphates in a tank during summer can lead to hydrolysis to orthophosphate. It can also result in a disassociation of sequestered metals, leaving residue in the tank. Storage of orthophosphates, such as Flowphos®, is not an issue, as they are stable and will not hydrolyse under heat.

Trace elements

After harvest almonds also need zinc and boron. EASY Liquids have an extensive range of blends, formulated for fertigated systems. For zinc, one could use Flowphos 10, Flowphos 13Z, Flowphos KZ or Flowphos SZ. For Boron, one could use a N-Cal + B.

TABLE 2: FLOWPHOS RANGE

PRODUCT	N	P	K	S	ZN
Flowphos 10	13	10	5		0.4
Flowphos 13Z	9	14	1		0.9
Flowphos 15	10	15			
Flowphos K	8	15	7		
Flowphos KZ	8	14	7		0.5
Flowphos SZ	10	7	1	6	0.5

Summary

In summary, tissue and soil testing are important when determining limiting factors in an almond crop. Use of such tools, in conjunction with a sound choice of liquid fertilisers can help agronomists and growers prime their trees for the following season.

FIND OUT MORE

For further information on the use of liquid fertilisers, please contact Conrad Leeks, Sales Agronomist EASY Liquids, on 0466 664 026.

References: Stigter KA, Plaxton WC. (2015) *Molecular Mechanisms of Phosphorus Metabolism and Transport during Leaf Senescence.* Plants (Basel). Dec 16;4(4):773-98. doi: 10.3390/plants 4040773. PMID: 27135351; PMCID: PMC4844268.

export/ trade + biosecurity update

Netafim design collaboration puts precision and sustainability at the forefront

In Gatton, Queensland, Australia, forward-thinking farmer Nathan Clackson has partnered with Netafim to transform a 200-hectare unattended and disused tobacco farm into a model of sustainable agriculture. The project, which began in 2020 and saw further enhancements in 2021, is setting new industry standards for farm design and planning. Focusing on superior agronomic results, the project employs sustainable practices guided by the Netafim team and their precision irrigation technology.

Initially faced with an empty canvas at the Inglewood farm, Nathan envisioned a fully integrated operation.

“Everything was designed and built from scratch,” says Nathan, “We focus on cultivating brassicas in the winter and pumpkins in the summer, adapting our methods to meet the unique demands of each crop.”

Seeking a sophisticated irrigation solution, Nathan Clackson reached out to Jason Scherer, Netafim’s Queensland State Manager and a trusted industry collaborator. This connection marked the beginning of a pivotal partnership.

"Nathan was clear from the start; he needed a system capable of managing and tracking detailed data," Jason explained. "Our conversations went beyond mere transactions, focusing on bringing his vision to life through our cutting-edge technology, including the Low Flow SLX 0.35l/hr drippers and FlexNet piping systems. This deep level of engagement set the stage for a transformative project."

Gennaro Vellotti, the Lead Irrigation Engineer on Netafim’s team, regards Nathan as a progressive, forward-thinking farmer.

"Nathan stands out as a grower deeply invested in achieving high standards," Gennaro notes. "Nathan insists on precision. He doesn’t just aim for adequate; he ensures each crop meets the highest quality standards, which significantly boosts his sales and reduces rejection rates at major retailers. While it’s hard to show on paper, Nathan’s meticulous approach typically allows him to sell about 80% of his produce, compared to the average 50% among other farmers. His investment in careful planning and design is akin to constructing a well-laid-out house, paying dividends in the long run. Seeing such foresight in the cultivation of staple crops is particularly impressive."

Nathan likens the precision of the irrigation system to a smart phone navigation app. "Using our system is like setting Google Maps for a precise route—it tells you exactly how long it takes for fertiliser to reach the crops."

The precise application of water and nutrients, regulated by state-of-the-art valves and monitored by the Octave water management system, has resulted in uniform crop sizes that facilitate quicker harvesting and improve time-to-market.

The system's effectiveness is further enhanced by Netafim’s Gravel filtration system, which keep the irrigation network free from sediment and clogs, thus extending its lifespan and maintaining performance.

As Nathan’s farm moves forward, he is not only excited about the immediate impact but also about setting a precedent for others in the industry.

"Jason and his team at Netafim really listened and helped refine our goals and methods for achieving them. What we've achieved here can serve as a blueprint for other farms aiming to enhance their practices. I hope our efforts encourage more farmers to adopt sustainable methods and forward-thinking technologies."

Through their strategic collaboration, Nathan and Netafim are not merely farming; they are redefining what it means to be agriculturally innovative.

"Navigating this project with Netafim has not only benefited my hip pocket by making the plants grow faster but also ensures that we are environmentally responsible, avoiding leaching fertiliser into sensitive areas like the Barrier Reef," Nathan reflected. "From the very beginning, Jason and the Netafim team were thorough; they listened to our needs, performed diligent work, and demonstrated the capabilities of their solutions. They clearly explained how each component, like valves, work, enabling me to address even the most detailed inquiries. This allowed me to confidently explain the system's benefits to my boss, who, while not a farmer, appreciates the clear economic value of our investment.”

This visionary approach showcases that with the right tools and foresight, farming can be both revolutionary and sustainable, ready to embrace whatever technological advances the future may bring.

Inset. FlexNet Piping.

FIND OUT MORE
Contact Netafim on 03 8331 6500
or email: AU.Net.Info@netafim.com
netafim.com.au

Scan the QR code to explore how Netafim can collaborate with you on your irrigation project.

Cross-industry collaboration key for Fall armyworm management

WATCH OUR VIDEO
WITH DR MELINA MILES HERE

Inset. Dr Melina Miles, Principal Entomologist with the Queensland Department of Agriculture and Fisheries.

Bringing together research and grower experiences from across the agriculture sector is critical to developing better management techniques for Fall armyworm.

Growers across the country have been struggling to deal with a resurgence of Fall armyworm this year, with numbers of the exotic pest bouncing to their highest levels since it was first detected in Australia in 2020.

Initially a problem in northern growing regions, Fall armyworm has now been detected in all states and territories except South Australia. Equally concerning is its appearance in a range of additional crops, well beyond the sweetcorn, maize and sorghum that had previously borne the brunt of Fall armyworm damage.

Fall armyworm (*Spodoptera frugiperda*) is a difficult pest to manage. It's a highly invasive and destructive caterpillar native to tropical and subtropical regions of the Americas, with a fast reproductive cycle and the ability to travel long distances in its moth stage.

It prefers grass species with whorls like sweetcorn, maize and sorghum, but in recent years it has also caused damage in brassicas, capsicum, melons, cucumber, eggplant, heliconia and okra.

Helping growers to handle the new pest is the focus of a levy-funded project being run by the Queensland Department of Agriculture and Fisheries, called the *National Fall armyworm innovation system for the Australian vegetable industry (VG22006)*. Starting in 2023, it follows a previous project that was launched in the wake of the initial Fall armyworm detection.

Many growers are getting their first introduction to Fall armyworm this year as it spreads to new areas, and they are having to learn management techniques quickly, according to Dr Melina Miles, Principal Entomologist with the Queensland Department of Agriculture and Fisheries.

"Fall armyworm arrived in Australia in 2020, and was first detected in Far North Queensland," she says. "It was detected in January, and by September it had made an appearance across most of eastern Australia. It's now in every major growing area."

The infestation in northern regions was severe in 2020, but the following few years were comparatively quiet. The situation changed this year, however, with the pest getting started early after a mild winter and warm spring. The result has been a significant infestation, with some sweetcorn growers in Queensland reporting large losses.

"From the beginning of 2024, we've seen pressure, numbers, densities, and damage that we haven't seen in previous years," she says. "It's been quite a wake-up this year."

Due to the broad range of Fall armyworm host crops and the significant threat posed by the pest, research into management practices has been taking place across different industries and regions.

Best practice management of Fall armyworm in Australia is still rapidly developing. It varies between crops, depending on how the caterpillar attacks each crop and how much damage that crop can sustain before it becomes unmarketable.

"The response of sweetcorn to Fall armyworm is much more severe than, say, in maize and sorghum," says Dr Miles.

"From a broadacre point of view, we went very well in the past two years with minimum chemical intervention and a move to early planting, so planting in spring rather than planting in summer."

"That has meant that the majority of crops have avoided higher Fall armyworm pressure. This year the pressure has been so high, and we've also had a lot of late cropping, so a lot of crops have experienced really high Fall armyworm pressure. There's been a lot more spraying as a consequence across broadacre and horticulture."

A rigorous insecticide spray regime has proven the most effective management practice so far. Fall armyworm has shown resistance to synthetic pyrethroids, organophosphates and carbamates, but insecticides like chlorantraniliprole, indoxacarb, spinosyns, and emamectin benzoate offer viable options.

Natural enemies of Fall armyworm can also help, including ladybirds, spiders, native earwigs, predatory shield bugs, assassin bugs, and tachinid flies, and endemic parasitoids like the trichogramma family.

Due to the broad range of Fall armyworm host crops and the significant threat posed by the pest, research into management practices has been taking place across different industries and regions. Dr Miles says a key goal of the current project is to bring that research together and disseminate findings to growers across the affected industries.

"This Fall armyworm area wide management project brings together the industries with an understanding that Fall armyworm doesn't recognise industry boundaries," she says.

"It's focused on learning the biology, the ecology, the interaction, the natural enemies of Fall armyworm – the common threads, whether you're growing sweetcorn or maize, whether you're feeding it to people or animals."

In March 2024, Dr Miles presented on Fall armyworm management techniques at a field day run by VegNET New South Wales and NSW Local Land Services.

Held in Richmond on the outskirts of Sydney, the NSW Vegetable Growers and Sweet Corn Field Day brought together growers and agronomists from the Sydney basin to discuss the pest, which has only recently started to have an impact in the region.

The event was one of many the Fall armyworm project team is taking part in.

"The real emphasis is on bringing people together to communicate the outcomes of research that is going on currently, but also to share the experiences growers are having and what is, or isn't, working for them."

For sweetcorn, a theme for upcoming research that has emerged out of the higher pest pressure this year is understanding how much damage is too much from an economic point of view, following a similar research thread in sorghum and maize.

Dr Miles says the goal for sweetcorn is to develop thresholds that will help growers make rational economic decisions around whether they can afford to spray a Fall armyworm-affected crop, or if the economic return will be outweighed by the cost.

In sweetcorn, that threshold could actually be quite low. Other endemic caterpillar species typically damage the tip of a sweetcorn cob, which can be trimmed off in processing. Fall armyworm caterpillars can chew into the cob from the base, sides or tip, however, in which case the cob can't be used for the fresh or processing markets.

"Sweetcorn looks to be much less resilient to Fall armyworm compared with maize and sorghum, so you can't allow much damage in the vegetative state," says Dr Miles. "It doesn't leave very much wiggle room in terms of minimising insecticide use."

"So there are some real challenges around how we change the system to reduce the very high reliance on insecticides that we currently have, and take advantage of more resilient varieties that may be around, and the natural enemies and other biological controls that we know are there, but currently can't get a foothold given the high intensity of insecticide use."

FIND OUT MORE

Head to the Fall armyworm engagement hub daf.engagementhub.com.au/fallarmyworm.

National Fall armyworm innovation system for the Australian vegetable industry is funded by Hort Innovation using the vegetable industry research and development levy and contributions from the Australian Government.

Project Number: VG22006

Hort Innovation VEGETABLE FUND

Fall armyworm symposium keeps industry informed

The national Fall armyworm symposium held in April 2024 gave an update on the current status of the pest here in Australia and globally.

The symposium held in Brisbane was also an opportunity to share research, development and extension activities that have occurred since Fall armyworm was first detected in Australia in 2020. Growers, researchers, industry, and government representatives presented their experiences and research involving Fall armyworm. Additionally, the symposium aimed to identify gaps in research, development and extension and what to focus on for future Fall armyworm management.

Since being detected in Queensland in 2020, Fall armyworm has wreaked havoc on sweet corn, maize, and sorghum crops. However, the host range of Fall armyworm is extensive. Other affected crops including millets, peanuts, mungbeans, soybeans, Rhodes grass field crops. Reports of Fall armyworm in other horticultural crops such as capsicum, ginger, heliconias, strawberries, ginger, womboks, celery, rockmelon and avocados have also been received. The 2023-2024 season has been particularly challenging, with an early start to the FAW season and late crop plantings allowing for large Fall armyworm populations.

While the pest is now present throughout Australia, with the exception of South Australia, Queensland has been hardest hit with the pest being present for prolonged periods of time. At the symposium, members of different industries including the cotton, horticulture, grains, animal, and grains industry shared their experiences with the pest, looking for more effective methods for control.

While there has been some success using different varieties or changed planting schedules, this leads to different production issues and new management tools are required. As there are no silver bullets for Fall armyworm management, the current approach to the pest is a reactive one based on managing caterpillars within the crop.

Researchers presented on their latest projects, focussing on gaining a better understanding on the background and biology of the pest, as well as overseas occurrence and management. While their ongoing research shows promise, a lot of the findings are not yet applicable on-farm.

During the symposium, cross-industry collaboration and area-wide management emerged as recurring themes in the discussions. Transboundary management, both on a national and international level makes sense. The need for diverse control options was also underscored. These outcomes are crucial as they serve as key drivers for the long-term management of Fall armyworm.

"Fall armyworm has caused significant damage to sweetcorn crops this year, and as it spreads to new areas, growers around the country are quickly trying to learn and apply best-practice management techniques," said AUSVEG CEO Michael Coote.

"With Fall armyworm being found on an increasing range of crops, this is an important time for industry, researchers, government and other stakeholders to get together to share the latest knowledge on this pest.

"As a cross-agriculture problem, it's heartening to see a broad range of industries working together to address the Fall armyworm challenge with events such as this symposium."

The outcomes from the event will be collated and used to make decisions on Fall armyworm research investments, development, and extension activities.

As there are no silver bullets for Fall armyworm management, the current approach to the pest is a reactive one based on managing caterpillars within the crop.

Above. AUSVEG was represented at the symposium by VegNET National Coordinator, Cherry Emerick, and Farm Biosecurity Officer, Marije van Beek.

FIND OUT MORE

Visit the Engagement hub (eHub) on *Fall armyworm research, development, and extension for horticulture*: daf.engagementhub.com.au/fallarmyworm or *The Fall armyworm management guide* from AUSVEG.

National Fall armyworm innovation system for the Australian vegetable industry is funded by Hort Innovation using the vegetable industry research and development levy and contributions from the Australian Government.

Project Number: VG22006

Hort Innovation VEGETABLE FUND

VEGETABLES
POTATOES
ONIONS

A harvest of abundant knowledge for DAFF

BY ZARMEEN HASSAN
NATIONAL MANAGER, BIOSECURITY AND EXTENSION

DAFF visits Rinaland

"Call us and test if the policy will work on-ground". Welcoming words from growers who hosted teams from the Department of Agriculture Fisheries and Forestry (DAFF) during March and April.

AUSVEG facilitated visits of DAFF representatives to vegetable, potato and onion farms with an intent to support policy makers and regulators to better understand the space they regulate to enable impactful policies for a resilient and robust industry.

These farm visits continue to be a key stakeholder engagement tool for both sides of the equation – both farmers and government. It builds bridges and breaks down barriers between two critical sides of food production. The revival of such visits after COVID gave DAFF the opportunity to show extremely strong commitment and a very high level of interest. Chris Percival, A/g Director for Biosecurity Plant and Science Services Division | Plant Systems and Strategies | Content Change Team with DAFF led the tours on behalf of DAFF says that these tours are always oversubscribed with a great desire from DAFF staff to be out on farm, engage with farmers, and to understand farming systems. For AUSVEG and the industry, it's an opportunity to showcase the spectacular work that our farmers do. To show policy makers, the literal blood, sweat and tears it takes to bring food to the Australian and global public and critically, the real impact that policies have.

And on a sombre note, the struggles that face our industry every day with 37% of vegetable growers surveyed recently saying that they were looking at getting out of the industry because "it's just too hard".

Watching the interactions and reactions of DAFF representatives across a range of functions diverse experiences, interact with the farm, the soil, the farmers, has re-iterated the importance of these visits. For the majority of the representatives, it was the first time that they have had the opportunity to visit a farm and meet a farmer. From an industry perspective, policy makers understanding farming and visiting a farm at a nascent stage of a career journey should be a critical component of an onboarding process to build more impactful policy.

The diversity of farming operations was a key standout for the DAFF representatives. We had the privilege to show them intensive cropping operations of leafy vegetables and brassicas in Werribee, Victoria and protected cropping and vast farming operations in Mornington, Victoria as well as potato cropping, carrots, spinach and cucurbits through NSW and the Riverina region. Catherine Velisha of Velisha farms, John Said from Fresh Select and Joseph Fragapane of Fragapane farms, with their teams, hosted the tours, showing not only their farming operations, but importantly their innovations.

The critical nature of innovation in managing waste and having non-farming incomes shone through with the value-add of a vegetable powders and vegetable chips processing facility at Fresh Select and the pristine nursery operations of GroLink by Fragapane farms.

Veg Education by Velisha Farms took them on a joyous journey of understanding where their food comes from – one specifically designed for education of school children visiting farms, in an effort to get them to eat more vegetables, but also to appreciate how food is produced. And to appreciate the two-legged carrot along with the one legged one, to reduce food waste.

The staggering level of on-farm food waste is probably the one thing that left the DAFF team most perplexed. Perfectly nutritious and edible food is not accepted by the supply chain because it does not look perfect. This food has the same inputs invested into it creating income loss, wasted inputs and above all, wasted food. As a result, Australia wastes approximately 2.6 million tonnes of food annually.

DAFF staff learned firsthand about soil health, environmental sustainability, regenerative agriculture and different farming systems. Especially by Garry Kadwell of Kadwell Potato Co who has given 40 per cent of his land back to the environment,

by developing tree corridors, native vegetation and watering holes. All while maintaining his yields. And developing a delicious heirloom potatoes product line! You can read his story on page 95.

It was an opportunity to showcase the commitment by AUSVEG in action to DAFF and demonstrate to farmers how simple measures can help protect pest and disease from entering a farm. Our mobile foot baths ensured that we all came in clean to every farm and left with a harvest of abundant knowledge of farming by the caretakers of the land!

Thank you to the following farmers who graciously hosted the team:

John Said
- Fresh Select

Catherine Velisha, Jodie Calwell, Mark Pullin
- Veg Education, Velisha Farms

Joseph Fragapane
- Fragapane Farms

Peter Smith, Jo Van Niekerk
- Boomaroo Nurseries

Rick Butler
- Butler Market Gardens

Paul Gazzola
- Gazzola Farms

Russel Lamattina
- A&G Lamattina & Sons

Garry Kadwell
- Kadwell Potato Co.

Brendan Cox
- Harvest Moon

Fernando Rombola
- Rombola Family Farms

Gary Snaidero
- Rinaland

L-R. Brendan Cox, Harvest Moon. Fernando Rombola, Rombola Family Farms.

Industry science and extension projects are funded by Hort Innovation using the vegetable and onion industry research and development levies and contributions from the Australian Government.

Project Numbers: VN21000, VG22004, VG21000

National Vegetable Extension Network VegNET

Hort Innovation VEGETABLE FUND

Hort Innovation ONION FUND

2024 International Trade development activities

AUSVEG stand at Gulfood trade event 2024.

GULFOOD 2024

In February 2024, AUSVEG led a trade mission delegation to attend and exhibit at Gulfood, the world's biggest annual food and beverage event, held from 19 February to 23 February 2024. Gulfood welcomed hundreds of thousands trade attendees from 195 countries, with 5,500 companies exhibiting at over 125 national pavilions across the different sectors of the show.

The United Arab Emirates and the Middle Eastern region are important trading partners for the Australian vegetable and onion industries, with the United Arab Emirates being the second largest destination for Australian vegetable and onion exports. The Australian vegetable industry exported $34 million at 36,714 tonnes of fresh vegetables to the United Arab Emirates in 2023.

AUSVEG had a 64sqm space at Gulfood, with the stand located at the World Food Sector within the Australia pavilion. The AUSVEG stand incorporated Australia's national brand as well as providing a centralised space for fruit and vegetable growers to meet with international buyers and businesses from across the MENA region.

The delegation visited a range of retail stores in Dubai during the market insights tour, including Carrefour, Grandiose, Spinneys, Lulu Hypermarket, and Kibsons International. The main objective of the market insights tour is to assist growers to gain deeper understanding of local consumer preferences, current retail landscapes as well as packaging solutions from other markets.

AUSVEG CEO Michael Coote hosted the Australian Ambassador to the United Arab Emirates, Mr Ridwaan Jadwat, and HE Bryony Hilless, Australian Consul-General Dubai at the AUSVEG stand and discussed the fresh produce market and landscape in the United Arab Emirates as well as the Middle Eastern region.

THE NEXT GULFOOD TRADE EVENT
17–21 FEBRUARY 2025

AUSVEG stand at Gulfood trade event 2024.

AUSVEG stands at FOODEX trade event 2024.

FOODEX 2024

In early March 2024, AUSVEG led a trade mission delegation to attend and exhibit at FOODEX Japan, held from 5 to 8 March 2024. This premier event attracted over 76,000 trade attendees from diverse sectors, making it a pivotal platform for fostering international connections and business opportunities in the Asian region.

Japan stands as a key export destination for the Australian fresh vegetable industry, with an annual export value of $9 million at 3,721 tonnes. Among the top 10 most exported crops to Japan are asparagus, onions, carrots, salad beets, pumpkins, Brussels sprouts, leek, celery, cauliflowers, and broccoli.

The delegation visited a range of retail stores in Tokyo during the market insights tour, such as Nissin World Delicatessen, National Azabu, Kinokuniya International, Seijo Ishi, and AEON. This immersive experience provided firsthand exposure to the diverse product offerings spanning from more budget-friendly grocery outlets to high-end premium supermarkets, offering participating growers valuable insights into Japan's retail landscape and consumer preferences.

The delegation's engagement with these retail environments offered a nuanced understanding of market dynamics and customer expectations, empowering AUSVEG and its members with actionable intelligence to enhance market positioning and expand export opportunities in Japan's thriving market. Trade buyer interest during the FOODEX tradeshow was particularly strong with buyers seeking Australian suppliers of onions, carrots, asparagus, broccoli, Brussels sprouts, pumpkins and melons.

THE NEXT FOODEX TRADE EVENT
11–14 MARCH 2025

AUSVEG stands at FHA Food & Beverage – trade show, Singapore.

FHA 2024

In April 2024, AUSVEG led a trade mission delegation to attend and exhibit at FHA Food & Beverage – Singapore's largest B2B trade show, held from 23 to 26 April 2024. FHA Food and Beverage attracted over 60,000 local and international visitors and over 1,500 exhibitors from 52 countries, underscoring its significance as an important platform for industry networking and collaboration.

Singapore is the top export destination for Australia's fresh vegetables industry, worth $42 million at 22,276 tonnes in 2023. Despite market challenges related to the rising cost of living, the Singaporean market exhibited resilience, returning to levels reminiscent of 2019, albeit with noticeable signs of a slower marketplace.

AUSVEG's participation at FHA Food & Beverage not only highlighted Australia's horti-cultural prowess but also facilitated strategic engagements with key stakeholders and industry players. The delegation visited a range of retail stores in Singapore during the market insights tour, such as CS Fresh Gold, Little Farms Market, Sheng Sion Supermarket, Cold Storage and FairPrice Finest.

This immersive experience provided a comprehensive view of market trends, consumer preferences, and emerging opportunities, equipping AUSVEG and participating growers with invaluable insights to navigate the evolving landscape of Singapore's food and beverage sector.

AUSVEG CEO Michael Coote hosted Mr. Allaster Cox, the Australian High Commissioner to Singapore, at the AUSVEG stand, where they engaged in discussions regarding the ongoing supermarket inquiry in Australia and market access opportunities in other southeast Asian markets. Interest from trade buyers visiting the AUSVEG stand included onions, potatoes, carrots, broccoli, eschalots, and a wide variety of other Australian vegetables and fruits.

AUSVEG FRESH PRODUCE SHOWCASE 2024

The AUSVEG Fresh Produce Showcase event will be back on Monday 3 June 2024 in Melbourne. The AUSVEG Fresh Produce Showcase provides growers from across the country the opportunity to display their produce to leading international fresh produce buyers. The event will be running as part of the 2024 Reverse Trade Mission, which sees AUSVEG bring over 40 fresh produce buyers from more than 10 markets to Australia to showcase local horticultural production.

The international markets participating in the 2024 Reverse Trade Mission delegation includes over 40 buyers from well-recognised companies from Taiwan, Malaysia, Singapore, UAE, Japan, South Korea, Philippines, Indonesia, Thailand, Brunei, Pacific Islands, Saudi Arabia, Qatar and Hong Kong.

UPCOMING SHOWCASE
MONDAY 3 JUNE 2024

11.00am—2.00pm
Great Room, W Melbourne
408 Flinders Lane, Melbourne VIC

FIND OUT MORE
This multi-industry project is a strategic levy investment in the Hort Innovation Melon, Onion and Vegetable Funds.
Project Number: MT21009

Hort Innovation VEGETABLE FUND
Hort Innovation ONION FUND
Hort Innovation MELON FUND

A new, modern brand for one of Australia's enduring agribusinesses

E.E. Muir & Sons has announced it is changing its name to Muirs, with a fresh logo and visual identity, along with a new corporate tagline of 'Grow Forward'.

This is the first change to the company's name in nearly 30 years. CEO and Managing Director Andrew Muir says it is an evolution of the brand to better support the company's deliberate shift to focus on innovative, sustainable products and practices – acknowledging the change won't be too unfamiliar to those in the sector.

"Yes, we are officially changing our name to the way many people across the industry refer to us, so it's probably not a revolution in that respect, but it is an important shift as we modernise our business, looking to maintain consistency while setting us up for the future.

"We want to positively impact grower profitability and future-proof industry opportunity.

"Our new position of Grow Forward is a clear articulation of this position to our clients, our people and consumers.

"We work hard to deliver long-term grower value and have evolved the way we deliver our distribution and agronomy services, so our new identity helps us articulate this more clearly."

This focus is evident across the company's portfolio, which makes some of the latest thinking and new tech available to Australian growers.

"Being innovative can be easy to say and hard to do, but it has been a business value of ours for a long time," Andrew says.

"For longer than I can remember, we've been involved in new technologies, searching for the best agricultural ideas from around the globe to drive change that helps Australian agribusinesses grow and flourish.

"Our focus is on creating value from innovation and delivering a sustainable product portfolio to the market.

"We are fortunate that we can leverage the foundation of our almost 100-year history as we deliver what a modern agri-sector and, most importantly, our growers need now and into the future."

Andrew says supporting change can be a challenge for any business.

"As a fourth-generation family business, managing this shift well is certainly something we are aware of.

"Our leadership team is driven by three strategic pillars, which are expansion, value creation and modernisation.

"It is our ambition to set ourselves and our highly valued clients up for the future changes and opportunities within the industry."

With a national network of more than 40 branches, the company's specialist agronomists and technical experts are available to growers across all key agricultural regions of Australia.

"We're now exposed to a lot more cropping zones across Australia and want to be very relevant to our client base. We want to make sure that we're taking an integrated approach to providing the many services and products growers need.

"We partner with local and international input providers to deliver best-in-class products, services and expertise. And as the industry and our business has evolved, so too has the way we engage with and talk to growers.

"We want success for the whole industry, to Grow Forward with sustainability as a core competency."

Andrew says the new Muirs identity will be rolled out across the company's mainland retail arm in the coming months.

"You will start to see our new brand come to life from mid to late May, and we will be working closely with all our business partners to ensure the transition is as smooth as possible," he explained.

"I am incredibly proud of what we've created and the efforts our people make every day to support our growers.

"Our new brand representation recognises and celebrates the changes we've already made to improve our organisation. It is a great endorsement of who we are and a significant progression as we build on our legacy.

"Our ambition is to build a strong future, to Grow Forward for everyone."

FIND OUT MORE

Further information will be available over coming weeks via the new Muirs website muirs.co

A local focus to build strategies for vegie growers to prepare and rebuild

Reducing farm biosecurity risks and better preparedness in the event of heavy and prolonged rainfall is the focus of the *Building Biosecurity Capacity and Resilience within the NSW Vegetable Industry project.*

Vegetable growers have faced additional challenges over recent years due to extreme or prolonged rain events impacting on various stages of crop production and farm profitability. While extreme weather events are generally outside the control of growers there are things that can be put in place to be better prepared, reduce risks and enable a return to production more quickly.

Local events run by AUSVEG as part of the *Building Biosecurity Capacity and Resilience within the NSW Vegetable Industry* project are bringing together growers, scientists and advisors to build knowledge and confidence to reduce farm biosecurity risks and be better prepared in the event of heavy and prolonged rainfall.

The program has taken the approach to deliver events and content based on local needs and circumstances, bringing experts and local advisors into the regions, to hold practical sessions on farm, and linking these topics to highlight biosecurity best practices. As well as directly damaging crops, excess water can also bring agronomic challenges and biosecurity risks, changes in pest and disease pressures, soil and water quality, and the movement of biological and other hazards via soil and water.

Focus for each region

A Community of Practice (CoP) for interested and engaged growers, agronomists and scientists has been established to share and discuss locally relevant issues that guide the focus of upcoming regional events. At the most recent CoP meeting Dr Sukhvinder Pal (SP) Singh, Senior Research Scientist, NSW DPI presented highlights from his research in improving food safety and traceability in horticulture. Dr Singh highlighted several commonalities in risks and best management practices between food safety and biosecurity, for example the risk of water and soil runoff in spreading soil or food borne pathogens.

Addressing local issues out in the field

AUSVEG led field days in the Sydney Basin, Cowra, Bathurst and North Coast regions with more to come in the second half of 2024.

"The field day programs included topics identified by the CoP, growers and advisors as locally challenging since the floods and erratic rain events over recent years," said Project Coordinator Marguerite White. "Soil structure and compaction issues have been a concern because of water sitting on the soil surface for extended periods and from machinery working on wet ground."

Simplot Australia's farm near Cowra was affected when the Lachlan River flooded, causing yield variations across impacted blocks as well as loss of soil and riverbanks. Farms in the region also reported damage to spray infrastructure and soil compaction due to the large volumes of water. Other growers and advisors echoed the sentiment that it has had on yield, disease management and other farm activities.

At Alandale Produce near Bathurst, NSW, attendees saw first-hand how owners Val and Sam Micallef have integrated cover-cropping into their crop rotations, a practice that has built soil biology (e.g. fungi, bacteria, worms) with positive outcomes for soil structure and water infiltration. Cover cropping and the use of 'brown fallow' can reduce the risk of losing topsoil and support a more rapid return to cropping after flood events.

Stephanie Tabone and Kelvin Montagu from Applied Horticultural Research (AHR) explained how cover cropping can help to improve soil structure, increase organic matter and biological activity, water infiltration and water holding capacity. This was evident from the fungal mycelium and worms that could be seen when digging into the soil under the terminated brown fallow crop on the farm.

"With biology, we are trying to build these [soil] aggregates, so clumping together of the soil, which are more stable in water than heavily cultivated soils," said Kelvin.

One of the consequences of poor soil structure is that if water penetration into the soil is limited, there is greater risk of runoff down the rows and erosion, and plants are more likely to be water stressed. Movement of water and soil can also move soil and waterborne pathogens, so practices that reduce this may have multiple benefits, including farm biosecurity for pest and disease management).

Top. L-R. John Duff, QDAF demonstrates the devastating damage on maize, sorghum and sweet corn from Fall armyworm. Dr Kelvin Montagu, AHR discusses the benefits of cover cropping on soil health with Val Micallef at Alandale Produce.

Andy Ryland of Integrated Pest Management Consultants monitoring the brassica crop at the Greater Sydney Demonstration Farm for beneficials.

A very hungry caterpillar – the importance of monitoring & diagnostics

For sweetcorn growers and crop advisors, Fall armyworm expertise was a strong drawcard to the events. Fall armyworm appears to have been more prevalent in the Sydney Basin this season, possibly due to a summer of high humidity and higher rainfall.

The impact of Fall armyworm on sweetcorn plant development was evident in the samples that members of the Queensland Government's Department of Agriculture and Fisheries (QDAF) extension team brought to the events. John Duff, Praise Tadle and Melina Miles (QDAF) showed that sweetcorn, planted at the same time as sorghum and maize, was much more stunted than the other crops, less able to recover from feeding damage.

What was also apparent was that destructive sampling is needed to truly know the numbers of Fall armyworm in the crop. Fall armyworm likes to hide – it can burrow in corn cobs and plants making it difficult to find. Evan Brown, Agricultural Manager, Simplot discussed how Simplot is managing Fall armyworm across their farms throughout the country, including monitoring and recording pests more broadly to implement management strategies.

Research continues into how best to manage Fall armyworm, including trapping efficacy, life cycle, the chemistry application on efficacy and rotation of chemistry to reduce the risk of resistance.

The Building Biosecurity Capacity and Resilience within the NSW Vegetable Industry project is also enabling vegetable growers and advisors to submit insect pest and diseased plant samples to the NSW Department of Primary Industries' plant health diagnostic service to monitor and diagnose pests and diseases.

FIND OUT MORE

Managing floodwater associated food safety risks in melon production and postharvest handling: dpi.nsw.gov.au/__data/assets/pdf_file/0019/1505251/Managing-floodwater-associated-food-safety-risks.pdf

If you would like to join the Community of Practice, or would like more information about what you have read please contact Marguerite White (Project coordinator) at mwhite@icdprojectservices.com.au or Rosalie Daniel (AUSVEG – Biosecurity) at Rosalie.daniel@ausveg.com.au.

A very big thanks to Sam & Val Micallef, Alandale Produce & Evan Brown, Simplot Australia for hosting the events. Thanks also to Andy Ryland, IPMC, Leigh James, AgriWest, Stephanie Tabone, Sophia Thach & Kelvin Montagu from AHR, Sylvia Jelenik & Jonathan Eccles, VegNET for their support.

The Building Biosecurity Capacity and Resilience within the NSW Vegetable Industry project is funded by the Australian and NSW Government's Storm and Flood Industry Recovery Program with support from AUSVEG.

The National Fall armyworm Innovation System for the Australian Vegetable Industry project is funded by Hort Innovation using the vegetable research and development levy, Queensland Department of Agriculture and Fisheries, the Victorian Department of Energy, Environment and Climate Action and funds from the Australian Government.

Project Number: VG22006

This event is also supported by AgriWest, Applied Horticultural Research (AHR) through the Soil wealth ICP project (MT22004), VegNET 3.0 (VG21000), NSWDPI Plant Health Diagnostics Service, Integrated Pest Management Consulting and Greater Sydney Local Land Services. The SFIRP project is coordinated by Marguerite White of ICD Project Services for AUSVEG.

Technicolour glasshouse offers energy saving productivity potential

Latest generation light-altering films being tested at a high-tech glasshouse in outer Sydney offer the potential to save protected cropping operations energy and boost productivity.

On the western outskirts of Sydney stands a glasshouse a little reminiscent of a cathedral window. Part of the facility glows pink in the afternoon sun, and part a pale blue.

The vibrant colours come from two special films applied to the glass, which are being trialled as part of a Hort Innovation levy-funded and CRC Future Food Systems supported project for their potential to reduce energy use and increase productivity in protected cropping.

Run out of the National Vegetable Protected Cropping Centre (NVPCC) at Western Sydney University's Hawkesbury Institute for the Environment and School of Science, the four-and-a-half-year glasshouse films project follows two previous projects investigating novel glass and photovoltaic technologies in protected cropping which ran from 2016 to 2021.

"What this project's trying to achieve is understanding how manipulating light diffusion and movement through films can affect plant growth," said WSU's Associate Professor Chris Cazzonelli, one of the chief investigators and plant molecular biologists leading the project.

"If we can understand how we can give the plants more light to sustain photosynthesis and how reducing some wavelengths within the spectrum can negatively affect photosynthesis and carbon production, we can then begin to manipulate those films to sustain plant growth and crop productivity, but at the same time tweak them in order to enhance our energy use efficiency as well."

WATCH OUR VIDEO
ON THE GLASSHOUSE FILMS PROJECT HERE

Above. The NVPCC facility is one of the few high-tech glasshouses for research, education and training in Australia.

Right. Professor Zhong-Hua Chen and Associate Professor Chris Cazzonelli of Western Sydney University's Hawkesbury Institute for the Environment.

The project is trialling two different retro-fitted films; a light-spectra-shifting agricultural film called LLEAF, and heat-blocking 'smart glass' called SG ULR-80.

Each film represents a different balancing act between reducing glasshouse cooling requirements, plant productivity and product quality.

For the films to be useful to industry, the trials need to quantify the benefits and trade-offs of each technology.

The potential benefits

Glasshouses use large amounts of energy to maintain a stable temperature, and even a small energy saving can yield big dividends for growers, according to project researcher and NVPCC Education and Training Director Professor Zhong-Hua Chen.

"The two biggest costs in the protected cropping industry are of course labour, followed by energy," he said.

"So reducing even five per cent of energy requirements from protected cropping will save millions of dollars for growers." Professor Chen said some growers had already expressed an interest in the films, particularly the red LLEAF film.

"Growers want to see the actual cost-benefits," says Professor Chen. "That's why we have a team of researchers from the School of Business at WSU looking at the life cycle assessment, to look at how growers interested in purchasing those films for their greenhouses can get economical returns."

Above. The films are a balancing act between energy efficiency, productivity and product quality.

A big plus for future commercialisation is the relatively low cost of the films, with any significant future adoption by industry driving costs even further down through economies of scale.

Another benefit is the ability to retrofit either film to existing protected cropping facilities. A future stage of the project will be exploring how the films perform in polytunnels.

"Ultimately we've got to get a fine balance from the film between the energy use efficiency, and whether you're seeking a gain in productivity or the nutritional value of the crop."

Red film shows promise

The pink or red tinted LLEAF film is now in its third generation, and is showing some promise in enhancing photosynthesis, according to Professor Cazzonelli. The polycarbonate film has been lined on the roof and sides of two of the six bays in the NVPCC research glasshouse to test its effect on different vegetable crops.

"What it's doing is providing more of the red wavelength of light," he explained.

"It's removing the green, translating it into more of a red, and it's also diffusing the light so different parts of the crop canopy can get exposed to that light as it diffuses through.

"Essentially that combination of more red and more diffused light can enhance growth, and the red film appears to be enhancing photosynthesis to some degree."

The energy saving balancing act

The SG ULR-80 film – given the more manageable 'blue film' moniker by those working on the project – has had some more challenges to overcome.

The blue film blocks parts of the ultraviolet and infrared spectrum of sunlight. Those parts of the spectrum are less useful to plants for photosynthesis, but are big contributors to heating in protected cropping, which then requires energy to cool.

Now in its second generation, the 'blue' film is noticeably less blue than the previous iteration. That visual difference reflects the work done on the product to balance its energy-saving properties with plant vigour.

"You've got to be careful when you're changing the spectrum of light coming through in films, whether it's appearing more red or more blue, because you can also alter the metabolism that's occurring within the plant and the product quality," said Professor Cazzonelli.

"With the first generation of blue film, there was a bit of a reduction in overall light transmission and it stole a bit of the blue and red wavelengths of light."

"In its second generation, we've re-engineered it to bring back some of that red and blue and a little bit of the ultraviolet and infrared, while still hoping that we can reduce the light energy that comes in that causes heating within the glasshouse."

"Unfortunately this film is reducing photosynthesis to some degree, and also affecting photo protection."

The blue film's trial results are still providing useful information, however, on the relationship between light capture and photosynthesis, carbon production and photo protection, which is the mechanism plants use to protect themselves on sunny days.

"We're trying to understand how these processes are coordinated, with the end goal of essentially keeping the plants on steroids, keeping them at maximum growth whether it's a cloudy day or sunny day," said Professor Cazzonelli.

'Chameleon glass' the end goal

Understanding how plants respond to different light spectra and intensities offers the potential to develop future films that respond actively to changing light conditions to maximise plant growth.

"Hopefully down the track that will lead to the engineering of films that could be almost like a chameleon, where they can change their spectrum and characteristics depending on if it's a bright sunny day or a cloudy day," said Professor Cazzonelli. "That's the end goal."

"Ultimately we've got to get a fine balance from the film between the energy use efficiency, and whether you're seeking a gain in productivity or the nutritional value of the crop."

FIND OUT MORE

Head to horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/vg21006

Glasshouse films is funded by Hort Innovation using the vegetable industry research and development levy and contributions from the Australian Government.

Project Number: VG21006

Hort Innovation VEGETABLE FUND

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onion fund update

This project has been funded by Hort Innovation using the onion research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Hort Innovation ONION FUND

Changing structure of school canteens offers potential for vegetables

The increasing number of school canteens being run by catering companies offers opportunities to increase the vegetable consumption of school children.

WATCH OUR VIDEO
WITH SHADIA DJAKOVIC HERE

Getting more vegetables on the menu in school canteens is not a straightforward task, and there are numerous hurdles that must be overcome. But the operational structure of canteens is also changing, and that provides opportunities to do things differently.

While they're not venues traditionally known for healthy food, school canteens have an important role to play in establishing healthy eating habits in young children, according to Shadia Djakovic of Healthy Kids Association.

"Kids are learning about nutrition in school, in the classroom, and the last thing that we want is for them to see the absolute opposite being done in the school canteen," she explains.

"The school canteen is there to reinforce the healthy eating messages that are taught in the classroom. They also teach kids about maths through dealing with money, how to have manners by getting in line and about food from different cultures. So the school canteen plays a massive role, and it has much bigger potential than traditionally thought."

Healthy Kids Association is currently running a project to understand and overcome the roadblocks to the use of more vegetables in school canteens.

"What we're aiming to do is increase veg on school canteen menus across the country," says Ms Djakovic, who is leading the project.

"To do that we will be creating resources and developing a veggie-full ready to eat meal that school canteens can use on their menu."

The three-year levy-funded project, *Education and tools for canteen managers to increase vegetables in primary school canteens and vegetable consumption by children (MT22006)*, is known as 'For the Love of Veg'.

Top. School canteens are required to adhere to state and territory nutrition guidelines.
Inset. Shadia Djakovic of Healthy Kids Association.

It's coordinated by Healthy Kids Association, run in collaboration with the Western Australian School Canteen Association (WASCA), Queensland Association of School Tuckshops (QAST), School Food Matters in Tasmania (SFM), the ACT Nutrition Support Service (ACTNSS), with the George Institute for Global Health as research partner.

School canteen needs assessment

The project has recently run a needs assessment that surveyed over 330 school canteens around the country to understand the opportunities and challenges.

"What we found is that most school canteen staff purchase their vegetables through major supermarkets," says Ms Djakovic. "So, what we're trying to do is find ways that they can save on the weekly veg shop, and connect them to local suppliers in the area."

"What we've started creating is a distributor /supplier tool, which is basically a map where school canteens can type in their postcode or their address, and that links them with local vegetable suppliers, or perhaps even a local farmer where they can get their vegetables at a cheaper price."

"We're also trying to work out what resources will assist them best to add more veg to the school canteen menus in new and innovative ways."

Changing canteen business structures

In previous years, time was often seen as the limiting factor to getting healthier food on school canteen menus. Canteens were run by individual schools and staffed by volunteers, and preparing food from scratch using vegetables was seen as too time consuming and requiring cooking skills that volunteers didn't necessarily have.

Most canteens aren't run that way anymore, however, meaning the time and skill limitations are no longer the primary concern.

"There certainly are school canteens that are still run only by volunteers, but they're very rare," says Ms Djakovic.

"Most school canteens these days are run by a parents and citizens (P&C) group, which is part of the school, and/or run by a lessee. So what that means is it's a catering company which leases the space from the school, and runs it as a business selling food through the school canteen."

Finding paid or volunteer staff for canteens run directly by the school or the more common P&C model is difficult, and single canteens often struggle financially. Over time, canteens run by catering businesses have become the dominant model, according to Ms Djakovic.

Many catering businesses will run multiple school canteens in a hub and spoke system, where they can produce food offsite. The Healthy Kids Association itself runs 23 school canteens, some using this hub and spoke arrangement, with three in Sydney and 20 in the ACT.

The growth of the multi-site catering company model means an increasing number of professional food service staff producing food for school canteens, and the ability to buy ingredients in bulk from wholesale suppliers or direct from growers.

Sourcing vegetables from outside the retail channel has the potential to lower the cost of vegetables, making them more accessible for low-margin operations like school canteens, as well as generating demand for produce that falls outside of supermarket specifications.

Healthy food requirements

The pressure is on for canteens to offer more healthy food. Public school canteens must adhere to the nutrition guidelines set by each state and territory.

"It depends what state and territory a canteen is in, but most states in the country run by a traffic light system. Those systems label unhealthy food as red, and a canteen might only sell those foods once or twice a term or not at all, amber foods which you serve occasionally, and green foods that can fill the menu."

The traffic light system is based on the *Australian Department of Health's Guidelines for healthy foods and drinks supplied in school canteens*, part of its National Healthy School Canteens program.

In Victoria, for example, the Department of Education advises green 'everyday' foods should make up more than 50 per cent of the menu, amber 'select carefully' foods should be less than 50 per cent, and red 'occasionally' foods should be served no more than two times per term. Schools must never supply confectionery.

New South Wales differs by using a binary 'occasional' and 'everyday' categorisation of foods. 'Every day' foods must comprise 75 per cent or more of a canteen's menu in that state, and the 'occasional' foods that make up the remainder can't be promoted to children.

FIND OUT MORE
Head to focis.com.au/ftlov or call 02 9876 1300

Education and tools for canteen managers to increase vegetables in primary school canteens and vegetable consumption by children is funded by Hort Innovation using the vegetable and onion industry research and development levies and contributions from the Australian Government.
Project Number: MT22006

Hort Innovation VEGETABLE FUND
Hort Innovation ONION FUND

Developing strategies to inhibit onion white rot

The project *Optimising chemical and cultural control of onion white rot (VN20007)* spanning five years, aims to develop an integrated disease management strategy for this soil borne disease caused by *Sclerotium cepivorum*.

The effects of onion white rot are far reaching with reduced yield in the field and the potential for disease spread in storage.

Onion white rot is a fungal disease that affects yields in commercial onion crops and it is prevalent throughout Tasmania but is also found in other onion growing regions. To date Western Australia is free from the disease. The fungi can remain dormant for as long as 20 years in the soil, but spreads quickly in the presence of Allium crops.

Onion white rot thrives in cool, moist soils with soil temperatures in the range of 7°C-22°C, with research showing that above 25°C, the disease is substantially inhibited. This suggests that planting later in the season in warmer conditions will limit the effects of the disease, but the drawback is missed early plantings and harvest.

Typical symptoms of onion white rot are brown to black rot predominantly on the roots near the soil. As the disease takes hold, a fluffy white fungal growth will appear at the base of the stem. Small poppy-seed size sclerotia will also be present on the bulbs. The disease can spread quickly, particularly through free-flowing water, with as little as one sclerotium per 10 kilograms enough to set the fungi spread in motion.

Recommendations for onion growers are to be vigilant around farm hygiene – minimising soil movement through personnel and equipment. Soil that is free draining so that it does not retain water will be of assistance as well as choosing varieties that have a strong root growth to assist with disease resistance.

During this project a soil DNA testing protocol is being developed to establish sampling procedures and pathogen thresholds. Further testing of the DNA test compared to field trials will determine the best method of soil sampling, as white rot can be sporadic throughout the paddock.

At a recent presentation at the Tasmania Ag Innovation Day, researcher Phillip Frost of Arvensis Research, said that white rot can be difficult to manage and can lie dormant until the next onion planting.

"Thankfully, white rot only affects allium crops particularly onion and garlic and is not hosted by other vegetables or weeds," he said.

"It is spread through physical movement in the soil, unlike botrytis and downy mildew which can be airborne.

"It has a pretty simple lifecycle – the sclerotes stay in the soil until the onion crop is planted, which triggers germination. From there mycelium fungal filaments develop and spread through the soil. It has no sexual reproduction, it is more like a clone, so there is low genetic variability, making it easier to manage."

It is known that germination of the schlerotes can be triggered by sulphide compounds released by the Allium root system. As a means of reducing disease pressure in the soil of onion white rot, the use of onion juice from waste onions or garlic extract may be useful. With the presence of the Allium compound as a germination stimulant, onion white rot will soon die away without the ongoing presence of an Allium plant. Further trials will determine application rates and timings with field trials commencing in the next growing season.

During field trials sampling for soil DNA tests showed the presence of pink root - it is unknown whether there is an interaction between the two pathogens. In the later stages of pink root, when the roots turn brown, it is difficult to visually distinguish between the two and the diseases often co-exist on onion roots.

Above. Phil Frost, Arvensis Research gives the latest update on white onion rot at the Tasmanian Ag Innovation Day.

Two new fungicides have recently been registered in onions for management of onion white rot, Luna Experience (Fluopyram, group 7 + Tebuconazole, group 3) and Intuity (Mandestrobin, group 11) which will offer growers two new fungicide groups (group 7 and 11) for management of onion white rot.

Trials conducted as part of this project have demonstrated both Intuity and Luna Experience provide effective control of onion white rot. Trials in the current season are focusing on optimising the placement and timing of fungicides to maximise their effectiveness.

"In terms of cultural management, later plantings definitely help but for the grower that puts a lot of pressure on harvest if it is wet. We estimate that 80 per cent of the cropping areas of Tasmania have white rot present so the risk is that growers push into more marginal soils creating pressures on quality and yield.

"In the next planting season, we will continue to compare soil samples in the field with lab tests to verify the DNA tests and the sampling methods. The use of a germination stimulant still has merit so we will continue to investigate a system for timing and application.

"With two new fungicides available, it will be about maintaining an optimum amount in the soil to hold the mycelium filaments at bay to protect the onion roots. It's not about eliminating the white rot pathogen but inhibiting it."

FIND OUT MORE
This project has been funded by Hort Innovation, using the onion research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.
Project Number: VN20007

Hort Innovation ONION FUND

Harvest of onion trials in SA continue to shed light on detection and management of onion basal rot

Leaf tipping due to basal rot.

The project *Epidemiology and management of fusarium basal rot in onions (VN20006)* aims to develop an integrated pest and disease management (IPDM) strategy to reduce the impact of fusarium basal rot in onions.

Infection of onion bulbs in the field by soil borne fusarium basal rot is known to result in substantial losses before harvest and in storage, however disease epidemiology was not well understood, which has limited the development of an appropriate management strategy.

In order to develop a best practice, cost-effective IPDM strategy, the project is working toward understanding of the pathogen and its epidemiology, and evaluate the use of cultural, biological and chemical controls.

Now in its final year, the project has identified *Fusarium oxysporum* f. sp. *cepae* (Foc) as the main cause of fusarium basal rot symptoms of onions in Australia.

During the 2022 and 2023 planting seasons, to understand key drivers of disease development, crops were monitored in paddocks that had a range of rotation and production practices, soil moisture conditions, and varieties. Incidence of bulb rot associated with Foc species ranged from nil to 55 per cent in monitored areas.

Testing of samples in the 2022 season at the five to seven leaf stage indicated that Foc infection can already have occurred, though may not be visually evident until late in the crop or storage. Subsequent testing this season has found some infection is already present at the one to two leaf stage, indicating control options may need to be applied at planting or early in the crop.

One key outcome of the research is that managing soil moisture to limit prolonged high or low soil moisture is required to optimise yield and reduce the risk of fusarium basal rot. Results from the first season of monitoring highlighted the impact that high and prolonged soil moisture can have on increased incidence of bulb rots caused by Foc and bacterial infection.

Trials and monitoring in the second season found that development of basal rot can also be favoured by persistent lower than optimum soil moisture through the duration of the growing season, that is at soil moisture levels at which some yield reduction occurs. In addition, while high and prolonged soil moisture supports basal rot development, continuously waterlogged conditions appear to be too wet for high levels of disease. Such conditions dramatically reduce yield and can favour bacterial rots.

Now in its final year, the project has identified *Fusarium oxysporum* f. sp. *cepae* (Foc) as the main cause of fusarium basal rot symptoms of onions in Australia.

The aggressiveness of *Fusarium* spp., including multiple Foc isolates, was assessed using three techniques (basal plate inoculation, injection into bulbs and injection in leaf scales) in controlled environment room studies. Results confirmed that inoculation with Foc produced similar symptoms to those visually identified in the field. Aggressive isolates were then used to screen chemistries for their ability to inhibit Foc infection of seedlings under controlled conditions. This assisted in selection of chemistries for field evaluation.

This season, field trials were set up to assess efficacy of products applied as seed treatments, in furrow or post planting band or boom sprays. Trials were conducted on mid to late season brown onions in centre pivot irrigated paddocks where inoculum of Foc had been confirmed in the soil by pre-plant DNA testing. These trials have provided promising results with some treatments that support progressing towards commercial availability.

The final phase of the project is to complete the assessments of the 2024 harvest samples, including after ambient storage of bulbs. Project findings including on soil moisture, nitrogen nutrition, rotation management, timing of management strategies will be incorporated into a new version of the fusarium basal rot management guide.

Above. Monitoring efficacy field trials

FIND OUT MORE

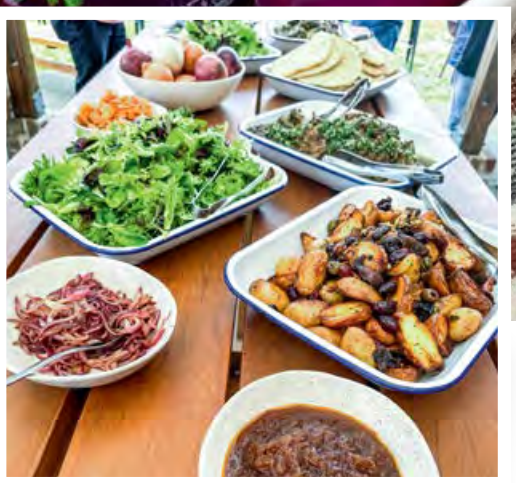
Fusarium Basal Rot guide horticulture.com.au/contentassets/32b961e9d8a947618188cdc83f832dfd/fusarium-basal-rot-guide-june-2022.pdf

This project has been funded by Hort Innovation, using the onion research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Project Number: VN20006

Hort Innovation ONION FUND

Moving onions from a humble flavour base to the hero of the plate



Caramelised onion pizza, a zingy red onion pickle, or maybe crispy onion rings topping a burger - if you're seeing more onion dishes on menus you're not alone.

More food service professions are using onions daily and more health professionals are recommending onions too. These are two key outcomes from the Hort Innovation *Onion Nutrition Education Program for Health Professionals and the Food Service Industry (VN20002)* program.

The three-year program wrapped up with the final 'farm to plate' tour for leading health and food service stakeholders in Tasmania. Premium Fresh's Jim Ertler shared his knowledge on onion growing, seasonality, processing, storage and packing. It was followed by an inspirational, bespoke onion lunch at the award-winning Stillwater Restaurant.

This was the fourth 'farm to plate' tour for the program, which has also included health professional conferences, culinary workshops, the creation of a digital hub and resources, as well as ongoing communications via EDM, all aimed at to inspire, educate, and ultimately increase the use of onions.

The program has delivered a significant shift in attitude, knowledge and usage. To measure the program's success surveys were undertaken with both health care professionals and food service professionals. The year-three final survey results showed an increase in knowledge of onion health and nutrition among health care professionals and a significant increase in daily onion use among food service professionals.

Below are key year-three final survey results and comparisons to the benchmark survey, conducted at the start of the program:

Health care professionals

- Nine out of 10 respondents agreed onions were important in supporting overall health, in the context of a balanced healthy diet. Notably, respondents who agreed onions were 'very important' in supporting overall health increased from 31 per cent to 41 per cent.
- 79 per cent agreed or strongly agreed that onions had unique health benefits and nutritional properties (up from 68 per cent).
- Almost a third (31 per cent) of respondents obtained resources on the health benefits and nutritional properties of onions and found them useful (up from 8 per cent).
- 44 per cent of respondents recommended their patients consume onions once a week or more (up from 41 per cent) with the top two reasons being onions contributed to daily vegetable intake (38 per cent) and their health benefits (38 per cent).

Onions are in the top five vegetables grown in Australia.

Right. Exclusive Qualipac onion farm tour for nutrition and health care professionals.

Above. Onion farm tour for health care professionals at Premium Fresh in Tasmania in April this year. Right. Fine Food Australia onion cooking demonstration participants

Food service professionals

- Two thirds of respondents (66 per cent) included onions daily in recipes or menu items (up from 30 per cent).
- More than a third (39 per cent) always included onion as a key ingredient in a meal or menu item (up from 22 per cent)
- More than half (57 per cent) of respondents obtained resources on the culinary tips and nutritional properties of onions and found them useful (up from 23 per cent).
- More than a third (37 per cent) of food service professionals reported that nutritional benefits were the reason they included onions in their recipes or menu items.

Dishing up education and inspiration

To reinvigorate health and food service professional interest in onions, a digital hub for onion nutrition research and culinary education was created to house a suite of downloadable new education resources. To disseminate this information, a database of health and food service professionals was created. The database, now totalling more than 2,700 subscribers, was used to maintain regular contact which included 26 EDMs and research alerts containing new science, educational materials, meal plans and recipes.

The digital hub also contained a suite of tools to directly support members of the Australian onion industry. These can be accessed by visiting the hub australianonions.com.au/health-professionals and clicking on the Industry Portal button to access the password-protected industry section of the website (password: AOIP).

What's next?

The VN20002 program has helped to revitalise health care and food service professional interest in onions and inspire recommendation and usage.

Based on its success, the program has been extended by a year to maintain the positive momentum and continue to update healthcare and food service professionals on the latest onion nutrition science.

FIND OUT MORE
Onion Nutrition Education Program for Health Professionals and the Food Service Industry (VN20002) program. horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/vn20002
This project has been funded by Hort Innovation, using the onion research and development levy and contributions from the Australian Government. Hort Innovation is the grower owned, not-for-profit research and development corporation for Australian horticulture.
Project Number: VN20002

Hort Innovation ONION FUND

Management of pink root rot in onions

Pink root rot in onions is a fungal disease affecting most onion growing regions in Australia, with a wide host range. Farm hygiene is an important strategy to manage the disease.

Pink root rot (*Septophoma terrestris*) is a fungal plant pathogen living on dead or decaying organic matter and plant roots.

Symptoms

- Symptoms appear 7-21 days after infection, and are more commonly seen in mature plants.
- Roots are initially pink, becoming semi-transparent and water soaked, before turning purple/brown as they wither and die. New roots will also be infected.
- Leaf tips of the plants may dieback showing symptoms similar to nutrient deficiencies, turning yellow/brown at the tip.
- Leaf size and number are reduced, bulbs are unmarketable, plants are easily uprooted.

Conditions

- Occurs in ground with poor crop rotation
- Waterlogged, poorly drainage, heavy soils
- Optimum temperature for the pathogen is 24°C- 28°C
- Can persist in soil indefinitely, and spread through water movement or dirty equipment.

Management

S. terrestris, like other soilborne diseases can be managed (but not eliminated) by using integrated crop production and protection methods. This aims to reduce pathogen levels in soil, disease pressure and plant stress levels while promoting vigorous plants that can compete with disease pressures.

Although *S. terrestris* is adapted to a wide range of conditions it is most severe in paddocks with poorly draining, heavy soils. Plant stressors such as heat, cold, drought, waterlogging and nutrient deficiencies and toxicities greatly increase disease risk.

Maintaining good farm hygiene practices is vital in reducing the risk of pink root by cleaning equipment. Remove and destroy infected plants and debris, source clean seed and be vigilant with volunteer seedlings and host plants.

The fungus can be spread by surface water moving infected soil. If infected soil reaches water sources, it can also spread to healthy plants if the water is used for irrigation.

Early detection and monitoring can be done via soil DNA diagnostic testing to understand infection risk before planting. Testing for *Rhizoctonia, Fusarium* and *Pythium* should be included in the testing as pink root often forms a disease complex with these pathogens.

Encouraging healthy soil microbes or the application of beneficial microorganisms such as *Trichoderma* spp., and *Bacillus subtilis* may help with disease suppression, however they can only be effective as part of an integrated management approach.

If infection occurs, optimising the irrigation interval to reduce stresses due to water logging has been shown to reduce the impact of pink root on yield. Promoting soil drainage, good soil structure and soil microbes may be beneficial as part of an integrated approach. Fungicides such as chlorothalonil, mancozeb, or copper hydroxide can be used, however chemical control without assessing how and why infection has occurred is only a short-term solution. Fumigation with metam sodium or chloropicrin can also be effective depending on which strains are present, however it may not be economically viable.

Crop rotations and alternate hosts

Pink root has many alternate hosts so managing weeds is an important strategy in controlling the disease (see Table 1). Crop rotations should be at least six years with non-host crops. It is important to note that adequate crop rotation only reduces disease inoculum rather than eliminating the pathogen.

Planting needs to be appropriate to the variety and season, as onions planted too deeply may have a greater risk of pink root infection. Pink root resistant cultivars are available, however it is important to note the disease strains the variety is resistant to, are based on the growing location. The optimum resistant varieties should be planted in any paddocks with a known history of disease.

TABLE 1

COMMON CROP HOSTS
Barley
Black eyed peas
Capsicums
Carrots
Cauliflower
Cucumber
Eggplant
Lima bean
Maize / Sweetcorn
Millet
Oats
Peas
Potatoes
Rockmelons
Soybeans
Spinach
Squash
Sugarcane
Sweet potato
Tomatoes
Wheat

Accelerating the adoption of best management practices for the Australian onion industry is funded by Hort Innovation using the onion industry research and development levy and contributions from the Australian Government.
Project Number: VN21000

Hort Innovation ONION FUND

Current Projects

HORT INNOVATION ONION FUND

Hort Innovation conducts a number of R&D projects funded by grower levies. Here is a list of some of the projects currently underway.

Optimising chemical and cultural control of onion white rot VN20007

KEY RESEARCH PROVIDER: **ARVENSIS**

This investment is developing a more effective integrated disease management strategy for control of onion white rot. Onion white rot is a highly destructive fungal disease of commercial onion crops. This project seeks to improve current control methods for the disease, as well as identify new methods that can be used to combat onion white rot.

The research will incorporate:

- Development of a pre-plant soil DNA test to identify disease risk prior to planting
- Identification and development of natural germination stimulants to reduce disease inoculum levels prior to planting
- Optimisation of spray timing and dose rates of current fungicides
- Identification of new fungicides and biological controls for onion white rot.

The project team will work closely with the onion industry to extend any new findings to onion growers. Regular updates will be provided to industry, as well as trial sites visits later on in the project to demonstrate the integrated onion white rot management program developed.

Epidemiology and management of fusarium basal rot in onions VN20006

KEY RESEARCH PROVIDER: **THE UNIVERSITY OF ADELAIDE**

This investment is developing an integrated pest and disease management (IPDM) strategy to reduce the impact of fusarium basal rot in onions. Infection of bulbs in the field has resulted in substantive losses in storage from this soilborne disease, however the epidemiology of the disease is not well characterised which limits capability to develop an appropriate management strategy.

In order to develop a best practice, cost-effective IPDM strategy, this project will improve understanding of the pathogen and its epidemiology, and evaluate the use of chemical, biological and chemical controls.

Onion nutrition education program for health professionals and the food service industry VN20002

KEY RESEARCH PROVIDER: **BITE COMMUNICATIONS**

This investment is delivering evidence-based information about the health benefits of Australian onions to health and food service professionals in Australia.

On average, Australian adults consume just three grams of onion per day. In contrast, consumers in the United States and Europe consume twice as many onions as Australians. In order to close this gap, initiatives to educate health professionals and the food service industry are key as they are significant influencers of consumer food behaviour.

This project will extend previous research conducted by levy-funded project Australian onions nutrition literature review (VN18002) and the Onions food service farm tour and education pilot (VN18000) by communicating the nutritional benefits of onions to health professionals, food service professionals and industry stakeholders.

Accelerating the adoption of best management practices for the Australian onion industry VN21000

KEY RESEARCH PROVIDER: **AUSVEG**

This investment ensures the onion industry is equipped with the information and resources they need to adopt best management practices. Onion growers will be brought into the existing *VegNET 3.0* program for the vegetable industry to support increased awareness and adoption of R&D.

VegNET is a nationally-coordinated, regionally-delivered extension program that increases the industry's awareness of and engagement with best practices in high-priority areas. The program has regional development officers (RDOs) in ten key vegetable-growing regions around Australia.

A vital component of the program is the establishment of five regionally-based onion grower groups in Tasmania, Queensland, New South Wales, Western Australia and South Australia. The relevant RDO will work with each group to identify regionally-specific issues facing onion growers and work with them to host seasonal activities, including demonstration sites, field days, and grower walks.

A wide range of communications outputs will also be delivered to onion growers, including:

- The quarterly *Australian Grower* magazine, with 36 pages of dedicated onion content
- The *AUSVEG Weekly Update* e-newsletter, with onion content
- A range of onion-focused content such as videos, podcast, case studies, factsheets, media releases and social media.
- An annual disease alert poster.

Onion international study tours – inbound and outbound VN22000

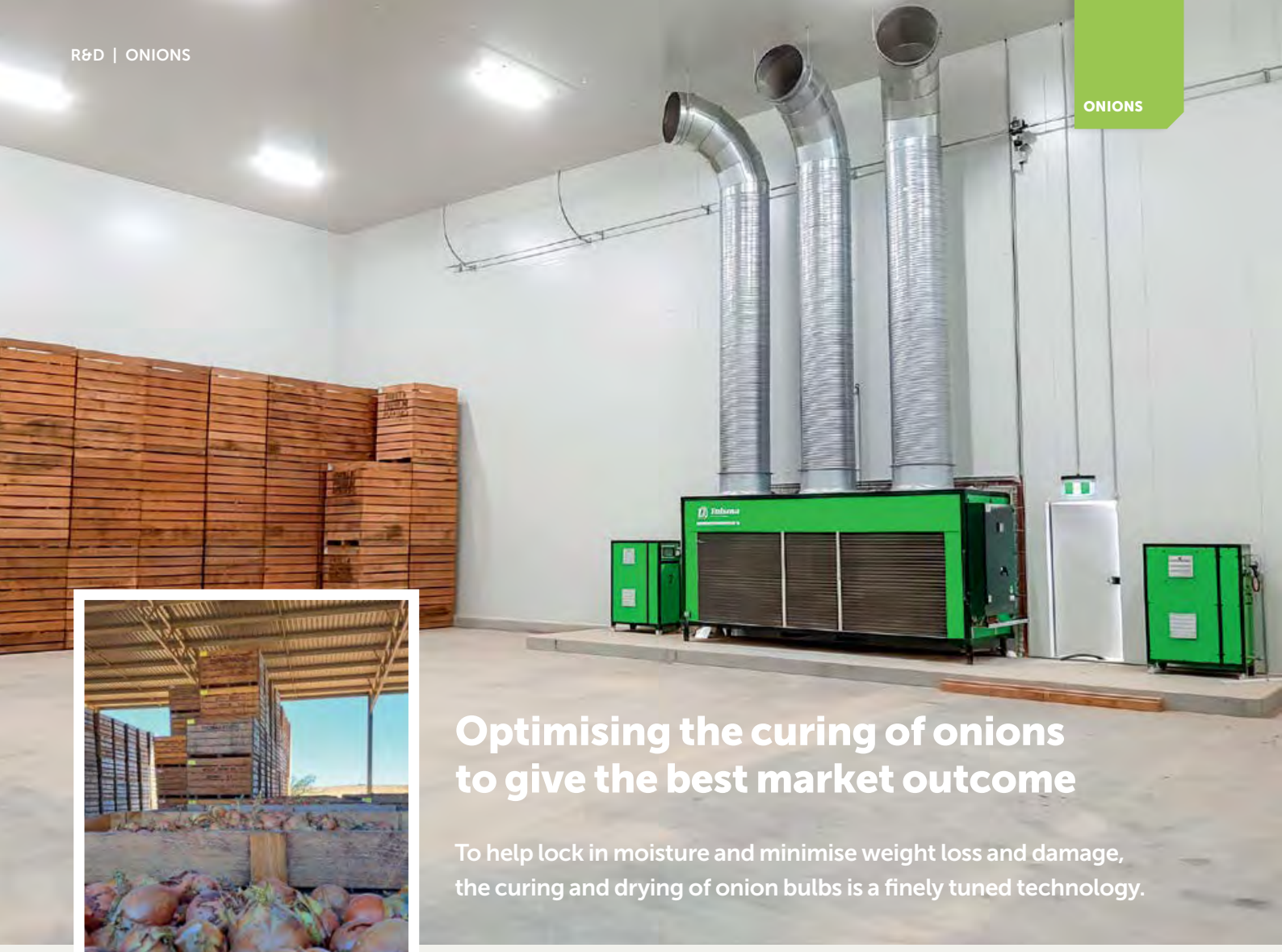
KEY RESEARCH PROVIDER: **AUSVEG**

This project provides opportunities for Australian onion growers and supply chain participants to increase their awareness and knowledge of research and innovation in the global horticulture industry by delivering international industry study tours to key onion-growing regions worldwide.

The two-year program will deliver two international study tours for up to 18 onion growers and industry supply chain members that align with industry needs.

The project will also bring two international researchers to Australia to visit key growing regions and attend industry events to help inject global knowledge related to technology and practices across the Australian industry without requiring every Australian grower to travel abroad.

This project will help ensure that the industry can build the capabilities of the Australian onion-growing community through increased networking, knowledge sharing and collaboration among levy-paying growers and supply chain members, which will improve the productivity, profitability and competitiveness of the industry.



Optimising the curing of onions to give the best market outcome

To help lock in moisture and minimise weight loss and damage, the curing and drying of onion bulbs is a finely tuned technology.

Brown, red or white onions, the market is based on weight. Therefore it is important to grow onions to specification. Curing and drying the bulb will extend the shelf life and reduce the risk of disease due to excess moisture.

Most of Australia's onions are long to intermediate-day varieties, which produce more leaves and skin to better protect the bulb during growth, harvesting, and during the drying process.

Harvesting of onions commences when the leaf top starts to dry and fall over. The most common practice is to machine harvest, but in southeast Queensland where the soil has greater moisture content, onions are generally harvested by hand. The Lockyer Valley predominantly grows intermediate day onions, which have less dry matter and are not as durable as long day onions. The hot humid conditions also contribute to the need for hand-harvesting, which is softer on the product. The length of the neck above the bulb plays a significant role in how well the onion dries.

As the onion dries, moisture is locked into the bulb at the neck, to maintain the weight of the bulb. It also minimises the risk of botrytis (neck rot) setting in during storage. Research in the USA has suggested that if the neck is too short, there is a risk of excess moisture remaining in the bulb.

In some regions of Australia where the temperature differential between day and night is small, once harvested the onions can remain in the field to dry. For some climates where the temperature range can fluctuate more markedly, or with higher humidity, it is necessary to cure and dry in climate-controlled conditions.

Drying and storage in an undercover open space shed can be a good short-term option for regions such as South Australia as the day to night temperatures are relatively stable, however, a sealed climate controlled cool room gives greater ability to control and monitor the internal environment.

After sales and service manager, Brad Hicks with Tolsma Australia said that "The risk of open shed storage is condensation forming at night when the air cools.

"This leaves the product wet in the mornings and a reliance on daytime air to evaporate that moisture. Onion skins will expand and absorb some of the moisture, but as it dries and shrinks, it can soften the neck seal, and allow moisture to escape from the bulb, resulting in weight loss and loss of the outer layers, exposing the bulb."

An enclosed shed can therefore be climate controlled in terms of air flow, temperature and air moisture content.

In essence, external air is brought into the shed when it contains less moisture per cubic meter (g/m³) than inside air, creating a drying effect with air movement; the temperature is kept stable, and the

Top. Inside the room - Open Space Ventilation System. **Inset.** Ambient onion storage, Mitolo.

Above. Force Air System - Air Bag Tasmania. Bulk storage of onions in Europe - notice how green the stems are?

"The benefit of a controlled drying system is the ability to harvest greener product when the weather is good and not have to wait for it to mature in the field, where it can be affected by weather events."

moisture removed with outgoing airflow with the aim of removing air moisture from the shed to allow the onion to dry.

"The time required to dry the onion, is dependent on how green it is and how much moisture is in the air. Most growers will know when it is ready by the crisp, rustling sound made when onions move. The neck will be flat and difficult to roll, and if you press on it, there will be no moisture forming.

"The benefit of a controlled drying system is the ability to harvest greener product when the weather is good and not have to wait for it to mature in the field, where it can be affected by weather events.

"Neck rot has a specific temperature range where it thrives, so we try to have the conditions either side of that window of 22-27°C.

"We measure the outside and inside air conditions. From temperature and humidity measurements, the 'absolute' moisture content (g/m³) can be determined to understand when outside air is dryer and will hold less moisture. High airflow and temperature requirements are automatically controlled by the system computer to provide an optimum state for drying. The Mollier chart is a useful reference to show the relationship between relative humidity to the temperature to give the air moisture content removal value.

"If the air outside has a higher moisture concentration, once brought into the shed, it will make the onions wetter. In that instance, the hatches on the shed will be closed and open when the outside moisture level drops below the level inside.

For example if the outside temperature is 30°C with 50% relative humidity, the Mollier chart gives a moisture content of 15.1gm/m³. Compare that to the shed temperature of 18°C and 90% relative humidity gives 13.7g/m³ – a differential of 1.4g/m³ – wetter than outside conditions.

Most curing shed designs will feature air inlet and outlet points and temperature controls. In more humid climates a dehumidifier can be added to the system. Brad says that the night time air is colder, and holds less moisture. Once that night air is heated it can hold more moisture, so the best time to dry is during the night with the addition of heaters.

It is common practice in Australia to store and cure onions in large wooden crates. The airflow system can be designed to push air between the bins to ensure that crates located in the middle still dry at an appropriate rate. Conditions can be monitored remotely and recorded should it be needed for compliance with food regulations.

In Europe, onions are stored in bulk without crates. In this instance, airflow is sourced from below the floor, and pushed upward through a grid. Traditionally, Australian growers store onions in the shed within crates.

"There are three systems typically used in Australia, each with their own pros and cons. The two forced air systems are the letterbox and airbag systems. A letter box system pushes air through the tyne pocket gaps, blocking the end bin forces the air up through the bins; and an airbag system blows air between the rows of bins, with an airbag used to block the end and top of the bins so that the air is forced left and right through the bins.

"The third system is the open space ventilation system, where air is blown over the top of the stacked bins and sucked back through the rows in a pressurised system.

"The onions can be packed into wooden crates without any problem, but the number of crates, stacking format, shed space and layout will determine which is the better method for air flow and business logistics and handling.

"It is important to consider the volume of onions, how moist they are after harvest and how quickly they need to be cured. With supermarkets setting onion specifications, supplying year-round onions at the right weight needs to be considered against the cost of the drying system."

FIND OUT MORE
Visit tolsmagrisnich.com/au

This project is funded by Hort Innovation using the onion industry research and development levy and contributions from the Australian Government.
Project Number: VN20001

Hort Innovation ONION FUND

potato update

This project has been funded by Hort Innovation using the potato - fresh and processing research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

Hort Innovation POTATO – FRESH FUND

Hort Innovation POTATO – PROCESSING FUND

The Front Line exotic pest profile Colorado potato beetle

The Colorado potato beetle (*Leptinotarsa decemlineata*) (CPB) is globally considered one of the most economically damaging pests to the potato industry. CPB is native to North America and widespread. It has hitchhiked its way to Europe and then into Northern Asia, where it has since spread rapidly and established itself firmly.

The Colorado potato beetle is not on Australia's doorstep and considered an exotic pest that is most likely to 'hitchhike' its way into Australia on cargo, imported produce, or farm equipment. Many potato-growing areas within the country are considered to have a suitable climate for CPB to establish.

Why should I be worried?

It thrives on Solanaceous (nightshade) hosts, including potatoes, eggplants, tomatoes and capsicums. They can also be found on other nightshade family members, such as Buffalo Burr and other weeds. It thrives in temperate regions and can cause significant potato yield losses.

The beetle is also thought to transmit several pathogens that may affect nightshade family members, such as potato spindle tuber viroid (PSTVd), bacterial wilt (*Ralstonia solanacearum*) and bacterial ring rot (*Clavibacter michiganensis* pv. *sepedonicus*).

Overseas, the beetle is known to have rapidly developed resistance against many insecticides, now being labelled a 'super pest'. Any beetle involved in an outbreak in Australia will likely carry at least some resistance to chemistry. Insecticide resistance can occur within four to 10 generations. As CPB is exotic to Australia, an introduction means that this exotic pest has little to no natural enemies.

How will it get here?

The beetle is known to travel short distances frequently looking for new nightshade hosts. When aided by strong winds they can fly up to 160km. The main risks for an incursion for this insect are human-aided pathways such as the importation of contaminated potato plants and tubers, packaging, transport and equipment. Additionally, the pest may hitch a ride on imported non-host crops, particularly leafy vegetables and grains, especially when they were produced on a field that previously had potatoes grown.

Worryingly, this pest is known to spread rapidly, so should an incursion occur, rapid identification and response are required. The flowering stage of the plant is the most critical moment for damage to occur, as the damage threshold is reduced to a maximum of 5-10% defoliation before yield loss will occur.

KEY POINTS

- Colorado potato beetle is an exotic pest.
- The insect affects plants from the nightshade family including potatoes, eggplants, tomatoes and capsicum
- Globally, one of the most economically damaging pests to the potato industry.
- Hitchhiking pest, most likely to arrive on imported goods.
- Rapid response is required should an incursion occur.

Colorado potato beetle larva.

Description

Colorado potato beetle larva.
Image credit: Peggy Greb, USDA Agricultural Research Service, Bugwood.org.

Adult Colorado potato beetle and eggs.
Image credit: Metin Gulesci, Leaf Tobacco, Bugwood.org

All larval stages have a double row of dark spots to give a ladybird resemblance, however both larvae and adults leave a black sticky excrement.

Beetles are 8.5-11.5mm long, with orange-yellow body and yellowish-white wings, with five black stripes.

Eggs are laid in masses of 12-25 eggs under the leaves and are about 1.2mm long. Typically are pale orange and oval in shape. Hatching occurs 4-14 days after laying.

Larvae are brick red colour, with a black head and legs. As it matures it changes from red through to pink. Full grown larvae are 15mm in length.

¹ *Image credit:* David Cappaert, Bugwood.org
² *Image credit:* Whitney Cranshaw, Colorado State University, Bugwood.org

Lifecycle

Beetles emerge from the soil during spring and early summer. Mating occurs in spring and the female can lay up to 2,000 eggs in her lifetime. Larvae start feeding on the plants' leaves, and moult three times over 8-28 days (depending on temperature), before dropping to the ground. This fourth instar larvae will burrow itself in the ground, undergoing a final pupal moult. After 8-18 days an adult beetle emerges. Optimum development occurs at temperatures between 25-33°C, during which the lifecycle can take as little as 21 days. The lifecycle can occur up to three times annually.

Adult beetles enter diapause before winter. They bury themselves in the soil, where they can survive for 3-24 months. Additionally, during hot and dry conditions, adults may enter 'aestival diapause', hiding in litter underneath the plants.

Symptoms

Both larvae and adult beetles quickly damage the plants by eating the leaves from the outer edges towards the inside. They quickly strip the plants, causing severe defoliation and skeletonisation skeletonisation *(Figure 1)*. Larvae chew through about 40cm² of leaf before moulting; adults can chew up to 10cm² daily. Additionally, they might affect stems and tubers. Many native nightshade species in Australia may act as a reservoir for CPB, including plants that are commonly grown in (community) gardens.

Severe potato plant damage caused by Colorado potato beetle.

What can I do?

- Have a Farm Biosecurity plan in place to protect your business.
- Always use certified plant material .
- Be mindful of the risk pathways associated.
- Train and educate staff on common pests and how to spot the difference.

If you have seen a Colorado potato beetle, call the Exotic Plant Pest Hotline at 1800 084 881.

FOR MORE INFORMATION
For further details on AUSVEG's biosecurity activities, please contact the AUSVEG Biosecurity & Extension Team on 03 9882 0277 or email science@ausveg.com.au.
The Farm Biosecurity Program is funded by the Plant Health Levy.

REFERENCES
AUSVEG (2019) *Fact Sheet – Colorado Potato Beetle,* accessed 26 March 2024
PHA (Plant Health Australia) (2019) Fact sheet – *Colorado potato beetle,* accessed 6 March 2024

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Where Service is Part of the Sale!

Farmers continue to protest transmission lines

The Ballarat potato growing region has been challenging the installation of transmission lines across valuable farmland for four years but is determined to continue applying pressure to overturn the proposal.

In a bid to connect renewable energy across the state, the Victorian government is proposing to construct 190km of high voltage transmission line from Sydenham to Bulgana (Western Renewables Link project – WRL) and onward to Dinawan in New South Wales (the VNI West project).

The route passes through highly productive agricultural land including 16 potato growing families in the Ballarat district.

The Moorabool and Central Highlands Power Alliance (the Alliance) has led the challenge and the most recent Supreme Court hearing sought to quash two unprecedented Victorian Ministerial Orders made in 2023 that authorised VNI West in Victoria (via an undisclosed Option 5A route) and authorised the uprating of WRL to much bigger 500kV lines all the way between Sydenham and Bulgana to technically align with VNI West.

In essence, the Order says that the Victorian Government is 'committed to accelerating VNI West (Victoria to NSW Interconnection West) to ensure a reliable, secure and affordable supply of electricity to all Victorians and recommends that the project be fast tracked and that AEMO commence early works and assessment, and selection of alternative project options...'.

The reality on the ground is that the community has not had adequate consultation on the impact it has on productive farmland, nor has the project been re-assessed for its cost-benefits given that the two sections have combined.

"There is no doubt that after four years, the pressure to keep going and fight this battle is making the community pretty fatigued,"

In the last week before Christmas 2023, the Supreme Court rejected the claims of the Alliance. In reviewing the judgement, the Alliance has appealed the decision. The hearing for the appeal is scheduled for early August 2024.

A spokesperson for the Alliance said that the Ministerial Orders by decree set a precedent for similar proposals, particularly in relation to how communities are not involved with the decision-making processes.

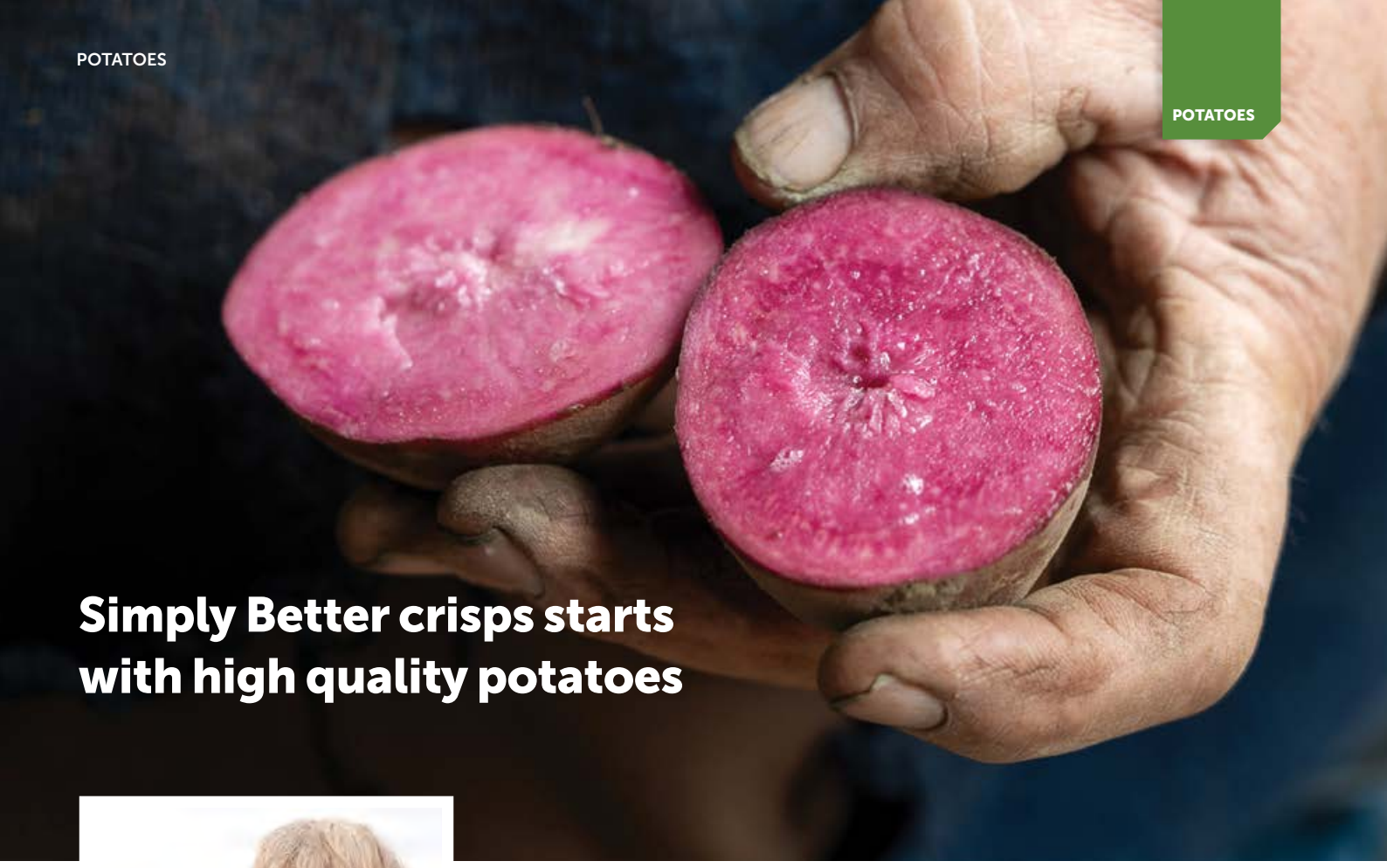
"There is no doubt that after four years, the pressure to keep going and fight this battle is making the community pretty fatigued," he said.

"There is a lot of vested interest on how this is done, how the government and regulators approach planning and working with communities, not just for the Ballarat region, but for any proposed works such as this across the state. There is a lot hanging on the August hearing."

Above L-R. Tractors roll past Parliament House in the Stop the Towers Tractor Rally in August 2023. Kevin Maher, Ballarat potato farmer is concerned about the impact that the high voltage transmission lines will have on potato productivity.

FOR MORE INFORMATION
Moorabool and Central Highlands Power Alliance
stoplaborstowers.com.au
Transmission Company Victoria:
transmissionvictoria.com.au
VNI West: transgrid.com.au/projects-innovation/vni-west

POTATOES



Simply Better crisps starts with high quality potatoes

Inset. DK's Simply Better chips, Peter Scott.

Seed potato grower Peter Scott describes himself as a simple man, but he is undoubtedly one who has a vision for the perfect red, purple or white potato crisp, and has doggedly kept at it to achieve the best possible results.

The Scott family have been in the Otway Ranges region of Victoria for many years, as dairy and potato farmers, originally growing Kennebecs for Melbourne fish and chip shops. Peter could see in the 1980s that as the potato industry was changing, there was an opportunity to diversify into certified seed potatoes.

As a long-term avid supporter of the Agriculture Victoria potato breeding program, Peter was for many years involved with multiplying up different breeding lines for evaluation by commercial growers.

Through this association, Agriculture Victoria offered Peter some new cultivars, including some coloured ones, that weren't considered commercially viable at the time. Further evaluation led to Peter being granted the licence for the PBR varieties he grows today. The idea was to sell the potatoes to the processing industry, and gain royalties for extra income. After expressing interest in early trials, the chip companies decided against continued evaluation.

The trialling of different cooking methods revealed a real potential for coloured crisps. DK's Simply Better chips was born.

Peter continues to breed potato varieties on farm that now suit the niche, coloured potato market, as well as to supply his own processing facility.

"Finally in 2016 we were able to get three batches of DK's Purple Chips produced enabling us to evaluate their market potential. This market trial gave us the confidence to produce our own chips on farm, it's taken seven years to achieve," says Peter.

"One of the PBR licenced purple potatoes that we have was only really good for crisps, which we have continued to grow, plus another five varieties of reds and purples that we are currently trialling. Our white potato crisp, is based on a breed developed many years ago, called Corina, named after Corina Horstra who managed the tissue culture lab at Toolangi for 25 years.

POTATOES

"By using coloured potatoes, we don't need to compete at the bottom end of the crisp market, we can market to the niche, higher end consumer."

"We leave the skins on, because that is where the majority of the antioxidants are and we use less salt than many other crisp brands, which means we can promote them as a healthier option chip – not as a health food, because they are still a snack.

"And because we only produce plain, salted potato crisps, there is no risk of allergens such as soy and nuts, so we are good option where that might be a concern."

After what Peter would describe as a 'few potholes in the road', the farm now has its own chip processing equipment and is operating at a comfortable level while sales and market awareness continues to grow.

To give the crispier chip, the red and purple potatoes are harvested and processed within a four-day window. Using primarily Australian made equipment, the potatoes are washed, loaded into a 75kg hopper, sliced and fried using sunflower oil. In an hour the facility can produce 1,500 x 90gram packets of crisps, using potatoes bred and grown on site.

The farm is about 600 acres of what Peter calls 'peasant soil' which is a grey bush loam, not the typical volcanic soils of many potato growing regions. With the addition of fertiliser, the Scott family have been able to maintain supply of potatoes, and certified seed.

The high rainfall of the Otway Ranges means that compared to many other regions of potato growing further north, irrigation is much lower. The risk of potato disease pressure is quite low, with only two other growers in the district, giving the Scott farm a degree of isolation.

For table and seed potatoes, Peter does a six-to-seven-year rotation with pasture and cattle.

"For seed potatoes, we can't just let the paddock fallow, because of the risk of self-sown potatoes coming up and messing with the rotations.

"Our breeding program is focused on finding a variety that is an improvement on what we already have – better to crisp, better to harvest, better taste."

DK Potatoes have developed a number of recipes to promote the red and purple potatoes and are keen to look at other ways of increasing the versatility of the varieties through value-add products such as potato flakes.

Long term the aim is to increase the volume of processing and to finalise varieties that will be used while continuing varietal improvement through breeding.

"I am one of those people who is full of ideas, but not a lot of discipline," he quipped.

"But it [the crisping equipment] has given me this opportunity. We will keep going with the crisps, and the seed breeding. We only live one life - I say have a crack. If it doesn't work out, that's ok, at least you know."

Restoring land, production and community

For more than 100 years, the Kadwell family has been growing potatoes in the Crookwell region. Farm revegetation has been integral to the success of the business and to the community.

The Crookwell region of New South Wales is prime potato country and in years gone by supported many small holding growers who supplied ware potatoes into the local co-op. In that mix, was seed potato grower, Garry Kadwell and his family.

The Kadwell family have been in the district for more than 100 years, establishing an orchard and a small market garden for the local community and markets. In the early years, Kennebecs, Sequoia and Sebago were the most popular varieties grown. Sebago K, a robust oval potato was bred by Garry's father.

In the 1970s, Garry could see that as the apple market changed the family orchard would not be viable long term and replaced it with an expansion to the potato production.

The Crookwell region is highly fertile, with granite through to basalt, with pockets of volcanic soil, giving a pH of 4.1 – 4.2. Water is plentiful with rainfall in the order of 800-900mm a year. Irrigation of crops is a recent addition for farmers in the district and gives an insurance policy to ensure that crops yield well to compete in a tougher market. Typical of volcanic soils, sulphur and magnesium can be low requiring a dressing to ensure the right nutrient balance. The Crookwell district is 1,000m above sea level, so winters give hard frosts and snow, and hot summers.

Over time, those 200 small holding farms have gone, leaving Garry and two other potato growers in the district. Garry's primary focus remains with certified seed potatoes.

Above. Garry Kadwell from the Crookwell region.

The farm now is around 2,100 acres, with around 160-200 acres used for seed potato production, in rotation with his flock of Hampshire Downs sheep, first cross ewes and pasture. Around 40 per cent of the property is remnant and rehabilitated bushland.

"My grandfather had the foresight to plant trees – I have great memories of planting with him when I was a child," says Garry.

"I have continued that practice by expanding the amount of bushland we have which puts us in a unique situation where we are isolated from other growers in the area, providing a quarantine zone which is perfect for seed potatoes."

Each year as part of the seed potato certification process, Garry tests for viruses such as PCN and comes up clean, giving high quality seed potatoes for other growers who supply the fresh and processor markets. Varieties include FL and Atlantic for crisping as well as Maranca.

Seed potato production represents about 90 per cent of the potato production, while ware potatoes account for about 10 per cent.

Garry has also begun the move across to more niche varieties for the hospitality market with Kipfler, Pink Fir Apple and Red Rouge, to give consumers an appreciation of what a potato truly tastes like. Gary readily admits that producing niche varieties does have additional complexities but says that his approach is to farm and harvest more slowly to protect the potato.

In his first year producing niche varieties, Garry took out the *delicious* Harvey Norman award for Producer of the Year in 2020. He says it has given the humble spud pride of place on consumers' plates.

The native bushland has provided many additional benefits for the farm including an increase in beneficial insects, reducing the need for insecticides. The bush blocks used for grazing, appeared to be healthy, but on closer inspection, the bush diversity was not as good as it could be. By fencing off those areas, the diversity balance has improved significantly.

The most recent rehabilitation of the property has been the development of a wetland in a natural valley. A chain of ponds in what was once an eroded gorge, now provides habitat for flora and fauna, some of which is listed as endangered. The flow on effect has been greater soil moisture retention. In five short years, Garry has seen a marked improvement in the overall health of the farm.

The return of the farmland to bush has been a carefully thought-out process, with what Garry describes as a wheel and spoke layout. The surrounding bushland forms a 'hub' around the property, with 'spokes' running through the property to provide connected corridors for wildlife. His work has been acknowledged by Landcare and Soils for Life for his innovative land management and sustainability, recognising his whole-of-farm practice.

By increasing the native vegetation to around 40 per cent, I have seen the yields go up and inputs down for our potatoes and pasture.

"By increasing the native vegetation to around 40 per cent, I have seen the yields go up and inputs down for our potatoes and pasture. The trees provide a source of natural mulch so the soil health has improved. For the lambs the trees have given protection from the harsh winter frost and snow.

"The rehabilitation of the wetland block was the first time I thought about land purchase with a mindset of fixing the soil rather than increasing production, it is quite a turnaround from what most farmers would do.

"We have had students come here to study what we have done, and they come in with the thought that it should all be protected, but what we have shown is that there can be a balance between the bush and viable production. Our ability to farm and our income has actually increased substantially with this work."

Farming to give the true paddock to plate experience

The niche potatoes are just one part of a greater picture for Garry to give consumers a better understanding of where their food comes from.

Acknowledging that many consumers no longer have a connection to the country, Garry has established The Gourmet Farmer with plans to establish a small market garden where visitors can see vegetables grown according to season. A restaurant will be established on site with a noted chef, so that visitors can pick their vegetable, including potatoes, and enjoy their meal on site.

"During the height of the Crookwell Potato Festival we used to have hundreds of visitors come to the farm to see how we grow potatoes. It was a real privilege to have them visit, and with The Gourmet Farmer, hopefully we can bring that back so that people know and enjoy the true flavours and nutrition of the vegetables and lamb that we grow."

A calm environment for a better community

One of the benefits that Garry had not foreseen was the sense of tranquility the bushland brings to the overall farm. He has noticed that he and his workers have a greater sense of calm going about their day, by having the opportunity to sit and enjoy the peace that the bush brings.

In 2006, the region suffered a dreadful drought that was hard on many farmers. Farmers that Garry looked up to were clearly under stress and nearing tipping point.

Working with the NSW DPI, Garry and the community organised an event 'Looking After Your Mates'. It was anticipated that perhaps 20-30 people might attend. Within 10 days of announcing the event, 600 people had registered. The Department used the concept as a pilot for other areas to reach farmers in need of support.

Garry also recognised that wives and families were also under stress, not just farmers. A second concept event was held with bands, discos, a carnival and fireworks called 'Drought Breaker Family Maker'. With an opportunity to share stories and talk to each other, a sense of community was born with neighbours helping neighbours.

In order to better help the community longer term, Garry was instrumental in setting up the Upper Lachlan Foundation, whereby those in need could apply for financial assistance to get through the tough times. Grants have been given to support to groups such as local sporting organisations, agricultural sponsorships and aged care. Through donations and bequests, the foundation recently hit a milestone of $1,000,000 to help those in the district who need it.

"The foundation doesn't really have anything to do with spuds, but we are still a community based on agriculture that now support and give each other resilience. If we look after our land and our people, they will look after you."

FOR MORE INFORMATION
Visit the Upper Lachlan Foundation at upperlachlanfoundation.com

Bringing the potato experts to growers

The February PotatoLink event to bring leading researchers to Gippsland growers provided an opportunity to talk one-on-one about the issues facing Australian potato growers.

Above. PotatoLink brought international speakers to Australia to discuss potato issues. L-R. Dr Mike Thornton, Dr Jeff Miller, Dr Bradley Geary and Dr Andy Robinson.

The *PotatoLink project (PT20000)*, led by Applied Horticultural Research has been ongoing since 2021, and gives the potato industry the latest in research and best practice.

A regular aspect of the extension program is presentations from leading experts on issues facing industry in management of disease, varieties and production.

The most recent event held in Thorpdale, Gippsland brought together four of USA's leading researchers in plant pathology and health for potatoes to discuss a range of topics including herbicide damage, late blight, fungicide resistance and blackleg.

In addition, Tolsma Australia gave insights into the latest technology for cool storage of potatoes with a demonstration at the recently opened Lamb Weston facility.

Visiting Australia for the event were:

- **Dr Andy Robinson,** associate professor and extension potato agronomist from North Dakota State University. A specialist in herbicide best practice for potatoes, he has been a regular visitor to Australia and provides good knowledge of the similarities, and differences between the two countries' potato industries.
- **Dr Mike Thornton,** professor of plant science, University of Idaho. A hands on researcher, Dr Thornton looks at management practices and variety evaluation to give the best outcomes for harvest and storage.
- **Dr Jeff Miller,** principal field investigator and owner of Miller Research. A plant pathologist, Dr Miller specialises in fungal diseases including rhizoctonia, blight, scab, pink rot, fusarium and verticillium wilt – all too familiar to Australian growers.
- **Dr Bradley Geary,** professor of plant health at Brigham Young University. Soil health, biological control and soil microbiome form the basis of Dr Geary's knowledge particularly in biological control of soil borne diseases.

The discussion was an opportunity for growers to lead the topics to be covered, that are relevant to their production issues. Guided by Dr Nigel Crump, the afternoon focused on pests and diseases, chemistries and soil health.

Dickeya of potato.

A common theme for the event was the need to use chemistries with caution to minimise the risk of resistance developing for weeds and fungi. With many chemistries either removed from use or no longer effective in the US, Australian growers were cautioned to plan ahead in the event that it may occur here.

Understanding the modes of action, and Groups that fungicides in particular operate, as well as timing can make the difference between effective control of soil borne diseases such as target spot, blackleg and verticillium wilt. Recognising the symptoms of disease is also important – late blight is a darker brown with light green halo, while target spot presents as a black lesion with concentric rings. Botrytis occurs lower down on the plant, while late blight is higher up the stem.

Blackleg is a bacterial infection that has two forms depending on location – the 'new' blackleg is *Dickeya* and *Pectobacterium parmentieri*. *Dickeya* is more active at warm temperatures can develop quickly, while *Pectobacterium parmentieri* is more aggressive. According to Dr Crump, it is becoming an emerging issue in Australia and testing is now available.

Dr Robinson commented that herbicide damage, is not unlike weather damage in that if it occurs, it can significantly set the yield potential back. Damage also opens the door to potential disease like black dot taking hold, through the wound sites.

As with fungicides, the available herbicide chemistries are reducing, particularly for post-emergent weeds, meaning that pre-emergent is the preferred application. Germination inhibitors are a good option for targeting weed seeds, before row closure, which also reduces the number of passes in the field.

In terms of non-chemistry management, biofumigants and cover crops are becoming increasingly common in the US. Typically rotations include corn, sugar beets, cereals and lucerne, depending on the region and climatic conditions. For the most part, potatoes are the cash crop, with the rotations providing the necessary break between potato plantings. In the US, a rotation with livestock is uncommon, however using locally sourced manures does occur.

In the US, sustainability is a big focus, particularly around soil health, said Dr Geary. The drive to improve soil health by adding large volumes of compost or microbiomes will be limited by the capacity of the soil. A soil that is already quite healthy in terms of structure, organic matter and organisms, may not show significant increases in yield compared to a soil that is poor in health prior to compost application. The type of soil can also be a factor – pH, aluminium and calcium presence will contribute to the ability of the plant to take on nutrients.

"As farmers we have to continually grow and keep up. The farmers are on one side, the idealistic is on the other, we meet somewhere in the middle, but we come out better as a result of it," said Dr Geary.

FIND OUT MORE
See presentations on page 132 of PotatoLink.

PotatoLink is part of the *Australian potato industry communication and extension* project (PT20000).

This project is a strategic levy investment in the Hort Innovation Potato - Fresh and Potato - Processing Funds.

Project Number: PT20000

Hort Innovation POTATO – FRESH FUND

Hort Innovation POTATO – PROCESSING FUND

Current Projects

HORT INNOVATION POTATO FUND

Hort Innovation conducts a number of R&D projects funded by grower levies. Here is a list of some of the projects currently underway.

Australian potato industry communication and extension project

PT20000

KEY RESEARCH PROVIDER: **APPLIED HORTICULTURAL RESEARCH**

Beginning in 2021, this investment is tasked with supporting Australian potato growers in adopting improved practices on-farm and keeping up to date with the latest industry news, information, resources and technologies.

The project delivers a nationally coordinated but locally implemented program which employs regional delivery partners who provide specialist skills and knowledge to the industry. The role of the regional delivery partners is a broad one, with all activities geared towards improving the circulation and uptake of information within the industry.

As well as extension activities, the project produces key communication channels for the potato industry, including a hard copy quarterly R&D magazine, online webinars and podcasts, social media, and a dedicated website to host industry resources.

Pomme de terre
the French potato industry

French agricultural journalist Blandine Cailliez on a recent trip to Australia to meet with Ballarat potato grower, Kain Richardson, describes the potato industry in France.

France is a major producer in Europe for potatoes, for the fresh and processed industries, and maintains a substantial export market principally to Belgium and the Netherlands for processing, which are then exported around the world. Imports of frozen potato goods from Belgium and Netherlands into Australia topped 74,369 and 43,600 tonnes, respectively in 2023.

The typical average farm size in France for agriculture is around 60 hectares; for potatoes it is nearer to 150-200 hectares. Within that farm, 30-40 hectares will be planted each year with potatoes, to give a five year rotation. Lease arrangements with neighbours are common, to give greater flexibility. Typical tonnage in a good year will be in the order of 40-60 tonnes per hectare.

Rotations for potato crops include wheat, barley and sugar beets. In the past, sugar beets provided a strong income, but in recent years the price has dropped, meaning that potatoes are the principal cash crop for French potato growers. Blandine says that just in the last year, a sugar beet processing factory was closed to be replaced with a potato processing facility in Cambrai, in northern France.

An analysis in 2022, showed that in France there are two leading growing regions: Hauts de France in the north giving 60 per cent of production and Brittany which accounts for 13 per cent. Other areas include Nord-Pad-de-Calais, Picardy, Champagne and Upper Normandy. The soils in these regions are deep loamy to sandy loam rich in organic matter, and pH from 5.0 to 7.0 with good drainage.

For processing, the principal company is McCain, with three locations in France – Bethune, Harnes and Matougues, all in the northern regions of the country.

"McCain use the Innovator and Fortane varieties for processing in France," said Blandine.

"The contract price with McCain is well known, and usually around €240 (around AUD$400) per tonne. The price on the fresh market changes from one year to another so it can vary from €60 - €400. The past three years have been good for growers."

According to Plant de Pomme Deterre organisation (France's seed potato organisation), France is one of the world's largest seed potato producers and exporters in Europe. The seed potato production areas, ranked by volume are north, centre and south, and Brittany. Rejection rates of certified seed are generally two to three per cent.

The top 10 varieties include Fontane and Innovator (both specified by McCain), Spunta, Agata, Monalisa, Amora, Markies and El Beida.

"The soils and growing conditions are quite good in France, but we still irrigate regularly, probably once every two weeks.

"Planting is usually in April and harvest begins in September, finishing around the end of October into November, before it gets too wet and cold with winter. Last season we had a lot of rain causing crop losses, and then a week in January below 10°C."

Planting, pest and disease, external pressures on French farmers

In Ballarat, most potato growers will do two rows per destoned row. In France, said Blandine it is also one or two, sometimes three. The most notable potato pests and diseases in France are well known in Australia – aphids, blight, alternaria and rhizoctonia. Colorado potato beetle and doryphore are also present in France.

"For herbicides French farmers can still use a number of chemicals to treat weeds. Farmers have been producing for a very long time, so weeds have built up and are a problem. We need to be careful with fungicides with resistances.

Feature image. Typical French potato farm. **Inset.** Blandine Cailliez, French potato industry journalist. *Images courtesy Blandine Cailiez.*

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Agriculture in France faces similar challenges to Australia, with an ageing population, and the cost of land.

"Regulations for pesticides to treat bugs like aphid is becoming increasingly difficult. The only option we have for aphid is oil-based. Many of our farmers are finding it harder to maintain the yields with no replacement for insecticides."

In Australia, many growers are frustrated with the cost of inputs and poor returns at the farm gate. In France, the biggest issue facing farmers is environmental regulation.

The push in Europe to reduce the use of chemistries on farm, Blandine says is reducing crop yields and introducing inefficiencies.

"We say in France we have 65 million people and 400,000 farmers, but we have 65 million farmers with an opinion on how to farm," jests Blandine. "With no fertiliser, no pesticides how can we produce the yields and quality the customer wants?"

In the driest winter in nearly 60 years, France faced drought in 2023 and introduced water restrictions to residential, commercial and agricultural sectors. A push to build water reservoirs for water security, has been faced with opposition based on environmental impact grounds. As it stands now, says Blandine, once you have used your allocation and the cut off date for irrigation is reached, there is no more water, unless it rains, proving a difficult scenario for crops if the rains do not deliver.

Agriculture in France faces similar challenges to Australia, with an ageing population, and the cost of land. The typical age of a French farmer is 51 – by 2026 40 per cent will be eligible for retirement, while aspiring young farmers are being priced out of the industry. The workforce (across the whole of agriculture) is also on the decline, with a decrease of more than 20 per cent between 2010 and 2020. (france24.com/en/business/20240-124-france-farming-crisis-in-numbers)

"Land is very expensive in the Netherlands and Belgium. In the French potato regions, it is increasing significantly. It is hard to know the exact price, as it is confidential. Which is why a lot of potatoes are exported to those countries – it is slightly cheaper to grow in France, but cheaper to process in Belgium."

The organic market in France is similar to Australia – sitting at around 10 per cent. With in an increasing interest in concepts such as regenerative agriculture, companies such as McCain's are encouraging growers to improve their farms.

Introduction of ag tech progresses slowly – GPS driven tractors, laser weeders and the like are gaining traction, but cost remains an issue for the French farmer.

On reflecting on Blandine's description of the French potato industry, Kain said that he was surprised at how much of the French production went to Belgium for processing.

"The amount that is then exported as frozen product out of Belgium to Australia, suggests that we could be doing so much more processing here," said Kain.

"In terms of insects, the Colorado beetle is not a major issue in Australia – in the USA it can cause huge damage. On the whole Australian chemical use standards and IPM seem to be keeping us in the game to keep the cost of production competitive on the global market.

"The Australian water market is probably better structured to manage water security, so issues like water restrictions during drought conditions are well known and understood. For a country that is not used to drought, I can imagine that it would have been unsettling for many growers in France.

"It was a real pleasure to have Blandine visit on the farm to talk about our industry and learn from each other," said Kain.

Above L-R. Typical French potato farm. Kain Richardson shows Blandine Cailliez potatoes growing in the Ballarat region. *Images courtesy Blandine Cailiez.*

KEY POINTS

Crunching the numbers of the French potato industry

AREA PLANTED WITH POTATOES IN 2023

- 157,650 ha plus 206,000 ha for starch and seed potatoes

PRINCIPAL GROWING REGIONS

Hauts de France: comprising Nord Pas-de-Calais and Picardy

- **Pas de Calais:** 54,940 ha
- **Picardy:** 44,980 ha
- **Champagne Ardenne:** 14,010 ha
- **Centre Val de Loire:** 12,220 ha
- **Normandy:** 11,040 ha

NUMBER OF GROWERS

17,000

YIELDS

Average yield in France: 43.3 t/ha 2023 normal year, in 2022 the yield was down significantly at 39.2 t/ha

PRODUCTION

6,818m tonnes in 2023
6,048m tonnes in 2022

FRESH MARKET

1.1m tonnes export: principally to Spain, Italy, Portugal + north Africa

PROCESSING

2.5m tonne

- French fries: 65%
- Crisps: 13%
- Dried mashed potatoes: 15%
- Production of potato for starch: 1.1m tonnes

TOTAL SALES

€2.3bn

Source: UNPT unpt.fr

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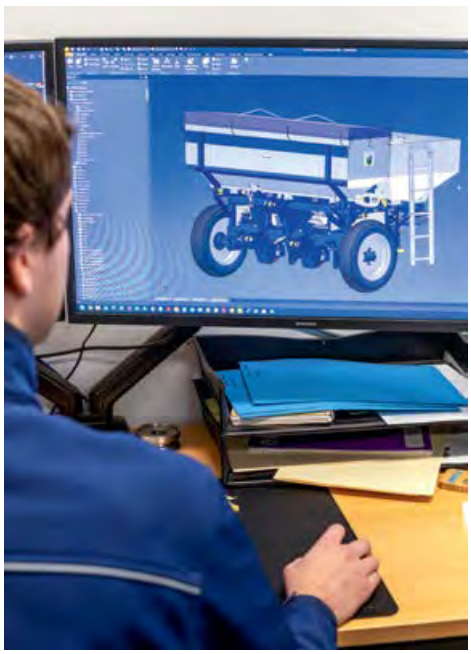

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Dobmac prides itself on its ability to adapt to the ever-evolving needs of the agricultural industry. Whether it's developing specialised equipment for niche markets or collaborating with international partners to integrate cutting-edge technology, Dobmac remains at the forefront of innovation, driving progress in Australian agriculture.

These partnerships underscore Dobmac's unwavering commitment to providing comprehensive solutions to its customers. With a team of highly skilled engineers and technicians, Dobmac offers comprehensive support, from initial design, customisation, and logistics to onsite commissioning, ongoing maintenance and supply of spare parts. By providing unrivalled service and expertise, Dobmac ensures that farmers can rely on their equipment season after season, maximising their productivity and profitability.

As a family-owned and operated business with deep roots in the Australian farming community, Dobmac understands the importance of trust and reliability. That's why they go above and beyond to deliver not just machinery, but peace of mind to their customers.

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ISSUE 12

2024

POTATO LINK

supplement

SPOTLIGHT ON SUSTAINABILITY

FEATURE ARTICLE

HARVEST AND STORAGE

INTERNATIONAL EXPERTS VISIT GIPPSLAND GROWERS

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POTATO LINK
AUSTRALIAN POTATO INDUSTRY EXTENSION PROJECT

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POTATO LINK AUSTRALIAN POTATO INDUSTRY EXTENSION PROJECT

FROM PETER O'BRIEN...

Welcome to the autumn issue of our publication.

We're delighted to present this collection of articles and features that we hope will engage and inform you on various aspects of potato growing.

PotatoLink postharvest expert, Dr Jenny Ekman, writes about the critical aspects of harvest and storage to ensure all the efforts of growing potatoes are not wasted.

In this issue, our new 'Spotlight on sustainability' section features just a few of the incredible efforts made to value add potato waste and we highlight the work of two agricultural engineers from Canada's Nova Scotia, who are working with industry to create innovative nutrient testing technology.

We hope you enjoy diving into the diverse range of topics covered in this issue. Your feedback is always appreciated, so feel free to reach out with your thoughts and suggestions.

For those reading online, remember that getting a hard copy is easy. Just click the **link** to subscribe and have it delivered to your doorstep.

Happy reading!

Peter O'Brien, PotatoLink Project Coordinator

Send your feedback to info@potatolink.com.au

IN THIS SUPPLEMENT

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HARVEST & STORAGE

POTATO HARVEST: WHERE YIELD GETS REAL

Harvest is where all the effort and expense that has gone into growing the crop finally comes to 'tuberition'. It is where money can be made or lost, and where the grower finally, conclusively, finds out what has been happening under their feet.

GROWING A GOOD CROP

A good harvest starts even before the potatoes are planted. This particularly means minimising the clods and rocks that can physically damage potatoes during harvesting, as well as acting as contaminants in the finished product.

Once the potatoes are growing, ensuring adequate nutrition and irrigation is an important part of preparing tubers for harvest day. For example, production factors that reduce the risk of bruising include:

- Moderate nitrogen fertiliser application (excessive nitrogen increases susceptibility to bruising, especially if applied late in the cropping cycle)
- Optimised levels of potassium
- High calcium – with a target of 250ppm tuber concentration
- Accurate irrigation, avoiding excessively wet or dry conditions

TERMINATING THE CROP

Vine kill is the first step in preparing the crop for harvest. It may occur when the crop is mature, or in response to market demand for a particular range of tuber sizes. Vine kill promotes tuber maturation and separation from the stolons, as well as removing plant material that would otherwise clog the harvester.

If vine kill is timed to meet market demand, growers may be tempted to allow the largest tubers to become oversize in the hope that more small tubers will reach the marketable range. However, larger tubers tend to be expanding faster than smaller ones, so this does not always work. Moreover, tubers can continue to expand slightly even after vine kill has occurred:

- If soil is dry, tubers are likely to only increase 1mm at most, regardless of kill method
- If soil is damp and vines are killed mechanically, tubers may increase by 1-2mm
- If soil is damp and vines are killed chemically, tubers may increase 2-3mm

Vine kill is usually conducted when the largest tubers from at least two-thirds of test digs have reached the maximum marketable size. Delaying further should only be considered if there is a good market for oversize tubers. To conduct test digs:

- Choose at least three locations within the crop, avoiding areas that look unusual or are growing poorly
- Conduct digs every 3–4 days once the largest tubers are within 10mm of maximum desired size
- Each dig should lift between 1-2m of the row (minimum three plants)
- Divide the tubers into appropriate size fractions and weigh each group to calculate percentage yield by size grade

Figure 1. Test digs should include at least three plants per location, and be repeated across the paddock.

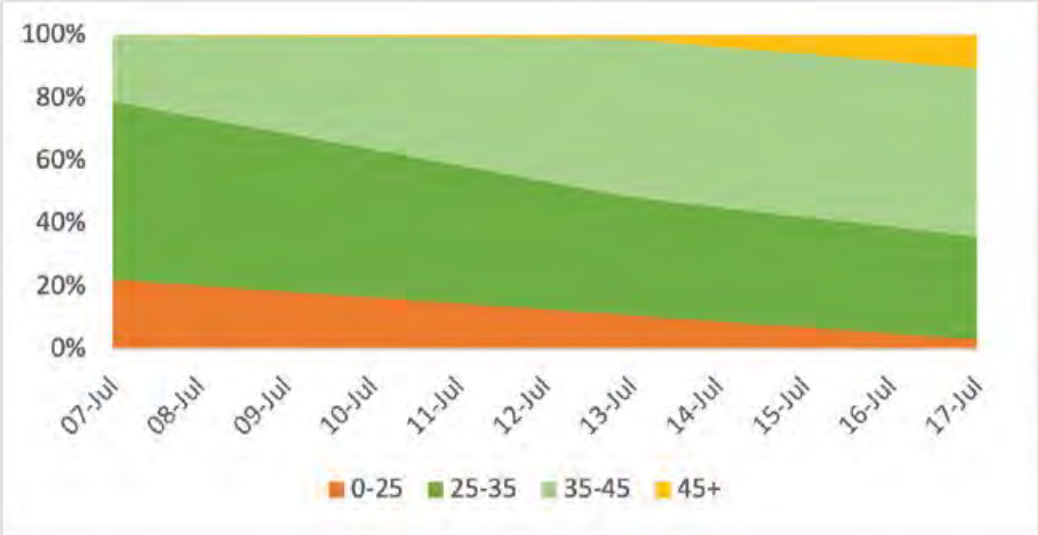


Figure 2. Example result from test digs for salad potatoes with a maximum marketable size of 45mm and optimum size grades of 25-35mm and 35-45mm. By 17 July, the crop was already passing optimum size. Data derived from summary by S. Wale, Teagasc.

Defoliation can be achieved using chemical, electrical or mechanical means.

Chemical

Chemical defoliants can provide a fast and efficient way to defoliate plants. Whatever product is used, it is essential to follow the label directions to avoid contaminating the tubers, soil or surrounding environment.

Diquat is commonly used for this purpose. Diquat acts by inhibiting photosynthesis. However, it is usually recommended to apply it under cloudy conditions, preferably later in the day. This is because the product works so fast when it is sunny that the plant tissue dies before the chemical can diffuse throughout the leaf.

One potential downside of rapid desiccation is the potential for vascular browning. To minimise risk, avoid applying defoliant when the soil is dry and plants are stressed.

For example, Syngenta recommends conducting a basic soil moisture test before application of diquat:

- Take a soil sample from the centre of the ridge (5cm below the deepest tuber)
- Gently squeeze into a ball
  - If it stays in a ball the soil is sufficiently moist
  - If it collapses the soil is too dry
- Repeat at several points across the paddock, particularly sampling in drier areas
- If the soil is too dry, delay application of diquat until after rain or irrigation

As diquat is a contact herbicide, it is essential to use nozzles that provide good penetration into the crop canopy. Achieving good contact also means avoiding application if plants are dusty, as this forms a barrier on the leaves.

Although diquat is deactivated when bound to clay particles, it is highly residual in both soil and water. Regulation of diquat is increasing; it is no longer approved for use within the European Union, but is still registered in other countries including the USA and Australia.

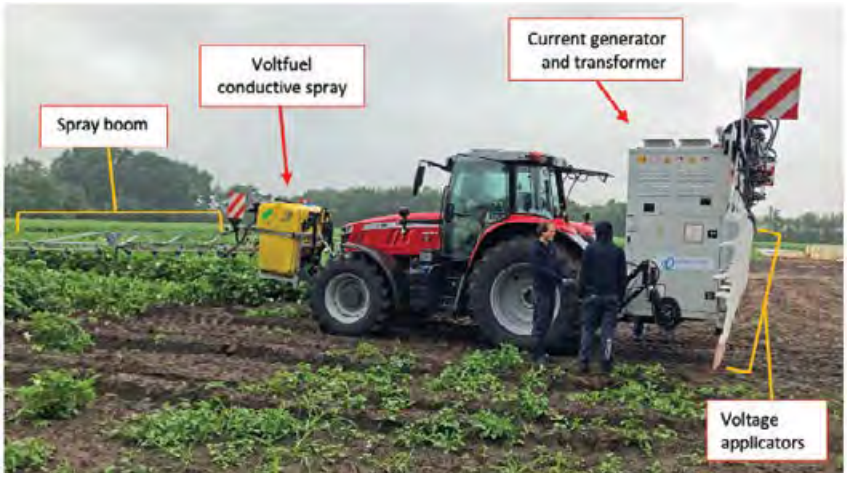
Note that the herbicides Pyraflufen-ethyl and Carfentrazone-ethyl are used for crop-termination in Europe but are NOT registered for pre-harvest application to potatoes in Australia.

Whichever product is used, it is important to follow label rates. In some cases, a lower rate may be used first to remove the leaves. The second application then directly contacts the plant stems, optimising vine kill.

Figure 3. Terminated vines at the PotatoLink Ballarat demonstration site. April 2023.

Electrical

The loss of chemicals in Europe has encouraged exploration of alternative crop termination methods. The CROP.ZONE system uses a combination of a conductive liquid and electrical current.



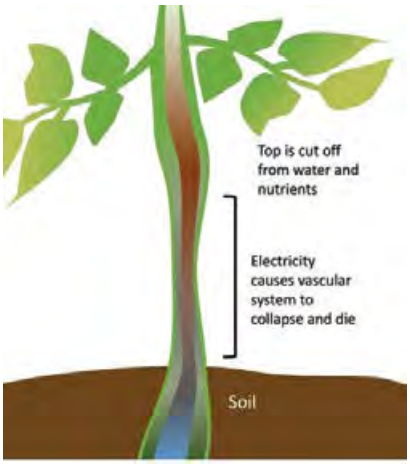


Figure 4. The CROP.ZONE system for vine termination combines an electrically conductive spray with voltage applicators, electrocuting the potato plants. This collapses the plant vascular system, starving the leaves of water and nutrients.

A 12m wide boom spray attached to the front of the tractor is used to apply "Volt.fuel" conductive liquid. This contains a spreader and dissolved solutes. The solution maximises electric conductivity between the applicator electrodes and the waxy, hairy, uneven surfaces of the plant leaves. Decreasing electrical resistance significantly reduces the voltage required.

Electricity is delivered using applicators attached to the rear of the tractor. This is most effective if the soil is relatively dry, as electricity will pass preferentially through the wet tissues of the plant vascular system. The current collapses the plant vascular bundles, stopping supply of water and nutrients to the plant leaves.

The system works best when applied to the crop twice in opposing directions. Unfortunately, the energy cost is estimated to be 5x higher than herbicides, and the 12m maximum boom width is likely to be limiting for larger growers. However, by reducing reliance on herbicides and avoiding impacts on soil biology, the system may meet sustainability objectives.

Mechanical

Mechanical methods of terminating the crop involve flailing and chopping. This may be combined with rolling to flatten the stems. Potential advantages of mechanical vine kill include speed and – possibly – a reduction in sprouting by remaining volunteer potatoes.

Speed can be important if growing seed or salad potatoes, where size specifications are relatively strict. Minimising the period between vine kill and harvest may also reduce incidence of black dot (*Colletotrichum coccodes*).

While chemical free, one key downside is the potential to spread disease. Mechanical methods break vines into tiny pieces. They then spread them around the paddock, along with any spores/oospores/bacteria that they might contain.

It is sometimes recommended to follow mechanical termination with application of a combined desiccant (e.g. diquat) plus a fungicide to prevent spread of diseases such as late blight. In this case, the cut stems should be left around 20cm long and the chemicals only applied once the leaf tissue has dried and exposed the cut stems (Wale, 2018).

Figure 5. This Grimme mechanical topper crushes and chops the plant haulm and deposits the trash in the interrow, leaving the plant stems exposed for further treatment. Image: R Halleron, Agriland.

SKIN SET

While tubers are still growing, their skins need to stay soft and flexible. Such soft skins are easily rubbed off (skinning) or wounded when handled.

Once tuber growth stops – whether naturally or at vine kill – the skin starts to harden and thicken. It also becomes more tightly attached to the flesh, protecting the underlying tissue. Good skin set is essential to reduce vulnerability to wounding and bruising, increasing storability of the tubers.

Complete skin set can take anywhere from one to four weeks, depending on variety and soil conditions. Skin set will take longer in cool, moist soil, yet still not achieve as good a result as that in warmer conditions. Also, if the crop is allowed to naturally senesce, the start (and finish) of skin set will vary between plants.

Potatoes that are to be processed immediately, or which are accessing a new market window, may sometimes be harvested before the skins set (green harvesting). Shelf life of such potatoes will be relatively short. For most end uses, it is important that harvest does not commence until the skins have properly set.

HARVEST

Once the skins have set, potatoes can be harvested. Avoiding damage during harvest is key to producing high quality potatoes with excellent potential storage life. Wounds and bruises inflicted during harvest detract from appearance, accelerate respiration and provide entry points for disease.

Factors that help reduce damage during harvest include:

- The field is free of clods and rocks
- The crop has grown evenly throughout the paddock
- The soil is moist and tubers are normally hydrated
- Soil temperature is 12 – 18°C; soil temperatures below 5°C or above 25°C increase risk of bruising
- Tubers have lower dry matter, with small starch granules

The way the harvesting machine is operated will also have a major impact. The speed at which the harvester moves through the paddock needs to be adjusted according to crop yield and soil type.

Driving the harvester too slowly allows tubers to pile up, be caught by the haulm roller and pushed against the sides. Conversely, driving the harvester too fast means tubers roll and bounce around.

- Ensure the digging blade is angled correctly, so that tubers travel smoothly from the blade onto the primary conveyor
- Adjust drive speed so that the web is around 85% full
- Adjust web speed so that soil goes right to the top
- Use the minimum shaking and agitation needed to separate tubers from clods and soil
- Minimise drops and/or provide padding to reduce damage; potatoes should not drop more than 30cm when transferring between conveyors or from the boom conveyor to the bin, trailer or truck

Figure 6. Potato skins remain soft while growing, and are easily rubbed off if the tubers are harvested before the skins have hardened and set. Image: Arvalis JM Gravouille

Figure 7. Preparing the site well, and ensuring weather and soil conditions are right, will reduce the risk of damage occurring at harvest.

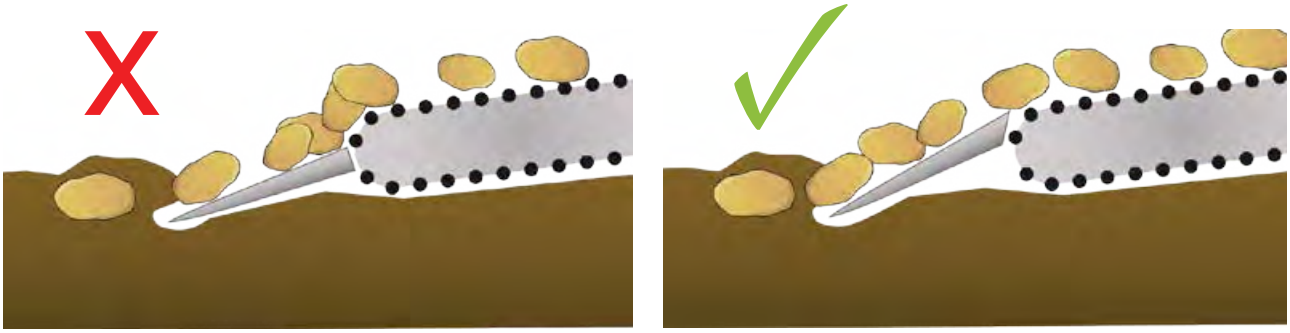


Figure 8. Ensure that the digger blade does not jam tubers into the primary conveyor, but delivers them smoothly onto the top of the chain.

BRUISING

Bruising can be roughly divided into two types - shatter bruises and blackspot. Shatter bruises are obvious. Damage is visible as cracks that can extend to the core of the tuber. These provide an easy entry point for rots and are visually unattractive. In contrast, blackspot bruises are internal, so more difficult to detect.

Potato skin is constructed from relatively small, corky cells that are good at resisting damage, so long as the skin has properly hardened off before harvest. However, the swollen, starch-laden cells that make up the underlying flesh are more fragile. Impacts can fracture the internal membranes of these cells, allowing the polyphenols (tyrosine) and enzymes (polyphenol oxidases) that are normally held separately inside the cells to mix.

The reaction between these compounds leads to the formation of melanin, the brown to black compound that makes bruises visible. The intensity of the colour that develops is directly related to the amount of substrate that is present. As the reaction is not instantaneous, bruises or 'blackspots' develop over at least 24 to 48 hours.

Bruise development is strongly variety dependant, with some varieties bruising more easily than others. Bruising is also more severe at low temperatures than warmer ones.

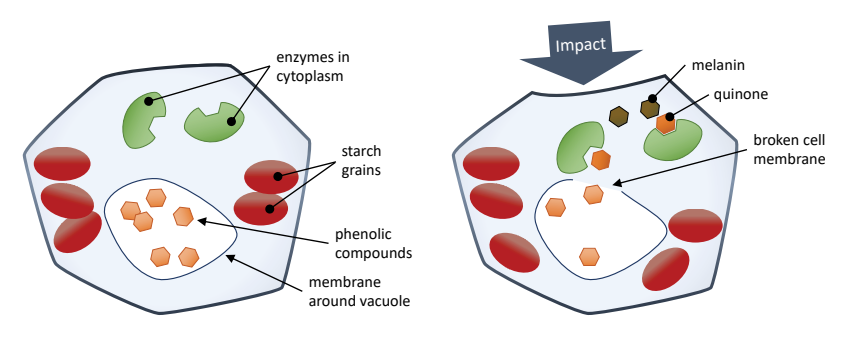


Figure 6. Intact potato cells (left) contain phenolic compounds and oxidising enzymes, kept separate by internal cell membranes. Impacts (right) can rupture this internal membrane, allowing mixing. Oxidation eventually gives rise to the dark compound melanin, visible as 'blackspot.'

For example, Dawson and Johnstone (2016) found that >50% of Nadine potatoes were bruised by a 50cm drop at 10°C, whereas drops less than 60cm did not cause any damage when the temperature was increased to 15°C. Moreover, while a drop of 80cm damaged virtually all Nadine potatoes (regardless of temperature), Ruby Lou was less susceptible. Approximately 20%/40% of Ruby Lou at 15°C/10°C were damaged by the same impact.

Impact recorders, such as the 'Smart Spud' or Techmark IRD (Impact Recording Device), can be used to identify points during harvesting with consistently high impacts. The device can be run again, after making changes, to confirm that impact intensity has been reduced. In the case of the IRD, the software includes a potato "damage boundary"; forces greater than this can potentially cause blackspot.

Figure 10. Impact recorders can be used to identify points on the harvester where consistently high impacts occur, then test ways to reduce these impacts.
Image: P. Morris, Techmark

EXPLORE THE TOPIC FURTHER

FACTSHEET: Potato bruising and management

WEBINAR: Harvesting: Bruise prevention and grading

STORING SPUDS

Once the stress of harvest is over, potatoes need to be cured and cooled, especially if they are to be stored for any length of time.

WOUND HEALING (CURING)

While it is clearly better to avoid wounding potatoes in the first place, to some extent potatoes can heal or 'cure' themselves postharvest. Facilitating this natural process is critical if they are to be stored for any length of time.

The rate of curing is affected by temperature and relative humidity. Wounds heal faster above 15°C. However, warm temperatures increase the risk of storage rots, as well as increasing respiration rate and, therefore, internal temperatures.

Conversely, wound healing is very slow at temperatures below 10°C. While such low temperatures reduce the risk from diseases such as pink rot (*Phytophthora erythroseptica*) and watery leak rot (*Pythium* spp.), the slow rate of healing that results can allow other, opportunistic pathogens to take hold.

The optimal conditions for curing are therefore 5 to 10 days at 10 to 15°C.

Ideally, relative humidity (RH) should be kept at 85 to 90% during curing. If RH is over 90%, even small temperature changes are likely to result in condensation. Condensation restricts respiration by the healing tissues and increases infection risk. Maintaining good air movement is the best way of reducing the risk of condensation, especially if cool air is actively pulled through bins of potatoes; as air warms as it flows through the bins, rather than cools, no condensation will occur.

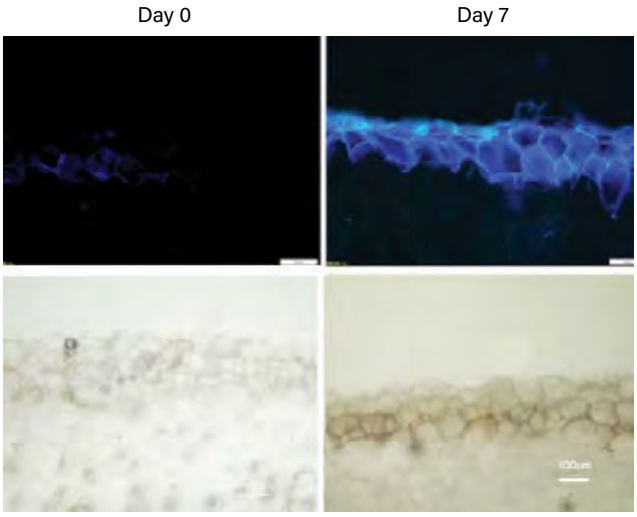


Figure 11. Cross section of freshly cut potato (left) and after 7 days curing (right). Top images use fluorescence to detect suberin; bottom images show lignification of cell walls. Image: Zhu et al., 2023.

Table 1.
Effect of temperature on wound healing. From Cunnington, 2019, ADHB Store Managers guide

Tuber temperature °C)	Initial suberisation (Days)	Suberisation complete (Days)
<5°C	7 to 14	21 to 42
10°C	4	7 to 14
20°C	1 to 2	3 to 6

The curing strategy will need to be adjusted if freshly harvested potatoes are wet. To reduce risk of rots, ventilation should be increased and relative humidity reduced, at least until the potatoes are dry.

While curing is an important step towards maintaining potato quality in storage, it should not be extended past what is needed. Curing is conducted at relatively high temperatures, so will accelerate ageing processes.

RESPIRATION

Stored potato tubers are **alive!** They can develop sprouts, produce chlorophyll, lose or absorb moisture, and continue to mature. All of this metabolic activity is fuelled by respiration.

Respiration breaks down stored carbohydrate reserves, consuming oxygen and releasing carbon dioxide, water and energy. While most energy is used by the cells, some is also lost as heat.

High respiration rates are associated with shortened storage life for many products. Moreover, as respiration produces heat and heat promotes respiration, a 'heat snowball' can develop, especially in poorly ventilated areas of the store.

Perhaps most importantly, high respiration increases the risk of high CO_2 building up in the storage environment. Ventilation rates need to match CO_2 production to avoid this occurring.

Effects of temperature

Respiration rates of potatoes are generally minimised between 3 and 8°C, and may show limited variation within this range. However,

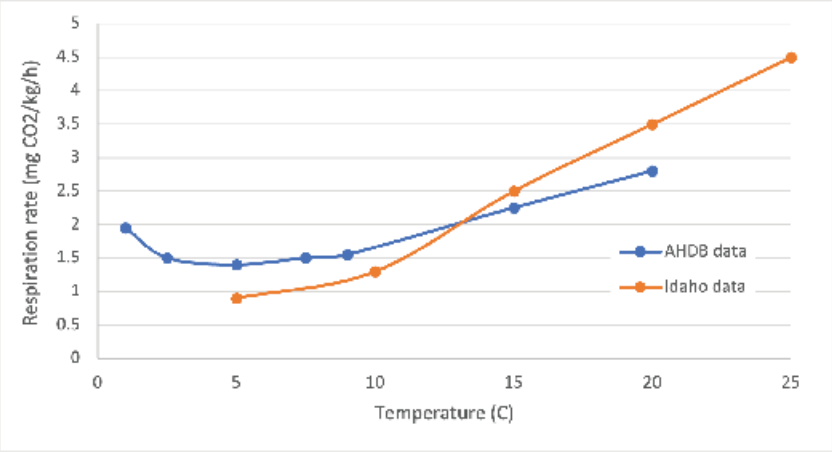


Figure 12. Effect of temperature on respiration rate of potatoes. Data derived from AHDB 2017 (average of five varieties including Russet Burbank and Maris Piper) and University of Idaho Extension 2024 (cv. Clearwater Russet).

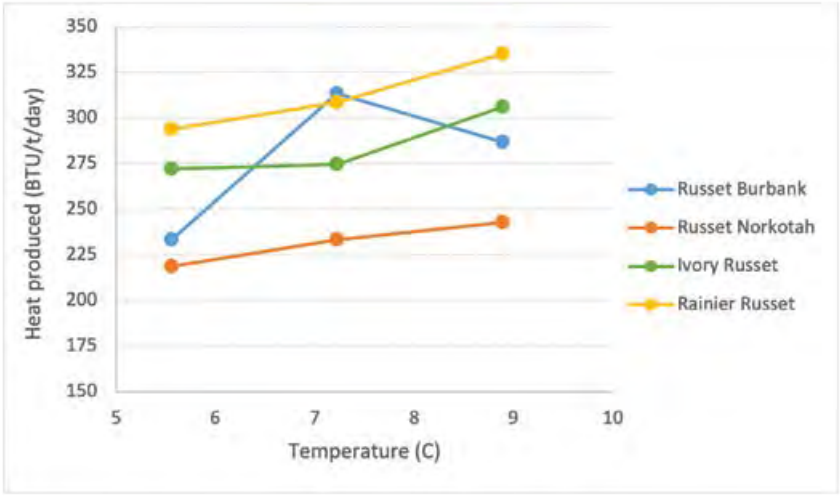


Figure 13. Average vital heat (BTU/t/day) generated by Russet potato cultivars treated with CIPC and stored for eight months at 5.6 to 8.9°C. Data derived from University of Idaho Extension (2024).

Figure 14. Blackheart can occur if internal tissues are starved of oxygen. Image: E. Banks, Ontario Potato Board.

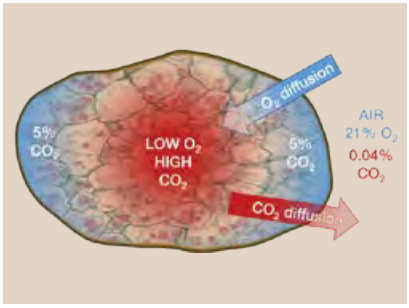


Figure 15. Limited gas diffusion between the external air and internal spaces inside potato tuber flesh means that significant gradients in CO_2 and O_2 are likely to occur, especially if respiration rate is high. For example, at 20°C the flesh immediately under the skin can contain 4 to 6% CO_2. The core may be even higher.

temperatures below 3°C can actually increase respiration rate – an indication that the potato is under stress (Figure 11). Temperatures higher than 10°C are associated with much higher respiration rates, doubling then tripling as potatoes approach ambient temperatures (20 to 25°C).

Respiration rate can vary between cultivars, by maturity at harvest, and with time in storage. After an initial decline, respiration generally remains fairly stable over several months of storage. They then tend to trend upwards as potatoes start to deteriorate. Rising respiration rates can sometimes be the first sign that stored products are starting to break down. For example, marked increases were commonly observed as potatoes kept at 15 or 20°C approached the end of storage life (AHDB, 2017). Damage (e.g. bruising) and sprouting also stimulate respiration.

Energy use in storage

The importance of respiration lies not just on its effects on ageing, but also its impact on the energy required to keep the storage room cool. According to the University of Idaho, a respiration rate of 1mg CO_2/kg/hour produces approximately 61.2 kcal/t/day energy, or 243 BTU/t/day heat.

This suggests that an increase in respiration rate from 1.0 to 1.5mg CO_2/kg/hour will increase the heat load on the cooling system to 364 BTU/t/day. This research also indicates that differences in respiration rates between varieties can change energy costs by 35% or more (Figure 13).

Cooling is essentially value adding with electricity. Although it may require more energy initially to cool potatoes below 7°C, this may be offset against lower energy costs once potatoes are cold. If potatoes warm back up, the value added is lost.

Ventilation

Preventing build-up of CO_2 is essential, especially during early storage.

One reason is that high CO_2 can stimulate production of ethylene. Both ethylene and CO_2 increase breakdown of starch into sugar thereby causing fry darkening and off flavours. High CO_2 can also result in 'blackheart', where the internal tissues blacken and die due to oxygen starvation

Potatoes are extremely susceptible to CO_2 damage because their dense structure limits gas diffusion into the internal flesh. This means there can be significant gradients between the inside and outside of tubers. For example, at 20°C, the outer tuber flesh of 'King Edward' potatoes contained 4 to 6% CO_2, compared to 0.04% in the ambient air (Banks and Kays, 1988). Accumulation of CO_2 is likely to be even greater at the tuber core, where the cells are most tightly packed (Gancarz and Konstankiewicz, 2007).

The threshold external CO_2 level that can cause damage varies between 1,200 to 5,000ppm (0.12 to 0.5%), and is likely to be affected by both respiration rate and tuber flesh density.

Increasing ventilation rates not only increases energy costs, but also, potentially, moisture loss and risk of condensation.

To minimise negative impacts of respiration:

- Harvest potatoes when mature; immature potatoes tend to have higher respiration rates
- Harvest when soil is cool to reduce cooling requirements
- Minimise harvest injuries
- Stimulate curing by keeping potatoes at 10 to 15°C after harvest
- Adjust ventilation rates so as to remove CO_2 generated by respiration;
  - » ventilation rates may be reduced as the potatoes cool to holding levels
  - » ventilation needs to increase if seed potatoes are warmed before unloading from storage

TEMPERATURE AND COOLING

Temperature is an extremely important factor in quality and storage life of potatoes. It is critical to ageing of stored seed, affects disease progression, and is key to sugar accumulation, sprouting and weight loss in ware and processing potatoes.

Once curing is complete, potatoes should be cooled as soon as possible. However, the ideal cooling method and storage temperature will vary with both cultivar and end purpose. It is critically important to avoid condensation on stored potatoes. This is very likely if bins of warm potatoes are simply placed directly into a cold room.

Cooling methods

One option to prevent condensation is to use positive pressure (forced air) to cool potatoes. Such systems use a powerful suction fan mounted into a plenum to pull cold room air through loaded bins or crates. Air is forced past individual potatoes, cooling the tubers much faster than passive room cooling. The air warms slightly as it moves through the product, so no condensation occurs.

Forced air systems are widely used for other horticultural products. Faster cooling rates mean that both total energy use and moisture lost by the product may be reduced.

Although not generally used for potatoes, forced air cooling should be considered if potatoes are harvested warm (>18°C) and/or wet. In this case, rapid removal of field heat is priority. Loading warm potatoes directly into trucks or shipping containers can easily end in disaster, with self-heating and disease rapidly destroying product quality.

The alternative to pressure cooling is to cool potatoes slowly, dropping the temperature gradually. The cold room air is set only 1°C to 4°C below the flesh temperature of the tubers, ensuring that dewpoint is not exceeded. This has long been standard practice for seed, processing and ware potatoes, with temperature reduced by 2 to 3°C weekly (approx. 0.5°C/day) until the potatoes reach the target temperature.

Effective storage

Maintaining good air movement around the bins or through a bulk load is essential during cooling, but remains important even once products have reached their ideal storage temperature. Well-designed stores have uniform airflow under normal operating conditions, preventing warm or cold spots developing. This may be achieved by adding air ducts or lateral outlets across the store.

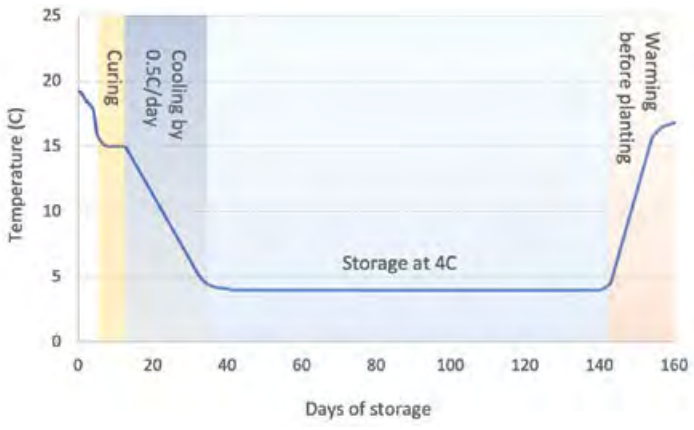


Figure 16. Recommended temperatures for seed potato curing, cooling and storage

A good store also needs to keep temperature stable, RH high, and include monitoring systems that can alert the grower if anything goes wrong.

In Australia's climate, getting the best possible insulation is a wise investment. Insulation works by trapping air in between layers of waterproof outer skin. Air is a poor conductor of heat – that's why puffer jackets are so warm! In contrast, water conducts heat very well. If insulation materials become wet, they will be ineffective.

Keeping floors, doors and walls properly sealed against moisture is an investment in infrastructure that will save energy costs and reduce internal temperature gradients.

- Always repair damage from forklifts or bins
- Check that door rubbers seal thoroughly
- Ensure seals between cold room panels are intact
- Keep the floor dry and sealed against moisture

Commercial systems are available which are designed specifically for storing potatoes. The Tolsma system (p17) is one example. A key benefit of using this technology is the timed ventilation that takes advantage of cool overnight air, providing energy efficiencies. Air refreshment can also be made through the 'Fresh Box', which pre-cools air in a heat recovery unit before using it to vent the room. This reduces CO_2 concentration without increasing room temperature. Automated temperature, atmosphere and humidity controls can be checked remotely, while a check-weigh system can be added to monitor weight loss in stored tubers.

All well designed rooms will provide good air movement, whether delivered above stacks of bins or through ducting on the floor of bulk stores. Air movement can be further improved by:

- Leaving gaps that allow the cool room air to circulate between stacks of bins
- Leaving gaps between bins and the cool room walls and ceiling
- Aligning pallet skids to airflow
- Ensuring the air intakes and cold air delivery system have clear space around them

Airflow can be checked using a hand-held anemometer. This is also a useful way to check that cold air is reaching all parts of the cold room. Adding flexible ducting or diffusers can help if airflow is limited.

Air temperature should be monitored at both the coldest and warmest parts of the room. However, it is the temperature of the potatoes, not the air, which is most important. Periodically checking the potato flesh temperature is an excellent way to double check the room is running well. Even simple, inexpensive temperature probes (such as those sold as kitchenware) can provide a reasonable result, especially if their calibration is checked (see breakout box below).

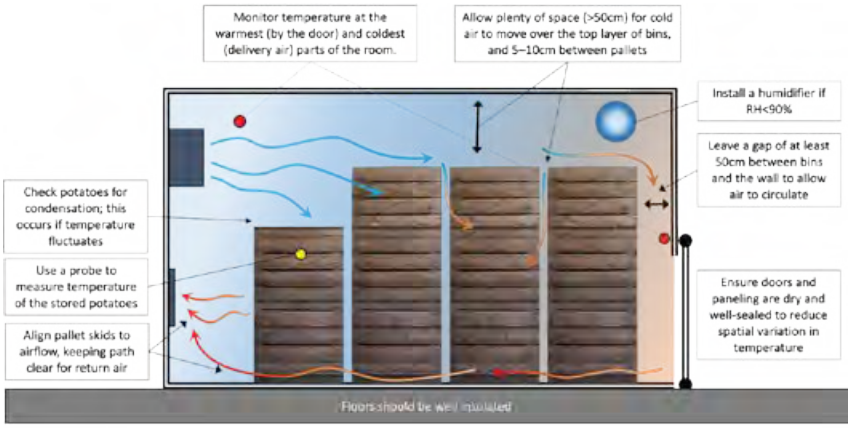


Figure 17. Cold storage rooms should be designed to allow cold air to circulate freely around the bins. For example, lleave gaps between stacks and around walls and consider how much air is reaching the far corners of the room. Monitor air temperature and humidity as well as checking flesh temperature of stored tubers.

PROBE CALIBRATION

The calibration of temperature probes can be readily checked using melting ice.

- Obtain some crushed ice or place ice cubes inside a double ziplock bag and smash with a hammer
- Place crushed ice in an insulated flask (e.g. a thermos, or double insulated container) with just enough water to cover
- Stir the water-ice slurry and allow to equilibrate for a few minutes
- Insert the probe into the slurry and stir gently
- Wait until the reading stabilises;
  - If it is 0°C, your probe is correctly calibrated
  - If it varies from 0°C then this figure needs to be added/subtracted
  - Record the correction (if any) and calibration date and sticker onto the probe for future reference

Typical temperatures used for long term storage are:

Use	Optimum storage temperature
Seed	3.5 – 4.5
Fresh market	3.5 – 7
Processed – Frying	7 – 10
Processed – Crisping	7 – 13

Cold temperatures and undesirable sweetening

Optimum storage temperatures vary between varieties. However, most varieties can suffer chilling injury if stored below 3°C.

Chilling damage does not cause obvious external symptoms, but the flesh can develop grey, discoloured areas that become more noticeable after cooking. Exposure to low temperatures can also reduce sprouting, making it particularly important to avoid temperatures below 3°C when storing seed.

Perhaps the most important impact of chilling temperatures is low temperature sweetening. This occurs due to conversion of starch into sucrose. As little as three days at 2°C can trigger significant accumulation of sucrose in some varieties. Some of this is further converted into the sugars glucose and fructose.

High levels of sugars result in undesirable browning when potatoes are roasted or fried. Not only do these compounds look unappealing and have a bitter taste, they include the probable carcinogen acrylamide.

Low temperature sweetening is due to a combination of both time and temperature. Risk differs greatly between varieties. For example, Figure 16, shows the difference in crisp colour of a variety highly sensitive to low temperature sweetening (Karaka) and one that is resistant (1021/1) after different storage periods.

In general, potatoes are most susceptible during the first two

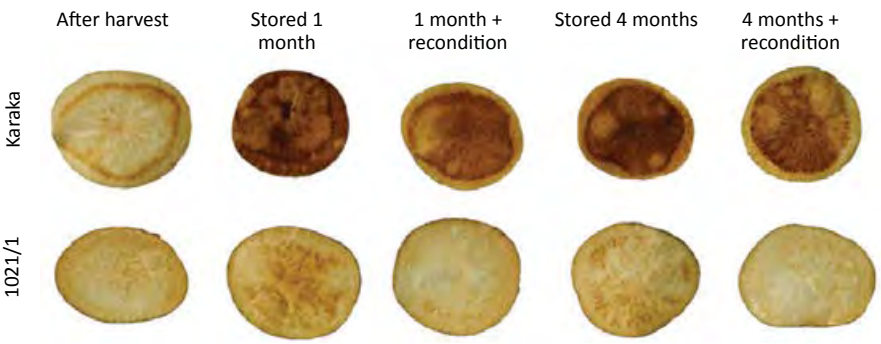


Figure 18. Colour of crisps prepared from cold sensitive (Karaka) and resistant (1021/1) potato varieties processed immediately after harvest, following storage at 6°C for 1 or 4 months and following storage plus reconditioning for 10 days at 18°C. Image: Datir, 2011.

COOLING POTATOES

Some industry members have suggested that seed potatoes should be cooled slowly so as to avoid cold 'shock'. However, there is little evidence for this in published literature.

The PotatoLink team is therefore conducting a small trial growing seed potatoes (cvs Crop 77 and SIFRA) which were cooled fast or slow then stored for over six months in facilities with different levels of environmental control:

1. **Cooled rapidly** (approx. 1 hour) one week after harvest, minimal temperature fluctuations during storage at 4°C
2. **Cooled slowly** four weeks after harvest, with temperature reduced to 3.5°C over a two-week period, occasional temperature fluctuations during storage to maximum 5°C
3. **Cooled rapidly** (approx. 1 hour) three weeks after harvest, stored in a cool room fluctuating daily between 2°C and 5°C

An initial assessment of stem number and plant height was conducted four weeks after planting. While extremely preliminary, there was a trend to slightly taller plants with more stems when grown from Treatment 1 seed. Crop 77 plants grown from Treatment 3 seed were smaller and had fewer stems than those from other treatments, but the same difference was not found for SIFRA.

Full results and description of this trial will be included in PotatoLink winter edition.

Figure 19. Crop 77 (left) and SIFRA (right) plants grown from seed stored under three different protocols (1 to 3, as described above), pictured four weeks after planting

months after harvest. Sensitivity can be reduced by harvesting potatoes at correct maturity (not immature or overmature) and through stepped cooling – where the temperature is gradually reduced.

Sweetening can be reversed to some extent through post-storage conditioning at 16 to 20°C. By increasing respiration rate, easily accessed sugars are metabolised and reconverted into starch. The process generally takes around three to four weeks.

It is important to monitor sugar levels and processing colour frequently during this time, so as not to over-condition and reduce quality. For example, reconditioning can promote sprouting and disease development. Moreover, post-storage conditioning does not always work. Reversing low temperature sweetening is most difficult if tubers have been stressed in the field.

Long term storage at temperatures above 10°C can also trigger sweetening. In this case, accumulation of sugars is due to ageing. This type of sweetening cannot be reversed.

Irreversible sweetening was also thought to occur in response to high levels of CO_2. However, recent research has found no relationship between storage atmosphere and fry colour.

In ground storage

In Australia, particularly South Australia, ground storage is a common practice for managing year-round supply for the fresh market and extending the supply period for processors.

If storage time is less than four months, and temperatures are cool, ground storage can achieve similar, or even better, outcomes than harvesting then storing in cold rooms. Ground stored potatoes have undergone skin set without the skin damage and wounding that is virtually inevitable during harvest. In the case of fresh market potatoes, skin finish may actually be better when potatoes

COOLING AND VENTILATION SYSTEMS

Sophisticated and specialised systems can help take the guess work out of potato storage. Tolsma sells a number of systems designed to cure, cool and store potatoes. The drying wall shown below (Figure 20, left) is designed to dry and control the temperature of freshly harvested/cut seed potatoes. Once cured, potatoes are stored in the open space ventilation and cooling system (Figure 20, right). The unit blows cool air over stored potatoes, sucking it back through the bins in the air return. An inlet hatch within the unit opens to draw in outside air for cooling, drying and to vent CO_2 as needed. Outlet hatches equalise pressure when outside air is drawn in.

Sensors measure potato pulp temperature and weight loss as well as temperature and relative humidity inside and outside the store. The temperature and absolute moisture differential between outside and inside air is calculated to determine whether outside air is suitable for cooling and/or drying.

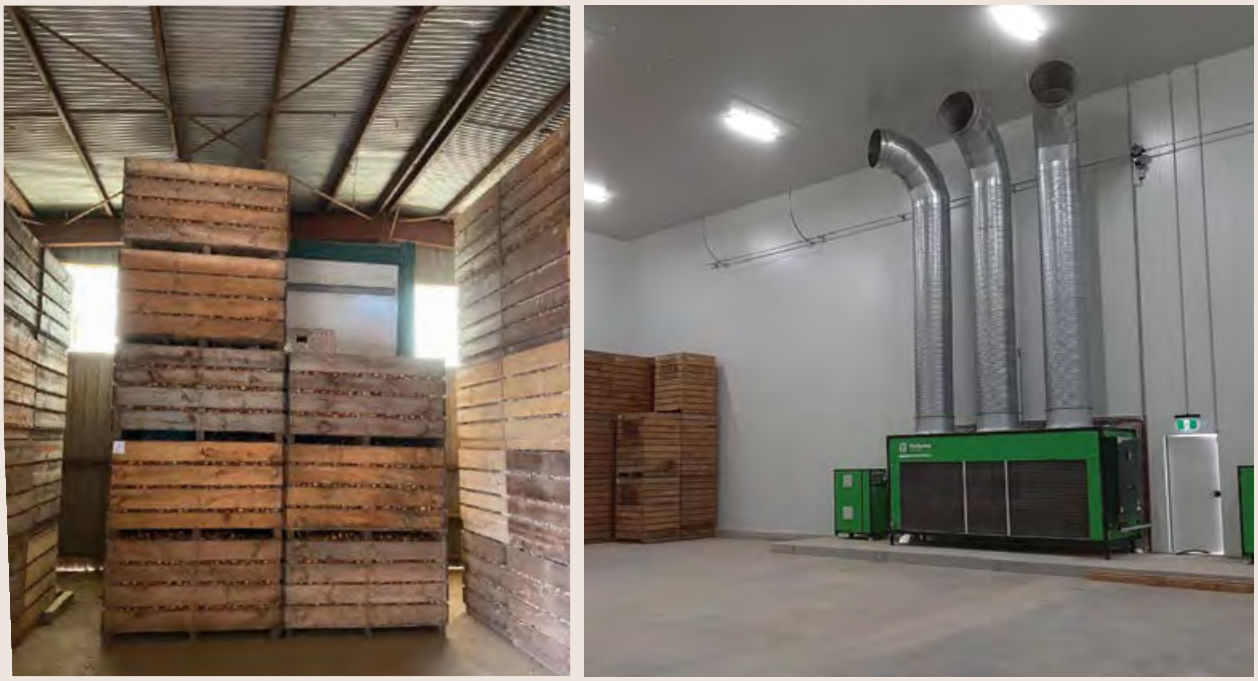


Figure 20. The Tolsma drying wall for curing freshly harvested/cut seed potatoes (left) and the Tolsma open space ventilation and cooling system (right). Images supplied by Tolsma.

have been ground stored instead of harvested and cold stored.

Depending on the dormancy characteristics of the variety, an in-crop application of a registered plant growth regulator (e.g. maleic hydrazide) may be needed to control sprouting. Timing is important, as early application can reduce yield whereas late spraying can be ineffective. Such products should always be applied according to label directions.

To be effective, ground storage also needs the right paddock conditions. Soil needs to be kept moist, but not wet, to stop tubers dehydrating. Regular, light irrigation can help reduce soil temperature during hot periods, maintaining more even conditions. This is because dry soils heat and cool easily, whereas moist soil is more stable.

Keeping soil moist also reduces the risk of wind eroding the hills. Erosion is more likely to become a problem as the vines die off and degrade. However, keeping the hills intact is essential to prevent tubers being exposed to the sun and, therefore, greening. Erosion and soil cracking also increase the risk from potato tuber moth. Caterpillars from eggs laid on dead haulms will crawl through soil cracks and burrow into the tubers below.

Once the vines are dead, weed seeds can germinate and grow in the moist soil. This can pose problems at harvest if not controlled early or managed. However, weeds do help protect the hills from erosion.

While it is important soil does not dry out, it is also important that soil does not stay wet. Wet or waterlogged conditions interfere with skin set, even if it has already occurred. Lenticels become swollen and risks from soil-borne diseases such as pink rot and bacterial rots massively increase.

Even under ideal conditions, ground storage can increase the risk of soil-borne diseases such as black dot, silver scurf and black scurf. Fresh market potatoes should not be ground stored in paddocks where there is high risk from these diseases.

Look out for more on anti-sprout agents in future editions of PotatoLink.

ACKNOWLEDGEMENTS

Much of the information presented here was sourced from the 2022 Australian Potato Growers Manual, specifically:

Chapter 4 – Harvest, by N Crump and N Malseed) and

Chapter 5 – Storage, by M Rettke and J Ekman

Hort Innovation project PT19003.

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Figure 20. Harvesting ground stored potatoes

STORAGE DISEASES

When the potatoes have been harvested, graded and put into storage a great weight has been lifted. The spuds aren't going to be stuck in the ground due to late season rain. Grubs and bugs aren't going to start affecting the tubers, and it looks like most of the disease issues have been avoided. They're safe. Except there is another consideration, and that is storage diseases.

Most postharvest pathogens are weak organisms, incapable of penetrating a tuber's skin directly. Instead, they rely on wounds as entry points, especially in moist conditions, for example, condensation.

Decreasing the temperature of stored potatoes diminishes the risk. Typically, the colder the storage temperature, the slower the pathogen's growth. However, the temperature needed to completely halt pathogen growth is often lower than what's ideal for other quality parameters. Development of many of the diseases listed here virtually stops below 4.4°C, however temperatures this low may not be practical or advisable.

Lowering humidity levels also helps reduce the risk of disease, but can cause dehydration.

EXPLORE THE TOPIC FURTHER

Factsheet: Pink rot

Factsheet: Black dot

Webinar: Dry rot

Australian Potato Growers Manual

SOURCES

- The Australian Potato Grower's Manual (2022)

SOFT ROT

(Pectobacterium spp., Dickeya spp.)

Soft rot bacteria can survive long periods in soil or on tubers without causing disease. However, periods of extended wetness can allow the bacteria to rapidly multiply and spread in the bacterial ooze created.

If rotten tubers are found at harvest, you should dry all other tubers as soon as possible to reduce further losses.

Temperatures below 10°C reduce the activity of soft rot bacteria, while spread virtually stops below 4.4°C.

Conversely, storage temperatures above 16°C and/or low oxygen levels will promote bacterial growth. The progression of soft rots can become extremely rapid as the temperature increases.

PINK ROT

(Phytophthora erythroseptica or P. cryptogea)

Storage temperature is critical to managing pink rot, with growth inhibited below 10°C. Temperatures below 5°C will inhibit the proliferation of pink rot. Depending how prevalent the disease is within the stored tubers, additional drying through ventilation with reduced humidity air may also be beneficial.

GANGRENE

(Phoma exigua var. foveata)

Gangrene primarily infects potato tubers through wounds. Fast and effective wound healing will limit its onset. Susceptibility increases during storage and the pathogen can continue to grow even at low temperatures. Keeping temperatures as low as possible in long-term storage will help slow the development and spread of gangrene.

BLACK DOT

(Colletotrichum coccodes)

Black dot infection occurs in the field. Infection can occur through the soil or when spores are washed off infected haulms onto the tubers below by irrigation or rain. Tuber symptoms reduce the marketability of washed potatoes grown for the fresh market.

The development of black dot symptoms on the skin of tubers is promoted by harvesting during hot conditions (>25°C). Rapidly cooling the harvested crop to 3.5°C or below will help to minimise disease severity. The severity of black dot symptoms increases at the temperatures used for skin curing (typically 10 to 15°C).

SILVER SCURF

(Helminthosporium solani)

Initial infection by silver scurf mainly occurs in the field. Moisture on the potato surface, caused by fluctuating temperatures and high relative humidity, allows spores to germinate and infect other tubers in storage. This makes avoiding condensation in storage critical.

Tubers should be stored at the lowest temperature possible, depending on market requirements. Maintaining lower humidity (<90%) will help control the spread of silver scurf by preventing spores from forming on any infected tubers.

PYTHIUM LEAK OR LEAK ROT

(Pythium spp.)

Pythium spp. mainly infects tubers through wounds caused during harvest. Rots then develop during storage, especially if the potatoes are wet due to condensation. As with pink rot, additional drying through ventilation with reduced humidity air may be beneficial if infection rates are low.

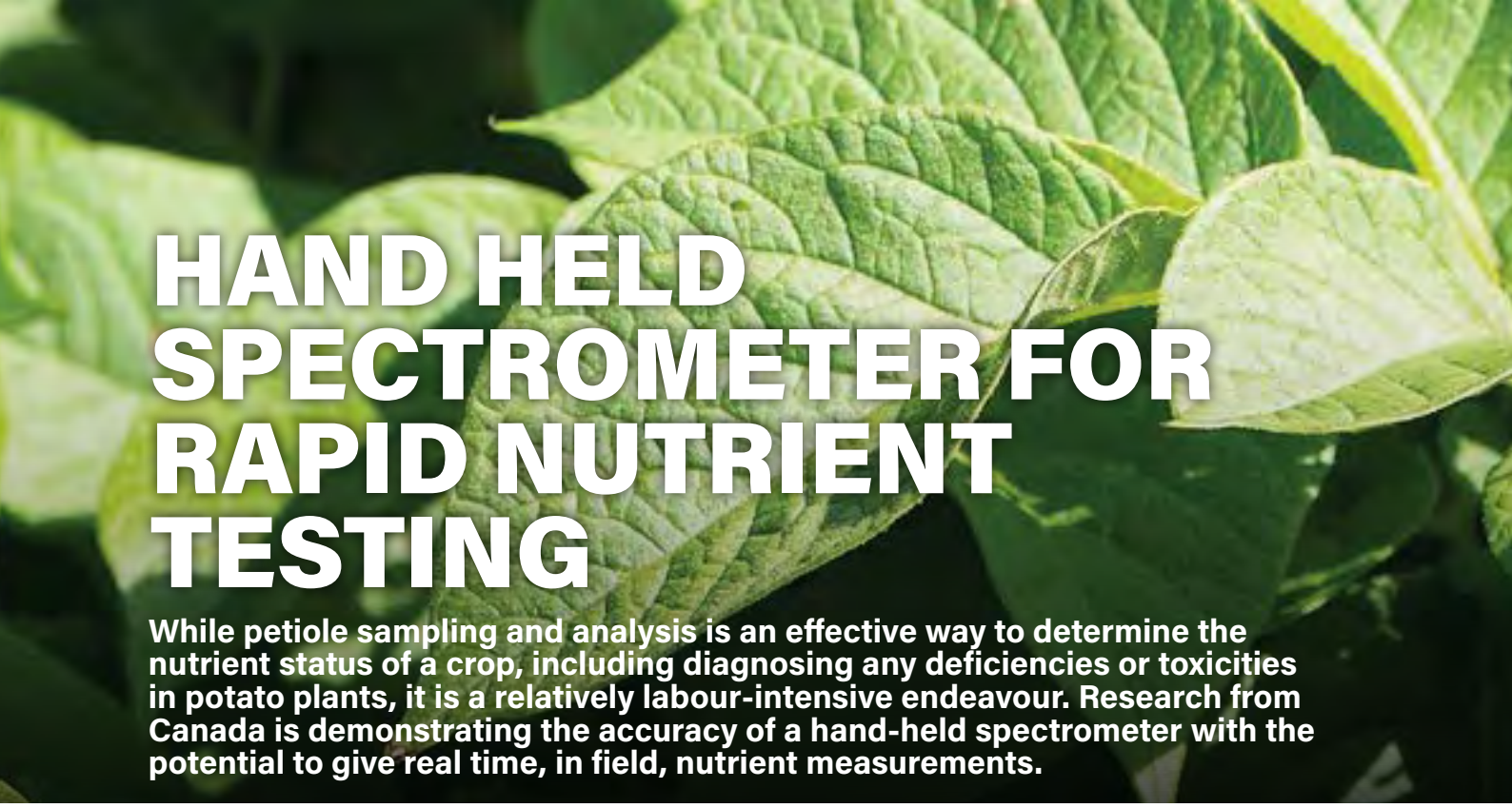
Temperatures below 5°C will inhibit development of leak rot. In contrast, storage at 16°C, or under warmer ambient conditions, will greatly increase progression.

FUSARIUM DRY ROT

(Fusarium spp.)

Fusarium infection usually occurs through wounds and the rot then expands within the tuber flesh. Susceptibility increases during storage.

If dry rot has been identified as a problem for a crop going into storage, fast and effective wound healing is required to limit onset. Storage temperatures below 8°C reduce disease progression while temperatures below 5°C greatly inhibit growth of this pathogen.



HAND HELD SPECTROMETER FOR RAPID NUTRIENT TESTING

While petiole sampling and analysis is an effective way to determine the nutrient status of a crop, including diagnosing any deficiencies or toxicities in potato plants, it is a relatively labour-intensive endeavour. Research from Canada is demonstrating the accuracy of a hand-held spectrometer with the potential to give real time, in field, nutrient measurements.

Regular petiole testing can assess the adequacy of fertiliser programs, diagnose deficiency or toxicity symptoms, and optimise fertiliser inputs. However, the process is time consuming, demands meticulous care and attention to detail, and results often take several days for analysis.

Compounding the issue is the sheer volume of petioles required for adequate sampling, often necessitating the collection of 40 to 50 specimens per sample for comprehensive laboratory analysis.

Standing hours in the field and searching for that all important fourth leaf may soon be a thing of the past, thanks to some new innovative technologies. Portable spectrophotometers and machine-learning algorithms are revolutionising real-time nutrient assessment in the field.

This new system enables rapid determination of petiole nutrient values, facilitating timely decision making for farmers. By leveraging historical data, these techniques offer the same valuable insights into nutrient status of a plant at a given time, without the laborious task of collecting and shipping samples.

Agricultural engineers, Associate Professor Ahmad Al-Mallahi and Reem Abukmeil (PhD candidate) from Dalhousie University in Canada, are pioneering efforts to redefine the relationship between spectral measurements and nutrient concentration. Their aim is to refine models to ensure the real-time nutrient measurements based on near-infrared spectroscopy (NIRS) are accurate.

THE CHALLENGE

The existing body of research has delved into various methods of assessing plant properties, including the use of ground-based and remote sensors. Ground-based sensors, employing vegetation indices, aim to estimate plant properties, while remote sensors detect stressed plants through electromagnetic wave reflectance data, such as the leaf area index (LAI). However, limitations persist with both sensor types, notably related to canopy reflectance issues caused by atmospheric and soil interference.

To mitigate these challenges, several studies have shifted their focus to leaf-level reflectance analysis to eliminate noise from atmospheric and soil interference. These studies correlate specific wavelengths to chemical analysis of leaves, providing a reference point for nutrient assessment. Different testing modes have been explored, ranging from intact analysis directly in the field to laboratory scanning of fresh removed leaves, and the analysis of dried and ground leaf samples.

Despite progress, challenges remain in predicting foliar nutrients other than nitrogen (N), with deficiencies often diagnosed through destructive methods. Additionally, while studies have successfully estimated leaf nitrogen, phosphorus (P), potassium (K), and micronutrients like iron (Fe) and manganese (Mn) in dried leaves, predicting other nutrients like copper (Cu) and zinc (Zn) remains unreliable.

Furthermore, while some research has explored the estimation of leaf NPK contents using specific wavelength ranges, the impracticality of spectral analysis over petioles persists due to their thin shape.

THE SOLUTION

The research of Dr Al-Mallahi and Ms Abukmeil aims to bridge the gap between leaf spectrum and petiole chemical testing, focusing on establishing correlations between the two. Recent studies have highlighted significant relationships between leaf reflectance and petiole nitrate-N, as well as correlations between petiole nitrate concentration, leaf protein content and chlorophyll content. However, there remains a lack of comparative studies between NIRS results from leaves and petiole chemical testing for nutrients other than N.

In light of these challenges, the overarching goal of their research is to investigate correlations between potato petiole chemical testing and leaf spectral data. This includes an examination of testing modes (dried or fresh leaves) to determine which yields higher correlations at a lab-based level. The analysis encompasses all macro and micronutrients investigated by farmers in Canada, with the ultimate aim of building validated robust models for nutrient assessment in potatoes.

RAPID AND ACCURATE

The research, which commenced in 2020, has now reached a level of first field deployment after expanding the data base to more than 350 samples. In one of the experiments, the researchers collected 45 samples of Russet Burbank potatoes from farms in New Brunswick, Canada, following the standard practice of taking the fourth leaf from the top of the plant for analysis. Each sample included 40 leaves, and data collection took place over five weeks from early July to mid-August 2021.

Spectral analysis was conducted on both fresh and dried leaves using a portable spectrophotometer. After scanning the fresh leaves, they were split in half, dried, ground into powder, and then scanned again. Statistical tests were performed to compare the spectra of fresh and dried leaves, assessing differences in variance and means. The results were analysed using statistical software to determine their significance.

Table 1. Comparison of approaches to assess the nutrients in potato plants in terms of sample size and time required to acquire the results.

Approach	Number of leaves removed per sample	Days to acquire results
Petiole chemical testing (current)	Up to 500	10-12*
Dried leaf lab spectroscopy (future)	20	4-5*
Fresh leaf lab spectroscopy (future)	20	2-3*
Dried leaf in-field spectroscopy (future)	10	1
Fresh leaf in-field spectroscopy (future)	1	0

* Approximate times

The study found that the spectral measurements of both fresh and dried potato leaves showed promising patterns. Peaks in reflectance were observed in the visible and near-infrared regions, with low reflectance in areas where water absorbs light. The reflectance peaks were consistent across fresh and dried leaves, with no significant differences between the spectral sets of leaves, indicating that it only takes one leaf to get an accurate measurement.

Overall, the findings suggest that spectral measurements of potato leaves, whether fresh or dried, provide reliable data for assessing nutrient levels in the plants.

HOW DOES THE SYSTEM WORK?

The sensing system works by connecting the handheld spectrophotometer, which serves as a proxy for assessing nutrient status, to the internet via mobile network. The leaf spectra is subsequently stored in a memory before sending them to a computational cloud. An embedded computational software, aimed at deriving petiole nutrient concentrations analyses the data. Finally, the nutrient values are provided as near real-time result to the end user through SMS messaging.

Dr Al-Mallahi and Ms Abukmeil will launch the sensing system in both fresh and dried modes in July 2024 at the Farms of the Future of McCain Foods in Canada. The launch will allow them to validate the performance of the estimation models and to evaluate the user experience of using rapid nutrient estimation to take informed decisions. This will be one step towards the wide spread of this new technology among potato growers across Canada and globally.

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SPOTLIGHT ON SUSTAINABILITY

Welcome to our new 'Spotlight on Sustainability' series, where we highlight the strides being made towards a greener future.

If you have a topic or question related to sustainability that you would like us to explore, don't hesitate to reach out. Alternatively, if you are doing some great work on your own patch that we could share, please write to us. We love highlighting grower stories!

In this first installment, we are dumpster diving into the world of potato waste. From cutting-edge research to products already on the shelves, our spotlight is on the many uses of potato waste.

Please email your story ideas to info@ahr.com.au

FROM SPUDS TO SOLUTIONS: REPURPOSING POTATO WASTE

Food waste is a hot issue in Australia, resonating with individuals across the country. Nobody likes to see resources go to waste. So what is being done?

Potato waste stems from various sources, from the rejected produce judged not perfect enough for 'Big Grocery', through to the waste generated through the manufacturing process in the form of peels, pulp, and rejects.

Reducing food waste not only addresses environmental sustainability issues, but also yields economic benefits. This symbiotic relationship between sustainability and profitability is increasingly recognised, driving initiatives globally.

Innovative solutions are emerging that convert potato waste into myriad useful products ranging from packaging, fuel and building materials. These developments highlight the creative problem-solving occurring worldwide to tackle the food waste challenge.

BIODEGRADABLE PLASTICS

The inspiring story of Australia's *Great Wrap* illustrates the outcomes possible when innovators and scientists work together to find solutions to complex problems. Plastic waste, along with climate change, are *the* complex problems of our time.

Through clever collaboration, entrepreneurial couple Julia and Jordy Kay teamed up with material scientists to convert potato waste into biodegradable plastic. This wrap is made from potato starch and polymers, using potato waste from food products such as fries and potato chips. With everyone keen to reduce their environmental footprint, biodegradable packaging is making headway into the market despite costing a little extra. With plans and funding to soon open their own biorefinery in Melbourne, the couple hopes that the cost of their clingfilm will soon match conventional plastic products.

Last year, the company launched the world's first biodegradable pallet wrap, available to Australian buyers now and soon to be exported.

Julia commented to *Business News Australia* that although the domestic cling wrap and the pallet wrap are similar, it took plenty of research and development for the pallet wrap to meet the tensile strength requirements for commercial customers.

"The new formula that we'll be launching is made from a combination of cassava and potato waste, and then we've developed a bioplasticiser made from used cooking oil," she said.

"That's been super incredible because we're using another type of waste, but it's also allowed us to get our pricing down to a point where we're comfortable we can compete with petroleum plastic."

Across in the USA, a company from Idaho has also turned to the state's beloved potatoes in a bid to reduce plastic waste.

BioLogiQ founders have developed plant based polymers that used within normal manufacturing processes. Their BioBlend XD products can be partnered with a range of other polymers, including polypropylene and high density polyethylene.

The system converts potato starch into natural resins. These can be blended with partner resins to produce everything from flexible films to hard plastic containers. BioBlends containing 5 to 40% plant based material are not only stable, but can increase material strength, allowing thickness to be reduced.

Inclusion of the BioBlend material also reduces the fossil fuel used. So polyethylene bags containing 25% NuPlastiQ were not only 30% thinner, but used 50% less fossil fuel to manufacture.

Although the blended films are still strong and durable, they provide microbes with relatively easy food sources as part of the matrix.

Great Wrap's potato starch pallet wrap. (Image: greatwrap.com.au)

This means they are more easily composted. For example, blends of 40% NuPlastiQ GP with LLDPE were 91 to 96% broken down (relative to pure cellulose) after approximately one year.

Perhaps next year, potato bags made (partly) of potatoes.

BIOENERGY

Biofuel from potato waste might be the white whale of many growers. Converting crop waste into fuel not only greatly reduces energy costs, but it is the ultimate closed-loop goal. While already used by some European farmers, it has yet to become a widespread viable solution for Australian growers.

As the world seeks alternative energy sources, potato peel waste is likely to play a role in biofuel production. The carbohydrates contained in potato peel can be readily converted into bioethanol through a combination of processes (saccharification, fermentation, and treatment that adds mould and yeast). Bioethanol is a renewable fuel that can be blended with petrol or used independently in vehicles. Studies are still in their early stages but moving fast towards efficiency and improvement, with researchers across the worlds addressing these challenges.

Meanwhile, researchers at the University of Prince Edward Island (UPEI) in Canada are pioneering a novel method for producing hydrogen from waste materials, offering a potentially more sustainable and cost-effective alternative to conventional hydrogen production techniques. Spearheaded by Yulin Hu, an assistant professor in the Faculty of Sustainable Design Engineering at University of Prince Edward Island (UPEI), the project aims to extract hydrogen from diverse waste sources, including used plastics and agricultural residues such as potato peelings.

The process uses a catalyst to break down the waste materials, releasing hydrogen gas. Currently, the research team at UPEI is working to refine the process and scale it up for industrial applications.

BUILDING MATERIALS

Bizarre as it sounds, British innovators have created strong materials based on potato waste.

Researchers at the University of Manchester have created a green alternative to concrete. Designed for space and known as 'StarCrete', it also shows great terrestrial promise.

This innovative material is twice as durable as conventional concrete. The researchers combined potato starch, salt and synthetic Martian soil to yield a concrete-like material, boasting a strength of 72 Megapascals (MPa), surpassing typical concrete's 32 MPa.

Calculations indicate that a 25 kg bag of dried potatoes contains enough starch to produce nearly half a tonne of 'StarCrete'.

Looking ahead, DeakinBio, a startup co-founded by Dr Aled Roberts, Research Fellow at The University of Manchester's Future Biomanufacturing Research Hub, is striving to refine 'StarCrete' for use on Earth. If successfully upscaled, 'StarCrete' could offer a greener alternative to traditional concrete production. Moreover, it can be fabricated in a standard oven or microwave, drastically reducing manufacturing energy costs.

At Cavendish Farms on Prince Edward Island, digesters break down potato waste, producing biogas that fuels the boilers in the company's nearby French fry processing facility. (Image: Pat Martel/CBC)

Block of 'StarCrete', made from potato waste, salt and dust. (Image: designboom)

Staying in the UK, a London-based group have designed an eco-friendly alternative to conventional medium-density fibreboard (MDF) using potato waste. Their innovation, aptly named Chip[s] board, is derived from non-food-grade industrial potato waste, addressing concerns about toxic compounds commonly found in MDF.

Peelings are refined through various processes to create a binding agent, eliminating the need for toxic resins and chemicals. This agent is then applied to fibres including potato skins, bamboo, beer hops, and recycled wood, forming a composite that is heat-pressed into sheets suitable for manufacturing furniture and building materials.

So whatever your need - food, packaging, energy or shelter – potatoes can potentially provide it!

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AUSTRALIA'S -AWARD WINING GIN AND VODKA TURNING POTATOES INTO PROFITS

Ruby Daly checking out local delights at the WPC in Ireland in 2022

Tasmanian farmers the Daly family, frustrated that 20% of their harvest was wasted each year due to cosmetic imperfections, turned frustration into opportunity.

After extensive research, they decided to transform their second-grade potatoes into value-added products. Thus, Daly Potato Co. and Hellfire Bluff Distillery were born.

Daly Potato Co. received a boost from a Regional Jobs and Investment Packages grant, allowing them to establish a facility specialising in ready-made potato products. The venture not only uses the second-grade potatoes but also created 30 new jobs in the local area. Using their popular Nicola potatoes, Daly Potato Co. began producing potato salads, mashed potatoes, and pre-seasoned roasting potatoes, leveraging consumer trust in the variety.

The second venture, Hellfire Bluff Distillery, produces potato vodka and gin. With mentorship from UK-based Chase Distillery, Ruby Daly and her team perfected the recipe just in time for the launch at AgFest 2016.

Both ventures proved successful in achieving their key mission: providing a home for the 20% of second-grade potatoes that would otherwise go to waste. However, regulatory requirements proved challenging and costly to the Daly Potato Co.. The family found a solution by selling the processing function to Pure Foods Tasmania, while still ensuring that Daly Farm remained the sole supplier of second-grade potatoes.

Hellfire Bluff Distillery now consistently wins awards for their innovative spirits. Not only did the distillery pay off its initial investment, but it also became a significant purchaser of second-grade potatoes from Daly Farm.

Ruby Daly's insights underscore the importance of embracing risk, seeking expertise, and empowering the younger generation in agricultural innovation. The Daly family's efforts were recognised nationally when they won the Australian Farmer of the Year Award in 2019, a testament to their innovative approach and commitment to sustainability and community development

Here are Ruby's top three tips for value-adding:

1. Be willing to take a risk to value-add If you don't take a risk and try something new, second-grade or undervalued products will continue going to waste. There is profit in value-adding, so give it a try.

2. If you're not the right person for the job, find the right people to help If you have an excellent idea for a value-add but don't know how to get started, ask for the help of experts or consultants.

3. Let the younger generation have a go: Ruby has found that she has a skill for reading the market and staying ahead of trends. Susie and Gerard have encouraged Ruby's creativity, which has catalysed the distillery's success.

Read the full case study at Growing Country https://growingcountry.com/case-studies/daly-farm-value-add-journey

EYES ON THE WORLD

RECENT ADVANCES IN POTATO RESEARCH AND INNOVATION

Polymer coated urea in 'Russet Burbank' potato: Yield and tuber quality

Taysom, T.W., LeMonte, J.J., Ransom, C.J., Stark, J.C., Hopkins, A.P.
Am. J. Potato Res. (2023). 100:451-463.

WHAT IS IT ABOUT?

It is often said that you need to spend money to make money, and potatoes are no exception. High productivity relies on high nutrient availability, particularly nitrogen (N). This is partly due to their relatively shallow, inefficient root system.

Getting fertiliser into the soil when and where it is needed is a constant challenge. Too little and growth is impaired. Too much and plants develop more canopy than tubers, with the excess N polluting groundwater and/or volatilising into the air.

To overcome this issue, growers may apply 25 to 40% of the total crop N requirements at or before plant emergence. The remainder is applied incrementally during the growing season, either as broadcast fertiliser or fertigation through irrigation. Both increase costs. Nitrogen for fertigation is typically more expensive than broadcast products. Conversely, mechanical spreading uses time and fuel and may damage a developed crop canopy.

Controlled or slow-release sources of N can potentially improve the synchronisation between plant development and availability of nutrients in the soil. Polymer coated urea (PCU) consists of granulated urea with a thin polymer coating. The rate of release depends on soil temperature together with coating thickness.

There have been many studies comparing PCU with traditional N sources for potato production. In all cases yield was similar or increased. However, previous studies were done in relatively high rainfall areas with good soils. This study was conducted in the Pacific Northwest USA, a semi-arid climate with relatively sandy soils - this makes it more analogous to the conditions in some Australian growing areas.

WHAT WAS DONE?

Three commercial grower properties were used for the trials. Four main treatments were applied at each property: control (no added N); PCU applied pre-emergence; urea applied pre-emergence; urea split applied four times over the growing period (50:16.7:16.7:16.7%). Nitrogen was applied at 33, 67, 100 or 133% of the University of Idaho recommended rate for each site. Once plants reached commercial maturity, vines were killed and 6m plots harvested. Tuber size, grade, internal quality and total yield were recorded.

Idaho potatoes (Image by Henry Gartley from Pixabay)

WHAT WAS FOUND?

While yield was reduced in the control (no added N) treatment, differences between the rates of N were generally not significant, so the data was combined.

Yield from PCU was significantly higher than the split applied urea at two of the three locations and significantly higher than urea applied at emergence at one location. Overall, both marketable yield and US No. 1 grade yield were increased by application of PCU compared to the urea based treatments. The proportion of potatoes that were small (114-170g), medium (170-284g), large (284-397g) or extra-large (>397g) was relatively unaffected by the N application method. However, there was a clear increase in small potatoes in the unfertilised controls. Specific gravity and physiological disorders were unaffected by N fertilisation.

The study demonstrates that application of PCU at emergence provides an efficient source of N for Russet Burbank potatoes grown with low rainfall in sandy, calcareous alkaline soils. While PCU is more expensive than urea, this may be offset by lower application costs, particularly where split applications are difficult to achieve.

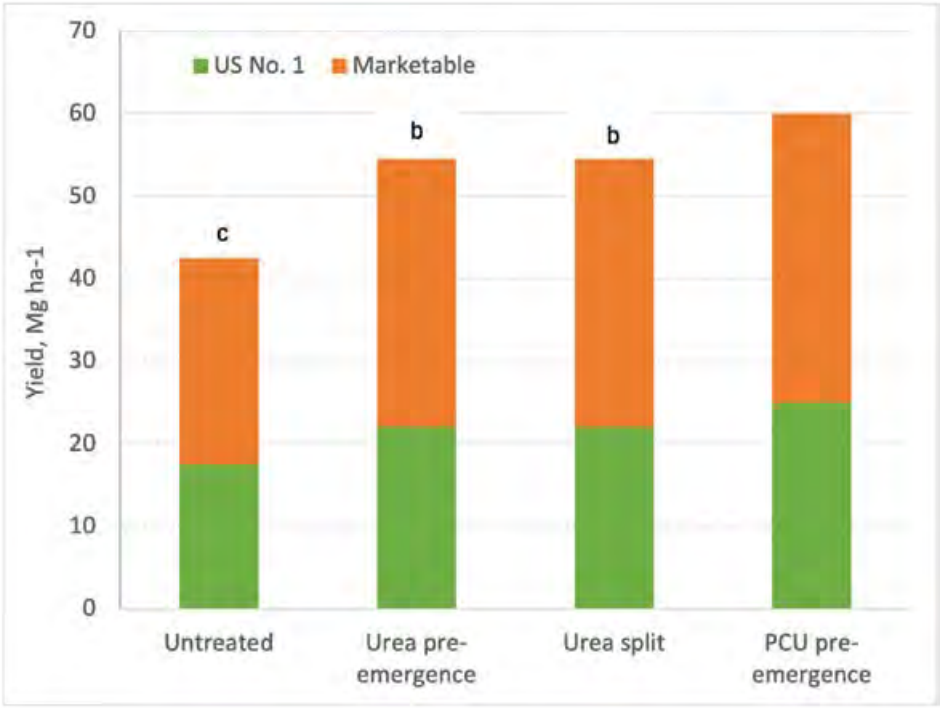

Figure 1. Yield of US No. 1 and marketable Russet Burbank potatoes, averaged across three locations and four N rates for different N sources (urea applied pre-emergence, urea split over 4 applications and polymer coated urea (PCU)) relative to an untreated control. Letters indicate values that are significantly different ($p<0.05$). Derived from Taysom et al, 2023.

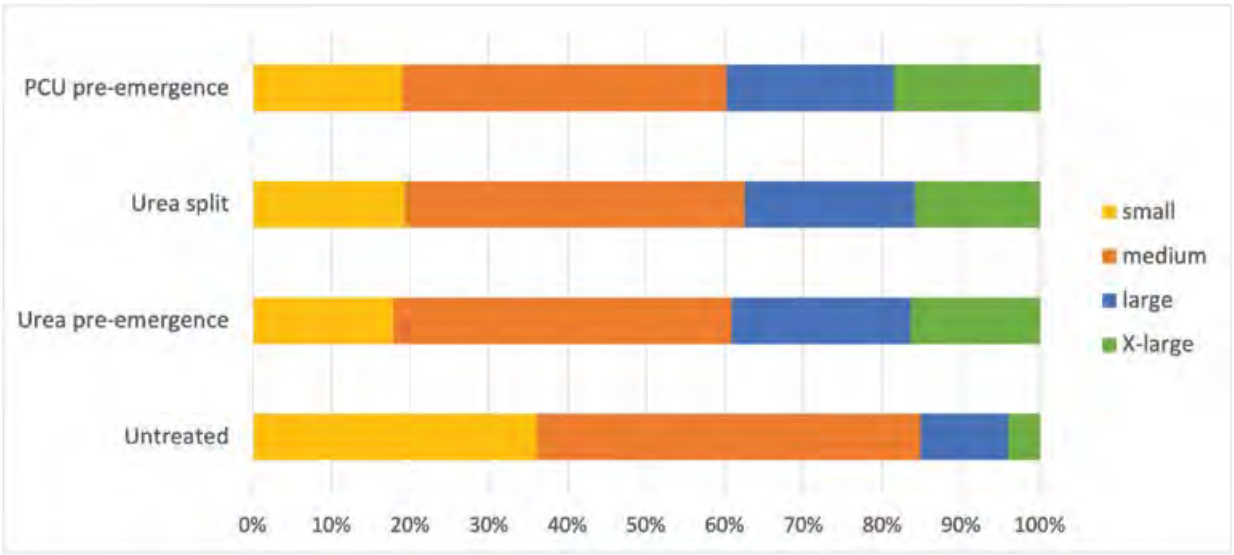

Figure 2. Proportion of yield of US No 1 grade potatoes falling within each size grade being small (114-170g), medium (170-284g), large (284-397g) or extra-large (>397g). Data averaged across three locations and four N rates for different N sources (urea applied pre-emergence, urea split over 4 applications and polymer coated urea (PCU)) relative to an untreated control. Derived from Taysom et al, 2023.

POTATOLINK BULLETIN

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AUSTRALIAN POTATO INDUSTRY
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vegnet update

National Vegetable Extension Network
VegNET

AUSVEG Hort Innovation VEGETABLE FUND

VegNET is funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government.

NATIONAL

VegNET Overview

VegNET is the vegetable industry extension program that is run by growers, for growers and delivered by AUSVEG.

The program aims to keep Australian vegetable growers informed about current R&D activities, results and resources – supporting the adoption of industry best practice and bolstering vegetable productivity and profitability in key growing areas across the country.

Coordinated nationally by AUSVEG, VegNET is delivered 'on-the ground' by regional development officers (RDOs) in key vegetable-growing regions who are responsible for developing and executing regional extension plans.

A critical step in ensuring growers receive assistance is the identification of each region's key priority issues, resources and connections requirements.

The most common challenges identified in consultation with industry are:

- Water (availability, quality and cost)
- Labour (availability, awards, HR and skills)
- Input costs
- Biosecurity
- Pest management
- Market development (including export)
- Post-harvest and marketing
- Urban encroachment
- Social license (environmental impact and chemical (mis)usage)
- Business management.

Now in **Phase Three,** the VegNET program is running with RDOs based in organisations with strong grower networks in vegetable production regions.

The program is overseen by a National Coordinator, who works with each regional group to ensure growers have consistent access to an industry-focused extension program that will put their needs first in their efforts to be productive, profitable and more competitive in an ever-increasingly global marketplace.

In 2016 Hort Innovation invested in ten regional capacity building projects to effectively transfer R&D information to vegetable growers through regionally-based extension projects and associated coordination and training projects. These projects were contracted to delivery partners based in the ten major vegetable growing regions and were unified under a national brand – VegNET.

Phase One The first phase of VegNET finished in early 2020, with the regional development officers (RDOs) delivering R&D awareness and extension activities in their geographical regions.

Phase Two The second phase of VegNET finished in September 2021, and resulted in each region developing regional priority areas for extension. These regional priorities were collated into national priority areas to inform a national extension program that is nationally-consistent and regionally-specific.

VegNET is funded by Hort Innovation, using the vegetable research and development levy and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

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Above L-R. Gippsland RDO Emily Scott at the recent drone spraying demonstration. The demonstration included Syngenta outlining chemical usage in drones.

Drone spraying demo showcases value of VegNET events for growers

The VegNET RDO role is varied and aims to help growers develop a more sustainable, healthy business.

A recent drone demonstration in Victoria run by VegNET Gippsland highlighted the role a VegNET regional development officer (RDO) plays in bringing information and knowledge to the local grower community.

Organised by Gippsland RDO Emily Scott, based with Food and Fibre Gippsland, the recent drone spraying demonstration night aimed to give growers a firsthand look at the technology and how it can be applied on farm.

Hosted on the Middle Tarwin property of third-generation growers Schreurs & Sons, the drone demonstration was sponsored by Syngenta and E.E. Muir & Sons. The event demonstrated that spraying can be achieved without disturbance to soil and crops. In turn, the potential for greater efficiencies in chemical use and labour, as well as a safer operating environment for workers and disease management was highlighted.

"As a VegNET RDO, my role is to help growers in any way they want to be helped and provide them with the resources they need," said Emily.

"Gippsland growers had a tough summer, with significant rain events that put a lot of crops at risk. Using a drone means that nutrients can still be delivered to crops when it is unsafe for workers and tractors to be in the field. It has been a catalyst for growers to learn more about drone technology."

Events form a cornerstone for VegNET RDOs to bring together growers and industry partners to increase knowledge and awareness of the latest R&D and technology, and to give an opportunity for networking and learning.

VegNET National Coordinator Cherry Emerick says that each RDO works with their regional partners and Regional Extension Advisory Group (REAG) annually to review and determine what the priorities are for the coming year as well as leaving scope for unforeseen issues such as biosecurity risks.

"Each region is different, with different issues. As a group, we see ourselves as a knowledge broker and conduit between R&D and the grower," says Cherry.

"Events such as the drone demonstration night are about getting growers together to showcase how AgTech can enhance their business with the opportunity to speak with suppliers and other growers who have made the investment. We aim to support them, listen and deliver greater knowledge. A lot of growers spend time in their business, but not on it, so events like this are invaluable."

Host for the drone demonstration, Adam Schreurs, co-director of Schreurs & Sons at Middle Tarwin, said that hosting the event was in part to measure for himself the performance of drone spraying that the business had been running for two years, but also to give other growers an opportunity to see the system in use firsthand and ask questions of the experts.

"I've been to quite a few VegNET field days and seminars, and find them valuable, you always learn something new to take back to the farm," he said.

"It might be a refresher of something you are already doing, or like the drones, new technology. It also gives growers a chance to socialise and learn from each other – the positives and the mistakes.

"We will continue to look at drones on farm to minimise the machinery movement around the crops for disease management, as well as for worker safety. It's a great system for spraying as far as I'm concerned."

Learn more about the drone spraying demonstration with VegNET Gippsland RDO Emily Scott on page 141.

VegNET National Coordinator Cherry Emerick

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Hort Innovation VEGETABLE FUND

VEGNET

Northern Territory

REGIONAL UPDATE

Above. Compost trial grower.

FIND OUT MORE

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Hort Innovation VEGETABLE FUND

VegNET farm trials in the Northern Territory

A key component of the VegNET project in the Northern Territory (NT) is farm trials. Farm trials allow the growers to trial concepts, technology, or management systems on farm before they invest in them fully.

During 2023/24, five farm trials have been completed or are set to take place; compost, hydroponics, cover cropping and bird control laser. The selection of each trial activity was based on grower feedback, current research and/or a solution to a production challenge.

Compost trial

In 2023 local commercial certified compost was available in the NT for the first time. VegNET worked with three growers wanting to trial the compost on their vegetable farms to monitor the impacts of the compost on soil health with the intent to share this information with other growers. Soil tests were taken prior and after applying compost to test for improvements in the soil as well as seek feedback from the growers on any visual improvements.

The soil tests from two out of the three trial farms showed that applying compost to soil improved their Cation Exchange Capacity (CEC) and organic matter considerably. The CEC of soil explains the soils' ability to hold essential nutrients. The higher the CEC, the greater the soil's ability to hold onto essential nutrients and provide a buffer against soil acidification. Organic matter assists in maintaining soil structure, the supply and retention of nutrients, soil life and water retention. Essentially, organic matter can greatly improve the health of soil and therefore have an impact on the plants grown from that soil.

Grower observations

The owner and manager of Farm 1 applied compost to an okra paddock and noted that it appeared less stressed and an increase in the up-take of fertiliser compared to other okra paddocks without compost. This grower also considers other soil management techniques

Hydroponic trial - growing area.

he applied to the paddock alongside his compost through consultation with an agronomist.

The owner and manager of Farm 2 found a considerable improvement in his crop since applying compost. He has found he has a longer harvesting window with a stronger and healthier crop. He also found he used slightly less fertiliser than the paddock without compost.

Farm 3, although seeing no change in their soil results, has seen an improvement in their crop. They feel investing in their soil is important and will consider topping up compost every two years.

Hydroponic trial

Since 2023, VegNET has been working with a grower to trial a simple hydroponic system to grow cucumbers. VegNET's goal with this trial is to create extension material including case studies, short videos, and one on one grower visits to the trial to increase grower awareness of how hydroponics works and what a simple hydroponic setup in the NT may look like. A case study on the trial was been provided to growers in December 2023 and a short video detailing how the system works is intended to be completed in the coming months.

Cover cropping trial

VegNET have partnered with Soil Wealth ICP and a vegetable grower to trial cover crops on farm. Most Asian vegetables are seeded by hand - finding a way to seed a cover crop without a seeder is necessary to increase adoption across farms.

The trial is looking at utilising a fertiliser spreader, as a means of seeding, whilst still achieving the desired seeding rate and spread. Another element of the trial is to explore what crop combinations are best to plant for the outer Darwin area.

As particular pest and disease concerns change throughout the year, cover crop species will vary. For this trial a combination of sunn hemp, sorghum and radish will be used. Time of planting is also another consideration the trial will be looking at, with one planting undertaken at the end of the wet season (February 2024). The second cover crop will be planted early in the next wet season (December) once the commercial crop is complete. Cover cropping is not a new concept however refining the seeding method, time of planting and crop species will help to improve outcomes and adoption. VegNET will track the trial through visual observations and soil test results.

Wildlife control

Bird

Birds can be a significant pest on vegetable farms in the NT, particularly on vegetable farms that also grow mangoes and tropical fruit. To combat the damage and financial losses pest birds have on horticultural crops, VegNET partnered with Bird Control Group to trial an automated laser on a vegetable and mango farm which has problems with birds. The trial will take place in the 2024 dry season with particular focus on how the laser responds in high UV environments and heat, and importantly, its ability to reduce pest presence and damage to produce.

Wallabies

In 2024 VegNET is initiating an electric fencing trial on a vegetable farm in the Katherine region to control damage to crops from Wallabies. Exclusion fencing is common in this area, however, is costly to install and maintain. This trial will be looking into the success of an electric fence system to see if the system successfully decreases the amount of pest damage to the farms pumpkin crop. The trial is likely to compare a more permanent but simple hard wire electric fence system and a portable electric tape system. Having a system that can easily be taken out and moved is ideal for nature management however durability is also required. In previous years the wallabies have damaged up to 100% of their pumpkin crop so it will be very interesting to see how the electric fencing goes!

QUEENSLAND
FAR NORTH

VEGNET FAR NORTH
Queensland
REGIONAL UPDATE

Empowering agricultural communities:
Insights from BGGA's Workshops

In a challenging agricultural landscape where digital innovation and market dynamics shape the future, Bowen Gumlu Growers Association (BGGA) recently hosted a series of workshops addressing two critical areas: 'Domestic and Export Opportunities' and 'Cyber and Data Security'.

The events garnered strong attendance, drawing in a wide range of growers and industry experts eager to navigate the complexities of safeguarding digital assets and exploring new market horizons within the agricultural sector.

The workshops featured distinguished guest speakers, including representatives from renowned institutions such as the Commonwealth Bank, Rabobank, as well as experts from the National Farm Data Panel, AUSVEG, and Bytewise IT. Each speaker brought unique insights and experiences to the table, enriching the discussions with their knowledge and expertise.

Throughout the sessions, participants actively engaged in discussions and interactive presentations. Attendees posed a wide range of questions, gaining valuable insights into emerging threats and best practices for mitigating risks associated with cyber and data security in farming operations.

A highlight of the workshops was the comprehensive overview provided by Adrian Roles from the National Farm Data Panel. Adrian's presentation delved into the evolving landscape of data security regulations and compliance standards, empowering farmers with the knowledge needed to navigate the complexities of managing farm data responsibly.

Similarly, Owen Land from Bytewise shared his insights into cutting-edge cybersecurity technologies and strategies tailored specifically for agricultural businesses. His talk underscored the importance of implementing robust security measures to protect sensitive data and infrastructure from cyber threats.

Shakira Johnson from AUSVEG provided valuable insights into domestic and export markets, offering strategies for managing commodities in a challenging domestic market and exploring opportunities abroad through AUSVEG's export programs.

Meanwhile, Brad Pozzi from Rabobank offered regional and national forecasts on locally grown produce, providing valuable insights into market trends over the past decade.

As the workshops concluded, it became evident that there is much work to be done to ensure farmers are up to date with the latest developments in rapidly evolving markets and cyber and data security. However, with the valuable insights gained from the workshops and the commitment of participants, there was a sense of optimism that BGGA members would be up to the challenges lad lay ahead to ensure their digital assets are well protected.

Above L-R. Participants from the series of workshops 'Cyber and Data Security' and 'Domestic and Export Opportunities'

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VEGNET VICTORIA
Gippsland
REGIONAL UPDATE

The role of spray drones in vegetable farming

Drone technology is showing itself to be a leader in the Agtech space and a versatile tool in vegetable farming.

From weed detection and monitoring of crop health and yield, to the spraying of chemicals and fertilisers, drones have the potential for enhanced crop management, improved efficiencies and productivity.

VegNET Gippsland, in partnership with Schreurs & Sons, Syngenta, and E.E. Muir & Sons hosted a drone spray demonstration night in April 2024. The event enabled Gippsland vegetable growers to witness a direct in-field comparison between conventional tractor mounted spray applications and new drone mounted technology. The event provided around 60 attendees with an opportunity to see spray drones in action and learn about the regulations and practicalities of utilising spray drones in intensive vegetable production.

Tailored event

Drones are of significant interest to Victorian vegetable growers following a very wet summer that saw substantial crop losses due to extended periods of restricted field access. Staff from 14 vegetable farms attended the event for a drone demonstration, technical presentation, networking BBQ, and a field walk.

The event kicked off with a drone spray demonstration featuring the latest model from Jamin Fleming at Oztech Drones. Jamin, alongside Adam Schreurs and Danny Rickard from Schreurs & Sons, provided practical information on the use of spray drones in vegetable farming.

Len Ibbotson from Syngenta led a technical discussion around the regulations associated with drone use for spraying chemicals. Following the BBQ and networking session there was a night-time field walk through snow pea tendrils and a celery crop, using UV light to compare the differences between tractor mounted and drone spray applications.

Above L-R. Spray drone demonstration night at Schreurs & Sons. Danny Rickard and Jamin Fleming giving a drone demonstration

Spray drone demonstration and smart phone interface (inset).

The benefits

Precision agriculture through drone technology can provide not only increased efficiencies, but also reduce fertiliser, chemical and water usage, delivering environmental and cost benefits. Unlike conventional tractor applications, drones can safely apply fertiliser to crops when vehicle access is restricted by water or mud.

A significant number of attendees commented that they saw accessibility during wet conditions as a primary benefit of the technology and the key reason they were interested in purchasing a drone.

The use of spray drones can decrease the number of tractor passes, reducing the impact on crops, wheel ruts, mud splatter, soil compaction and the spread of disease. Adam noted that disease was a key factor in Schreurs & Sons' decision to go airborne.

"We could see a physical pattern where the tractor had gone, moving the disease around the paddock," he explained. "We had no diseases, no issues at all following the change. I was impressed straight away," said Adam after he switched to drones.

The effective automation of a manual process can reduce labour requirements and speed up application. An easy-to-use smartphone app allows for accurate site-specific programming, with automatic or manual operation available.

"We average around eight hectares per hour with the drone, which is about the same as we get with a ground rig," said Adam.

Len identified that using the right product was half the solution to successful crop protection, with optimal timing and the correct application technique also essential for exceptional results. Spray drift, droplet size, swath width, water rate, and evaporation rate are key considerations when using spray drones.

"Products that don't have any mention of aircraft or aerial application on the label cannot be put through a drone," stated Len. "As the type of technology changes, the regulations need to change; we need to be future-proofing products that are being introduced now."

Danny stressed that the key to efficiency was having a good set-up for transporting, charging, and refilling the drone. "I can't emphasise enough the need to have a good setup. Don't skimp, go bigger; have a good mixing vat, make sure the chemicals are mixed well," he said.

Weight was also a highlight. Drones are becoming lighter and more easily managed by one person, with removable batteries and tank, and foldable props. With advanced technology, batteries are also lasting longer and charging faster.

Drones can be adapted to hold a seeder that can distribute granular fertiliser, seed and beneficials for integrated pest management. Powdered products can also be used in a spray drone through pre-mixing and good agitation.

"We are finding more and more uses for it," said Adam. "Initially it was just fungicides and insecticides, but now we are applying herbicides with it as well."

Left. Len Ibbotson from Syngenta outlining chemical usage in drones.

Top L-R. Jamin Fleming explaining the features of a spray drone. UV dye spray patterns on celery, snow-pea tendrils (inset).

Conclusions

Following the field walk, both Danny and Adam were surprised at the effectiveness of the drone in the celery crop.

"The celery, I was surprised and impressed," said Adam. "One hundred litres per hectare with the drone compared to 250 litres per hectare with the spray boom, to me, it was the equivalent job, if not a little bit better with the drone."

Danny added, "It got rained on a little bit. I was surprised, the top of the leaf didn't run or get smeared as much as I thought. I'm super impressed at how much the droplets penetrated the bottom canopy of the celery.

"The drone produces more disturbance from the airflow. If you look at the top-leaf of the celery, there were droplets on both sides of the leaf, which is better," Danny said.

It was clear throughout the drone spray demonstration night that being able to see a spray drone in action and hear directly from those using it, took drones from a concept to something that is well within reach for many growers. One attendee noted that they saw drones as being very practical and viable in the vegetable industry, while others noted the efficiency gains and coverage.

Qualitative feedback showed that there was, on average, an 80 per cent increase in attendees' knowledge and skills. Additionally, responses indicated a 90 per cent increase in awareness associated with drone spray technology following the event. One attendee stated, "the event was far more in-depth than I expected; well worth the time." Another noted, "it was very well done and informative and nice to see farmers get together over common interests."

The benefits of spray drone technology were clear to attendees, with 90 per cent of those who completed the feedback form stating that they would likely change farm practices due to the event, with a significant number of growers stating that they plan to hire or purchase a drone.

Special thanks to Len Ibbotson from Syngenta, Jamin Fleming from Oztech Drones, E.E. Muir & Sons, and Adam Schreurs and Danny Rickard from Schreurs & Sons.

The Civil Aviation Safety Authority (CASA) is the regulatory body. Drones (or Unmanned Aerial Vehicle – UAV or Remote Piloted Aircraft (RPA)) for agricultural purposes need to be registered prior to use. A Remote Pilot Licence (RePL) is also required, obtainable through CASA. Consideration of restricted airspace also needs to be considered.

For more information visit casa.gov.au/drones

The Australian Pesticides and Veterinary Medicines Authority (APVMA) regulates the use of agricultural chemical products in Australia. Chemical safety is a key consideration as drone technology means operators are handling chemicals in much higher concentrations than they normally would.

"It is not just your own safety, but your team's safety, your crops' safety and your neighbours' as well," emphasised Len.

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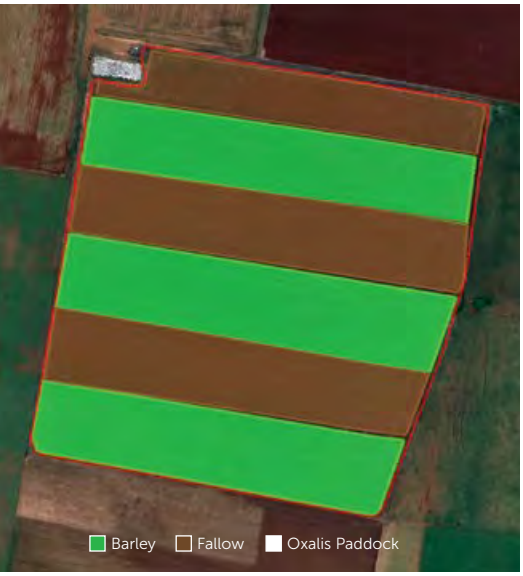
VEGNET
Tasmania
REGIONAL UPDATE

Oxalis – What have we learned?

In the Winter 2023 edition of Australian Grower, VegNET Tasmania presented a story on the significant weed threat to Tasmanian cropping systems of *Oxalis latifolia*, commonly known as fish-tail sorrel or pink sorrel. Following a field walk last season the impacted paddock has been used as a testing site for some potential management options.



Top. The demonstration paddock. Although it made for a pretty patchwork view from on top of the hill, achieving good management of the weed issue proved challenging.

Above. Site plan - Oxalis Paddock. To determine the efficacy of herbicide management of Oxalis latifolia in crop and in fallow.

Oxalis is a perennial weed but is often mistaken for an annual weed. It spreads vigorously through its corms (small bulb-like structures), hitching rides on machinery, shoes, and vehicles. Cultivation is the main cause of a paddock infestation, as each corm can set dozens of bulbils (small baby corms) in a season, which break off the main corm and further spread in the paddock.

As a result 'an ounce of prevention is worth a pound of cure'. For Tasmanian rotations through good biosecurity practices to prevent infestation should be the focus. Once the weed has infested a paddock, isolating, and treating affected patches is the best response. Addressing areas requiring intensive control will ensure the control is more effective and reduce the cost.

Although there are a range of herbicides available, these primarily work only to defoliate the plant. To kill the corm and cease further germination requires careful timing, with glyphosate being most effective between the four to five leaf stage. Pre-emergent herbicides have shown some efficacy to reduce corm germination, but in Tasmania potential plant-back issues for other crops need to be considered when selecting control measures.

The overall discussion at the field walk was that to get on top of Oxalis will requires will require multiple modes of control in every year and every rotation, to avoid a 'stop cropping' situation.

Treatment this season

The field walk paddock in 2023 remained fallow for that winter, with the prospect of remaining fallow through the summer. The grower offered to leave the paddock fallow through summer to facilitate a strip trial or demonstration. Horticultural cropping ground on the north-west coast of Tasmania is expensive, however, so the decision to crop spring barley was made while achieving an acceptable control of the weed. Spring barley lent itself as a potential option for a few reasons:

- There is a good range of herbicide options for *Oxalis latifolia* in barley.
- Inputs are minimal, reducing the risks for the grower.
- Crop management is relatively simple, also reducing the commitment and risk for the grower.
- Barley can function as a cover crop.

Above L-R. The strip of barley alongside the fallow strip. The plant doesn't care whether you want it to germinate evenly or not. A plant in flower while some had not even germinated.

The treatments were set up in three spray run widths (refer to trial set-up image) across the paddock to capture the variability in weed burden and soil type across the paddock. The barley was dry sown quite late, in November. The grower found it difficult to manage the paddock due to the drier spring/summer compared with previous seasons. With limited irrigation capacity and other higher priority vegetable crops to maintain there was no irrigation applied to the paddock.

The dry conditions caused difficulties in controlling the Oxalis. Firstly by reducing the activity of the applied pre-emergent. Secondly the germination of the Oxalis was uneven, meaning that it was harder to time the application of the post-emergent herbicides to kill off the corms.

To manage the oxalis effectively, the grower said, "[a] good moisture level to get the bulbs germinating evenly. Make sure you are watching it carefully to get the timing right to get the bulbs to die at the right stage."

Where the glyphosate was applied in the fallow strips, the plants that were at the correct timing were completely killed. Due to logistical difficulties of managing the barley this spring, the control in the crop strips was worse than the control in the fallow strips.

Lessons learned

This season's experience has informed the grower and agronomist to focus on utilising the paddock through winter, so that it can be left fallow through summer. In most cases fodder or grain crops are the only option for winter cropping that will allow good fallow management in the summer. Depending on the season, these crops offer limited margins compared with other options available in the rich red soil of north-west Tasmania. The grower was offered a lease for the ground to grow broccoli through the winter for this upcoming season, which will provide a better return than could be achieved with a fodder or winter grain crop.

Right. Corm germinated from depth, showing difficulty of achieving even germination.

"Hopefully broccoli means that I can get the crop out in enough time to manage the oxalis over the summer period when its active to get a bit of money coming in," said the grower.

Leasing the paddock for a winter cash crop means that the grower can meet his financial obligations for that piece of land and fund the treatment of the weed issue throughout the summer fallow period. The transplanted broccoli is already up and away while the oxalis is dormant until spring.

Above. Transplanted broccoli which will be harvested in spring.
Left Inset. Corm and bulbils destroyed after a glyphosate application at the right timing.
Below. A survivor on the surface set many bulbils saving its energy for next spring.

"We need to do more research on this weed because it's going to be a big problem for more and more people every year." said the grower.

Leaving a paddock fallow to control Oxalis will unfortunately run the risk of erosion and cause loss of organic matter. Therefore, the focus has to be on avoidance via good farm hygiene.

While this season threw up some challenges that impacted this paddock between the work of the grower and the agronomist, with support from VegNET, we have more knowledge on managing this weed now than we did 12 months ago. These lessons will continue to be built on as we progress with this work.

As a final comment for other growers our grower said, "better to take a small patch out of production early than to let it get away."

The Tasmanian Institute of Agriculture currently have a PhD candidate researching the systematic weed management with a focus on Oxalis through the Hort Frontiers program *Sustainably Growing horticulture value in cool climate Australia* (AS20004). This research will yield some insights into more effective treatments that can be applied in the Tasmanian cropping system.

"better to take a small patch out of production early than to let it get away."

FIND OUT MORE

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WESTERN AUSTRALIA

VEGNET

Western Australia

REGIONAL UPDATE

Benchmark Roadshow

Monitoring performance metrics for horticultural management success

Horticultural benchmarking in Western Australia is set to land another milestone in the coming month with the release of the seventh set of annual horticultural benchmark and the first national vegetable and onion benchmark.

What started back in 2017 with vegetablesWA and Planfarm, with funding from DPIRD and Hort Innovation Australia, the Building Horticulture Business Capacity program (BHBC), has made its mark on horticulture with the launch of the *National Vegetable and Onion Benchmarking Program, Level Up Hort (MT22009)*, in 2023.

The WA Building Horticulture Business Capacity program will draw to a close in June this year, after building a databank of seven years of horticulture benchmarks. The Vegetable and Onion Benchmarking Program will run until 2028. The first set of National Vegetable and Onion Benchmarks will be released in June at Hort Connections and a series of workshops will be held throughout Australia in the coming months to showcase the benchmark data to horticultural producers and support industries.

Insights gained from the WA BHBC program will be regionally circulated through up-coming VegNET Business Capacity Costs and Labor extension activities planned for both priority project focus areas - business capacity and input use efficiency. The release of both sets of benchmarks is set to confirm a substantive shift in horticulture in Australia with increasing costs, lower returns and a tightening of margins.

What the benchmarks have highlighted over the years, and this year will be no exception, is that the horticultural businesses which are the strongest performers, year in and year out, are those where management has the ability to maximise income per hectare, while keeping their costs (as a percentage of vegetable income) below 65 per cent, which delivers greater returns per hectare.

Key findings

The key findings that the past seven years data has shown include:

- Increasing saleable yield per hectare directly increases income and profit per hectare.
- A higher price per unit of product sold alone, does not drive higher profit per hectare.
- For the top performing producers (determined by profit per hectare), a higher labour cost per hectare often translates into higher income per hectare, however, overall labour costs (as a percentage of income) is lower – the increase in income counteracts the higher operating labour cost.
- Small reductions across a range of operating costs per hectare directly increase profit per hectare – a focus on small changes over several large cost items cumulates into significant operating cost savings.
- Size of land farmed does not directly influence profit per hectare.
- Producers with a focus on management timing, production planning and financial management more often produce higher profit per hectare.
- Location of the farm did not affect profit per hectare.
- The type of fruit or vegetable grown does not directly influence profit per hectare.

Bryn Edwards presented the BHBC Benchmark data at Guilderton WA.

Business efficiency

What these key findings ultimately point towards is business efficiency. It is about the management of the horticultural business and management's ability to know and monitor their performance metrics and continually improve to drive better efficiencies throughout many areas of the business that need focus.

When it comes to key costs, the better performing horticultural businesses do not necessarily have the lowest cost per hectare profile. Rather, they invest resources (time, energy, money) into areas of the business that deliver higher income per hectare and at more efficient levels. They make more income for the operating costs they deploy.

Growers who have participated in the projects will receive a confidential one-on-one business analysis culminating in a report indicating the business performance on key ratios and business metrics. They also receive an individual grower benchmark report, where data is stacked against all other growers in the respective benchmark dataset.

This enables growers to gauge their business performance relative to others in the benchmark program. It will highlight to them where others can gain greater efficiencies and assist with internal goal setting and targets to aim for with their business performance.

Benchmark roadshow

A series of workshops will be held throughout Australia in the coming months to showcase the benchmark data to horticultural producers and support industries. Planfarm is available to help businesses and industry bodies gain greater insights into key performance drivers and for them to use the benchmark data to advocate for their needs.

For Level Up Hort growers, in the next five years, carbon emissions for interested growers will be captured. We will be keen to know what data you already have that could be leveraged to calculate emissions. The messaging throughout the industry suggests that all businesses along the supply chain will need to have baseline carbon emissions data for market access within the next few years to comply with market and legislative reporting requirements.

Year on year data will improve your baseline data and assist you in implementing systems to capture, calculate and report your emissions. It will also help you to be part of the conversation about what methodology and reporting format is adopted if you start now.

Hort Innovation VEGETABLE FUND

Hort Innovation ONION FUND

FIND OUT MORE

Please contact Katrina Hill on 0427 373 037 or email katrina.hill@vegetableswa.com.au

VG21000 VegNET 3.0 is a strategic levy investment under the Hort Innovation Vegetable Fund.

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Project Number: VG21000

If you would like to talk to Planfarm about service offerings and joining the Level Up Hort program, head to our website planfarm.com.au or call project manager, Steff Carstairs 0428 712 852.

The Building Horticulture Business Capacity project is funded by The Department of Primary Industries and Regional Development, Hort Innovation Frontiers Leadership Funds and Agricultural Produce Commission pome and vegetables sub committees.

VEGNET

Wide Bay Burnett

REGIONAL UPDATE

Workshops, workshops, and more workshops!

VegNET Regional Development Officer (RDO) Jessy Logan has had a busy couple of months with three workshops being delivered. The first event was the Soil Management workshop which was held on-farm at Baldwin Produce and supported by the Soil Wealth ICP and Australian Horticulture Research team. Attendees heard Dr Kelvin Montague speak about soil management practises that help maximise crop returns through improved health and input use efficiencies. There were several topics discussed which aid in improved soil health including reduced tillage, building soil organic matter, structure, and infiltration through well timed rotations and understanding how soil biology works.

We were also fortunate to see an in-field demonstration of the Horsch Cultro TC – double knife roller which showed how it effectively lays and chops forage sorghum in the field. The day received positive feedback from those participating.
For anyone looking for some additional info around soil management, they can explore the Soil Wealth ICP website at soilwealth.com.au.

The Bugs & Bites Workshop hosted by VegNET in partnership with FMC, on site at the Department of Agriculture Research facility located in Kalkie. The day kicked off with a networking BBQ lunch where participants were able to catch up with each other and discuss current happenings. The first session was with Integrated Pest Management (IPM) specialist Dr Paul Horne and Rebecca Addison who discussed IPM strategies to managed key pests of interest to the group.

The group heard from Biosecurity guru Shakira Johnson from AUSVEG on practical strategies you can put in place to minimise the risk of pest/disease incursions across farms. The day ended with a field walk to put skills to the test in identifying beneficial insects under the watchful guide of Dr Paul Horne and Rebecca Addison. For those looking for any advice in the IPM space, you can reach out to direct to Dr Paul Horne M: 0419 891 575 e: paul@ipmtechnologies.com.au or Rebecca Addison M: 0422 365 478 E: rebecca@ipmtechnologies.com.au. For anyone looking for advice with Biosecurity risk pathways on farm, they can contact Shakira Johnson at M: 0433 937 564 E: Shakira.johnson@ausveg.com.au.

The last workshop facilitated by VegNET was the Authorised Inspection Person Training, which saw nine participants join Department of Agriculture and Fisheries Market Access expert Tim Fischer to upskill in the inspection and identification of suspect melon thrips. The group was able to finish all theory exercises and pass their practical tasks. We look forward to seeing these newly trained participants put their skills to the test for the ICA38 Accredited Businesses they work for.

It was great to offer a diverse series of workshops which tie in with multiple regional focus areas of the Wide Bay Burnett VegNET project including sustainable farming practises; reducing input costs; and biosecurity/pest management.

Top. Group shot at Soil Management Workshop. **Below.** Group shot at Bugs & Bites Workshop.

FIND OUT MORE

Please contact Jessy Logan on 0407 366 797 or email VegNET@bfvg.com.au

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Hort Innovation VEGETABLE FUND

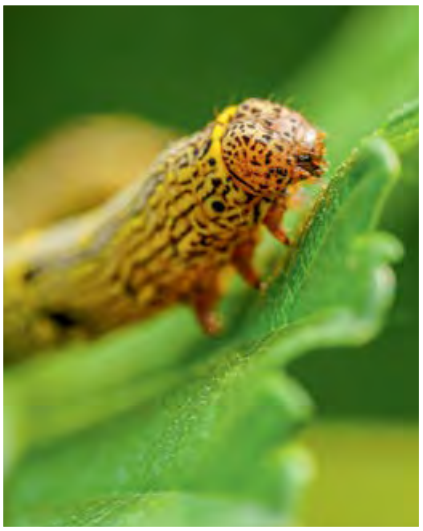
NEW SOUTH WALES

VEGNET

New South Wales

REGIONAL UPDATE

A round up of all things VegNET NSW



Top. Dr Ramesh Puri from Queensland DAF studying Fall armyworm affected corn at the field day in Richmond NSW in March.
Inset. Fall armyworm detail.

We have been busily running workshops, field days, creating videos, planning for food safety changes and up coming Innovation Fund projects.

Food safety changes on the horizon

With the introduction of the Food Standards Australia New Zealand's (FSANZ) Primary Production and Processing Standard for Leafy Vegetables, Berries and Melons coming into effect in February 2025, VegNET NSW has been working with NSW Department of Primary Industries' (NSW DPI) Food Safety Team in planning extension activities to get the message out to all grower groups in NSW.

As part of the Industry Outreach Strategy for Food Safety Standards initiative funded by NSW DPI in 2022, the Fresh Produce Safety Centre developed 13 Food Safety Grower Guides to fill recognised gaps in industry resources for small growers. The guides provide key information and best practice guidance on food safety for fresh produce growers, from pre-harvest to post-harvest activities and will also help growers adopt practices that will ensure compliance. They are available in English, Arabic, Punjabi, Traditional Chinese, Chinese Simplified and Vietnamese and can be downloaded at fpsc-anz.com/food-safety-grower-guides.

Storm and flood industry recovery project events

The VegNET NSW team has joined forces with AUSVEG in delivering the Storm and Flood Industry Recovery Project in Building Biosecurity Capacity and Resilience, headed by Rosalie Daniel AUSVEG's biosecurity coordinator and Marguerite White (ICD Project Services). The NSW Vegetable Biosecurity Community of Practice was developed to bring together grower champions and advisers who are providing on-farm advisory services to vegetable growers in agronomy, soil and fertility management (organic or in-organic fertiliser), irrigation management, and pest and disease control (IPDM and/or chemical spraying advice).

The project aims to:

- Deliver a significant step-change in the use of on-farm biosecurity measures by providing practical information on both proactive and responsive best management practices.

Above. Dr Melina Miles from Queensland DAF presenting on Fall Armyworm at the field day in Richmond NSW in March. **Below.** Hands on demonstration at the field day in Richmond NSW in March.

- Build a vegetable specific surveillance program across growing regions, engaging with key private, commercial and agency on-farm advisers, to encourage monitoring and exchange of information on pest and disease pressures.
- Develop a pest and disease diagnostics program to support the surveillance program and evaluate the value to industry of early detection.

We have hosted one event in Sydney in March with a Fall Armyworm (FAW) focus, two field days in the NSW Central Tablelands in April with a FAW and clubroot focus. A further two field days on the NSW North Coast focused on pest and disease identification, easy to achieve proactive on-farm biosecurity checks, and getting targeted results from spray programs and equipment while caring for beneficial predators.

Sustainable vegetable management videos released

The Sustainable Vegetable Farming Series is designed to give vegetable growers a deeper understanding of sustainable best management practices that can be implemented on farm. The topics are Integrated Pest and Disease Management, Water and Irrigation, and Soil Management. The series finishes with a range of tools and resources that assist vegetable growers to develop their own property plans, supported by Greater Sydney Local Land Services.

These videos have been distributed extensively through the VegNET network with funding provided by the Australian Department of Agriculture through funding from Australian Government's National Landcare Program.

To view the videos, visit Sustainable Vegetable Farming, Local Land Services NSW on YouTube.

Innovation in practice through VegNET projects

The VegNET NSW team has successfully been awarded two VegNET Innovation Fund Project grants to undertake activities to accelerate best practice and capacity building for vegetable growers.

The first project is called Establishing a *National Soil Wealth Applied Research and Development Demonstration Site* at Richmond Lowlands. The aim is to establish a long-term soil wealth trial site that leverages funding from the Hort Innovation *Soil Wealth and Integrated Crop Protection project (MT22004)* to demonstrate the long-term benefits of a range of improved soil management practices.

A range of improved soil management practices will be monitored over time and a range of extension resources developed and extended to growers to facilitate adoption. A focus on soil carbon and maintaining natural capital in soils will be a focus together with demonstrating new innovations such as alternatives to plastics in field-based production of melons and other field vegetable crops.

The second project is a series of Vegetable Innovation Days (with a Greater Sydney and NSW North Coast focus). The aim is to demonstrate new varieties based on different crop segments, showcase and extend the latest research on Integrated Pest and Disease Management, particularly with regards to Fall armyworm, Serpentine Leaf Miner, Diamondback Moth and Cucumber Green Mottle Mosaic Virus.

Demonstrating new innovations in agtech and irrigation management will also be a focus. Given that we are now entering an El Niño weather pattern, these innovation days will focus on water use efficiency and maximising returns and reducing the costs of production.

FIND OUT MORE

Please contact Sylvia Jelinek on 0427 086 724 or email sylvia.jelinek@lls.nsw.gov.au

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Project Number: VG21000

Hort Innovation VEGETABLE FUND

SOUTH AUSTRALIA

VEGNET

South Australia

REGIONAL UPDATE

Focus on Industry Development and Support

Fruit Fly Outbreak and an expanded Industry Development Activities headline early 2024 efforts for VegNET SA team.

The early stages of 2024 have been headlined by the industry response to the Salisbury Q-Fly outbreak which has caused significant market disruption to South Australia's greenhouse sector. Other key activities have included management and rollout of an expanded program of industry development events.

Fruit Fly outbreak response

AUSVEG SA and VegNET SA have recently led strong advocacy and coordination of the industry's response to the current Fruit Fly outbreak, with AUSVEG SA securing significant government funds to provide a 50 per cent subsidy for fumigation services. VegNET SA has played an important role in coordinating information sharing around fumigation requirements and educating growers on how to implement CA-33 baiting programs in response to the outbreak.

Beet Cyst Nematode trials

AUSVEG SA is close to finalising our Beet Cyst Nematode trial program with strong results for participating brassica growers. Beet Cyst Nematode was causing growers on the Northern Adelaide Plains around $20 million in crop losses per year. VegNET SA has partnered with SARDI to develop a PredictaPT test for the issue to allow agronomists to better assess nematode numbers and trial new approaches for management. VegNET SA has partnered with a number of regional agronomists and growers where we have demonstrated strong suppression results through use of trap crops and other controls combined with fumigation in some instances. This project is showing significant promise in assisting local producers to manage this highly damaging pest.

Above + Right. Grower Workshops

Expanded Industry Development Program

VegNET SA has been successful in securing funding for new industry development projects in quality assurance and fertiliser efficiency through the VegNET Innovation Fund. The expansion of our Industry Development Program with the addition of new programs demonstrates our commitment to enhancing productivity and sustainability within the industry.

The program commenced this year with masterclasses in grower negotiation skills and energy efficiency that were well attended with positive feedback from the growers. VegNET SA supported the delivery of these programs funded under the Farm Business Resilience Program under the Federal Drought Fund initiative.

AUSVEG SA and VegNET SA have been working with the SA Government on headline research and development bids, taking a proactive approach to addressing the challenges and opportunities facing the sector in the coming years. These initiatives have the potential to drive innovation, improve competitiveness, and ultimately benefit growers and stakeholders across the region.

The expansion of the Industry Development Program is being achieved by working collaboratively across programs and organisations to deliver opportunities for development to our growers.

Grower recognition

The South Australian vegetable growing industry was recognised and celebrated at the 9th Annual Premier's Horticultural Award for Excellence 2024 being held on 17 May.

Growers face many challenges, labour shortages, rising input costs, biosecurity risks and uncertainty created by the impact of the supermarkets on market access, pricing, and profitability. Despite these hurdles, growers persevere, seeking out opportunities for efficiency gains, technological advancements, and collaboration to meet these challenges. There was a strong field of nominations for the awards with more than 300 growers, industry partners, supporters, political representatives and advocates attending to mark this important event.

FIND OUT MORE
Please contact Peta Coughlin on 0409 029 745 or email peta.coughlin@ausveg.com.au
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Project Number: VG21000

SOUTH AUSTRALIA CASE STUDY

Biosecurity threat prompts SA industry collaboration

Case Study September 2023

National Vegetable Extension Network SOUTH AUSTRALIA

Introduction

A well-managed biosecurity system is fundamental to maintain the resilience, profitability and sustainability of the Australian vegetable industry. Managing biosecurity risks requires collaboration among growers and industry stakeholders, government agencies, researchers and biosecurity experts.

In March 2023, the Western Australian Department of Primary Industries and Regional Development (DPIRD) announced a change to its serpentine leafminer biosecurity requirements. WA proposed to apply the quarantine import requirements for serpentine leafminer to South Australia (where the pest was not yet detected) which would cause significant economic losses to leafy vegetable growers trading with WA. A secondary impact would be a reduction of leafy vegetables supplied to WA that would unlikely be filled by the state's growers.

The change was set to be introduced in early April 2023 but was reversed due to the establishment of SA's area freedom claim for serpentine leafminer.

VegNET SA, through AUSVEG SA, played a vital role in linking growers to national levy-funded resources, providing support to implement biosecurity practices and helping the industry provide the evidence to support the area freedom claim.

Serpentine leafminer life cycle. Image courtesy of Dr Elia Pirtle, Cesar Australia.

Key messages

- **VegNET SA worked with local growers to respond to a change to Western Australian biosecurity requirements for serpentine leafminer which would have resulted in the loss of market access for leafy vegetable growers in South Australia, potentially worth tens of millions of dollars.**
- **A collaborative approach with growers, industry and regulators is required to manage biosecurity risks and responses to potential market access restrictions.**
- **There are many practical actions that growers can take to enhance their preparedness for potential biosecurity threats and safeguard the productivity and profitability of their businesses.**

Serpentine leafminer in Australia

Serpentine leafminer was first detected in Australia in October 2020 in New South Wales. The NSW Department of Primary Industries launched an emergency response to this detection which involved surveillance and tracing to delimit the extent of the infestation.

In early 2021, the response transitioned to management once it was determined that it was not technically feasible to eradicate. The pest is now considered established in New South Wales, Queensland and Victoria.

Human-assisted movement has contributed to the spread of this pest through the movement of plant material, soil and debris as well as hitchhiking on goods, aircraft and vehicles.

Hort Innovation Strategic levy investment | VEGETABLE FUND

This project has been funded by Hort Innovation using the vegetable research and development levy and funds from the Australian Government. For more information on the fund and strategic levy investment visit horticulture.com.au

AUSVEG AUSVEG SA

SOUTH AUSTRALIA CASE STUDY

Biosecurity threat prompts SA industry collaboration

A swift response

The change to the WA quarantine import requirements for serpentine leafminer was announced six weeks prior to their proposed introduction which meant there was a tight timeframe to address the issue and prove that serpentine leafminer had not been detected in SA.

This involved a systematic process where AUSVEG SA and VegNET SA worked with growers, local agronomists and the state government biosecurity department to support the state area freedom claim. VegNET SA helped the vegetable industry to provide an assessment of the pest, key areas of risk, surveillance and monitoring activities, tracing and traceability systems, and biosecurity measures. The process identified practical activities that growers can implement to strengthen their on-farm biosecurity, which are listed in further detail below.

Risk assessments

Conduct a thorough risk assessment to identify the pest or disease of concern and evaluate its likelihood of presence in the area. Consider factors such as geographical location, climate, proximity to potential sources of infestation, historical data and the presence of suitable hosts for the pest or disease.

Risk management plan

Develop and maintain a risk management plan that outlines the strategies used to manage and prevent the introduction and spread of the target pest or disease in the area.

Biosecurity measures

Implement strict biosecurity measures to prevent the introduction and spread of the pest or disease in the area. This may include quarantine protocols, movement restrictions, hygiene practices and communication with stakeholders about biosecurity responsibilities.

Surveillance

Implement a comprehensive surveillance program to actively monitor the area for the target pest or disease. This may involve regular inspections, trapping, sampling and testing of plants, crops, soil, water, and other relevant materials.

Tracing and traceability

Ensure proper traceability of plants, plant products and materials moving in and out of the area. Maintain accurate records to demonstrate the origin and destination of these items and verify their pest- or disease-free status.

Collaboration and reporting

Work closely with relevant government agencies, industry bodies, research institutions and other stakeholders to collaborate on biosecurity efforts. Regularly report surveillance results and any biosecurity incidents to the appropriate authorities.

Verification and validation

If necessary, engage with regulatory authorities to seek verification and validation of an area freedom claim. This may involve providing comprehensive data, evidence and documentation to support the claim.

Continuous monitoring

Monitor the area regularly to ensure ongoing compliance with the area freedom claim and to detect any potential reinfestations or incursions.

L-R: Serpentine leafminer and leaf damage. Images courtesy of AUSVEG.

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AUSVEG AUSVEG SA

SOUTH AUSTRALIA CASE STUDY

Biosecurity threat prompts SA industry collaboration

Improving grower productivity, profitability, preparedness and competitiveness

The vegetable industry is a significant contributor to Australia's agricultural sector and economy. Managing biosecurity risks helps to protect vegetable crops from the introduction and spread of pests and diseases that could cause substantial economic losses. Infestations and outbreaks can lead to reduced crop yields, increased production costs and market access restrictions.

A proactive approach to biosecurity allows for early detection and rapid response to potential threats. Quick action can prevent the establishment and spread of pests and diseases, minimising their impact on vegetable crops.

The SA vegetable industry's experience in establishing an area freedom claim for serpentine leafminer presented a checklist of activities that growers can put in place to strengthen their preparedness for future pest incursions, safeguard the productivity and profitability of their businesses and support an area freedom claim.

Next steps

The response to this event demonstrates that effective partnerships enhance the collective ability of the vegetable industry to identify, prevent and respond to biosecurity threats and mitigate the associated impacts on economic activity and fresh produce supply.

It's important to note that the specific requirements and processes for establishing an area freedom claim may vary depending on the pest or disease and the jurisdiction within Australia. The process often involves close collaboration with relevant biosecurity authorities to ensure that the claim meets all regulatory and scientific standards.

VegNET SA and AUSVEG SA will work to implement a testing regime to support future claims using existing agronomist records and potential implementation of testing moving forward.

Further information

Contact VegNET SA Regional Development Officer Peta Coughlin at
peta.coughlin@ausveg.com.au
or 0409 029 745

VEGNET NORTH, WEST & SOUTH-EAST

Victoria

REGIONAL UPDATE

Celebrating R&D impact with VegNET Victoria

The VegNET Victoria – Northern, Western & South Eastern project highlights and support R&D adoption within the vegetable industry including supporting the R&D Adoption and Industry Impact Award in Victoria.

Promoting and championing Victoria's highest achieving growers, the AUSVEG VIC and E.E. Muir & Sons Awards for Excellence were held on Saturday 27th April 2024.

The evening provided a fantastic opportunity to acknowledge and celebrate the nominees and winners but also the Victorian vegetable and potato industries, with growers and supply chain coming together to enjoy each other's company.

R&D Adoption and Industry Impact Award

Supported by the VegNET project in Victoria, the R&D Adoption and Industry Impact Award highlights those that have demonstrated a commitment to industry funded research and development projects. In the winners' case this included the hosting of demonstration sites and associated events for the benefit of the broader vegetable industry.

Also important to this award, is the influence upon the industry to improve the productivity, profitability and sustainability of the vegetable industry beyond an individual business.

Joint winners were announced during the AUSVEG VIC Awards for Excellence:

- Andrew Bulmer & Stuart Griggs - EGVID - 10th International Spinach Conference
- Victorian Vegetable Innovation Days (VicVID).

EGVID – 10th International Spinach Conference

The 10th International Spinach Conference was held in Victoria in May 2023. This was the first time that this event has been held in the southern hemisphere.

Stuart Grigg and Andrew Bulmer of EGVID were instrumental in masterminding the event coming to Melbourne, as well as Food & Fibre Gippsland's Bonnie Dawson.

Crucial to the success of the conference was Boratto Farms, the host of a significant spinach trial in Bacchus Marsh with around 150 different seed varieties and treatments and displays from BASF/Nunhems, Enza Zaden, Fairbank Seeds, Lefroy Valley, Rijk Zwaan, Syngenta and E.E. Muir & Sons.

The highly acclaimed researcher Professor Jim Correll from the University of Arkansas attended, as well as respected plant pathologist Dr Lindsey du Toit from Washington State University.

Topics covered included pest and nutrient management in the paddock, to consumer preferences on the supermarket shelf.

The conference and field day provided a unique opportunity for the local spinach industry to learn from international partners and researchers, with presenters and delegates travelling from the USA, New Zealand, the Netherlands, France, Japan, Denmark and Spain to attend the Conference.

The organisers demonstrated their dedication to the exchange of information across the international spinach community.

Above. The organising committee for the VicVID 2023 event (L-R) Dale Creed, Rick Butler, Danielle Park, Bonnie Dawson and Stuart Grigg

Victorian Vegetable Innovation Days 2023

The second of the joint winners of the award, was for the April 2023 Victorian Vegetable Innovation Days and to recognise the contribution of Stuart Grigg and the VicVID Organising Committee for their activities in supporting the Victorian vegetable industry through their actions to plan, coordinate and hold the two-day field trials.

VicVID allowed for the showcasing of vegetable variety trials from ten different seed companies as well as agricultural chemical and fertiliser products to support the development of the vegetable industry in Victoria.

In excess of 600 vegetable growers and interested parties travelled from across Victoria and interstate to attend VicVID, hosted by Butler Market Gardens at their Catani site and supported by their field team. Representatives from across the vegetable supply chain, finance, energy and agtech sectors were in also in attendance.

Register for VegNET – Victoria's Regional Update

A calendar of events have been planned for 2024 as a part of *VegNET 3.0* and the VegNET – Victoria (North, West and South-East) project.

To find out about AUSVEG VIC please see our website: ausvegvic.com.au

FIND OUT MORE

Please contact Danielle Park on 0432 324 822 or email rdo@ausvegvic.com.au

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VEGNET
SOUTHEAST QUEENSLAND
Lockyer Valley
REGIONAL UPDATE

Early season of hope - Grower Events

While summer may be a slightly less busy time on the farm, it presents an opportune moment for grower-led VegNET events. Lockyer Valley Growers Inc. and the Southeast Queensland RDO have been actively engaging with growers through February and March, hosting four events targeting different focus areas outlined in the regional plan.

Grower BBQ
Fostering community and advocacy

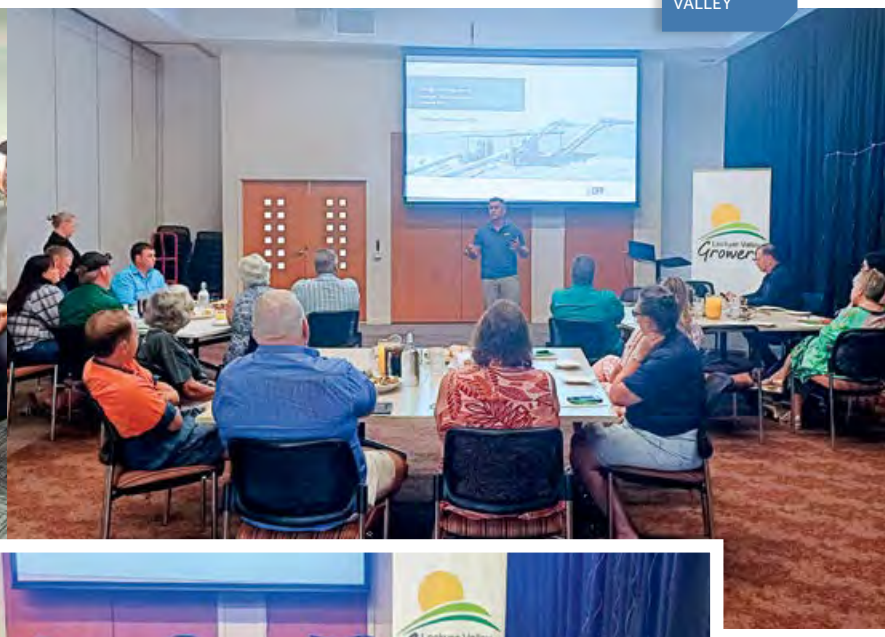
The grower BBQ held on February 7th brought together 38 individuals, including representatives from Hort Innovation, local government officials, and growers. Rachel Chambers, CEO of Queensland Fruit and Vegetable Growers (QFVG), delivered insights into the 'We Give a Fork' campaign, emphasising advocacy efforts on behalf of growers. Discussions ranged from fair work conditions to engagement with governmental bodies, underscoring the importance of collective representation. Cecile Godde from CSIRO presented findings from the Resilience of the Lockyer Valley-Brisbane horticulture supply chain study, emphasising the need for adaptation to disruptions like droughts, fires, floods, and COVID-19.

Further presentations delved into critical topics such as implications of water management plans, and post-farm gate initiatives led by Hort Innovation. The event provided a platform for knowledge exchange and networking crucial for navigating challenges in the agricultural sector.

Agronomists breakfast
Insights into pest management and research

On March 8th, the Agronomists Breakfast convened experts and stakeholders to delve into pest management strategies and research updates. Discussions revolved around pest threats such as Diamondback moth and Fall armyworm (including promising findings on *Telenomus* sp., a parasitoid wasp), along with the latest advancements in Integrated Pest Management (IPM) strategies. The event also featured field walks highlighting ongoing research trials, providing tangible insights for attendees.

Above L-R. John Duff presenting on Serpentine Leaf Minor at Agro's breakfast. Michael Sippel presenting on PC Cropping in Mexico at the PC Growers BBQ.



Working lunch

Empowering growers through energy efficiency

The Working Lunch, hosted on March 14th, attracted twenty participants, primarily growers. A presentation by Andrew Chamberlin from the Queensland Farmers Federation focused on empowering growers with knowledge about energy efficiency and audits. Presentations by industry experts illuminated the intricacies of energy consumption, tariff structures, differences between small and large customers, and available funding for efficiency upgrades. Case studies displayed tangible benefits achieved through energy audits, underlining the potential for significant savings and improved sustainability practices within farming operations.

Protected cropping growers BBQ

Innovations and best practices

The concluding event, the Protected Cropping Growers BBQ on March 19th, attracted 55 attendees eager to explore innovations in protected cropping. Presentations highlighted advancements in greenhouse films that enhance crop growth and yield, hydroponic growing systems, and global insights from Mexico. Discussions also touched upon crucial aspects of workplace health and safety, as well as fungicide options tailored for protected cropping environments.

Each event provided valuable insights and updates for growers, helping them make informed decisions and adapt to the challenges and opportunities in the horticulture industry.

These events demonstrate the ongoing commitment of the Lockyer Valley Growers inc and Southeast Queensland VegNET RDO in engaging Growers, agronomists, and industry experts to exchange knowledge, foster collaboration, and address challenges facing the agricultural sector ensuring innovation and growth, for the region's growers.

Above L-R. Growers and Industry Representatives at the PC Growers BBQ. Andrew Chamberlin presenting a case study on Energy Audits.
Inset. Small group discussing Electricity Working Lunch.

FIND OUT MORE

Please contact Darren Brown on 0456 956 340 or email ido@lockyervalleygrowers.com.au

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Hort Innovation VEGETABLE FUND

AUSVEG state update

VICTORIA

AUSVEG VIC Announces Industry Award Winners

The AUSVEG VIC Awards for Excellence 2024 highlighted the outstanding contributions of individuals and companies to the vegetable and potato industries of Victoria.

Life members Luis Gazzola and Peter Cochrane joined in the festivities, MC'd by Brian Nankervis of Rockwiz fame, and a musical and laughter-packed evening celebrated the best in the industry as well as a chance to come together and what has been a tough year for Victorian vegetable growers.

AUSVEG VIC Awards Winners 2024

GROWER OF THE YEAR
Rocky Lamattina
Lamattina & Sons

YOUNG GROWER OF THE YEAR
Lachlan Schreurs
Schreurs & Sons

COMMUNITY STEWARDSHIP AWARD
Mark Pullin
VEG Education

ENVIRONMENTAL & SUSTAINABILITY AWARD
Vince Lamattina
Clyde Compost

WOMEN IN HORTICULTURE AWARD
Stephanie Knight
Rijk Zwaan

R&D ADOPTION & INDUSTRY IMPACT AWARD
Andrew Bulmer & Stuart Grigg
EGVID & Victorian Vegetable Innovation Days

Top Left. AUSVEG VIC Executive Committee.
Left L-R. Young Grower of the Year - Donna Schreurs, Young Grower award winner Lachlan Schreurs, Brooke Anderson and Adam Schreurs.
Women in Horticulture Award - Jo van Nerkierk, Boomaroo Nurseries presents Stephanie Knight, Rijk Zwaan

Images courtesy Laura Jayne Photography.

Zaine Watson
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AUSVEG State News

NORTHERN TERRITORY

The vegetable production season in the Northern Territory (NT) has commenced for 2024 with positive wholesale market prices for snake bean and okra which are two of the most common vegetable crops in the NT. Time will tell as to how prices will track as we head into full production but the growers producing Asian vegetables are hopeful for better prices than the 2023 season.

The Northern Territory Government has committed to delivering new legislation to replace the *Water Act 1992* under the Territory Water Plan. Peak industry and interest groups, including NT Farmers, will be involved in early, targeted engagement on the reform to ensure that the voice of agriculture is heard, and that policy positions are suitable and support the sustainable growth of agriculture. Water resource management can often be a contentious and complex topic with a vast variety of stakeholders involved. NT Farmers seeks to promote and support agricultural water use and development that is sustainable and responsible in the management of the NT water recourses.

On the pest front, invasive insect pest papaya mealybug has been wreaking havoc across Darwin, and outer Darwin regions of late, attacking backyard papaya, frangipani and hibiscus, and posing a threat to commercial papaya production in the NT. In an effort to curb its destruction, NT Government has announced a new trial to combat the exotic pest by releasing Mealy Ladybirds - a natural predator of the papaya mealybug in certain areas. These yellow and black ladybirds are native to Australia, will support further research efforts and allow a team of scientists to make recommendations on the use Ladybirds by growers and community members. Their release aims to create a build-up of natural predators, reducing the infestation of papaya mealybug in Darwin. Due to the name, some could easily assume the pest does not pose a risk to vegetable production in the NT however this is incorrect. Papaya mealybug has a host range of over 200 plants including okra and eggplant, as well as mangoes which poses a real concern to horticultural production systems.

NT Farmers is gearing up for a busy Dry Season with workshops, industry tours and one on one support being delivered to industry in a variety of areas including: soil health, biosecurity, pest management, market access and protected cropping. As the peak industry body for plant industries, NT Farmers looks forward to what they will deliver in what is the busiest time of the year for agriculture in the NT and is hopeful for a successful and profitable season for NT growers.

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QUEENSLAND

QLD investing in levelling up the playing field

2024 – What a year so far! We can't quite decide if it should be named "The Year of the Supermarket Inquiry" or the "The Year of Great Deflection".

Since the launch of QFVG's 'We Give A Fork' campaign back in November 2023, where we suggested growers across the state had three main issues to their ongoing viability including: margin squeeze, policy pile on and reputation - a lot has happened!

Who knew that six months on we would be neck deep in multiple inquiries triggering media attention on growers nationally like never before. Who knew that government would be pointing fingers in every direction, but their own. And who knew that growers would be ready to talk least to their industry body/s and share the pain points they're experiencing.

One of the most common concerns from growers we've spoken with is the thought that nothing will change. Growers are understandably sceptical, and their previous experience certainly supports their concerns; however, we are of the mindset that nothing changes unless we change something.

We know Queensland's (and indeed the nation's) produce holds more value than what is currently being paid and horticultural growers work hard and deserve a fair return at market. We also know consumers deserve access to affordable produce, guaranteed for generations to come.

We also recognise the cornerstone of a grower's financial viability lies in their negotiation skills. Whether engaging with retailers, agents, energy providers, or other supply chain stakeholders, expert negotiation is paramount in both a cost of production sense and a fair return.

That's why, with the support of the Queensland Government, we are delivering a project designed to help the state's growers guarantee their futures. The project, 'Geared Up Growers' is about levelling the playing field. It is a collective, statewide effort at no cost to the grower, which will support Queensland growers to understand their true production costs and empower them to become great negotiators in every facet of their agribusiness.

Information about this important project, which has been fast-tracked to deliver immediate benefits to growers, is available on the QFVG website. As a pilot project we will share all our learnings from the project with our fellow state and commodity bodies, because together, we all give a fork about our grower's future.

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AUSVEG State News

NEW SOUTH WALES

Advocacy for important and meaningful competition reforms has continued to be a core focus for NSW Farmers in the horticulture space including:

- The Senate Inquiry on Supermarket Prices
- The Australian Competition and Consumer Commission (ACCC) Inquiry into Supermarkets
- The Food and Grocery Code of Conduct Review
- The proposed divestiture powers amendment to the *Competition and Consumer Act 2010*
- Planned reforms to Australia's mergers and acquisition framework.

In recent months, NSW Farmers has entered its submission to the ACCC Supermarket Inquiry, which urged the ACCC to further examine how anti-competitive business practices – such as land banking – have allowed large retailers to under-pay farmers and over-charge consumers. Challenging the long-held belief that supermarkets have gained their market power through economies of scale that generate efficiencies in the supply chain, our submission highlights the many key issues surrounding the current supermarket sector. We look forward to receiving the results of this inquiry which will begin to emerge from August this year.

In the meantime, NSW Farmers has welcomed the Food and Grocery Code Review's interim report recommendation of a mandatory Code, complete with increased penalties and independent dispute resolution options. This is certainly positive news, and a necessary step towards dealing with the symptoms of market power.

However, there is still more to be done to ensure a fairer playing field for suppliers in relation to supermarkets – and the proposed revamp of Australia's mergers and acquisition framework is what could help get to the heart of the issues at play.

With these reforms set to ensure markets will not continue to be crowded out by big players, NSW Farmers is proud to note that its policy positions are clearly reflected in the new mergers and acquisitions framework, and we look forward to the future implementation of this framework.

These wins notwithstanding, the fact remains that several tools and reforms are needed to address the issues at hand – and NSW Farmers has pointed to divestiture powers as one of these additional mechanisms that could be used as an ultimate sanction in extreme cases of continued and malicious breaches. To be applied when it is in the national interest to do so, this measure would also provide a significant disincentive for corporations to participate in anticompetitive practices, and so we will continue to advocate in favour of these powers moving forward.

While all this activity has been underway, it is important to note that NSW Farmers has also continued to lobby in the interests of the horticultural industry within the biosecurity space as well.

The focus of has been centred around our call to scrap the proposed biosecurity tax on farmers, with farmers already paying their fair share of biosecurity dues. Despite a last-minute redesign, NSW Farmers continues to oppose the flawed biosecurity levy bill, and has fronted a Senate Inquiry into the proposed tax to further our campaign against its implementation.

Moving forward, we will continue to call on the Federal Government to review and renew our biosecurity funding models so we can ensure passengers and products entering Australia are being adequately charged for the costs of the risks they create.

Fair outcomes for farmers is our goal. NSW Farmers advocates for a profitable and sustainable NSW farming sector and you can find out more including how to become a member via our website nswfarmers.org.au.

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Muirs
GROW FORWARD

We're for the farmers and growers wanting a bright future on this land. Empowering them to face the challenges, and see the opportunities to flourish. To improve farming efficiency, profitability and sustainability by having the conversations that matter. And embrace innovative products and services to stay ahead of the pack, so that the next generation of agribusinesses can continue to

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GRIMME

GRIMME is the undisputed world leader in potato planting, harvesting and handling technology. From cultivators, separators, bed formers and planters right through to trailed and self-propelled harvesters and super-efficient grading and handling systems.

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SPUDNIK provides solutions for the potato, sugar beet and other vegetable industries. Supported by revolutionary innovation and quality that is second to none to help you achieve harvesting success.

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