AUTUMN 2023

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Cover. Competition was fierce in the potato sack race at Thorpdale Potato Festival. *See page 12.*

AUSVEG

ISSN 1834-2493

From the Editor

It is extraordinary how quickly we have moved into Autumn – Hort Connections is now weeks away, not months, and plans, programs and speakers, and finer details are well underway..

In this issue, advocacy is a focus in light of recent changes to the Fair Work Act, some of which are already in play, and many more to come in effect throughout the year. We strongly urge you to take the time to familiarise your business with the changes, which are detailed on page 16.

The latest data is out for potatoes in the Hort Innovation Hort Stats handbook – we have a look at what that means for the value and volume of domestic and export production. We have some terrific resources for potato growers as well as industry news that are well worth a read.

In the past couple of months, a number of horticulture industry members have been recognised for their contributions to the sector. The Weekly Times Coles Horticulture Farmer of the Year finalists included the Donovan Family from Bundaberg, the Jurgens Family for Vee Jay's Kalfresh, and Quality Fresh, South Australia for herbs and Asian vegetables. The Donovan Family, who have a substantial avocado business, were the Hort Connections 2022 Syngenta Grower of the Year, while Damian Manno of Quality Harvest was the winner of the Hort Connections 2022 Corteva Agriscience Young Grower of the Year. Congratulations to the Jurgens Family on their win as the Weekly Times Coles Horticulture Farmer of the Year.

Closer to home, the nominations for the Hort Connections 2023 Awards for Excellence are open.

The winners will be announced during the Gala Dinner at Hort Connections. If you know a person or business who should be recognised for game changing improvements and achievements for our industry, nominate now via the Hort Connections website.

I am loving the journey into horticulture and looking forward to presenting you with some lovely surprises in future issues of our dedicated industry magazines.

Stay safe
Deborah

Message from the CEO

The potato industry has faced significant stress and hardship over the last 12-24 months, whether it be from severe weather events, increases to costs of production, labour shortages or dealing with the increased costs of living that every Australian family and household is dealing with.

In February, AUSVEG presented to the Senate Select Committee on the Cost of Living, with key areas of conversation including increases to critical farm inputs, labour shortages, retailer price challenges, food security including recent significant weather events and the availability of fresh produce.

AUSVEG advised the Committee that part of the long-term solution to this issue is changing the current perception and building awareness of the fresh produce sector in the public eye. This will help educate the consumer about the food system and the real cost of fresh produce.

AUSVEG also discussed sustainability and climate change, highlighting the decades of on-farm improvements growers have undertaken to become more sustainable, such as increasing efficiencies in irrigation management. While this will be an ongoing discussion for the broader agricultural industry, potato growers should be applauded for the work already undertaken to operate more sustainable businesses and help boost the sustainability of the entire sector.

Given the significant challenges of the sector in recent times, it is critical that we take the opportunities to meet up with each other face-to-face. There is no better opportunity to do this for growers than the upcoming Hort Connections conference in Adelaide from 5-7 June, with the theme '*Growing Together*'.

The conference Trade Show is sold-out with over 200 businesses exhibiting this year, and the lineup of speakers is shaping up to be the biggest and most engaging yet, with new speakers still being added to the program.

An important aspect of the event is acknowledging the outstanding businesses and individuals who have contributed significantly to our industry through the year at the Hort Connections Awards for Excellence, presented at the Hort Connections Gala Dinner. Nominations are still open for industry members to nominate those in their communities who have excelled not only in growing produce, but also those who have excelled in marketing, exporting, sustainability and other ways to serve in the community and create impact in the industry.

It will be an extraordinary event this year and I look forward to meeting with many of you in Adelaide.

Michael Coote
CEO, AUSVEG

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Message from the Chair

The latest Hort Stats industry data has been released by Hort Innovation, which highlights that the Australian vegetable and potato industries are one of Australia's strongest performers in the agriculture industry. This is due to the growing value of production, prominence in retail and market settings across the country as well as the rising technical and innovative nature of many growing businesses.

Vegetables and potatoes have a farmgate value of over $5.5 billion, which makes it the largest contributor of all of horticulture. The potato industry, which produces over 1.46 million tonnes with a farmgate value of over $830 million, is far and away the biggest commodity that sits within this sector.

This tremendous effort is possible because of the hard work and determination of potato growers, who are major contributors to agricultural employment and provide economic benefits to all businesses throughout the agricultural supply chain.

We know that weather events over the last 12-18 months have caused significant stress on growers and their businesses, and that cost increases on items such as fertiliser, fuel, chemicals, freight containers, packaging and wood pallets and other vital farm inputs are significantly impacting growers' bottom lines.

Potato growers are the backbone of this significant industry and the lifeblood of many regional and rural communities that rely on a thriving agriculture sector.

This is why AUSVEG – as the only national industry body that represents the interests of growers to government and the broader supply chain – advocates strongly on their behalf on issues that are important to their businesses and their crops.

The core mission of AUSVEG is to represent and support the Australian potato and vegetable industry by promoting the interests of growers, advocating for policy and regulatory changes and delivering industry development programs in the areas that make a meaningful difference to growers and their businesses.

The AUSVEG Board and team are working in the background to represent the interests of growers on the issues that are impacting your business and your community to support you in growing the highest quality potatoes.

The AUSVEG Board and I are looking forward to getting growers and the wider industry together at Hort Connections in Adelaide from 5-7 June. There will be many opportunities to meet us and the AUSVEG team at the AUSVEG Trade Show stand and at the many other networking events for growers integrated throughout the program. I look forward to seeing you all in-person to speak about the issues that are important to you, your business and your industry.

On behalf of the AUSVEG Board, I wish you well with the coming season.

Bill Bulmer
AUSVEG CHAIR

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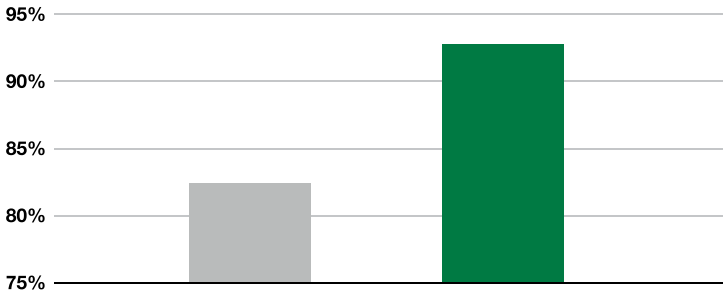

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Andrew Klein
Master of Ceremonies,
Hort Connections

Sharon Chapman
Founder,
ABC Software

Jordy Kitschke
Founder,
Flux Robotics

Jeff Kraak
Program Manager,
Fertilizer Australia

Tony Hunter
Global Food
Futurist Speaker,
Future Cubed

Stephanie Alexander
Cook, restaurateur, food writer and champion of the quality and diversity of Australian food.

Hort Connections 2023 is thrilled with the stellar line-up of speakers.

HORT CONNECTIONS 5-7 June 2023 Adelaide Convention Centre

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With a range of trade show speakers, plenary sessions and industry specific themes, the three day event will give delegates knowledge and advice for their business. Hort Connections will also host the horticulture National Awards for Excellence at the Hort Connections Gala Dinner, Women in Horticulture event, and farm and retail tours in conjunction with the event.

While at the venue, you need never experience 'extreme boredom' with our **MC Andrew Klein**, who left the law profession for exciting adventures as a professional presenter. An engaging presenter, Andrew has more than 25 years' experience with Australian conferences with a casual yet corporate style that is well respected by his peers and clients alike.

The Trade Show speaker sessions bring together knowledgeable industry leaders in their field from software, AgTech, to agronomy.

There is a saying that goes, you can't improve on what you can't measure – understanding what your labour costs, harvest and inputs can lead to greater efficiencies. One speaker on Day 1, **Sharon Chapman**, Founder of ABC Software, will present *"Information Automation to grow your knowledge and grow your business".*

Sharon Chapman is the founder of ABC Software, a company specialising in on-farm and packhouse software solutions. She was raised on a farm in the fruit bowl region of Hawkes' Bay, New Zealand, and began her career in IT in 1983, and founded ABC Software in 1996. Her understanding of horticulture and software enables a deep insight into her clients' businesses. ABC Software offers solutions to help growers and packers automate their information and grow efficiencies.

Some people see an endless spray boom, others see opportunities for improvement. Such is the case with **Jordy Kitschke** who is a serial AgTech entrepreneur and problem solver, born and bred in the mid-north of South Australia. Jordy's presentation, His presentation, *Farmer-Driven R&D: How to go from Back-of-Napkin to Paddock in 15 months,* highlights the possibilities as he sees them.

Jordy has founded multiple companies and has worked on technologies across several agriculture sectors including livestock, cropping, and horticulture. Jordy's latest enterprise is Flux Robotics, an AgTech startup working on robotic solutions to reduce the reliance of pesticides on-farm.

Knowing which fertiliser to use in Jordy's latest venture is vital to ensure good growth, with knowledge of how, where and when to use it. **Jeff Kraak**, Program Manager of Fertilizer Australia will present *Sourcing fertilizer with poor labelling & truth in labelling, could be placing your business at risk.*

Jeff has a long history in the fertiliser industry in a range of sales, marketing and technical support roles, including many years with Incitec Pivot Fertilisers.

Having worked across much of eastern Australia, he has had exposure to industries such as vegetables, tree crops, sugar cane and grains. Jeff is now part of Fertilizer Australia. His main area of responsibility is to manage the industry's environment and food safety stewardship program, Fertcare.

With a broader industry mindset, the plenary sessions will give delegates food for thought, starting out with **Tony Hunter**, who is a global futuristic speaker with Future Cubed. Tony is a food scientist,

Mark Bennett
Head of Agribusiness and Emerging Corporate, Regional Business Banking,
ANZ Banking Group

Gus-Balbontin
Former Executive Director and CTO,
Lonely Planet

Jan Kamper
Market Development Lead, Glasshouse,
Bayer Vegetable Seeds

Matty Blomfield
CEO and Co-Founder
Hectre

Dr Max Teplitski
Chief Science Officer,
International Fresh Produce Association

Bridgit Hawkins
Chief Sustainability Officer
CropX

author and strategic consultant specialising in the future of Food and Agriculture. He speaks on and advises global food and agricultural companies on the technology and consumer trends shaping this rapidly changing sector.

His distinctive combination of scientific qualifications, business experience and detailed understanding of food technologies allow him to deliver a unique perspective on the Future of Food.

Closer to home, **Stephanie Alexander** aims to bring the next generation closer to food through her well regarded Stephanie Alexander Kitchen Garden Foundation. Her presentation on her own exposure to fruits and vegetables at a young age and how it affected her own life and carried through her work with children is sure to inspire.

Stephanie Alexander AO is regarded as one of Australia's great food educators. Her reputation has been earned through her thirty years as an owner-chef in several restaurants, as the author of 18 influential books and hundreds of articles about food matters, and for her ground-breaking work in founding and supporting the Stephanie Alexander Kitchen Garden Foundation.

Stephanie's fifth book, The Cook's Companion is regarded as an Australian classic and has sold over 5,000 copies, now in its 24th printing. In 2013 this monumental work, was published as a successful digital app. Her latest book, 'Home' was published in September 2021. Stephanie states that her life's work has been to convince as many as possible that cooking a lovely meal without anxiety adds so much to the joy of living.

Stephanie has always had a commitment to training and mentoring young people.

She was awarded an Order of Australia (OAM) in 1994 for her services to the hospitality industry and to tourism, and for encouraging young apprentices. In 2004 she established the Stephanie Alexander Kitchen Garden Foundation, a not-for-profit organisation, with the aim of introducing pleasurable food education to Australian children. The program originally concentrated on the primary years but has since expanded its reach with pilot programs The Kitchen Garden Program for Early Childhood and The Kitchen Garden Program for Secondary Years.

Mark Bennett, Head of Agribusiness and Emerging corporate, regional business banking with the ANZ Group. His *Greener Pastures 2* presentation looks at how the Australian agriculture sector has developed to become a world leader in quality, safety, environmental awareness and investment.

Mark was raised on a dry land cropping property at Waitchie, Northwest Victoria where the family continue to farm today. With a degree in Business Economics, Mark has dedicated his career to banking Australian agriculture, with a career spanning nearly 30 years.

For the last 11 years, Mark has been responsible for the performance of ANZ Agribusiness in Australia, providing service to family farms through to the broad financial needs of larger corporate farmers, investors and Agribusiness.

FOR MORE INFORMATION

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

WA Potato Industry
Biosecurity Manual Launch

On 16th February the Potato Growers Association of WA (PGA WA), hosted a sundowner at Tall Timbers Restaurant in Manjimup. Nearly 35 growers and stakeholders attended to hear the latest biosecurity updates.

Simon Moltoni, CEO of the PGA WA kicked off proceedings by launching the new WA Potato Industry Biosecurity Manual. The manual was developed by the PGA WA in collaboration with the Department of Primary Industries and Regional Development (DPIRD) and AUSVEG and funded by the Agriculture Produce Commission Potato fee for service.

"The new biosecurity manual has been designed to be user-friendly for growers, explaining their rights and responsibilities, current threats and links to online resources with QR codes throughout," said Simon.

FIND OUT MORE

For more information contact Potato Growers of WA, or download the Biosecurity Manual at **thegoodcarb.com.au/potato-growers-association**

Simon then acknowledged and introduced grower and newly appointed Chair of the Agriculture Produce Commission (APC) Monica Radomiljac, who addressed the audience to explain the role of the APC to industry.

Presentations then commenced with the following speakers:

- Vincent Lanoiselet, Deputy Chief Plant Biosecurity Officer DPIRD
- David Cousins, Senior Biosecurity Officer, DPIRD
- David Tooke, Manager of WA Certified Seed Potato Scheme, DPIRD
- Patrick Fox, Grower, and Exporter
- Glen Ryan, APC Potato Producers Committee (APC PPC) Chair and Grower

Vincent Lanoiselet spoke about the national biosecurity framework and Emergency Plant Response Deed and how the system works on a local level. Vincent also highlighted a few specific potential threats, and how the department tracks and manages these to protect the agriculture industry in WA.

David Cousins presented an example of how a response to an incursion works, and the resources that can be activated to manage the threat to industry.

David Tooke then reminded growers about the responsibilities each one has to report any potential threats, as the consequences of not doing so can be far reaching and devastating for individual businesses and the industry as a whole.

Patrick Fox emphasised the critical nature of biosecurity from an export perspective, including maintaining market access for trade and WA's clean and green image. Especially considering the potential for expansion of WA potato exports in the future.

In wrapping up, Glen Ryan discussed the APC PPC functions and how the funding process works, and projects that are currently funded.

Following the presentations, attendees were able to chat further to presenters about any concerns and enjoyed catching up over nibbles and drinks.

Above. The latest Biosecurity Manual for potato growers in WA has been launched.

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Adam Bremner
Wombat Forest Organics, VIC

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UPDATE

Ballarat growers power on with Western Renewables Link fight

The Supreme Court of Victoria hearing to hear the case regarding the proposed high voltage powerline proposal through central Victoria, which was due to be held in February, has brought forward more challenges. DEBORAH HILL REPORTS.

The proposed route for the Western Renewables Link Project (formerly known as the Western Victoria Transmission Network Project) runs through prime farmland and significant environmental regions from north west Melbourne, past Ballarat and into central western Victoria.

For the Ballarat district, it impacts some 16 potato growing families in one of Victoria's prime potato growing regions.

The Moorabool and Central Highlands Power Alliance (the Alliance) had met previously with the legal team of the Australian Energy Market Operator (AEMO) to agree on a procedural timetable commencing with the Hearing.

Two days before the Supreme Court hearing, the Victorian Government issued a Ministerial Order in relation to the transmission line project.

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, to commence in the third quarter of 2023, a year earlier than originally proposed'. The Order also means that the responsibility of the project now resides with the Victorian State Government rather than AEMO.

While the Order limits further legal challenges, it has resulted in offers of compensation payments for farmers for whom the transmission lines will traverse their properties.

Above. Potato paddock with 220kV tower in the background.

Compensation offered to landholders not enough

The compensation offered is $200,000 for every kilometre of new transmission lines, to be payable as annual instalments of $8,000 over 25 years, on top of the Land Acquisition and Compensation Act payments that cover the market value of the land.

Potato farmer Katherine Myers said that for smaller landholders, with a 500m easement, the towers had the potentially to cross 100 acres of potato growing land and that the compensation is nowhere near enough.

In response, the Victorian Farmers Federation president Emma Germano has said that the payment was nowhere near enough to offset the impact the project would have on landholders.

"It's an arbitrary number that's not enough to mean anything," Ms Germano said. "The impact has to be assessed commercially, on production."

Ms Germano said despite the government's offer of landholder payments, farmers deserved the right to fair compensation process and the ability to access documents that determine the transmission process and avenues to appeal the lines on their property.

"The future of farmers and communities along the hundreds of kilometres of new powerlines is incredibly unclear. We need to know whether the government has decided to steamroll through these projects and what that means."

The VFF has since set up a taskforce for farmers in the St Arnaud and Ballarat districts to give greater voice to address the issue. The initial meeting attracted around 160 people, while at a consultation meeting in Dean, an impromptu farmer demonstration with more than 40 tractors was held.

AEMO chief executive Daniel Westerman was present at the Dean meeting and protest and conceded that the community had not had adequate consultation, and that the process had not 'kicked off in the right way'. "These communities have legitimate concerns that frankly need to be dealt with," he told media.

The Hearing has been adjourned to 5 April 2023, to allow the Alliance's legal team sufficient time to fully determine the most appropriate next steps.

For more information
Please visit **stopausnetstowers.com.au**

Potato festival a boon for Thorpdale

The community of Thorpdale, Gippsland, welcomed visitors to the town for the biennial Thorpdale Potato Festival, the first since 2019 with covid preventing the 2021 event from going ahead.

The festival is an opportunity to celebrate the region's primary crop, the well known Thorpdale potatoes, and to bring the community together.

Established in 1977, the festival hosts a number of potato-related events, aimed at celebrating the spud, in a family-friendly atmosphere. For local organisations, it also represents a significant opportunity for fundraising.

This year, the event was attended by around 12,000 people, raising more than $100,000. Local businesses such as Vin Rowe, EE Muir, Tolsma Grisnich, LambWeston, local governments, and Durkin provided producers with an opportunity to speak to suppliers regarding local growing conditions and needs.

As part of the fun, events such as potato packing, Hessian on the Field fashion parade and potato racing gave amateurs and juniors an opportunity to compete with the professionals. A tradition since the early days of the festival, the 'chip drop' is one for the young and old, where potato crisp packets are dropped from an aeroplane!

Above. Potato Packing – who can pack 4 boxes the quickest?
Right. Hessian on the Field fashion parade.

We have a lot of new faces that have come into the district to farm looking to be a part of the community. It is also important for our local economy. It is a new committee with a fresh outlook, and as volunteers they have done a wonderful job."

Above. Shearing demonstration *Thorpdale potato varieties L-R.* White Star, Kipfler, Bliss, Ranger Russet and Dutch Cream.
Below. Tractors and equipment new and old.

Local farmer, Stu Jennings, who hosted the shearing demonstrations, and created the Young Potato People social page, said it has been a great promotion for the area, for such a small community, and that to achieve the level of success this year is testament to the hard work everyone has put in.

Master of Ceremonies for the day, Kelly Durkin, said that the committee were overwhelmed with the attendance for the event commenting that, "this event is important for potato growers in the area.

Damper Gully Farm
nurturing soil health for productivity

Replenishing the soil health has become the focus of potato growers in the Southern Forest region of WA to improve productivity and long term health of the farm.

The Manjimup region is the food bowl of southern Western Australia, known for its highly productive Karri loam, a red chromosol soil, named for the Karri forests on its doorstep. A timber and horticulture town, potatoes, cherries and black truffles are some of the key products for the region.

With three generations of agriculture behind him, Andrew Falcinella, and his wife Lisa, have continued the family practice of farming potatoes. It was becoming increasingly obvious that the soils were becoming depleted and less productive using generational techniques of farming.

Damper Gully Farm, covers around 340 acres, with potatoes and 100 head of cattle as the primary focus. Potatoes supply the fresh market which are then distributed into the major supermarkets. This season, 12 varieties have been planted – reds, blues, creams and whites.

"The farm was doing what it had always done, and it was not working as well as it had," says Lisa. "Andy knew there had to be a better way to improve the soil and productivity.

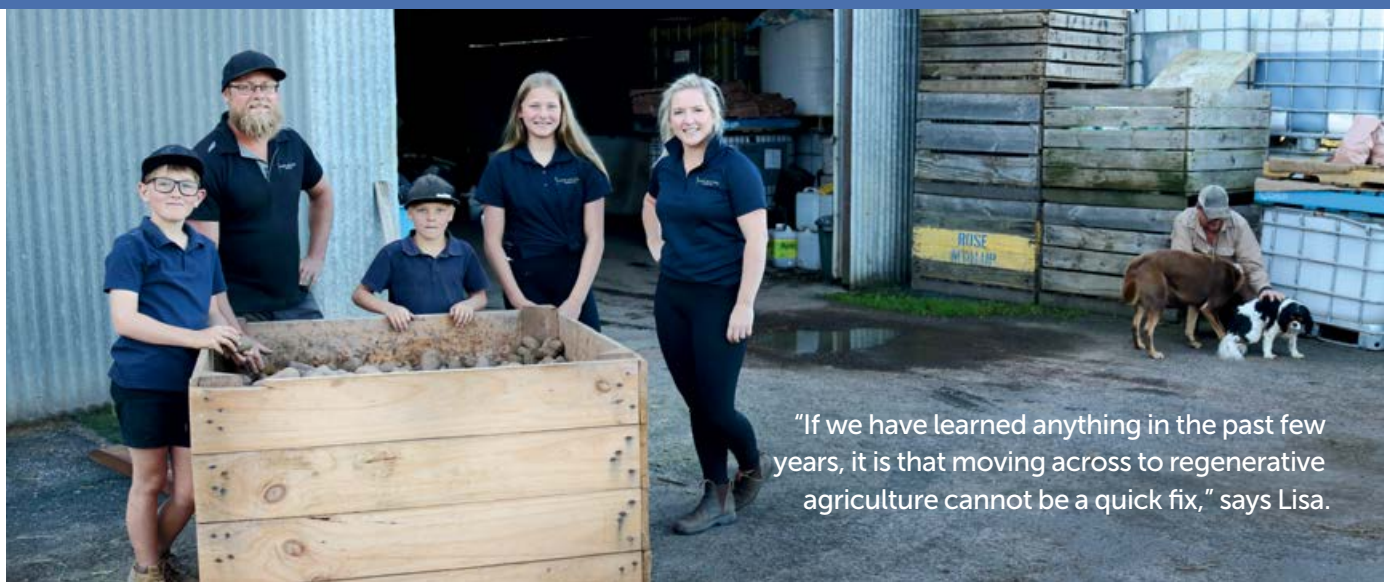
"About six years ago, he tried some small changes. Improving the soil health through regenerative agriculture techniques seemed the best way to go, which in itself is a challenge with potatoes given the high tillage needed."

The path of regenerative agriculture involves increasing soil health, organic matter and diversity by reducing tillage, attaining a soil biology balance and nourishing the soil with plant coverage.

The Falcinella's have begun to incorporate crop rotation, with cover crops three years out of four – one mix prior to the potato season, another for the year after, and a third mix for the rest year in between. The cattle will also be utilised for strip grazing - a change from the traditional set stock system that had been used.

"It is still early days yet, but we have tried a few things that have worked, and others that have not," says Lisa. "We have also put a companion crop with the potatoes to add to the diversity rather than have a monoculture. One lesson that we learned very quickly is that buckwheat in that mix is very dominant and tended to overshadow the potatoes. The field peas and fava beans were definitely a success, so is saio oats.

Above L-R. Cover crops are used for rotation to improve soil organic matter, and biodiversity. Andrew Falcinella, Damper Gully Farms, is turning to regenerative agriculture to lift productivity of the family farm, and restore soil health.
Right. The Falcinella family.
Photos courtesy Mel Arnold.



"If we have learned anything in the past few years, it is that moving across to regenerative agriculture cannot be a quick fix," says Lisa.

"We also learned that tillage radish is not such a good idea, as they are difficult to remove prior to planting the potatoes. Using caliente mustard as a biofumigant has definitely been beneficial, but we still have to do more trials."

Andrew and Lisa have the potatoes tested every two weeks to ensure that the growth and health of the potatoes are on track, and learn from that season's trials. Lisa readily admits, that in this transition phase between traditional and regenerative agriculture techniques, some spraying and inputs still need to occur to ensure the crop's success.

To assist with planning of the trials, Andrew and Lisa have enlisted the help of an agronomist, and a specialist in regenerative agriculture who both provide guidance on what is working and what still needs to be done.

"It is a constantly evolving and we have had to do smaller trials to see what works, so that we still have a viable farm in the meantime. To get the balance right, to know which cover crops will work takes time. But for the long term health and productivity of the farm, it will be worth it."

Know the changes to the Fair Work Act

Horticulture has a heavy reliance on workforce – it's the nature of the industry and changes to workplace law can have substantial impacts on our sector.

In late 2022 there were significant reforms to the Fair Work Act with the passing of the *Fair Work Legislation Amendment (Secure Jobs, Better Pay) Act 2022*. Since the passing the Act it has been difficult to source detailed information on how the changes may affect the horticultural sector specifically.

Given the uncertainty around the changes, AUSVEG wants to ensure that growers had access to accurate information and timely advice and kept informed about what changes may be ahead in further industrial reforms planned for 2023.

AUSVEG understands how important workplace relations are in the running of horticultural businesses. Recently we have made submissions reinforcing the importance of PALM and other visa schemes, provided feedback into the Jobs and Skills White Paper, and highlighted the fact that workforce shortages have and will continue to affect the price and availability of vegetables in our Food Security in Australia submission.

In February, AUSVEG appeared at the Senate Select Committee Hearing into the Cost of Living and once again highlighted impacts of workforce challenges on the sector and the flow effects to consumers. AUSVEG is also providing input to the Agricultural Workforce Working Group (AWWG) (formed as a result of the Jobs and Skills Summit) and are a member of the AWWG Worker Protection and Migration Sub-Group.

AUSVEG have partnered with AiGroup to bring our growers a series of four Workplace Relations webinars to be held in the first half of 2023. AiGroup is one of Australia's largest national industry associations which, represents the interests of more than 60,000 Australian businesses. AiGroup have a strong focus on industrial relations and they employ around 40 industrial relations lawyers across the country.

The first webinar, held in January, was designed as an overview of the changes and what they mean for the sector. Table 1 gives a list of the topics covered in the first session and Fact Sheets can be found on the AUSVEG website for each of the changes and what it means for your business.

AUSVEG have partnered with AiGroup to bring our growers a series of four Workplace Relations webinars to be held in the first half of 2023.

Table 1. *Fair Work Legislation Amendment (Secure Jobs Better Pay) Act 2022* – **Operative Dates**

7 December 2022	6 March 2023	Earlier of 6 March 2023 or an earlier day to be proclaimed	6 June 2023	Earlier of 6 June 2023 or an earlier day to be proclaimed	1 July 2023	Earlier of 6 Dec 2023 or an earlier day to be proclaimed
Initiating Bargaining	Sexual Harassment	FWC Expert Panels	Flexible Work	Multi-employer bargaining	Small Claims Jurisdiction	Fixed Term Contracts
Termination of EAs and			Unpaid Parental Leave	EA Approvals		
Sunsetting of Zombie Agreements				BOOT		
Pay Secrecy				Industrial Action		
Job Advertisements				Intractable bargaining		
Anti-Discrimination						
Equal remuneration						

- Enterprise Making and BOOT
- Fixed Term Contracts
- Industrial Action and Bargaining Disputes
- Initiating Bargaining and Termination of EAs
- Job Ads and Small Claims
- Multi-Enterprise Bargaining: Cooperative Bargaining Stream
- Multi-Enterprise Bargaining: The Supported Bargaining Stream
- Multi-Enterprise Bargaining: Single Interest Bargaining Stream
- Pay Secrecy
- Sexual Harassment and Anti-Discrimination
- Zombie Agreements.

Importantly some of the changes to the Legislation commenced on 6 December 2022 including workplace rights in regards to pay secrecy, rules in relation to advertising pay rates in job advertisements and new prohibition against sexual harassment in the Fair Work Act 2009.

Table 1 shows the dates that changes will come in to affect.

A link to the first webinar can be found at **ausveg.com.au/ausveg-webinars.**

A second webinar held on 9 March 2023 on Workplace Agreements and the accompanying Fact Sheets are now available on the AUSVEG website. The topics for the subsequent seminars will be chosen based on feedback from the growers participating in the on-line webinar surveys. Details of future webinars will be available through Weekly Updates and Advocacy Updates or the AUSVEG website.

Fair Work Legislation Amendment (Secure Jobs Better Pay) Act 2022 – Job Advertisements and Small Claims Jurisdiction

On 2 December 2022, the **Fair Work Legislation Amendment (Secure Jobs, Better Pay) Act 2022** (Cth) (**Amendment Act**) was passed by the Commonwealth Parliament and received Royal Assent on 6 December 2022.

The Amendment Act introduces major changes to the Fair Work Act 2009 (FW Act) including a new prohibition on non-compliant job advertisements and the monetary threshold to the small claims jurisdiction

This Summary provides an overview to the new requirements on the contents of job advertisements and the change small claims jurisdiction.

Job Advertisements

The Amendment Act prohibits employers from advertising, or causing to be advertised, a job with a pay rate that would breach the FW Act or a fair work instrument. For example, a job advertisement that specifies a rate of pay below the applicable modern award rate would contravene the new provision.

The Amendment Act also requires advertisements that include specific piece rates to specify any periodic rate of pay to which the pieceworker would be entitled. For example, the Horticulture Award 2020 contains a minimum wage guarantee. This means that growers who propose to hire an employee under a fair work instrument that contains both a piece rate and a minimum wage, and who choose to specify a piece rate in their advertisement, would need to also specify either the hourly or weekly rate which would be payable, or include a statement to the effect that a periodic rate of pay applies.

Fair Work Inspectors can now also issue compliance notices if a reasonable belief is formed that the provision has been contravened. A compliance notice can required employers take specified action to remedy the contravention, which in this case could require an employer take down or revise the advertisement.

The FW Act introduces a civil remedy provision to enable Fair Work Inspectors and unions to commence legal proceedings for breaches of this provision. A failure to comply with a compliance notice is also a civil remedy provision.

On 2 December 2022, the Fair Work Legislation Amendment (Secure Jobs, Better Pay) Act 2022 (Cth) (Amendment Act) was passed by the Commonwealth Parliament and received Royal Assent on 6 December 2022.

The Amendment Act introduces major changes to the Fair Work Act 2009 (FW Act) including a new prohibition on non-compliant job advertisements and the monetary threshold to the small claims jurisdiction

This Summary provides an overview to the new requirements on the contents of job advertisements and the change small claims jurisdiction.

An employer will not contravene this provision if they have a 'reasonable excuse' for non-compliance. The term 'reasonable excuse' is not defined. What a reasonable excuse is will depend on the circumstances, considering the purpose of the provision. For example, an employer may have a reasonable excuse if they exercised due diligence to ensure they advertised compliant rates of pay, but incorrect advice about the applicable rates was given to them and they reasonably relied upon on it.

When do these changes come into effect?

These provisions commenced on 7 December 2022 and are already in operation.

What should Growers do?

As a matter of legal compliance, it will be necessary to ensure that all job advertisements contain the correct rates of pay in line with the minimum rates of pay and entitlements relevant to the applicable modern award, or other instrument that may apply.

FOR MORE INFORMATION

Contact the AUSVEG Advocacy team,
Lucy Gregg on lucy.gregg@ausveg.com.au and
Chloe Betts on **chloe.betts@ausveg.com.au**

Small Claims

Under the FW Act, an employee can make an application in the small claims jurisdiction within the Fair Work Division of the Federal Circuit and Family Court of Australia, or a Magistrates Court, and seek orders for compensation relating to entitlements that an employer was required to pay to, or on behalf of, an employee.

Currently, an employee can make an application for compensation in the small claims court if the claim is $20,000 or less and the order for compensation of unpaid/underpaid entitlements relates to:

- a term of a NES;
- a term of a Modern Award;
- a term of an enterprise agreement;
- a workplace determination;
- a national minimum wage order;
- an equal remuneration order; or
- a safety net contractual entitlement (which could include a contractual entitlement that relates to the NES or any term that is permitted by a modern award, for example minimum wages, overtime, penalty rates, allowances etc).

Employees are also permitted to make an application in the small claims jurisdiction to settle some disputes that relate to the conversion of casual employment to full-time or part-time employment.

The small claims jurisdiction is not bound by the ordinary rules of evidence and may inform itself in any manner it thinks fit, without regard to legal forms or technicalities and therefore the process is generally informal compared to most court proceedings. Further, lawyers do not have an automatic right of appearance and are not permitted to appear on behalf of parties unless permission is granted from the court.

From 1 July 2023, the Amendment Act increases the maximum monetary threshold on amounts that can be awarded in small claims proceedings from $20,000 to $100,000 (exclusive of interest). The types of claims that can be brought by an employee (limited to those listed) not changed.

The court in a small claims proceeding will also be empowered to award to a successful claimant any filing fees they paid to the court, as costs from the other party (which is not currently available).

When do these changes come into effect?
These provisions commence on 1 July 2023

NOW AVAILABLE

Latest horticulture industry statistics

The *Australian Horticulture Statistics Handbook* (Hort Stats) is the leading resource for Australian horticulture statistics and market information. It is an analysis that combines all available data on production, international trade, processing volumes and fresh market distribution to produce statistics on more than 70 horticultural categories. The latest edition of the Handbook was released in February 2023, unpacking the sector's performance during the financial year of 2021/22.

The latest Hort Stats Handbook has officially been launched, offering the most comprehensive and contemporary data available on all sectors of the Australian horticulture industry in one easy-to-read guide.

The Handbook, developed by Freshlogic and funded by Hort Innovation, features more than 470 pages of information drawn from several supply chain sources, including international trade statistics and industry peak bodies. It includes data on more than 70 horticultural products including fruit, nuts, vegetables, nursery, turf and cut flowers.

Hort Innovation CEO Brett Fifield said that "In 2021/22 the production value of Australia's horticulture industry grew to $15.62B, with the total production value of Australian's horticulture industry growing steadily by $381.3M (2.5 per cent)," Mr Fifield said.

"Australia is producing 850,000 additional tonnes of produce than we were in 2012/13, and the annual value of horticulture production is up $6.15B compared to the same period. This means the industry has added, on average, around $680M in value every year for the past decade"

AUSVEG CEO Michael Coote said that while the long-term growth in the vegetable industry has been impressive, the industry has recently been struggling with weather events, higher production costs and labour shortages.

"Weather events, labour shortages and supply chain issues have impacted production volumes of many vegetables, which has been challenging for growers," said Mr Coote.

"High production costs and challenges in sourcing labour have also significantly impacted growers' bottom lines, so while the overall production value of many lines is higher than previous years, the profitability of many growers is lower as these increases have not been enough to meet increases in costs."

HORTICULTURE
All fruit, vegetables, nuts and cut flowers

Year ending June	2021	2022	▲%
Production (t)	6,639,296	6,545,575	- 1%
Production ($m)	$15,241.10	$15,622.40	+ 3%
Fresh Export (t)	761,560	754,504	>-1%
Fresh Export ($m)	$2,368.80	$2,471.00	+4%
Fresh Supply (t)	4,061,886	3,965,822	-2%
Fresh Supply Wholesale Value ($m)	$15,633.50	$15,939.50	+2%
Supply per capita (kg)	157.74	152.84	-3%

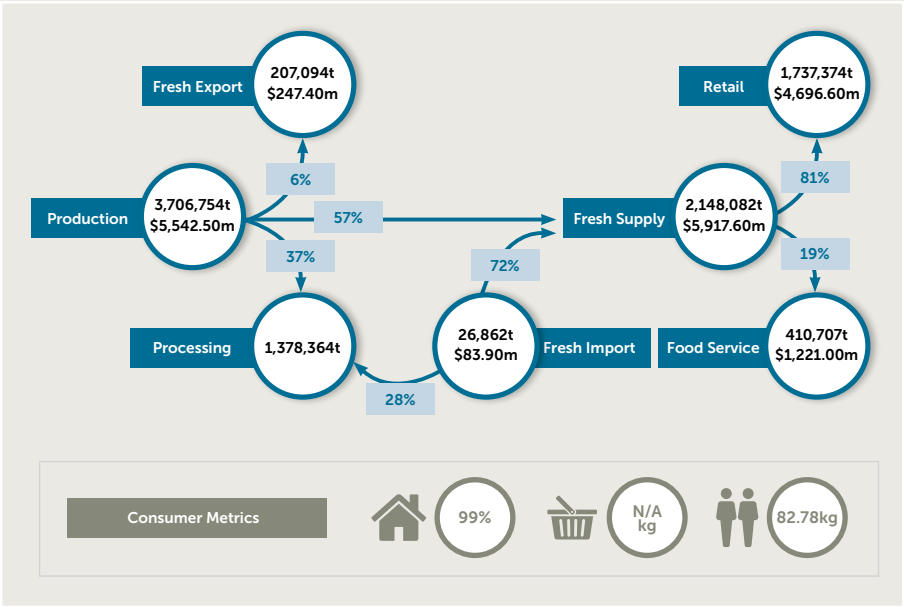
Highlights for 2021/22

More data and insights from the 2021/2022 Handbook include:

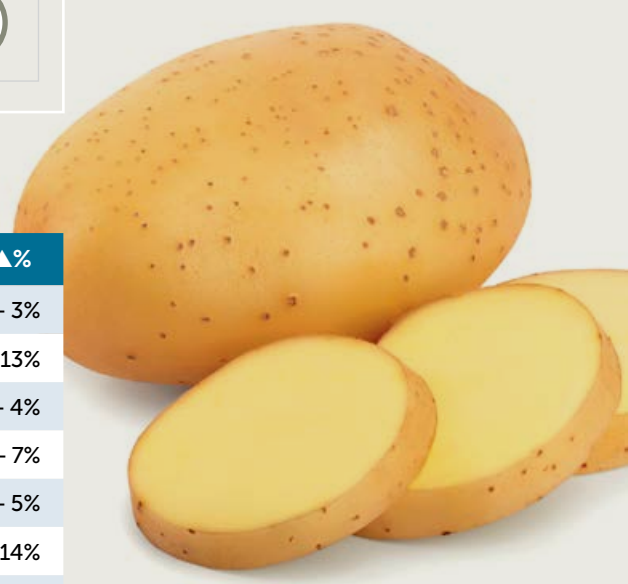
- Head lettuce increased by 55% (+$94.8 million), leafy salad vegetables increased by 19% (+$94.2 million), and tomatoes increased by 15% (+$83 million).
- Leafy salad vegetables also reached new production volumes, increasing by 5.3% in 2021/22.
- Vegetable production values reached an all-time high of $5.54 billion in 2021/22, despite a modest decrease in volume.
- Beans had the highest annual growth rate of all vegetables, with value up 64% in 2021/22 and recording its highest production value of $134.4 million.

FRESH VEGETABLES

Supply chain overview - Year ending June 2022



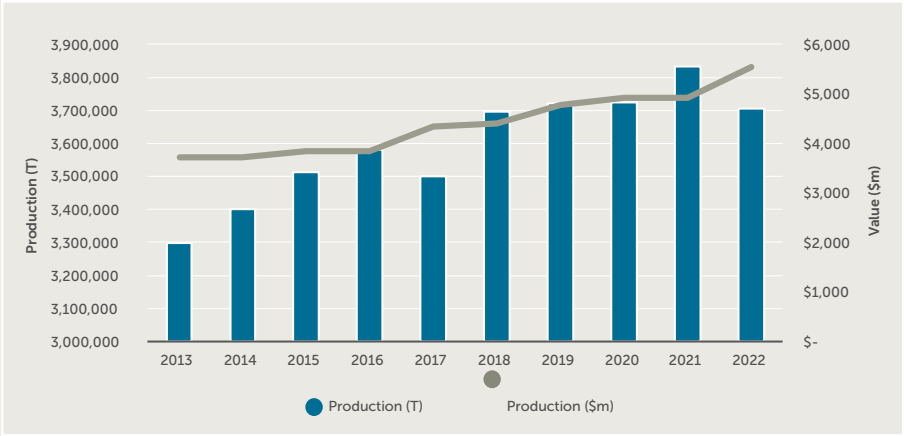
Sources. ABS; AC; AUSVEG; CFVIWA; GTA; MP & DD (Freshlogic Analysis)



Vegetables 2021-2022

Year ending June	2021	2022	▲%
Production (t)	3,830,319	3,706,754	- 3%
Production ($m)	$4,910.90	$5,542.50	+13%
Fresh Export (t)	215,396	207,094	- 4%
Fresh Export ($m)	$264.60	$247.40	- 7%
Fresh Supply (t)	2,256,376	2,148,082	- 5%
Fresh Supply Wholesale Value ($m)	$5,190.70	$5,917.60	+ 14%
Supply per capita (kg)	87.63	82.78	- 6%
Retail Supply (t)	1,835,743	1,737,374	- 5%
Retail Supply Wholesale Value ($m)	$4,130.50	$4,696.60	+ 14%
Food Service Supply (t)	420,634	410,707	- 2%
Food Service Supply Wholesale Value ($m)	$1,006.00	$1,221.00	+ 15%

All vegetables production value and volume 2013-2022

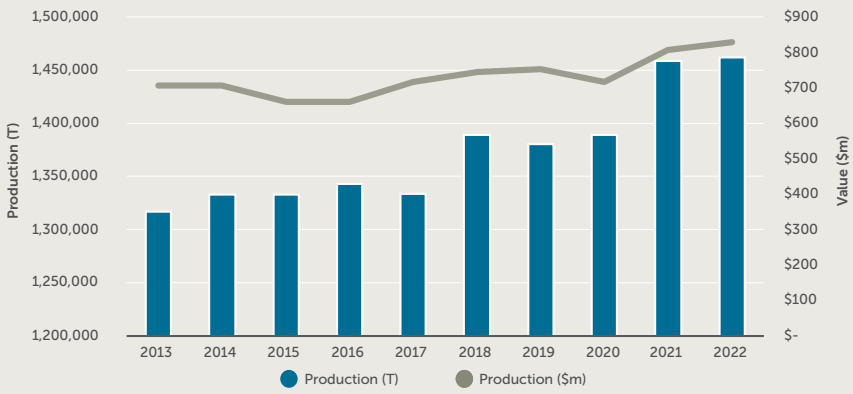


Source. Hort Statistics

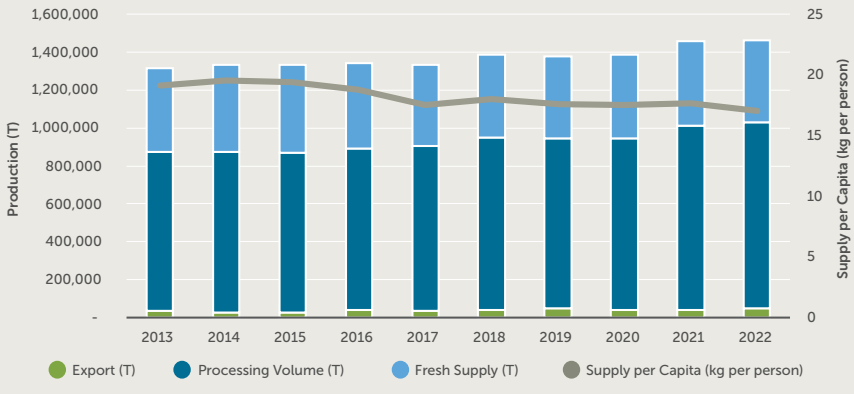
Potatoes

Year ending June	2021	2022	▲%
Production (t)	1,458,991	1,462,065	<1%
Production ($m)	$807.30	$830.20	+3%
Processing volume (t)	975,000	982,700	-3%
Fresh Export (t)	37,274	45,661	+23%
Fresh Export ($m)	$31.10	$36.20	+17%
Fresh Supply (t)	446,717	433,705	-3%
Fresh Supply Wholesale Value ($m)	$522.80	$526.30	<1%
Supply per capita (kg)	17.65	17.01	-4%

Production volume and value 2013-2022



Production and supply per capita 2013-2022



Find out more

To access Hort Innovation's Australian Horticulture Statistics Handbook, please **visit horticulture.com.au/growers/help-your-business-grow/research-reports-publications-fact-sheets-and-more/australian-horticulture-statistics-handbook/**

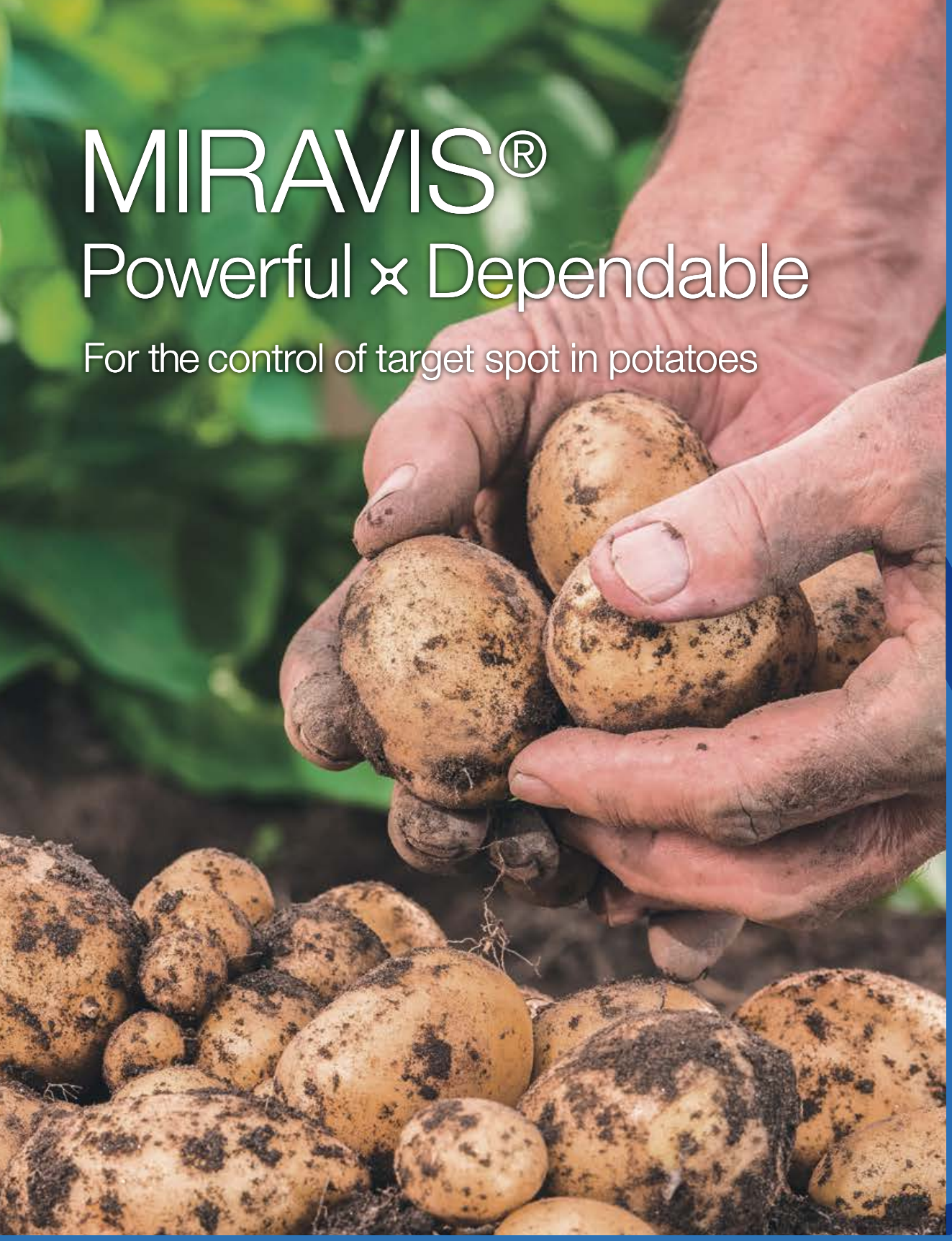
The Handbook's interactive dashboard is suitable for viewing on desktop computers and mobile phones.

Australian Horticulture Statistics Handbook 2021-22 to 2023-24 is a whole-of-horticulture project that has been funded by Hort Innovation using industry levies and contributions from the Australian Government.

Project Code: **MT21006**

Hort Innovation

Source. Hort Statistics



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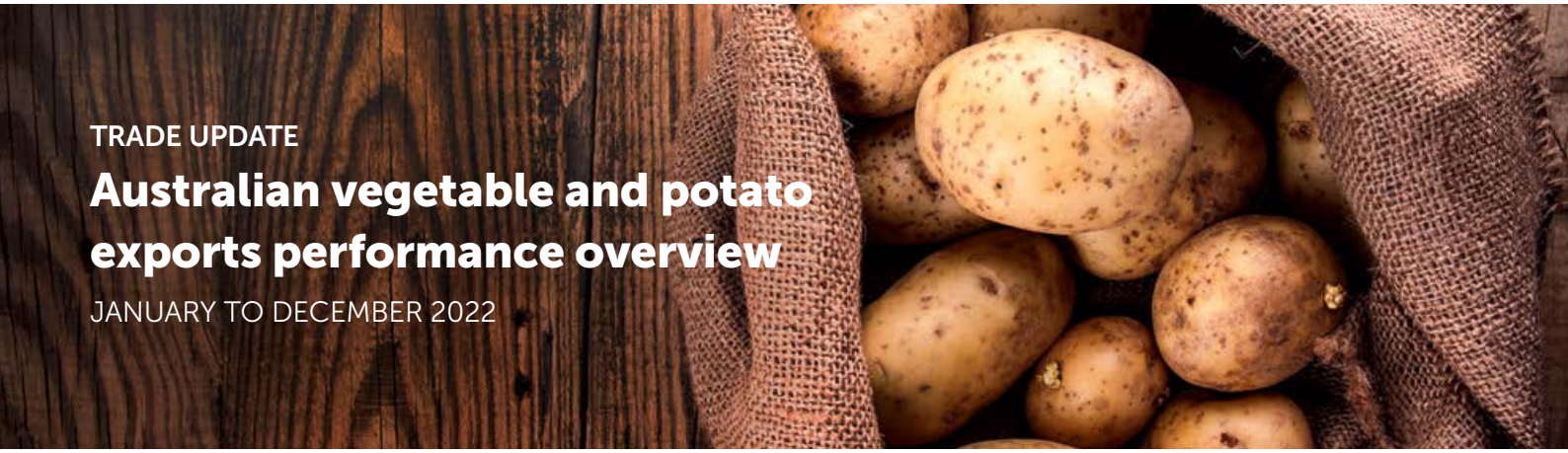


TRADE UPDATE

Australian vegetable and potato exports performance overview

JANUARY TO DECEMBER 2022

Based on data from the Global Trade Atlas, there was a 6 percent decrease in export value, from $250 million to $235 million and total export volume dropped by 14 percent from 221,675 tonnes to 190,740 tonnes. Singapore, United Arab Emirates, Malaysia, and Thailand remained as the top four markets for fresh vegetable exports.

In 2022, Singapore was the top Australian fresh vegetable export destination by value, despite a decline in export value by 13 percent, from AUD$49 million to AUD$42 million and a decrease in export volume by 16 percent, from 27,493 tonnes to 22,975 tonnes. The United Arab Emirates was the top export destination by volume, recording a slight increase of 2 percent in export value, from AUD$32 million to $32.7 million, with a decline of export volume by 4 percent, from 34,634 tonnes to 33,392 tonnes. Australian fresh vegetable exports to Malaysia contracted by 21 percent in value and decline by 31 percent in volume (*refer to Table 1*).

Singapore, United Arab Emirates, Malaysia, and Thailand remained as the top four markets for fresh vegetable exports.

TABLE 1. CHANGE IN VEGETABLE EXPORTS BY DESTINATIONS JAN TO DEC 2021- 2022

Trade Partner	2021		2022		%↑ 2021–2022	
	AUD$	TONNES	AUD$	TONNES	AUD$	TONNES
Total Fresh Vegetable Exports	**$250,303,308**	**221,675**	**$235,377,494**	**190,740**	**-6%**	**-14%**
Singapore	$48,535,891	27,493	$42,130,029	22,975	-13%	-16%
United Arab Emirates	$32,072,117	34,634	$32,717,628	33,392	2%	-4%
Malaysia	$29,057,227	29,092	$23,031,131	20,208	-21%	-31%
Thailand	$14,948,269	19,118	$18,298,466	17,388	22%	-9%
Korea, South	$12,294,061	16,973	$16,512,819	19,712	34%	16%
Hong Kong	$18,984,376	8,465	$16,223,290	7,205	-15%	-15%
Saudi Arabia	$16,574,589	18,774	$13,896,998	14,630	-16%	-22%
Taiwan	$9,162,121	10,734	$10,352,258	7,905	13%	-26%
Japan	$7,938,657	2,714	$8,858,454	4,786	12%	76%
Qatar	$8,774,982	9,039	$8,178,295	8,454	-7%	-6%

Potato exports highlights

TABLE 2. CHANGE IN VEGETABLE EXPORTS BY CROP JAN TO DEC 2021- 2022

Root vegetables such as carrots, potatoes and onions remained as the top three export crops for the industry.

Crop	2021		2022		%↑ 2021–2022	
	AUD$	TONNES	AUD$	TONNES	AUD$	TONNES
Carrots	$91,287,607	103,045	$89,283,499	93,453	-2%	-9%
Potatoes	$40,392,764	47,781	$41,009,661	46,754	2%	-2%
Onions	$33,460,527	49,552	$29,729,874	33,934	-11%	-32%
Cauliflowers & Broccoli	$15,171,676	3,167	$11,844,827	2,010	-22%	-37%
Asparagus	$9,970,168	1,183	$10,737,665	1,026	8%	-13%
Lettuce	$8,738,453	1,261	$7,825,567	1,113	-10%	-12%
Celery	$8,495,970	4,695	$7,137,617	3,904	-16%	-17%
Tomatoes	$5,116,715	1,021	$5,132,234	849	0%	-17%
Beans	$7,562,470	1,511	$4,874,406	702	-36%	-54%
Pumpkins	$4,464,659	3,072	$3,711,751	2,544	-17%	-17%

Source. Global Trade Atlas 2023

Potato exports by country highlights

TABLE 3. JAN TO DEC 2021- 2022

Trade Partner	2021		2022		%↑ 2021–2022	
	AUD$	TONNES	AUD$	TONNES	AUD$	TONNES
Singapore	$4,036,974	2,699	$4,102,341	2,636	2%	-2%
Malaysia	$3,845,985	3,456	$2,919,409	2,235	-24%	-35%
South Korea	$9,642,314	16,512	12,578,309	19,402	30%	18%

International trade events 2023

Through the *Multi-Industry Export Program (Vegetables, Onions, Melons)*, AUSVEG coordinates grower participation in and exhibition at several international trade missions aligned with major trade events in regions.

Trade Events	Trade Mission Date	Location
Foodex	7–10 March 2023	**Tokyo Big Sight** Japan
FHA F&B	25–28 April 2023	**Singapore Expo**
Reverse Trade Mission (inbound)	June 2023	Various states within Australia
Asia Fruit Logistica	September 2023 (TBC)	**Asia World Expo** Hong Kong

Find out more

Please contact Andrea Lin, International Trade Specialist, AUSVEG
andrea.lin@ausveg.com.au.
P. +61 3 9882 0277, M. 0420 236 211

Through the Multi-Industry Export Program (Vegetables, Onions, Melons), AUSVEG coordinates grower participation in and exhibitions at several international trade missions aligned with major trade events in regions.

Project Number: **MT21009**

Hort Innovation Strategic levy investment | VEGETABLE FUND

Hort Innovation Strategic levy investment | ONION FUND

Hort Innovation Strategic levy investment | MELON FUND

Growing a Career in Horticulture

A career in horticulture can be rewarding and satisfying with a diverse range of skills and aptitude from working outside with your hands to transport to business analyst. If you are looking for a new opportunity in horticulture, the AUSVEG Career booklet may have the new you.

It's time to start showing off our industry and all the incredible careers and pathways it has to offer. From an irrigation manager in the NSW Riverina to an agronomist in Tasmania, a quality assurance manager in QLD, or a Horticulture Grower in WA there are many opportunities to be excited about.

The horticultural industry is short 10,000 workers spanning from roles on farm, in packing sheds, management, and administration. In September 2022, there were six jobs for every agriculture graduate in Australia. The industry is booming and growing exponentially with innovation, ag-tech, and efficiencies across the sector.

Unlike many other industries, there will always be a job in horticulture, because we all need to eat, every day, three times a day.

The current public perception of careers in horticulture is limited to very physical or unskilled seasonal roles such as harvesting or packing. Whilst these roles are critical for our industry, there are so many more exciting and rewarding opportunities.

Because of this perception, there are fewer and fewer students studying horticulture. As a result, there are fewer training organisations offering certificates and degrees in horticulture. The reality is, is that we have an aging workforce - the average farmer is 58 - and less than a quarter of the workforce is under 35.

We need to change the perception of our industry and showcase what is has to offer to attract young people back into horticulture.

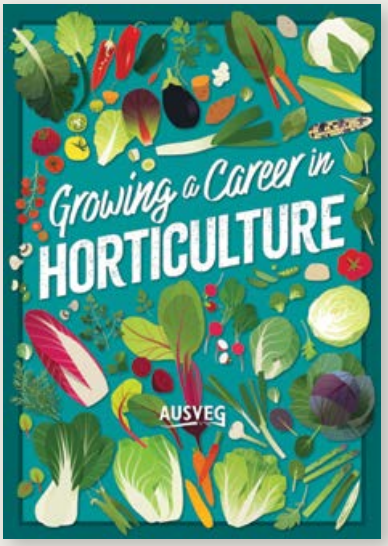
There are careers to suit everyone from all backgrounds, disciplines, and ages. Choose a role that is hands on/off, inside/outside, with/without people, whatever suits you!

AUSVEG has produced a Career booklet to show off an array of careers in horticulture at all stages of production. The booklet highlights the relevant skill and core tasks of each role as well as the different study pathways. Accompanying each career is a video of an employee on an Australian farm doing that role.

The booklet is aimed at students, teachers, parents, career counsellors and anyone looking to make a career change or learn about the industry.

AUSVEG has developed a Careers Strategy and will be engaging with secondary and tertiary schools and institutions, attending career expos and sharing the Careers booklet and other resources with our state members and other organisations to help encourage more people into our great industry.

Please share this resource with anyone who is considering (and not considering) a career in horticulture.



Careers covered in this booklet:

- Agronomist
- Biosecurity Officer
- Entomologist
- IMP Officer
- Mechanic
- Mechanical Engineer
- Ag technician
- Maintenance Electrician
- Fitter and Welder
- Hort Grower
- Hort Farm Manager
- Senior Nursery Person
- Nursery Person
- Nursery Supervisor
- Irrigationist and Irrigationist Assistant
- Horticulture Section Manager
- Production Horticulture Supervisor
- Farm Assistant
- Harvest Hand
- Machinery Manager
- Machinery Supervisor
- Irrigation designer/ Manager
- Cold Storage Manager
- Facility Plant Manager
- Facility Supervisor
- Truck Driver
- Forklift driver
- Mobile Plant Operator
- Section Supervisor
- Warehouse Packer
- Distribution Manager
- Human Resource Manager
- Marketing Manager
- Hort R&D Officer
- Quality Assurance Manager
- Health & Safety Manager and Officer
- Sales Manager
- Finance Manager
- Operations Manager.

FIND OUT MORE

For more information contact the AUSVEG Advocacy team, Lucy Gregg on **lucy.gregg@ausveg.com.au** or Chloe Betts at **chloe.betts@ausveg.com.au**

Growing a Career in Horticulture Booklet
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Tracing Potatoes and Cherries through the supply chain

A multi-faceted trial to test traceability through the supply chain for Woolworths using GS1 Global Location Numbers and QR codes has been completed, with promising results.

The traceability project was developed to assess ISO/IEC recognised GS1 global data standards in the fresh food industry to track products from the property to the consumer. Using potatoes and cherries, the investigation looked at the benefits of having real time information on plant produce from paddock to plate. In the event that an emergency response is needed, or a biosecurity incursion is detected, traceability can also assist with identifying a product's location anywhere along the supply chain from the point of origin to its intended destination.

The contributing partners, headed up by NSW Department of Primary Industries, included Woolworths Supermarkets, Food Agility CRC, FreshChain Systems and GS1 Australia, with Mitolo Family Farms and Cantrill Organics participating for potato and cherry tracing, respectively.

Potato bag with unique code for traceability.

About the project

The overall objectives of the project were to use ISO/IEC compliant data standards to:

- Identify the product and its properties throughout the supply chain;
- Demonstrate that the data associated with the product was sufficient to provide efficient emergency responses and supply chain logistics;
- Identify points in the supply chain where product remained too long or was exposed to unfavourable conditions, thereby reducing waste.

Full traceability to date has been problematic, often as different supply chain points have differing systems that do not 'talk' to each other, making it difficult to maintain connection throughout the supply chain.

The GS1 system utilises an international common data structure that is readily integrated. A unique identifier using a QR code was applied to punnets of organic cherries and bags of brushed potatoes for the program.

The location data was encrypted into the GS1 system, which was also scannable by consumers to provide feedback on their experience. The GS1 Digital Link enabled the product to be traced in real time, from property to store, including how long it spent at each location.

Specifically, the following outcomes were achieved:

- successful proof-of-concept of ISO/IEC-compliant data standards;
- understanding the value of the GS1 Global Location Number and National Location Registry for integrated traceability;
- understanding the importance of a digital traceability system for managing an emergency, biosecurity incursion or food safety recall;
- exploring the importance of data sharing agreements and permissions-based data;
- realising the potential for data standards to provide a framework for electronic certification for market access and protocol requirements;
- increased awareness of the value of connecting the grower and consumer via the GS1 Digital Link.

How the traceability system worked

Potatoes were used as it is a well-established industry and staple product for Woolworths, while the organic cherries are keen to use traceability technology to gain market access under the Woolworths 'Macro Organics' brand.

Labels with unique QR codes were applied to potato bags and punnets, linking them to shipping crates and containers. These unique identifiers were than shared into the FreshChain platform which would then identify where the product was in the supply chain. Dataloggers were incorporated into the information for each product unit (bag or punnet) to record temperature, location and light interception.

To verify the data, samples of potatoes and cherries were compared to their physical presence to the digital information to verify the accuracy of the data. A simulated food recall was also set in place to test the effectiveness of a recall for consumers.

The FreshChain dashboard gives a visual display of the location, and in the instance of an issue, an alert is raised when the QR code is scanned. Product can be traced

Image. Courtesy Melanie Wishart, GS1 Australia

by entering the batch number or packed date and all data associated with that number will be identified and displayed as shown in batches. There is a 'lock down all' button that, when activated, will send a recall message to the identified affected batches.

For the consumer, the benefit of a unique QR code is the ability to access the provenance of the product, health ratings, ingredients, the organic accreditation for the cherries, or other agreements such as FairTrade. Consumers can also opt to provide feedback and ratings to the grower and retailer.

Biosecurity and tampering

A clear benefit of a traceability system is the ability to identify where product originates from, and prevent movement into sensitive regions. A good example is Queensland Fruit Fly (QFF), where the FreshChain system can hold certificates of treatment against QFF to facilitate trade access into other domestic markets, or export.

Product tampering points can also be more readily identified, with each point in the supply chain verifying the integrity of the product, and certificates electronically moving along the chain of data. Should environmental conditions of storage or transport be altered, datalogger information can also be linked in the FreshChain system.

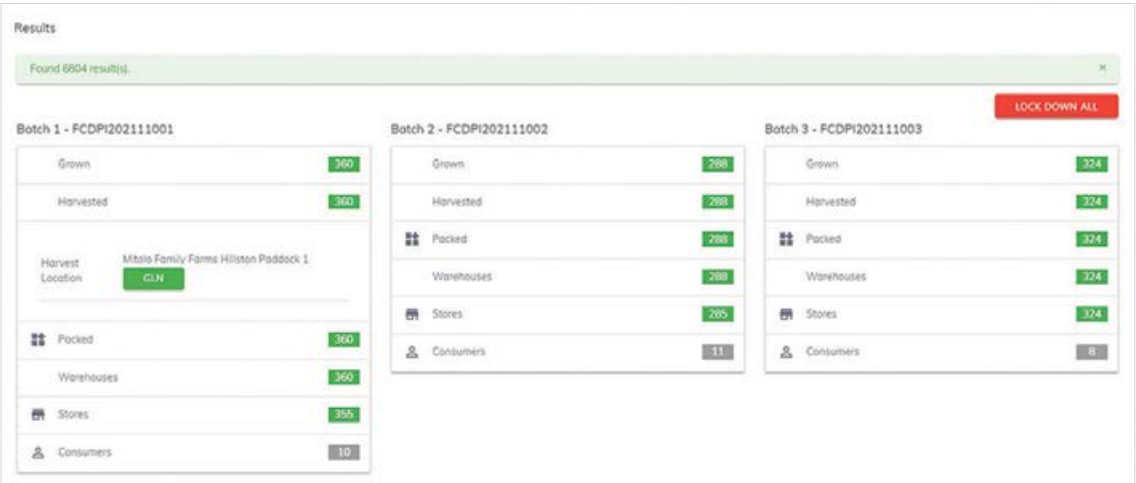
Project lead with NSW DPI, Jessica Fearnley said, "A key objective of the trial was to assess the ability to instantly identify properties in NSW through a central repository in the event of a biosecurity threat such as bushfires and deploy resources where they are needed.

"We are all too aware that these threats remain and it is critical that we work toward a more centralised approach for identification, containment and support deployment," added Fearnley

Director of FreshChain Systems, Greg Calvert, welcomed the opportunity to provide the digital traceability solution and advanced quality control sensors for the project.

"We will continue to see further benefits of digital transformation and that is an exciting prospect for speed, accuracy and data access. More relevant data, linked to create valuable insights and enhanced visibility, will support all partners in the supply chain. For consumers, this is the next best thing to being on-farm."

Figure 1: FreshChain dashboard



Donating to Foodbank has never been simpler for growers

Tayla Field National Program Manager Agri - Foodbank Australia.

The ever-increasing need in our communities to provide food relief is a daily challenge for organisations such as Foodbank, but a collaborative approach between growers and the organization makes the process that much more easy, and timely.

Joining the team at Foodbank Australia in November 2022, is Tayla Field as the national program manager for agriculture. Her role is to work with Foodbank's national produce donors to help deliver more fruit and vegetables to Foodbank via various structured supply and donation programs.

Foodbank Australia coordinates procurement of in-demand produce for state members, manages the national donor and national food programs, undertakes federal government advocacy and conducts research and analysis at a national level to help raise awareness. Tayla says that Foodbank is the 'pantry for the charity sector'.

At last count, Foodbank provided food and groceries to 2,625 registered charities and provided food for school breakfast programs to around 3,000 schools around the country, making it the largest food relief organisation in Australia. In 2022, Foodbank sourced 45.6 million kilograms of product, equating to 82 million meals. Many people have the misconception that food insecurity is a city problem, but in fact 30% of all the resources provided by Foodbank went into rural and regional charities to meet local community needs.

"The increase in needing help has risen significantly even just in the past 12 months," said Tayla. "A lot is due to the rise in the cost of living. For many, bill shock from a cold winter or a large repair expense may put families back for a month or two and they need assistance, but now we are seeing people who need help for longer periods of time. They have the same income, but the dollar doesn't stretch as far as it did 12 months ago. We don't see that changing anytime soon."

Advocacy has played a pivotal role in addressing the issue of food relief. Foodbank Australia CEO Brianna Casey and other organisations such as OzHarvest, SecondBite and Fight Food Waste CRC have been integral to conversations with state and federal governments.

Currently, a tax proposal has been presented to coincide with the next federal budget, to give growers an additional incentive to donate rather than dump unwanted produce into landfill. The National Food Donation Tax Incentive aims to reward growers (and transporters, coolstore and others) with donating product to charities to give food relief, and reduce food waste.

Meeting the demand and supply logistics

As families feel the pinch, often the first thing that is taken out of the supermarket trolley is protein, followed by fruit and vegetables. As a consequence, demand for fresh produce for the fridge, or supplies to make value-add products such as pasta sauce is rising.

"There is plenty of opportunity for fruit and vegetables that are surplus, out of-spec, or nearing the minimum acceptance date for the retailers. A lot of our donors support us directly from the farm. Our challenge is more around consistency of supply. For example, bananas are a staple part of the food for the school breakfast program, but if they are not available, our members need to find other options to fill that gap."

For growers that supply ALDI and Woolworths, an initiative advocated by Foodbank is via the HarvestMark system used by the supermarkets to accept – or reject – produce. In the event that produce is rejected, the grower can opt for the produce to be donated to Foodbank, rather than being collected or sent to landfill. Foodbank then collects the produce from the distribution centres alongside other produce that is to be donated. Foodbank has also received authorisation from the retailers for suppliers to donate packaged private label products to Foodbank, to avoid growers having to remove product from packaging and or send it to landfill.

A common scenario, said Tayla, is for collection directly from farm, to minimise the transit and handling of product from farm to families.

"There are a few different ways we can work with growers to pick up donated produce off-farm. The first is ad hoc donations, where a grower has surplus and or non-spec stock, that is still fit for us but they can't find a buyer or home for it. We can usually find a home for it and will work with the grower to find a simple solution for them.

"There are also seasonal opportunities, where a grower may have surplus supply of product or non-spec produce throughout the season that can be donated to Foodbank. In this instance, we can plan ahead on how to best use the resource and work out the logistics ahead of time.

"We can work with growers to have Hat bins and or CHEP bins available on farm at the start or throughout a season, so product can be loaded straight into bins allocated to Foodbank from the packing line or harvest. They can let us know a few days ahead of time when pick up is available and transport can be arranged."

"One of the bigger challenges is actually around freight as it is one of the biggest costs for the donation process. If the grower has contracts in place with a transport company, it can be easier to piggyback on that. We do have partner freight companies that will do pro-bono pick ups for Foodbank, and we also have some resources to pay for the freight."

Looking ahead at what is needed

Collaborative agreements along the supply chain, for example to make pasta sauce or sausages, means that the cost burden of donating is reduced for each supply chain member. Foodbank may find opportunities to source inputs for the grower, the pasta sauce manufacturer may donate time on the production line, the packing shed may pack in bulk rather than punnets.

Tayla sees an opportunity to grow Foodbank's national potato program and establish similar programs across other categories such as tomatoes to provide in demand products ongoing.

"If we know we have four bins of potatoes coming in every week for the next eight weeks, we can streamline the delivery of produce programs for agencies, and work with other supplies that we have sourced, rather than an ad hoc approach. Potatoes and tomatoes are such versatile staples.

"Having said that, ad hoc donations of vegetables such as corn and beans are a nice change in variety, and well appreciated – they go out the door very quickly."

Get in touch and donate

Tayla recognises that each grower has a unique set of circumstances to overcome to become a donor directly from-farm but sees that increasing demand by families will require extra resources.

"I want to make the process of donation as simple and rewarding as possible for the grower," she said.

"I encourage growers to get in touch with me or their State Foodbanks, to start the conversation, about how much they feel comfortable with donating, whether it is a seasonal surplus or something more long term.

"We can have a chat about how often it is picked up, what we can do about transport costs, or alternatively establishing a collaborative partnership for processed goods. Let's work together to create a calendar for our members and agencies that shows what produce is coming in and when."

About Tayla Field

Tayla is passionate about horticulture, coming to love the industry through university. Raised in Sydney, Tayla initially studied environmental systems, where many subjects had crossovers with agricultural science streams. She quickly swapped over and hasn't looked back. Following a career pathway program with the International Fresh Produce Association, she knew horticulture was her future.

Her background includes several years with One Harvest in Tasmania working on the farms, before moving back to Sydney to work in the manufacturing side of the business. She has also spent time as an account manager with the sales team.

As an advocate for agriculture, Tayla is also involved in a program to foster emerging young leaders to become confident role models and trusted choices for the industry.

FOR MORE INFORMATION

Please contact Tayla Field National Program Manager Agri - Foodbank Australia on 0433 744 075 or email **tayla@foodbank.org.au**

Soil health improvements triggering better potato yields

With ammonium phosphate prices at some of the highest levels seen since 2008, it's important to get the most out of your crop nutrition.

Soil testing before planting is one way to understand and address the nutritional requirements of your potato crop. Improving soil health can also help balance crop nutrition, and humic substances are an effective way to do this.

Humic substances are a mixture of organic materials, created by the decay of plant and animal residues. As organic materials, they are a good source of carbon and provide a food source for soil microorganisms, bacteria, algae, fungi and earthworms.

Increasing the humic content in soils has the potential to improve overall soil health resulting in healthier crops that are better able to withstand biotic and abiotic stress.

Humic substances are made up of three distinct groups: humic acids, fulvic acids and humin. Humic acids can have beneficial effects on soil function such as improved biological activity, nutrient activity, cation exchange capacity, pH buffering, carbon sequestration, soil water relations and plant biomass.

Trigger®, a new humic granule developed by Incitec Pivot Fertilisers, contains both humic and fulvic acid.

It's a hard granule, with a high crush strength, 2.4-2.6 mm in size, low in dust and air dried, helping it maintain the integrity of functional groups and making it ideal for blending with most custom-made blends.

Incitec Pivot Fertilisers Commercial Manager, Farming Services Phil Hoult believes the versatility of Trigger® makes it an appealing option for growers across a range of crops.

"Long term soil health is key to consistent potato production, regardless of soil texture," Mr Hoult said.

"Building and maintaining carbon and structure over time in soils that are cultivated and cropped frequently is a major challenge for growers."

"Having a high quality, low dust, granulated humic product like Trigger® allows growers to easily develop targeted custom blends for use at planting, specifically to suit their soil types and production needs without the cost of separate application."

In potatoes, Trigger® is applied with the base planting blend at just 40kg/ha. It can pass through fertiliser equipment with relative ease, and can be broadcast, air seeded and banded at planting.

"We are seeing and hearing from growers that Trigger® is helping deliver yield improvements in soils with lower than desired Caption Exchange Capacity (CEC) and Organic Carbon percentages," Mr Hoult said.

"Trigger® granules themselves have a very high CEC and can provide 'localised' improvements in CEC or the ability to hold nutrient. Trigger® also appears to give a localised buffering against alkalinity, helping the uptake of key nutrients like phosphorus, which is a key element for tuber set and yield in potatoes.

"In other crops we have also seen Trigger® provide a buffering effect in saline soils, reducing chloride levels and EC. With some mainstream potato varieties being sensitive to high levels of chloride building up, we are looking to do more work in the future in these varieties."

A three-year experiment on potatoes grown in Idaho on low organic matter (1%), calcareous soils (pH>8), demonstrated that incorporation of liquid humates at planting at a rate of 2.64 to 5.2 litres/ha resulted in increased petiole P uptake, increased tuber size, and an increased gross return per ha of $USD61.

In other crops, inclusion of humates has also shown to help improve yield and quality, boosting the bottom line for the grower.

Top. Phil Hoult believes the versatility of Trigger® is an appealing option for potato growers.
Above. The granules of Trigger® contains humic and fulvic acid.

FOR MORE INFORMATION

For more information regarding Trigger® visit. **incitecpivotfertilisers.com.au/products-and-services/our-products/trigger**

Or contact Incitec Pivot Fertilisers at **ipfhorticulture.com.au**

Benevia®
INSECTICIDE

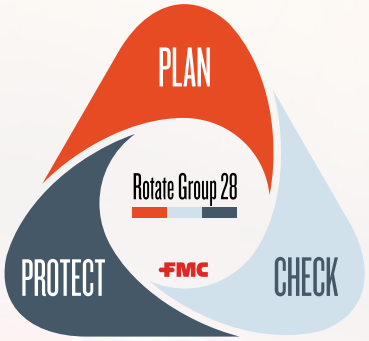
Expand your horizons

Benevia® provides highly effective cross spectrum protection that rapidly stops insects feeding. Further damage to the plant is reduced, ensuring maximum marketability of your crop.

Benevia® is specifically designed for use in Integrated Pest Management (IPM) schemes, in fact, it's so effective on pests in Fruiting vegetable and Cucurbit crops that we're expanding the label to cover Bulb vegetables, Potatoes and Strawberries.

Being a Group 28 insecticide tool to fight pests, it's important to use Benevia® in accordance with the current Insecticide Resistance Management (IRM) strategy in your area. Remember to rotate with a different mode of action insecticide, as required.

Visit www.fmccrop.com.au for more information.



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www.fmccrop.com.au

AUSVEG

Fall Armyworm resources

Fall armyworm (FAW; *Spodoptera frugiperda*) is a destructive pest that attacks more than 350 plant species overseas. Affected vegetable crops include sweet corn, capsicum, beetroot, tomato, onion, cauliflower, cucumber, lettuce and potato. Other crops affected include maize, rice, sorghum, sugarcane and wheat.

Fall armyworm (FAW) continues to be a headache for Australian horticultural since its detection in 2020 and is a recognised pest in many states.

What does Fall armyworm look like?

The caterpillar phase of the FAW causes extensive damage to foliage by attacking leaves, stems, shoots, flowers and fruit and feeds at night. The females lay eggs on leaves, which hatch after 2-4 days when the temperate is favourable (21-27°C). The newly hatched larvae will cause some damage, which increases as the caterpillar grows. The larvae will burrow into the soil where the adult develops. By 8-9 days the moth emerges, and the cycle starts once more.

Correct identification of FAW is important as there are a number of armyworm, cutworms, and native species in Australia. However, there are two distinguishing features to identify a FAW caterpillar:

1. **Four black spots, arranged in a square configuration on the end of its body.**
2. **Dark head with an upside down, pale Y-shaped marking.**

If you are unsure growers can utilise the **MyPestGuide Reporter** for confirmation.

MyPestGuide Reporter

A communiation tool for everyone to report pests

MyPestGuide Reporter is a free photo reporting app built for the public, farmers, agronomists, landholders, pest controllers, researchers and the entire industry community to quickly and easily report pests (insects, animals, weeds, diseases) across Australia.

For more information regarding MyPestGuide Reporter visit agric.wa.gov.au/apps/mypestguide-reporter **or via the QR code.**

Access the APVMA website portal.apvma.gov.au/permits or via this QR code and search 'fall armyworm'for a comprehensive permit list.

For more information

Download the AUSVEG Fall Armyworm fact sheet here: ausveg.com.au/app/uploads/2021/12/Final-pdf-standard-faw-guide_compressed.pdf

Integrated pest management approach

Research of the genetic origins of Fall Armyworm show that it is likely to have originated in West Africa and evolved to suit local conditions across East Africa, equatorial regions of north and south Americas, India and southern China. Genetic markers of the populations in Australia show that while they look the same, the FAW in rice and corn crops, are hybrids.

Dr WeeTek Tay, senior research scientist with CSIRO, said in a **Plant Biosecurity Research Initiative podcast** that, "We know that there is resistance in FAW genetics to Bt3 and Cry1AC for cotton overseas, it is not unreasonable to expect that with further migration into Australia FAW will bring that resistance into Australian crops. Populations in Africa and China have the genes for organophosphate resistance – it is possible that within a short time frame, that we will see the same here." This knowledge has helped inform pest management strategies, and the need for further research into biosecurity preparedness and response.

The key to controlling FAW populations comes down to a successful integrated pest management (IPM) program, early detection and implementation of control methods. There are now several insecticides that are available for FAW control in Australia.

Choosing the right chemical control needs to consider the affect the active ingredient may have on beneficial insects, Mode of Action and the timing of application in relation to the lifecycle of FAW. There are several emergency minor-use permits issued by the Australian Pest and Veterinary Medicine Authority (APVMA), which are listed at **portal.apvma.gov.au/permits**

The use of biological controls – through natural predators, parasites and pathogens – has had varied success internationally. Research into biological controls in Australia is still in the early stage. Some Australian predators (Assassin bugs, black ants, earwigs and spine shield bugs) have been noted attacking FAW eggs and larvae, are under investigation through Hort Innovation funded project (MT19015) by Queensland DAF.

Pathogens including bacteria, viruses and fungi, need to be applied with caution, and effectiveness to date has been variable.

Crop management through crop residue clean up after harvest, farm hygiene, crop rotation, and weed control are encouraged to reduce the risk of pest establishment, reproduction, dispersal and survival of FAW.

The Plant Health Australia and AUSVEG Fall Armyworm Guide outlines the methodology for crop monitoring to detect FAW eggs and larvae, and reduce damage and harvest losses.

1. Check a sample of seedlings prior to planting for eggs and larvae
2. Monitor susceptible host crops as soon as plants emerge
3. Weekly monitoring during plant growth
4. Recording of plants infested with eggs and larvae. Keep track of leaf damage – small amounts indicates young larvae, while 'shotgun' damage suggests older larvae.

Top Left. FAW neonate larva on maize.
Above. FAW corn leaf damage. **Below.** FAW egg mass on maize.

Potato Levy Update

It is Hort Innovation's job to work with industry to invest the potato levies and Australian Government contributions into initiatives to help growers be as productive and profitable as possible, through the Hort Innovation Fresh Potato and Potato Processing Funds.

What is the potato levy?

Levy is payable on potatoes that are produced in Australia and either sold by the producer or used by the producer in the production of other goods. The R&D levy rate on unprocessed potatoes is 48 cents per tonne.

This levy is 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 in the case of R&D – into strategic R&D initiatives.

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/vegetables.**

How are levy investment decisions made?

Investments specific to the Hort Innovation Fresh Potato Fund 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 potato Strategic Investment Plan?

The potato SIP 2022-2026 is the roadmap that helps guide Hort Innovation's oversight and management of both the fresh potato and potato processing levies and Australian Government contributions, ensuring investment decisions are aligned with industry priorities.

The SIP lays the foundation for decision-making in levy investments and represents the balanced interest of the potato industry. The most important function of the SIP is to make sure that levy investment decisions align with industry priorities.

Previously, the Potato – Fresh Fund had a separate SIP, called the potato grower SIP, and in 2021, it was refreshed and combined with the processing potato SIP to reflect the current needs of industry. The refresh involved close consultation with growers, industry participants and the wider research community.

The current potato SIP details the industry's strategic goals centred around four outcome areas: extension and capability; industry supply, productivity and sustainability; demand creation; and business insights. Under each of those outcomes, there are industry-specific strategies and key performance indicators that provide guidance on how the potato - fresh industry will work towards achieving the outcomes.

For the previous potato grower SIP, a performance report has been developed to demonstrate how investments delivered in the Potato – Fresh Fund from 2016/17 to 2020/21 generated impact for potato growers. The report provides 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 potato grower SIP 2017-2021, going forward an annual performance report will be provided for the potato SIP 2022-2026.

What is the potato Annual Investment Plan?

While the potato SIP provides an oversight of investment over the next five years, the potato AIP explains how levy funds are going to be invested over a twelve-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 potato 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 potato Strategic Investment Advisory Panel (SIAP).

Hort Innovation develops draft investment recommendations based on investment ideas that are aligned to the potato 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 potato SIAP consists of supply-chain stakeholders from both the fresh and processing potato 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's 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 and Potato Processing Funds are detailed in the Your investments page of this Fresh Potato and Potato Processing Fund sections 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 program, run through the investment *Australian potato industry communication and extension project* (PT20000; *PotatoLink*), also provides regular information on levy-funded activity.

Find out more

Please visit **horticulture.com.au/growers/potato-fresh-fund/** to read more about the Hort Innovation Fresh Potato Fund, and **horticulture.com.au/growers/potato-processing-fund/** to read more about the Hort Innovation Potato Processing Fund.

For further details or if you have any questions, please contact Hort Innovation Service and Delivery Manager Jason Hingston on 0429 793 496 or email **Jason.Hingston@horticulture.com.au**. Alternatively, you can phone the AUSVEG office on 03 9882 0277.

Hort Innovation Strategic levy investment | POTATO – PROCESSING FUND

Hort Innovation Strategic levy investment | POTATO – FRESH FUND

Hort Innovation
Fresh Potato Fund Update

The potato Strategic Investment Plan (SIP) 2022-2026 provides a roadmap to guide Hort Innovation's investment of potato industry levies and Australian Government contributions, ensuring investment decisions are aligned with industry priorities.

The SIP's intent is to reduce the cost of production and improve the sustainability of production practices with effective management of pests, diseases, weeds and biosecurity threats. Growth in domestic and international consumer demand is also a focus for the potato industry.

Currently, both the fresh potato and processing potato research and development (R&D) funds have capacity to invest over the life of the SIP. Careful prioritisation of investment needs is required by industry over the next five years.

The four outcome areas of this SIP cover significant themes under which programs and investments will be focused.

Industry outcomes

Outcome statements as identified and prioritised by the potato industry have been prepared under four key outcome areas:

- Extension and capability.
- Industry supply, productivity and sustainability.
- Demand creation.
- Business insights.

OUTCOME 1

Extension and capability

To manage knowledge, relationships, systems and processes required to communicate effectively with internal and external stakeholders.

Achieving the outcome will involve:

- 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.

OUTCOME 2

Industry supply, productivity and sustainability

To accelerate the application of production practices that optimise returns and reduce risk to growers.

Achieving the outcome will involve:

- 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.

OUTCOME 3

Demand creation

To maintain and strengthen consumer demand for fresh potatoes as the foundation for sustainable expansion of production and consumption in domestic and international markets.

Achieving the outcome will involve:

- 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.

OUTCOME 4

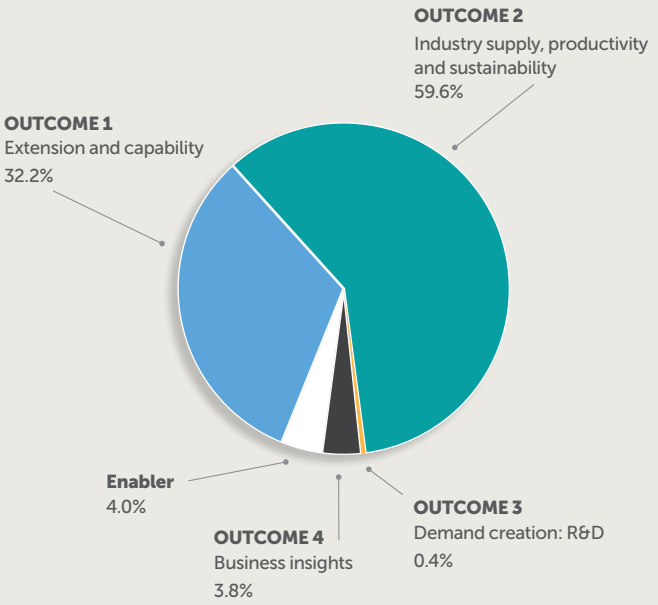
Business insights

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.

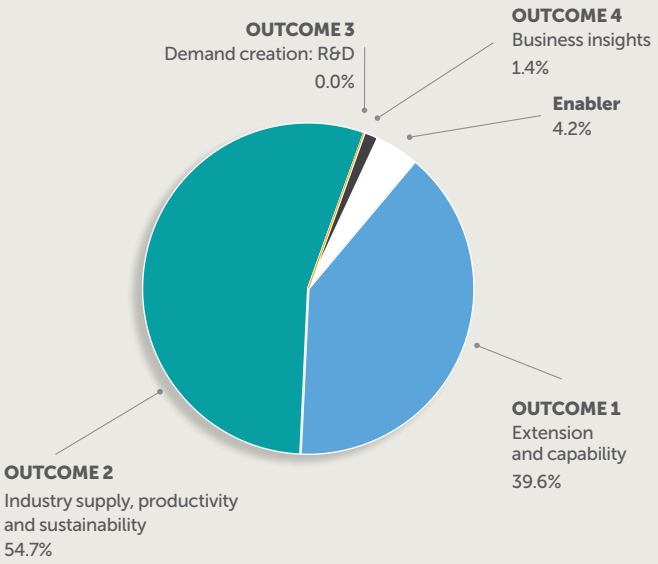
Achieving the outcome will involve reliable baseline data and analysis to provide insights and understand current and emerging trends. Key investments will support the provision of consumer knowledge and tracking, trade data and independent reviews to enable better decision-making process at industry level and individual businesses.

These investments underpin and are complementary to delivery of the other outcome areas.

$636,597 has been invested by the Fresh Potato Fund
in the Strategic Investment Plan – July 2021–June 2022



$508,514 has been invested by the Potato Processing Fund
in the Strategic Investment Plan – July 2021–June 2022



Investment expenditure analysis

Investments specific to the Hort Innovation Fresh Potato and Potato Processing Funds are guided by the potato Strategic Investment Plan (SIP). The SIP features four priority outcome areas that have been identified and agreed upon by the industry, and Hort Innovation works to invest in R&D initiatives that are aligned to these.

Find out more

Please visit **horticulture.com.au** to read the full Hort Innovation Potato 2022-2026 Strategic Investment Plan.

For further details or if you have any questions, please contact Hort Innovation Service and Delivery Manager Jason Hingston on 0429 793 496 or email **Jason.Hingston@horticulture.com.au**. Alternatively, you can phone the AUSVEG office on 03 9882 0277.

Hort Innovation Strategic levy investment | POTATO – PROCESSING FUND

Hort Innovation Strategic levy investment | POTATO – FRESH FUND

FLIP

to read PotatoLink

to read Potatoes Australia

FLIP

ISSUE 08

AUTUMN 2023

POTATO LINK

FEATURE ARTICLE

SEEDS: AN EXTENDED FEATURE

ahr applied horticultural research
Hort Innovation Strategic levy investment | POTATO – FRESH FUND
Hort Innovation Strategic levy investment | POTATO – PROCESSING FUND
POTATO LINK AUSTRALIAN POTATO INDUSTRY EXTENSION PROJECT

POTATO LINK
AUSTRALIAN POTATO INDUSTRY EXTENSION PROJECT

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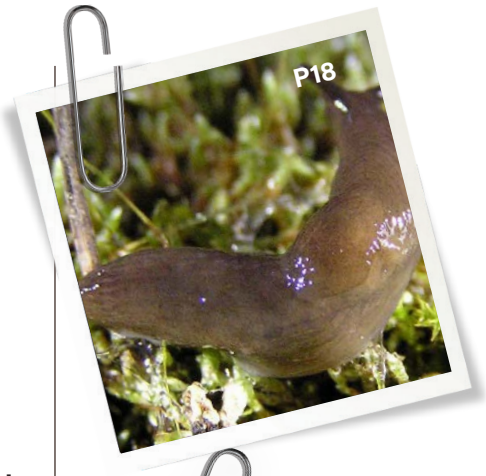

SPECIAL FEATURE: SEED POTATOES

As every vegetable grower understands, all good crops start with good seed, and potatoes are no exception. However, potato tubers, unlike many other seeds, need a considerable care and attention to optimise results. Seed potatoes, themselves a perishable input, power the young plants for their first 40 days and account for about 30% of the total cost of production. Understanding what they need, and why, is of great value.

By Paulette Baumgartl

EXPLORE A TOPIC FURTHER

Our special extended feature on seed includes information on age, diseases, storage, cutting, treatment, and certification. Some topics have been extensively covered in previous editions of this magazine or elsewhere; look for this symbol for links to articles, webinars, and fact sheets.

SEED AGE

At any one time the seed tuber has two ages: its chronological age and its physiological age. Chronological age is, as the name suggests, a time marker, usually from harvest. Physiological age reflects the life the tuber has led since harvest.

The physiological age of seed will influence how a potato crop will perform (Table 1). Growers can effectively manipulate the physiological age of seed potatoes according to growing conditions and desired outcome. For example, seed growers may prefer older seed that yields many smaller tubers, whereas growers producing processing potatoes may favour younger seed so as to produce larger tubers.

Young seed	Old seed
Slow emergence	Rapid emergence
Fewer stems / hill	More stems / hill
Low tuber set	Higher tuber set
Longer tuber bulking period	Shorter tuber bulking period
Long tuberisation period	Uniform tuber set
Larger tubers at harvest	Smaller tubers at harvest
More foliar growth	Less foliar growth

Table 1. Characteristics of old tubers versus young tubers (Adapted from Bohl, Nolte, Kleinkopf and Thorton; Struik (2007))

Many factors effect physiological age, including:

- Depending on cultivar, seed **dormancy** may vary from a few weeks to several months.
- **Growing conditions** of the seed. Crop stress due to high temperatures, low moisture, poor nutrition, frost, or disease pressure increase ageing.
- **Mechanical damage and bruising** of the tubers increases seed respiration rate and accelerates ageing.
- **Cold storage temperatures** reduce respiration rate and therefore ageing. Avoid fluctuating temperatures due to low ventilation rates.
- **Respiration rates of cut seed** rise during healing, increasing physiological age. Providing optimal conditions for rapid curing after seed cutting minimises ageing and disease risk.

EXPLORE FURTHER

For a deeper dive into the topic of seed age, read more in Issue 1 of PotatoLink Magazine:
http://bitly.ws/BFzD

To read more about diseases, access the fact sheets here:
https://potatolink.com.au/factsheets

To watch webinars about diseases, access here:
https://potatolink.com.au/webinars

DISEASES AND DEFECTS OF SEEDS

Potato seed tubers can be an important source of disease inoculum, and, when present, can cause substantial reductions in yield or quality in the subsequent crop under the right environmental conditions.

Some diseases are more likely to cause significant losses than others.

Diseases, such as ring rot, late blight, and leafroll (net necrosis) (Figure 1), are carried on or in the seed, and have the potential to spread very quickly through the crop. Tubers infected with such diseases need to be safely discarded. Other diseases, including rhizoctonia black scurf and pythium leak, have limited secondary spread from the tuber (other sources of inoculum are usually more concerning) and are less serious.

Importantly, the absolute losses resulting from specific tuber problems will depend upon environmental conditions and disease management practices. The most important aspect of disease management in potato production is the use of certified seed potatoes (see break out box on page 12).

Table 2 provides a useful summary of typical tuber diseases, physical symptoms and risks.

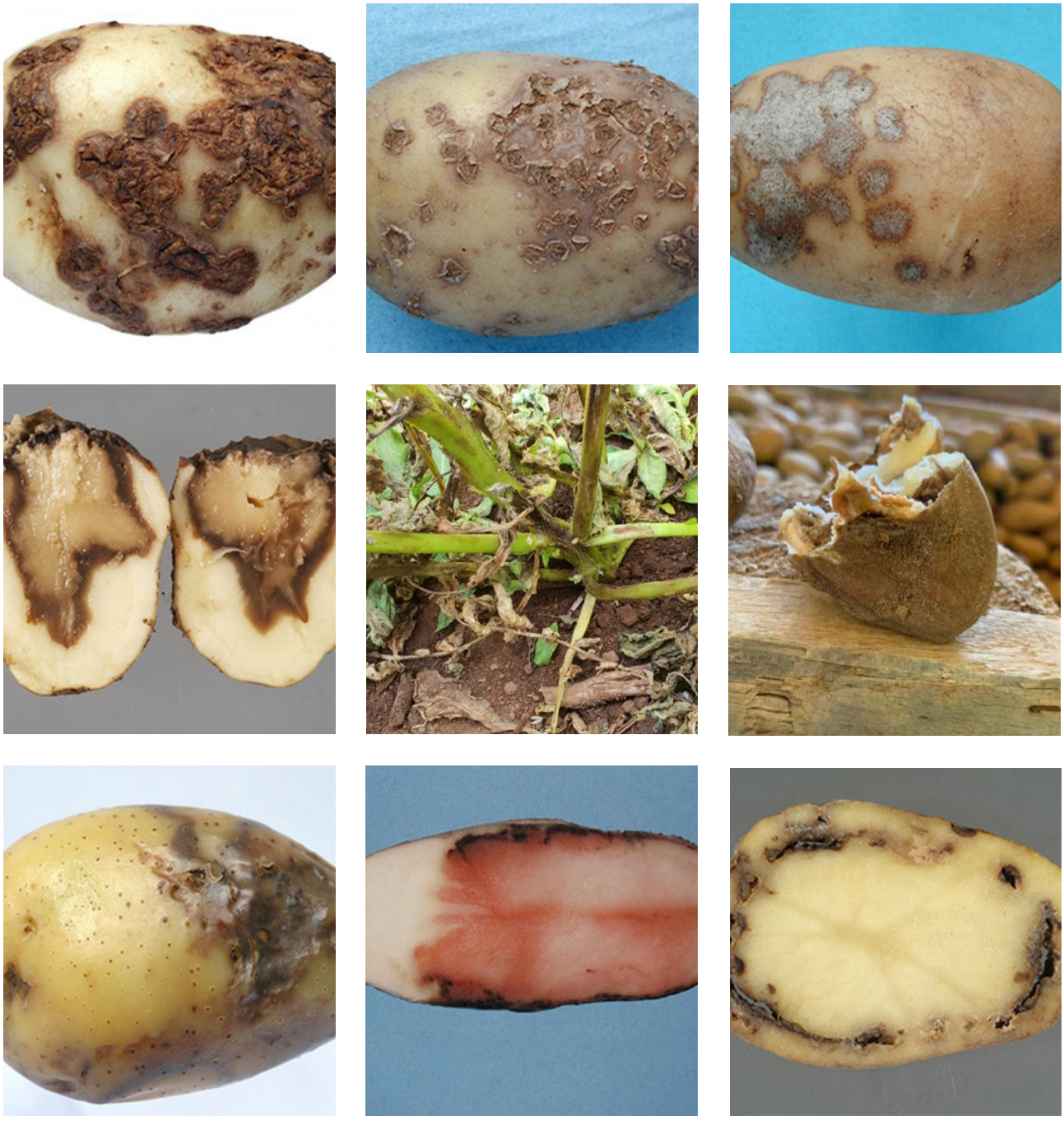

Figure 1. From top, left to right: common scab, powdery scab, silver scurf, soft rot, blackleg, fusarium rot, late blight, pink rot, ring rot (Source: Agriculture and Horticulture Development Board (AHDB) potatoes archives website).

Disease or defect	Source of pathogen or disorder			Diagnosis & location on/ in tuber	Spread within storage[1]	Other comments
	Soil	Seed	Other			
Common scab	✓	✓		External, general	No	
Powdery scab[2]	✓	✓		External, general		See footnote 2
Rhizoctonia	✓	✓		External, general, must wash	No	
Silver scurf[3]	✓	✓		External, general, must wash		See footnote 3
Bacterial soft rot	✓	✓	✓	External general; internal general	Yes	Other sources are from cull piles and irrigation water
Blackleg	✓	✓		External, stem end; cut internal stem end and longitudinal	No	
Early blight	✓	✓		External, general; internal, make shallow cuts through lesions	Yes	
Freezing and chilling			✓	External, general; internal, stem end and cross section	No	
Fusarium rot	✓	✓		External, general; internal, cut through lesions	No	
Late blight		✓	✓	External, general; internal, cut through lesions	Yes	Other sources include cull piles and volunteers
Mechanical injury			✓	External, general; internal, cut through damaged area	No	
Pink rot	✓			External, stem end, eyes, lenticels; cut internal, turns pink	Yes	
Ring rot*		✓	✓	External skin cracks; cut internal, near stem end	No	Other sources of inoculum include volunteers, equipment, and containers
Root knot nematode	✓	✓		External, general; internal, cut tangential	No	
Black heart	✓	✓		Cut internal, longitudinal	No	Caused by lack of oxygen under certain field conditions, in storage, and in transit.
Black spot			✓	Cut internal, stem end half or on shoulder	No	Deep piles contribute to problem
Fusarium wilt	✓	✓		Cut internal, through stem end, only in xylem	No	
Leaf roll virus		✓	✓	Cut internal, cross section	No	Insect transmission from infected plants in cull piles and volunteers
Verticillium wilt	✓	✓		Cut internal, extends through vascular ring	No	

Table 2. Summary of important potato tuber disease and defects (Source: Cornell College of Agriculture and Life Sciences https://www.vegetables.cornell.edu/pest-management/disease-factsheets/detection-of-potato-tuber-diseases-defects/summary-of-important-aspects-of-20-potato-diseases-and-defects/)

[1]Refers to tuber-to-tuber spread. Some of the diseases and disorders will progress within affected tubers in storage but will not spread to healthy tubers.

[2]Powdery scab is caused by the pathogen *Spongospora subterranea*. It is not directly spread by tuber to tuber contact in the store. Spore balls, also called cystori, are produced by the powdery scab pathogen and can survive in soil for lengthy periods and the inoculum load can carried on the surface of tubers in infested soil or shed dust. Powdery scab is primarily a soilborne disease and does not develop in the potato storage.

[3]Silver scurf of potatoes is caused by the fungal pathogen *Helminthosporium solani*. The disease occurrence can be promoted in store with free moisture on the tuber surface. In the store, spores of *H. solani* can be spread in air. In addition, the spores of the fungus can be spread in contaminated shed dust coating tubers with inoculum load.

* Not recorded in Australia, and listed as a zero-tolerance disease in seed certification scheme conditions.

SEED STORAGE

Potato tubers are living, breathing, organisms. Keeping this in mind, the particulars around how to keep them happy during storage make a lot more sense.

Potato seeds respire, 'sweat' and convert starch to sugars to use as energy. How much they do any of these things depends on the environment in which they are stored. Are they a little high maintenance? Perhaps. But the correct storage conditions are not complicated. Maintaining them ensures that money invested into quality seed is not wasted.

TEMPERATURE AND RELATIVE HUMIDITY

Note the following key considerations:

1. Maintain uniform temperatures and high (85% to 95%) relative humidity (RH) during storage. **WHY:** Low RH leads to dehydration and shrinkage.
2. Avoid temperature fluctuations by setting maximum and minimum points close together. **WHY:** Fluctuations can reduce the RH in the room and result in condensation on the tubers. The fungi and bacteria that cause breakdown in storage flourish under wet conditions, so seed must be kept dry.
3. Minimise spatial variation within the room to keep humidity high and temperature uniform. Replace leaky insulation and avoid frequent door opening.
4. Ensure potatoes are stacked in a manner that allows air to circulate. **WHY:** Even at 4°C, seed potatoes are still respiring and producing heat. This heat needs to be removed by the cold room air; if the air cannot circulate over and under the bins, hot spots will develop.
5. When warming up or cooling down, change temperatures gradually over several days.
6. Temperature management is most important as the tubers reach the end of their natural dormancy. For example, trials in the Netherlands found that yield was reduced if seed stored at 4°C was warmed to 16°C for more than six weeks before planting. Yield was less affected if seed were stored at 16°C for the same period before cooling to 4°C (Struik et al., 2006). However, the best results were achieved when tubers were kept continually at 4°C throughout storage.

OXYGEN

Seed potatoes are, like humans, sensitive to the concentrations of O_2 and CO_2. If CO_2 levels are too high, potatoes are unable to respire normally. As little as 4,000ppm CO_2 (0.4%) can reduce seed vigour after planting. In severe cases, lack of air inside the centre of the tuber leads to black heart.

EXPLORE FURTHER

Watch more: Dr Jenny Ekman, Maarten van Delden, and Dr Nigel Crump discuss the importance of correct seed potato storage, optimal storage conditions and management of physiological age.
http://bitly.ws/BFAk

Read more: Click here for the seed storage and physiological age factsheet.
http://bitly.ws/BFAy

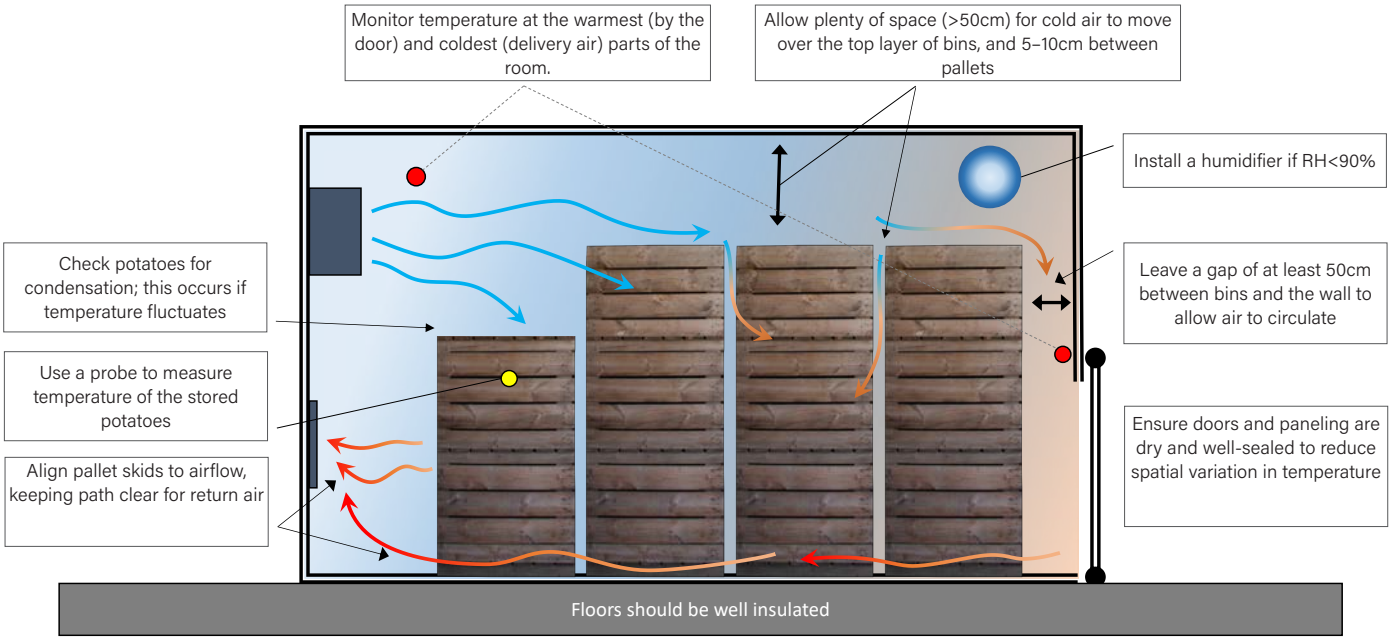

Figure 2. Cold storage rooms should be set up to allow the cold air to circulate around the bins; leave gaps between pallet stacks and the walls, align pallet skids to airflow; leave clear space for the return air intake. Temperature should be monitored and condensation checked in different parts of the room as well as in the stored seed (Source: J. Ekman)

TREATMENT AND HANDLING OF SEED

SEED CUTTING

With seed costing up to 30% of the total cost of potato production in Australia, seed cutting is a common practice.

As well as cost savings, cutting offers several advantages. Properly cut and cured seed, if held for three or four weeks, will overcome dormancy for some varieties. Careful cutting that results in uniform sized pieces with consistent numbers of eyes can improve uniformity of emergence. Cutting is particularly useful for varieties that have slow seed curing ability, such as Atlantic and Kennebec.

Seed cutting: age and temperature

1. Young or middle-aged (physiologically) seed is best suited to cutting, as cutting will further age the seed as it heals.
2. Young seed can be cut up to one month before planting. However, if the seed has already sprouted, this time should be reduced to 2 weeks.
3. Middle-aged seed that has not sprouted can be cut up to two weeks ahead of planting. Middle-aged seed that has sprouted and been de-sprouted is considered old and therefore not suitable for cutting.
4. The temperatures at which to cut and then hold seed varies with physiological age and sprouting.
   - Potatoes shouuld be warmed prior to cutting over approximately 10 days.
   - The younger the seed, the higher the cutting and holding temperatures.
   - Young seed can be cut and held at about 10°C.
   - Older seed should not be warmed or held above 7°C.
   - If the seed has already sprouted, warm to 10°C and cut as soon as the temperature is reached.
5. Carefully consider the effects of temperature and timing on physiological age. Keep in mind that warming, cutting, and holding will all advance physiological age.
6. Remember, pre-cutting is not for all seed.

Cut potatoes will be particularly sensitive to the soil into which they are planted. Delayed emergence, slow, uneven establishment and reduced plant stands are all symptoms of planting seed in soil that may have been either too cold, too wet or too dry. Recently cut seed will be particularly vulnerable to infection and dehydration if planted into an unfavourable environment.

Seed cutting: size

The clear objective is to create pieces that fit into the planter and provide uniform stands. Mechanical cutters may not always be perfect, but can handle large volumes of seed, cutting the tubers into two or four pieces.

The size of a potato seed piece affects early plant vigour a great deal. Larger seed pieces usually emerge faster than smaller ones.

Ideally, cut seed tubers into blocky pieces about 50g in size. Discard poorly cut seed pieces, such as slivers or slabs (Figure 3). Remove seed pieces ripped or torn by dull knives.

Each seed piece should have at least one eye. For varieties with poor eye distribution, such as Atlantic and Shepody, consider cutting seed pieces closer to 55g each.

Also use larger seed pieces (55 – 70g) for Russet Burbank and similar varieties. Adjust planting distances for

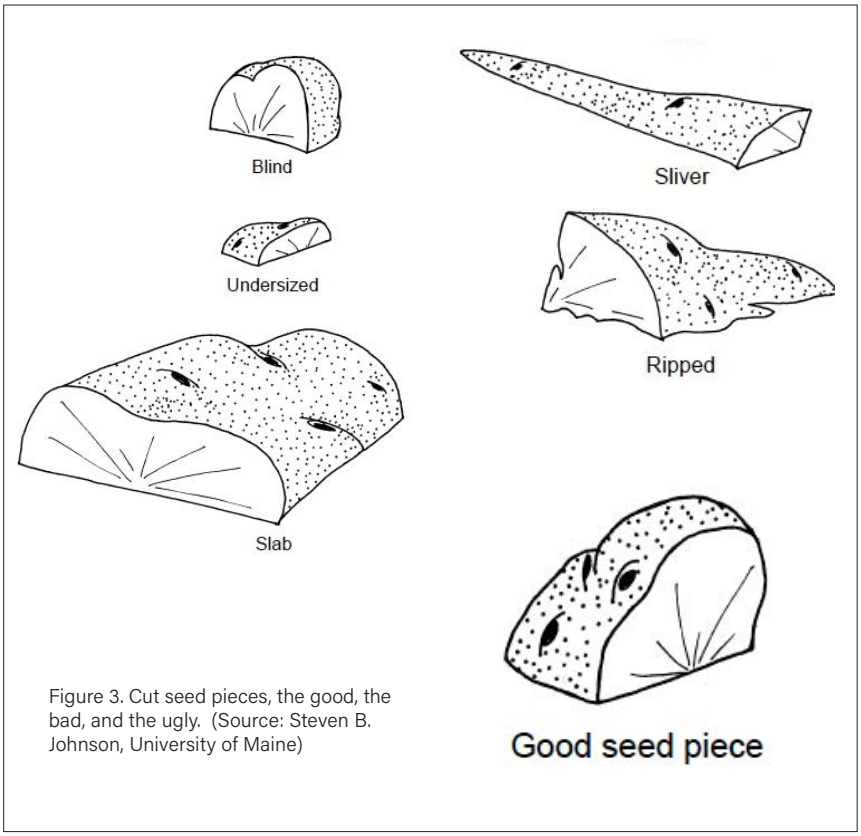

Figure 3. Cut seed pieces, the good, the bad, and the ugly. (Source: Steven B. Johnson, University of Maine)

such large pieces, allowing each extra space to grow.

Higher total yields are generally associated with larger seed pieces, but at some point, the seed piece size will not result in increased yield.

Bruise problems are more likely with very large seed pieces, especially at warmer temepratures. Excess bruising increases the risk of seed decay and accelerates ageing.

If cutting very large seed, also note that each piece will have a relatively large cut surface area. More stored energy will be used for wound healing, leaving less to support new plant growth. Emergence will likely be slowed, and plants will be less vigorous. A good rule is to keep the number of cut surfaces per tuber to a minimum.

Undersized seed pieces can contribute greatly to the number of doubles or triples planted. Oversized seed pieces can cause skips and are also prone to fall out of the planter.

To assess the seed cutting operation, count out 100 seed pieces and weigh them. If aiming for 50g per piece, no more than 10 pieces should be less than 30g or more than 70g. For most planters to run smoothly, at least 70 percent of the seed should be in the 43 – 85g range.

Other key points

1. Seed tubers should not be washed.
2. Do not try to salvage diseased potatoes or those that are breaking down.
3. Grade out bent or very rough tubers for hand cutting.
4. Size seed potatoes before cutting:
   - Less than 50g should not be planted
   - Between 50-100g should be planted whole
   - Between 100-150g should be cut into two pieces
   - Between 150 – 300g should be cut into three pieces
   - Greater that 300g should be cut by hand or not used at all
5. Keep the number of cut surfaces to a minimum to reduce bruising during handling and planting.
6. Seed pieces should have 2-3 eyes.
7. Disinfect all equipment before each seed cutting session and between seed lots.
8. Calibrate the seed cutter daily and between lots.
9. Keep the seed cutter knives sharp and straight to prevent ripping the potato surface. Ripping provides an ideal area for disease organisms to attack the seed.

CURING AND HANDLING CUT POTATO SEED - STEP BY STEP

The curing process takes between six to 10 days when the following steps are followed:

1. Cure cut seed optimally around 15 degrees and with high humidity and good ventilation.
2. Do not pile more than 1.8m deep - good air circulation will keep the temperature uniform and prevent build up of carbon dioxide and ethylene, which interferes with wound healing.
3. Relative humidity levels of 85 – 95% promote healing and prevent dehydration.
4. If there is too much air flow and not enough humidity, a thin skin may form on the cut surfaces. This thin layer is not enough to provide wound protection and can be easily sloughed during handling.

Care in handling cut potato seed is perhaps the most underrated aspect of commercial potato production. Cut potato seed is much more easily bruised than whole potatoes of similar weights. The most vulnerable areas of the seed pieces are the edges of the cut surfaces. Very small impacts can damage cells on the edges of the cut seed. These damaged areas make it easy for pathogens to infect the seed piece. Damaged cells may not heal.

As already noted, there is increasing recognition that optimising emergence and growth means minimising bruising to both seed-tubers and seed pieces. These are effectively baby plants; they need to be handled gently.

TREATING THE SEED: FUNGICIDES AND OTHER ACTIVE INGREDIENTS

Sourcing high quality, certified seed is an investment worth protecting. Seed treatments are therefore an important component of the overall disease management program.

Properly treated seed will provide a better, more uniform plant stand. However, more is not always better, as high concentrations of some products can be phytotoxic. Conversely, inadequate coverage may not provide good control.

Dust formulations are preferred for cut seed. If using a liquid, remove any diseased tubers before treatment to avoid spreading pathogens. As liquid formulations can inhibit wound healing, cut seed should ideally be fully cured before treatment.

Treatment will not be effective on seeds already diseased.

Determining which product to use will depend on a number of factors, including site history and other testing data that is supplied with the certified seeds. It is always a good idea to discuss requirements with a local agronomist.

THE VALUE OF CERTIFIED SEED

The adage 'rubbish in, rubbish out', succintly summarises the importance of buying good seed.

In 2013, The Australian Seed Potato Council (ASPC) was established to provide a collaborative framework involving the four respective State-based seed potato Certification Authorities, which includes the Department of Agriculture and Food Western Australia (DDLS Seed Testing and Certification), Australian Seed Potato Certification Authority (AuSPICA), Crookwell Seed Potato Growers and the Tasmanian Institute of Agriculture (TIA).

Certified seed potatoes underpin the security of the national potato industry. Seed certification provides some certainty that the investment made on seed is a good one, ensuringe that the seed potatoes meet quality standards set by the authority.

The benefits of potato seed certification are numerous and include:

- Avoiding spread of disease and maintaining tuber quality.
- Ensuring the genetic purity of potato varieties.
- Upholding common terminology.
- Creating uniform national labeling for both domestic and export certified seed potatoes, and uniform guidelines for seed production.

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MANAGEMENT OF POTATOES UNDER WET CONDITIONS

Many parts of Australia have seen Dorothea Mackellar's famous poem writ large across the landscape over the past few years. Three successive La Niña seasons have left prime potato growing areas waterlogged. Farmers more used to managing drought now find themselves with a suite of new challenges.
By Paulette Baumgartl

KEY POINTS

- Plant cover crops/green manure to improve soil physical properties that can better cope with wet conditions
- Ensure hills are stable and water can drain away in furrows. Reassess furrows following heavy rain
- Closely monitor nutrient levels, particularly in sandy soils, or if sub-soils are waterlogged
- Check moisture content of soil at different levels. A shovel is your best friend!
- If soil moisture below 25cm is at field capacity, the root system will be severely impacted
- Make sure hills are staying in place
- Avoid harvesting when soil conditions are wet; this will save soil structure and machinery

While flooding rains provide much needed relief to parched catchments and water tables, too much rainfall has consequences that are numerous and complex for potato growing. Challenges for growers are evident at every stage, from managing seed, planting, crop management and storage.

PRE-PLANTING

COVER CROPS AND PREPARING THE SOIL

Waterlogged soils are bad news for potato plants. Although we cannot control the weather, with some preparation we can create conditions that are better adapted to extreme wet conditions.

When soil is saturated, it cannot drain properly. The excess water inhibits the movement of oxygen into the soil, and thus the soil ecosystem quickly becomes anaerobic (Figure 1).

With a relatively shallow root system, potatoes have a very low tolerance to waterlogging and anaerobic conditions. Obviously, waterlogging cannot always be prevented, but improving drainage of water away from the crop and improving the soil's physical structure will help when the rains set in.

The many benefits of cover crops and green manures to soil health are widely known. These extend to helping soils prepare for a deluge by promoting a good physical structure through the addition of organic matter

Waterlogging in Ballarat, Feb 2023 - J Ekman

to the soil. The extra organic matter improves drainage and optimises the amount of oxygen in the soil pores. Organic matter also increases the field capacity of soil, which is the amount of water the soil can hold before the air pockets fill with water and become waterlogged.

Organic matter from cover crops helps improve the physical properties, and thus the soil's ability to cope with excess water in a number of ways by:

- 'Gluing' particles together to form soil aggregates, creating a more porous soil structure.
- Acting as a sponge to absorb water and making it available to plants, slows down saturation, reducing the risk of waterlogging.
- Improving aeration by creating channels for air and water exchange. This is important for soil microorganisms, which are critical for soil health.
- Creating voids following decay: larger organic debris, for example roots and stems from green manure decay, leave an empty space, improving soil structure.

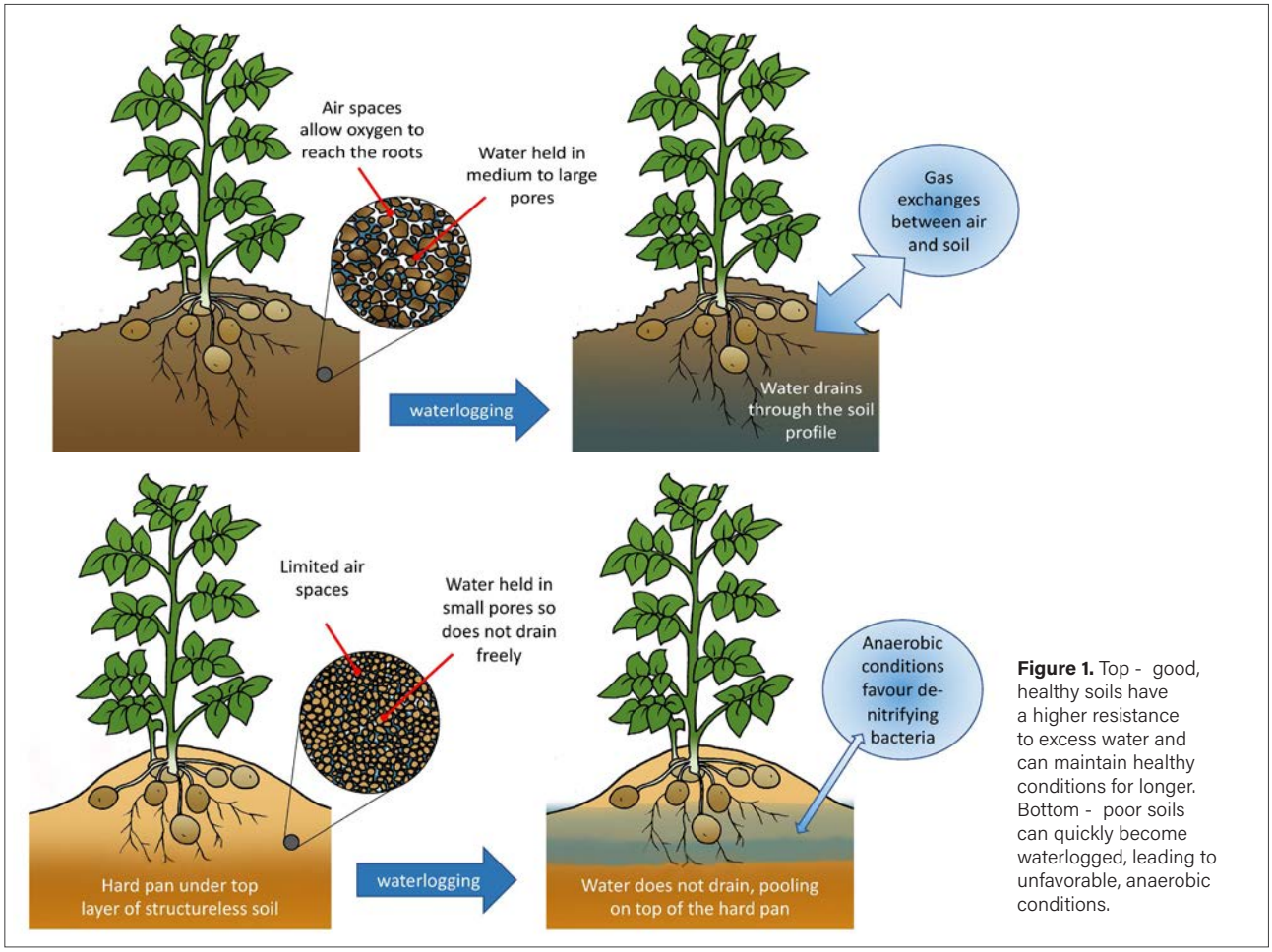

Figure 1. Top - good, healthy soils have a higher resistance to excess water and can maintain healthy conditions for longer. Bottom - poor soils can quickly become waterlogged, leading to unfavorable, anaerobic conditions.

Most soils, especially those with a high clay content, become compacted and slump after heavy rainfall and local flooding. This can form a crust, preventing oxygen and water penetrating the soil. Driving on the cropping area while the soil is very wet will result in further compaction and potential damage to expensive machinery.

However, once the paddock has dried, a light cultivation can be used to break up the crust to allow water and oxygen to penetrate. Care should be taken during cultivation not to cause further damage the soil structure.

Waterlogged ares are more prone to disease - T. Walker

SEEDBED PREPARATION

When a wet season is forecast, particular care needs to be taken when hilling potatoes. Potato seed pieces should be grown in hills of moist, weed free, stone free, friable soil, usually about 25-30cm high.

For soils that are prone to waterlogging, a bed former can be used before planting. This eases the planting operation by creating stable furrows and raised beds. These assist water flow and aeration through the hills. If a deluge occurs after hill formation, it is worthwhile checking the hills for damage and reconstructing if necessary. It is equally important to ensure that existing hills are not capturing water and preventing effective drainage.

Drainage can be either natural or artificial. Many areas have some natural drainage; this means that excess water flows from the farmers' fields to swamps or to lakes and rivers. Natural drainage, however, is often inadequate and artificial or man-made drainage is required.

There are two types of artificial drainage: surface drainage and subsurface drainage.

Surface drainage is the removal of excess water from the surface of the land. This is normally accomplished by shallow ditches, also called open drains. The shallow ditches discharge into larger and deeper collector drains. In order to facilitate the flow of excess water toward the drains, the field is given an artificial slope by means of land grading.

Subsurface drainage is the removal of water from the rootzone. It is accomplished by deep open drains or buried pipe drains.

i. Deep open drains

The excess water from the rootzone flows into the open drains. The disadvantage of this type of subsurface drainage is that it makes the use of machinery difficult.

ii. Pipe drains

Pipe drains are buried pipes with openings through which the soil water can enter. The pipes convey the water to a collector drain.

Buried pipes cause no loss of cultivable land and maintenance requirements are very limited. The installation costs, however, of pipe drains are likely to be higher due to the materials, equipment and skilled manpower involved.

Waterlogging can lead to nutrient deficiencies - Daniel Geisseler, UC Davis

DURING CROP GROWTH

MANAGING NUTRITION

Heavy rainfall and flooding can lead to nutritional deficiencies, especially in sandy soils.

If significant rain events occur after the crop has been planted, nutrient levels need to be closely monitored through regular soil and tissue testing.

Elements such as nitrogen and potassium are readily leached from the soil. Fertiliser applications should be adjusted to make up for shortfalls. Rates should be increased with caution though, as over application adds unnecessary cost and pollutes the environment.

Soils containing clay have a higher CEC so leaching is less of a problem. However there are other risks, including denitrification. The anaerobic conditions in wet soils favour denitrifying soil bacteria; these microbes convert nitrates into nitrogen gas, reducing available soil nitrogen.

MANAGING WEEDS

Pre-emergent herbicides are an important tool. If a dry window of 48 hours can be relied upon, these products can be highly effective.

Post-emergent herbicides need to be used with caution and are not generally recommended when wet conditions have reduced the growing season. Herbicides easily burn new potato leaves, damaging the ancillary parts of the leaves where important hormones for root growth are formed. While the potato leaves can recover, below the ground the root growth has been stunted. Recovery can take

a week or more. If wet conditions have already shortened the growing season, even one lost week will have a significant impact on yield and quality.

In general, applying chemicals in the right conditions can be hard in wet years. If possible look out for a dry window to apply pre-emergent herbicide.

MANAGING PESTS AND DISEASE

Very wet weather clearly increases the risk of fungal disease, including late blight, pink rot, and powdery scab.

Mild growing conditions also create a heavy but soft potato canopy, increasing the risk of foliar disease. Observe your crop carefully (potentially using a drone) and remove infected plants to reduce the spread of disease. Powdery scab, for example, will make itself known at around day 20 after planting.

Although it is difficult to keep fungicide applications on schedule during wet conditions, they are vital to prevent spread and entry of disease. To ensure the best outcomes, consider the following:

- Adhere to correct rates and concentrations to reduce risk of resistance.
- Speak to your local agronomist to ensure timely application.
- Prevention and not cure is the key. Where late blight was last year, it will most likely be present this year. Be swift, take early action.
- Inform yourself on the latest, approved products.
- Ensure hills and furrows are well managed.
- Check spray nozzles are calibrated and oriented correctly.

OTHER PROBLEMS

Lenticels are the pores in the skin of a potato tuber that allow gas exchange between the internal tissues and external atmosphere.

Under waterlogged conditions tubers struggle to get enough oxygen to support normal respiration. In response, the lenticels swell into puffy, corky white growths. This is not only unsightly, but makes infection easier for a range of fungal and bacterial pathogens.

If the soil remains waterlogged for an extended period, plant health will suffer. The roots are restricted and may die, crops become stressed and nutrient uptake is reduced. The air between soil particles is displaced by water, eventually leading to plant death due to lack of oxygen. It may seem counter-intuitive, but waterlogging can lead to wilting, as the oxygen starvation kills the roots and vascular system blocks.

Even after the sun comes out, problems may persist, as damaged root systems struggle to keep up with demand from an oversize leaf canopy.

Puffed lenticels on waterlogged potatoes - R. Hall

HARVESTING AND POST-HARVEST CONSIDERATIONS

When harvesting the crop following the challenges of a wet season, the best advice is to understand the variability in your crop and identify problematic areas.

Some important considerations when harvesting in wet conditions:

- If you know an area has disease present, avoid placing the potatoes in a storage facility.
- Keep everyone informed. Buyers and processors need to know about issues. Talk to customers and discuss issues with your local agronomist.
- If the potatoes are stored by the processing company, it is vital they know about and can anticipate potential problems.
- If soft rot is suspected, delay crop harvest and let soft rot run its course, which should take approximately two weeks.
- Potato tubers normally contain air spaces, which allow gas to diffuse for respiration but also provide some 'cushioning' of impacts during harvest. These are reduced when potatoes are fully turgid (i.e. the plant cells are full with water), increasing the risk of bruising during harvesting.
- Waterlogged soils are heavy and can break expensive machinery.
- Waterlogged but otherwise 'valuable' soils can be sticky and leave the farm via machinery.

EXPLORE FURTHER

Watch more in these PotatoLink webinars:

Pink rot with Dr Robert Tegg.
http://bitly.ws/BFB7

Late blight with Professor Steven Johnson and Dr Rudolf de Boer
http://bitly.ws/BFBa

Common scab with Dr Tonya Wiechel.
http://bitly.ws/BFBj

Panel discussion on managing potatoes in wet conditions with Peter O'Brien, Peter Philp, and Tim Walker.
http://bitly.ws/BFCh

Read more about soil test reports in this PotatoLink factsheet:

http://bitly.ws/BUKX

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https://www.fao.org/3/r4082e/r4082e07.htm

Panel discussion: Managing potatoes in wet conditions Peter O'Brien, Peter Philp, and Tim Walker

SLUGS IN POTATO CROPS

The recent wet spring and summer has provided ideal conditions for slugs to build their populations. As soils start to dry out during Autumn, slugs will seek moisture in soils and crop residue. Potato crops become targets for slug attacks, with the potato tuber providing an ideal harbour for this serious pest.

In recent years, slugs have emerged as a significant pest group in Australian agriculture. Potato tubers, rich in starch and with high water content, are attractive to slugs. The rasping mouth parts of slugs can penetrate the tuber. Feeding creates a cavity that increases risk of disease.

For both processing and fresh crops, the presence of slugs in tubers can result in load rejection and significant financial loss.

While these slug species differ in appearance, they can coexist in the same area. Accurate identification is essential for effective control. Incorrect identification can mean that controls miss peak activity, or are applied to non-pest species, allowing the real problem to persist.

THE UNUSUAL LIFECYCLE OF SLUGS

Slugs are hermaphrodites. That is, they have both male and female sexual parts.

Unlimited by a biological gender, any two individuals can mate and both then lay eggs. The breeding period occurs when moisture and temperature conditions are suitable, which is generally over winter and spring.

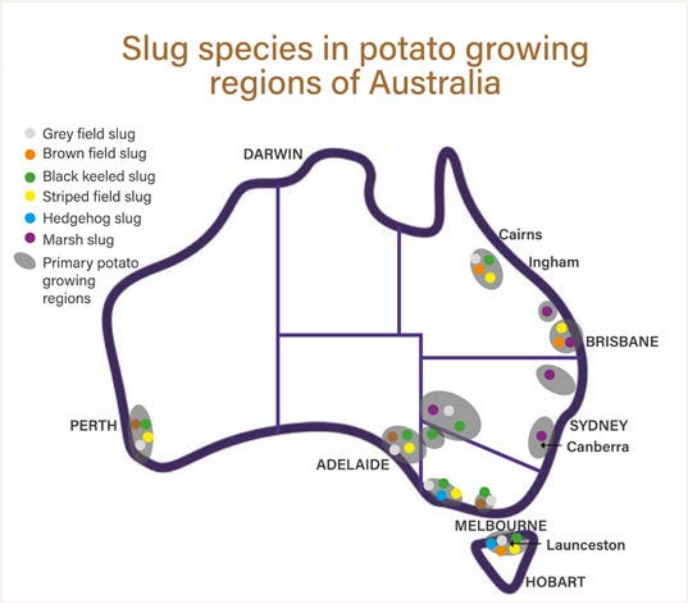
Slugs will lay eggs in clutches into moist soil over one to two month periods. The ideal soil temperature for egg development is between 10°C and 16°C for grey field slugs. Neonates hatch from the eggs within three to six weeks. These initially grow slowly, but accelerate as they develop into juveniles, especially given damp conditions and plenty of food. Temperatures ranging between 4°C to 21°C are suitable to many species.

The juveniles can become as large as adults, reaching sexual maturity after 10 to 40 weeks, depending on the species and conditions.

One intriguing aspect of slug development is that development times vary between individuals hatched from the same clutch. Within a population, there are both slow and quick breeders. This staggered breeding is believed to be an adaptation to survive difficult conditions.

Adult slugs can survive dry conditions by hiding under the top layer of soil and lowering their metabolism. They re-emerge once the subsurface wets up, which generally occurs after 75 to 100 millimetres of rain. However, emergence is often staggered, another adaptation to variable conditions.

Perforations and holes caused by slugs - potato-tuber-blemishes.com



Distribution of common slugs in Australia's potato growing regions

Along with plant damage, slugs leave a silvery, slime trail in their wake, caused by a secretion of mucus. Slugs a ravenous feeders, and can kill seedlings.

Factors which may cause a slug infestation include:

- A nearby crop, or weedy and grassy areas nearby
- Long grass in drains
- Wet areas from leaking irrigation
- Following a pasture crop
- Minimum tillage
- Wet, moist weather

The control of slugs is best achieved by adopting effective Integrated Pest Management (IPM) strategies (Table 1). Sampling, for example using slug mats, should the first step in any control program to determine the location, population and species present.

Cultural practices	Biological control	Chemical control	Physical barriers
Reduce soil moisture (if practical and suitable); remove weeds that provide favourable habitats; use trap crops to keep slugs and snails away; cultivate weed free strips between crop and headland to prevent migration; keep gully lines clean.	Birds, rats, frogs, and lizards feed on slugs and snails. Carabid beetles and native earwigs also feed on slugs.	Chemical baits are effective when used with cultural practices at those times when the populations have not reached damaging levels. Bait choice is important. Small, even sized pellets/granules will give a better coverage, increasing the likelihood of slugs and snails finding the baits	A protective border can be used to prevent the movement to crops. Lines of sawdust, ash, lime, and copper sulphate are effective barriers but efficacy is often reduced on wetting.

Table 1: IPM for the control of slugs (adapted from https://ausveg.com.au/biosecurity-agrichemical/crop-protection/overview-pests-diseases-disorders/slugs-and-snails/)

COMMON SLUGS FOUND IN AUSTRALIA (IMAGE CREDITS, WIKIMEDIA)

Grey field slug (*Deroceras reticulatum*); 50mm long. PEST: Yes (all crop types)

Brown field slug (*Deroceras invadens*); 30mm long. PEST: Yes (all crop types)

Black keeled slug (*Milax gagates*); 50mm long. PEST: Yes (all crop types)

Striped field slug (*D. nyctelius, Ambigolimax valentianus*); 70mm long. PEST: No

Hedgehog slug (*Aron intermedius*); 20mm long. PEST: Yes (wheat and pasture)

Marsh slug (*Deroceras laeve*); 25mm long. PEST: Yes (all crop types)

SOURCES

Nash, M. 2022. Slugs in crops: The back pocket guide. GDRC

https://ausveg.com.au/biosecurity-agrichemical/crop-protection/overview-pests-diseases-disorders/slugs-and-snails/

https://www.potato-tuber-blemishes.com/Symptoms/Pitted-or-raised-symptoms/Slug-holes

https://ahdb.org.uk/knowledge-library/how-do-slugs-damage-crops

USING LEGUMES TO SUPPLEMENT NITROGEN

The world may be easing its way into post-pandemic normality, however latest market research shows that this will have limited impact on the historically high prices of nitrogen and imported fertilisers for Australian farmers. By Paulette Baumgartl

According to Rabobank's 2022 Fertiliser Affordability Index Report, despite predictions that the global price of fertilisers will fall in the coming months, Australian farmers will enjoy no such reprieve.

Contributing to these high prices are Australia's heavy reliance on imported fertilisers, unpredictable bulk freight rates, ongoing currency and interest rate challenges, and domestic freight and logistics constraints.

With prices of urea still hovering around $1300-$2000/tonne, understanding alternative, cheaper ways to add nitrogen to the soil is more important than ever.

THE BIOLOGY OF 'CHEAP NITROGEN'

The many benefits of cover crops are well-documented. When legumes are part of the cover crop, the benefits extend to adding atmospheric nitrogen, of which there is an abundance, to the soil.

The process of fixing nitrogen from the atmosphere into the soil is called biological nitrogen fixation (BNF). This process occurs when legume plants form symbiotic (i.e., mutually beneficial) relationships with nitrogen-fixing bacteria, such as rhizobia, which live in root nodules.

TIPS TO GET THE MOST NITROGEN OUT OF YOUR LEGUME COVER CROP

- If nitrate levels are low in the soil, select and grow a vigorous legume cover crop; the more biomass grown, the more nitrogen fixed and added to the soil.
- Add the right rhizobium inoculant for your selected cover crop to ensure maximum results. Sow within 24 hours of inoculation.
- If nitrate levels are too high, a mixed crop can remove nitrate form the soil, paving the way for effective fixation from legumes, which provides better long-term results.
- The timing of the cover crop is important to ensure nitrogen is available when the potatoes need it most.

In this process, the bacteria convert atmospheric nitrogen (N_2) into a plant available form, for example ammonia (NH_3) or nitrate (NO_3). By way of thanks, the plant then provides the bacteria with energy in the form of sugars produced through photosynthesis (Figure 1). Once the nitrogen has been fixed, it is available for the plant.

EXPLORE FURTHER

Watch the recent webinar *Legumes in rotation with potatoes - an alternative nitrogen source*. In this webinar, Dr Kelvin Montagu and Peter O'Brien discuss the principles of using legumes as an alternative nitrogen source, the importance of legume inoculants and considerations for best results in rotation with potatoes.

http://bitly.ws/BS77

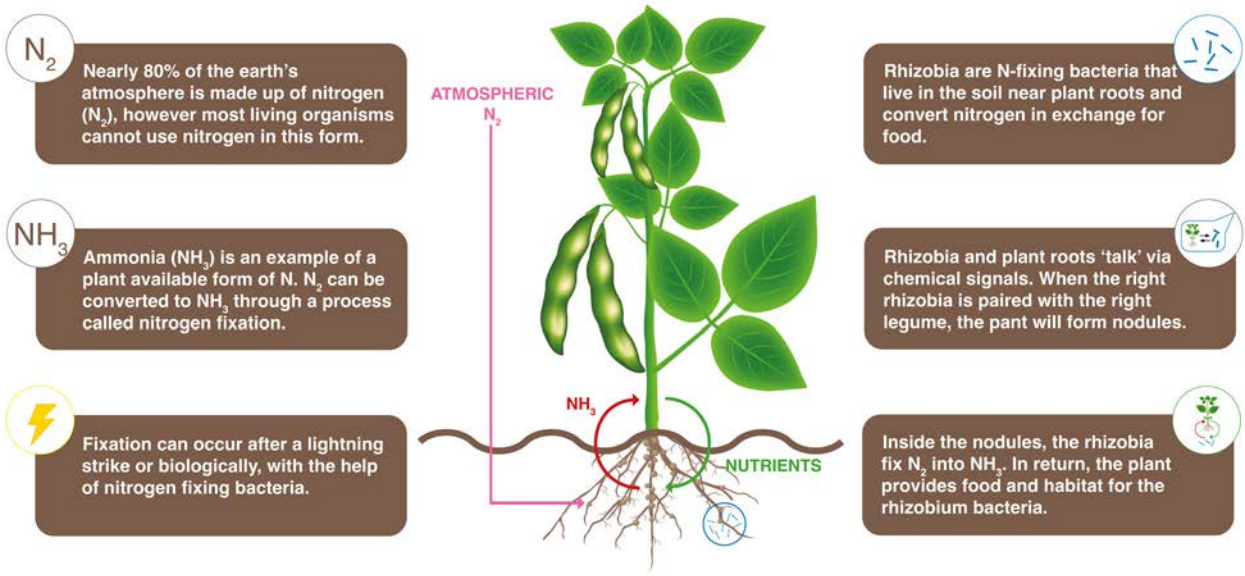


Figure 1. Converting atmospheric nitrogen to plant available nitrogen through biological fixation. (Based on figure from https://xitebio.ca)

COVER CROPS, BIOMASS, AND NITROGEN

Potatoes are a nitrogen-hungry crop. The nitrogen budget in a crop cycle depends on many factors, including yield, soil type and how much in-crop nitrogen fertiliser was used, and whether cover crops are part of the crop cycle on the paddock.

While all cover crops add some nitrogen to the soil, legume cover crops are the big contributors, owing to their ability to fix nitrogen. On average, for every tonne of shoot biomass grown, approximately 20kg of nitrogen will be added. A good legume cover crop with the right inoculant can produce 8-10 tonnes of shoot biomass, which equates to 160-200kg of nitrogen added. Cover crop roots can add a further 30-100kg of nitrogen.

Which cover crop is best will depend on local factors, including soil type and climate. For help with choosing the right legume for your area, the *Cover Crops for Australian Vegetable Growers* poster provides a handy overview.

Cover crop mixes add less nitrogen and sometimes this is the preferred option when growing a potato crop, particularly in soils with high soil nitrate levels. Plants, like humans, will favour the easy option, so if free nitrogen is available in the soil, legumes are less likely to make the effort to enter a partnership with rhizobium bacteria to create nitrogen.

Before selecting a cover crop, it is worthwhile to conduct a soil test to determine nitrate levels:

- At nitrogen levels of 50kg per ha (to 30cm), the legumes will add lots of nitrogen.
- At nitrogen levels above 200kg per ha, the legume will not add much nitrogen.

In soils with high nitrogen levels, a mixed cover crop of a sunn hemp, sorghum and tillage radish for summer, or oats and vetch mix for winter, could be a good option. The cereal and broadleaf species will recover and store the nitrogen, while 'forcing' the legume to fix its own nitrogen.

The nitrogen stored in the biomass can be later re-released when the crop is terminated and left as green manure.

WHEN TO GROW A COVER CROP

Generally, it is best to grow a legume cover crop prior to the potatoes. Although legumes can host some diseases, for example grey mould, this rarely presents a major problem.

As the nitrogen demands of the crop vary at different stages, controlling the amount of available nitrogen is important. Too much in the first few stages can delay tuber initiation and cause some internal defects; conversely too little in stage 4 will have an impact of tuber bulking.

Matching nitrogen supply to the nitrogen demand requires systematic soil and tissue testing, both before and during a season. Understanding the movement and release of N from legume biomass (or other forms of biomass) is also useful.

There are three important factors to consider about nitrogen and potatoes:

1. Potatoes require most nitrogen during stage 3.
2. Too much nitrogen before tuber initiation (growth stage 2) can delay initiation.
3. Potassium must also be present during the middle growth stages. Excess nitrogen with limited potassium is associated with reduced specific gravity, an important consideration for processing potatoes.

Therefore, terminating a legume cover crop in summer, six weeks prior to planting an indeterminate potato variety (some varieties are not impacted by too much nitrogen) is not advisable as there would be too much nitrogen still present at stage 2.

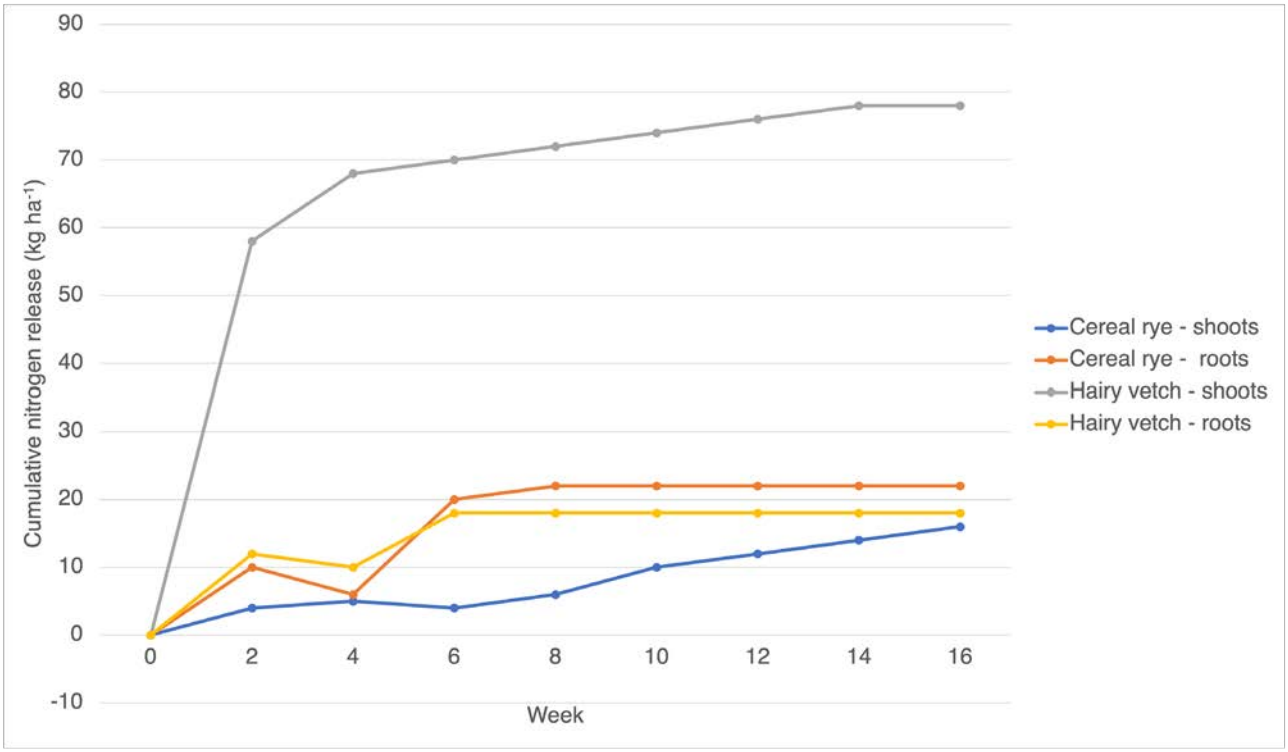


Figure 2. Estimated cumulative nitrogen release of cereal rye and hairy vetch residual biomass over 16 weeks of decomposition with potato growth stages. (Based on Sievers and Cook, 2018)

However, if it was terminated and left to dry out (no rain or no irrigation), the release would be timed in a way that would be suitable for potato growth, i.e., the residual cover crop would not start releasing nitrogen until the potatoes were planted and irrigated.

Figure 2 illustrates some results from an American study showing the release of nitrogen from different cover crop biomass residues, following termination with herbicides. Rate of decomposition is effected by the carbon:nitrogen ratio - cereal rye biomass residues decompose much slower and may also immobilise N as it has a higher C to N ratio than vetch. However, although a cover crop like hairy vetch contains more N and releases it more quickly, the rapid, early release may not suit potatoes.

THE IMPORTANCE OF ADDING THE RIGHT RHIZOBIA

Rhizobium bacteria do much of the heavy lifting in fixing nitrogen, and if they are not present in the soil, the legume cover crop cannot do its job.

Compatible, effective rhizobia must be present before nodulation and N fixation can occur. When a legume is grown for the first time in a particular soil, it is unlikely that the correct rhizobia will be present. Therefore, the rhizobia must be supplied in a highly concentrated form as inoculants.

Each species of legume has a specific strain of rhizobium that it needs for this process. To ensure adequate plant growth, it is important to inoculate legume seed at planting with the correct strain of rhizobium. A number of reliable resources are available to help select the right rhizobium.

The Australian Inoculant Research Group (AIRG) curates a selection of suitable rhizobia for inoculant products. These products have a green tick and have been independently tested for Australian farming conditions.

Currently there are 42 strains covering over 100 species and cultivars of grain and pasture legumes approved by the AIRG and the National Rhizobium Steering Committee.

Usually a seed supplier can provide the right rhizobium when purchasing legume seed.

It is also important to sow the seed within 24 hours of inoculation.

Morgan field pea - K. Montagu

Sunn hemp - K. Montagu

Lupin - D Long

EXPLORE FURTHER

Download the *Cover crops for Australian vegetable growers* poster - **http://bitly.ws/BULf**

Read more about the AIRG and the list of inoculants -**http://bitly.ws/BULg, http://bitly.ws/BULj**

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Sievers, T. and Cook, R.L. (2018), Aboveground and Root Decomposition of Cereal Rye and Hairy Vetch Cover Crops. Soil Science Society of America Journal, 82: 147-155. https://doi.org/10.2136/sssaj2017.05.0139

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MANAGING HERBICIDES AND HERBICIDE INJURY

In February we had the pleasure of meeting Professor Andy Robinson and welcoming him, in person, to the PotatoLink project. While visiting Australia, Professor Robinson took time out of a busy schedule to take part in our Ballarat workshop and field walk. Professor Robinson is a highly regarded extension agronomist and academic from North Dakota State University and the University of Minnesota. Before heading our way, he presented a webinar on chemical weed control and herbicide injury. By Paulette Baumgartl

WATCH THE WEBINAR

This article summarises key points from Prof Robinson's webinar regarding best management for weeds and how to recognise the difference between herbicide injury and diseases or defects in your potato crops. The webinar is available to watch any time via the PotatoLink website. at this link:
http://bitly.ws/BFEY

When no pre-emergent herbicide has been applied, a post-emergent treatment is the only option - A. Robinson

WEED CONTROL TOOLBOX

Potato growers have many options to control weeds, from prevention and cultural management to mechanical and physical weed control, and chemical and biological methods. With so many choices, the key to success is knowing which method to use, and how to combine them for maximum impact.

As the name suggests, **prevention and cultural management** are all about growing potatoes in a way that inhibits weed growth. This includes factors like row width, canopy closure, water and fertiliser management.

Creating shade and reducing weed space promotes potato growth and can reduce the volume of herbicides needed for chemical weed control. Likewise, taking care not to transfer seeds from one area to another can help prevent the spread of weeds (as well as disease).

Mechanical and physical weed removal also play a role. Each pass across a field disrupts the soil and prevents weed growth. Hilling can also be an opportunity to remove weeds.

Chemical weed control, or herbicides, is the primary method used by most potato growers. Herbicides facilitate reduced tillage (which is good for maintaining soil structure), can target specific weeds, and are effective for treating large acreage.

Choosing the right herbicide requires careful consideration of factors including variety sensitivity, the weed spectrum present, timing, and cost.

Timing is particularly crucial when using herbicides. Pre-emergent herbicides provide a window of 3-5 weeks for weed control, giving potato plants time to grow, form a canopy and prevent weed emergence. But the effectiveness of pre-emergent herbicides can be impacted by weather conditions, often beyond the grower's control.

Also note that slow growing weeds need a slower acting herbicide, i.e., a herbicide with lower water solubility. Conversely, if quick action is required, a herbicide that dissolves quickly in water is more suitable.

PRE-PLANT (KNOCKDOWN) HERBICIDES

Knockdown herbicides, as the name suggests, are applied just prior to planting and designed to work rapidly. They can also be useful in reducing a seedbank.

Glyphosate remains a popular choice in Australia but can cause herbicide injury if mismanaged.

Table 1 highlights the man advantages and challenges of the typical knockdown herbicides used in Australia.

Herbicide - Active (trade name)	Targets	Advantages	Challenges
Glyphosate (Round up*)	All weeds - burndown, good for pre-plant, can be a problem during growth	▪ Translocates ▪ Low water volume ▪ Adjuvants can be added to improve results ▪ Good on grasses ▪ Can withstand sunlight and warm temperatures ▪ Low cost	▪ Weed resistance ▪ Potential damage to potato plant
Paraquat and diquat (Gramaxonae, Spray seed)	All weeds	▪ Kills on contact ▪ High volume of water needed ▪ Herbicide resistance low	▪ No contact, no kill ▪ Injury to plant ▪ Sunlight is needed ▪ Human safety

Table 1. Common pre-plant (knockdown) herbicides used in Australia (Source: A. Robinson). Always refer to directions on the label
*Or other generic herbicides with the same active ingredient.

PRE-EMERGENT HERBICIDE

Pre-emergent herbicides prevent germinated weed seedlings from becoming established.

For maximum efficacy, several factors should be considered:

- As they require 10-20mm of water to activate, if no rainfall is expected irrigation is required.
- Incorporating the herbicides through tillage or water can also improve their effectiveness.
- Timing is paramount: apply before weed seeds germinate.
- With the right knowledge, tank mixing herbicides can expand the weed control spectrum.
- Soil factors, including pH, organic matter, texture, and moisture need to be considered before application to ensure optimal results.

Metribuzin injury - A. Robinson

Wrinkly leaves caused by herbicide injury from metolachlor - A. Robinson

Table 2. Common pre-emergent herbicides used in Australia (Source: A. Robinson). Always refer to directions on the label

Herbicide - Active (trade name)	Targets	Advantages	Challenges
Metribuzin (Sencor, Mentor)	Broadleaves, grasses	▪ Good general weed control ▪ Water soluble ▪ More active in soils with pH > 7.5, low organic matter, stressed plants	Foliar: symptoms can be severe when applied when plant metabolism is slowed, or within 3 days after periods of cool, wet, or cloudy weather. Can affect sensitive cultivars, can cause venal chlorosis.
Linuron (Linex)	Blackberry, nightshades, broadleaves	▪ Great on fat hen ▪ Good on nightshades ▪ 1/12th as soluble as metribuzin – needs more water to activate but lasts a lot longer. ▪ Late PRE herbicide treatment ▪ Tank mixes well with metribuzin and S-metolachlor	▪ Linuron binds to OM, will be less effective (don't use in high OM soils) ▪ Limited weeds controlled ▪ Cost
Metobromuron (Soleto)	Broadleaves	▪ Good control of many small-seeded broadleaves	-
EPTC (Eptam)	Nut grass, broadleaves	▪ Incorporation is key - fertigate, tillage	▪ Cost ▪ Photodegrades so needs to be tilled in immediately
Metolachlor, prosulfocar (Boxer gold)	Grasses, Nightshades, Fat Hen, Redroot Amaranth, Toad Rush	▪ Ideal for resistance management ▪ Versatile ▪ Good compatibility with other herbicides	Irrigation or rainfall is required to a depth of 3 to 5 cm and should occur within 7 days of application.

Table 2 (over page) highlights the main advantages and challenges of the typical pre-emergent herbicides used in Australia.

POST EMERGENT HERBICIDES

Most post emergent herbicides fall into two categories, **graminicides and desiccants**.

Graminicides target weedy grasses and should be used on weeds less than 15 cm tall (Table 3).

- Use the full label rate, as a reduced rate will lessen efficacy and could lead to herbicide resistance.
- Add an adjuvant to help break the barrier on the leaf surface and get more herbicide in the plant.
- Use a high volume of water to achieve good spray coverage on leaves.

Desiccants prevent specific functions within the plant, such as interfering with photosynthesis or disrupting cell membranes. The internal structure collapses and the plant dies, drying out almost as rapidly as if it had been burned (Table 4).

Glyphosate is not considered a 'true' desiccant, as plants take weeks, rather than days, to die.

Trade name	Active	Targets
Fusilade*	Fusilade	Grasses
Select, Clethodim*	Clethodim	Grasses

Table 3: Common **grass herbicides** used in Australia (Source: A. Robinson).
Always refer to directions on the label.
*Or other generic herbicides with the same active ingredient.

Trade name	Active	Targets
Reglone	Diquat	Potato foliage
Spray Seed**	Paraquat + diquat	Weed destruction

Table 4. Common **desiccants** used in Australia (Source: A. Robinson).
Always refer to directions on the label.
**DO NOT use SPRAY.SEED® 250 for potato haulm desiccation.

AN INTEGRATED, COMBINED APPROACH IS ALWAYS BEST

As every grower knows, an integrated approach usually yields the best results. Timely application of herbicides appropriate to the specific needs of the crop and the weed pressure it is under is a useful tool.

Combining this with good cultural management practices, such as crop rotation and cover cropping, is the best way to reduce weed pressure and avoid herbicide resistance.

HERBICIDE INJURY

Herbicide injury can cause a variety of problems for potato growers, including reduced stand, slow canopy closure, damaged leaves, malformed tubers, reduced yield and quality, and unacceptable accumulation of contaminants in the tuber.

There are three main ways herbicide injury can occur: **soil carryover, foliar exposure,** and **seed contamination.** Common modes of 'unwanted herbicide transport' include drift (Figure 1), tank contamination (tank and/or boom not cleaned out properly), misapplication, volatisation, or sometimes even a broken hose.

SOIL CARRYOVER

Microbial decomposition, together with UV light and other environmental factors, generally breaks down herbicides in soil.

However, if conditions are too cold, dry or wet for microbial activity, or hard pans are present that trap herbicide within the profile, then some products can persist. Herbicides can also potentially be released from treated materials that have not broken down before planting.

Signs of soil carryover include slow emergence, pruned or brown roots, stunted plants, shortened stolons, and early tuber set or malformation.

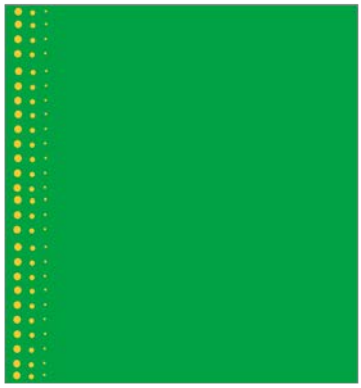
If large areas or whole fields show symptoms, this can indicate contamination via a sprayer (tank contamination).

FOLIAR EXPOSURE

Herbicides can also cause damage through foliar exposure. This can occur via particle drift, inversion, contamination of spraying equipment, volatilisation, misapplication, contaminated water, and more.

Symptoms of foliar exposure include leaf injury and tuber cracking or malformations. The specific symptoms vary depending on the herbicide's mode of action. These can include twisting of leaves and stems, cupped leaflets, wrinkled leaflet margins, misshapen tubers, yellowing of youngest leaves, and elongated and wrinkled leaflets.

Herbicides that translocate within the plant can potentially damage both the leaves, especially young leaves, and the underground tubers (Figure 2).



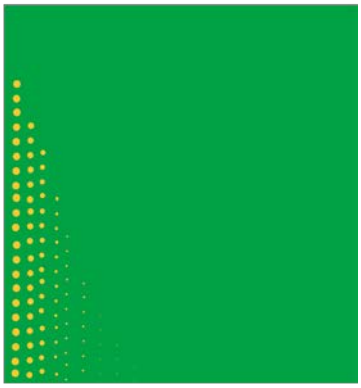


Figure 1. Typical patterns caused by herbicide drift (Source: A. Robinson)

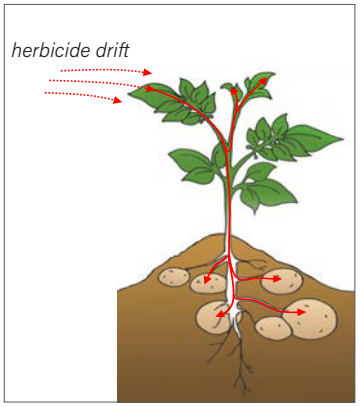


Figure 2. Translocating herbicides can cause chemical build up in tubers (Source: A. Robinson)

Contact herbicides will affect what they touch, including both young and old leaves equally.

In addition to direct damage, herbicide injury increases plant stress, which can result in tuber cracking or malformations in tubers.

GLYPHOSATE DAMAGE

Glyphosate is a commonly used herbicide with wide benefits in agriculture. However, it can have negative effects on crop growth and development if misused. Accidental exposure to glyphosate can cause yellowing of new leaflets, stunting of plant growth, and reductions in plant height and leaf size.

These effects can be particularly pronounced at higher application rates, where leaves can become chlorotic and necrotic.

The often subtle effects of glyphosate drift, or other herbicide injury, can make identification challenging, even for experienced experts. Patterns in the field can provide some helpful clues: if symptoms are present throughout the field, the issue may be related to nutrient deficiencies. However, if only the edges of the field are affected, herbicide drift may be the culprit (Figure 1).

In addition to its effects on foliage, glyphosate can have negative impacts on tuber development during the early bulking stages. Exposure can result in smaller, irregularly shaped tubers that have folds, cracks, knobs, and 'elephant hide'. Even minute amounts of glyphosate can cause significant damage to tuber development, ultimately leading to reduced yields and lower quality crops.

Glyphosate can also leave residues in seeds. These affect seed germination and plant growth. When seeds are contaminated with glyphosate residues, typical symptoms include erratic and slow emergence, bending and twisting of leaves, multiple stems from a single eye, and "cauliflower" or

"candelabra" formations of stems with no dominant growing point.

IS IT HERBICIDE INJURY OR SOMETHING ELSE?

Identifying herbicide injury in plants is not always straightforward as many other causes have similar symptoms.

In potatoes, high turgor pressure and rapid tuber growth can cause cracking, while drought stress and fertility stress can cause discoloured leaves. Potato virus Y can cause mosaic patterns, small leaflets, and wavy leaf margins.

To properly diagnose whether it is herbicide injury or something else, consult your local agronomist, take samples and test, test, test. It is essential to document the symptoms immediately and collect multiple samples for laboratory analysis.

Prevention is always better than cure. It is crucial to check previous herbicides used in the field, communicate with neighbouring farmers about sensitive crops, and work closely with seed growers to ensure seed is clean.

Proper tank cleanout procedures and training for spray system users are essential. Herbicides should always be kept separately to other pesticides in clearly labelled containers.

WHAT TO DO IF YOU SUSPECT HERBICIDE DAMAGE ON A LARGE SCALE?

If you suspect herbicide injury has occurred, it's important to document it immediately because symptoms may decrease over time, making it more difficult to capture. A laboratory analysis is also necessary. When sampling, take multiple leaves and/or tubers and use clean gloves and an unused bag. Comparing affected and non-affected areas is also recommended, as is sampling multiple intensities of damage.

Chain of custody is also essential, especially if the issue becomes litigious. Chronological documentation of the individuals who take custody of the sample should be maintained, and a third party can be used to verify when and where samples were taken.

After sampling, gently clean the samples if necessary and store refrigerated. Samples need to be kept cool and preferably shipped overnight to the laboratory. Information on how to sample and get tests for herbicides can be found at **z.umn.edu/injury.**

Left: Edge of fields or lower point in field – herbicide residues accumulate in low spot causing carry over. Right: Tank/boom contamination - A. Robinson

Left: Two seed lots, one with glyphosate contamination in seed and one with no contamination. Right: 'Cauliflower sprouts' due to glyphosate exposure - A. Robinson

Left: Fluorescent green foliage from glyphosate drift on a seed paddock. Right: Extremely malformed tubers - A. Robinson

Left: Uneven irrigation can also cause malformed tubers - J Ekman. Right: Diseases and fertility deficiencies can display symptoms similar to herbicide injury - A. Robinson

KEY POINTS

- Pre-emergent herbicides usually require 10-20mm of water to activate.
- Incorporate pre-emergent herbicides through tillage or water for improved effectiveness.
- Apply pre-emergent herbicides before weed seeds germinate.
- Tank mixing herbicides can expand the weed control spectrum.
- Consider soil factors such as pH, organic matter, texture, and moisture, adjust rates and application timing accordingly.
- While herbicides are extremely useful tools, especially when used within an integrated approach, accidental exposure can significantly reduce potato yield and quality.
- Herbicide injury can occur through soil carryover, foliar exposure, and seed contamination.
  - Soil carryover can cause slow emergence, pruned or brown roots, stunted plants, shortened stolons, and early tuber set or malformation.
  - Foliar exposure can occur due to particle drift, inversion, contamination of spraying equipment, volatilisation, misapplication, contaminated water, and more.
  - Symptoms of foliar exposure include leaf injury and tuber cracking or malformations, which can vary depending on the herbicide's mode of action.

GLYPHOSATE DAMAGE:

- Glyphosate can cause yellowing of new leaflets, stunting of plant growth, and chlorotic and necrotic leaves.
- Glyphosate exposure can result in smaller, irregularly shaped tubers with folds, cracks, knobs, and 'elephant hide'.
- Even extremely low levels of contamination can have a significant impact on tuber growth, quality and yield.
- Glyphosate residues in seeds can cause erratic and slow emergence patterns, bending and twisting of leaves, multiple stems from an eye, and enlarged stems.

FACTORS THAT CAN MIMIC HERBICIDE INJURY:

- Environmental stress, nutritional imbalance, diseases, and genetics; drought stress can reduce plant growth; irregular soil moisture can result in cracked and deformed tubers; nutrient stress can cause leaf discolouration.
- High turgor pressure and rapid tuber growth can cause early cracking and larger cracks.
- Potato Virus Y can cause mosaic effects on leaves, wavy leaf margins and deformed tubers.

WHAT TO DO IF YOU SUSPECT HERBICIDE DAMAGE ON A LARGE SCALE?

- Document symptoms immediately because they may decrease over time.
- Sample multiple leaves and/or tubers, compare affected and non-affected, and sample multiple intensities of damage.
- Chain of custody is important if this becomes litigious.
- Clean and store samples properly and ship them to a laboratory.

HOW TO PREVENT HERBICIDE INJURY:

- Check previous use of potentially persistent herbicides or bioassay soil.
- Communicate and cooperate with neighbours.
- Follow tank cleanout instructions and have specific herbicide-only equipment.
- Train spray applicators to ensure spray drift does not occur.
- Keep herbicides separately from other pesticides.

SOURCES

Information for this article has been sourced from the webinar "Herbicide damage and weed management in potatoes" (Professor Andrew Robinson)

https://potatolink.com.au/resources/webinar-recording-herbicide-damage-and-weed-management-in-potatoes

POTATOLINK MAGAZINE

ATTENTION ALL POTATOLINK ENTHUSIASTS!

After eight issues of co-publication with *Potatoes Australia*, we're excited to announce that PotatoLink magazine is branching out as a stand-alone publication.

We will continue our commitment to delivering the latest in R&D extension, tech updates, and scientific explanations of all things spud-related.

To keep receiving a printed copy of PotatoLink magazine, please scan the QR code and subscribe today!

SCAN THE QR CODE TO RECEIVE A PRINTED COPY OF POTATOLINK MAGAZINE

Even if you currently receive a printed copy, it is essential to re-subscribe

POTATOLINK BULLETIN

Wondering when the next in-person event will be held in your area? Looking for a factsheet or an update on a demonstration site? Or want to join the next webinar?

For all this and more, subscribe to our monthly newsletter.

The PotatoLink Bulletin is a free e-newsletter emailed to subscribers each month and is brimming with information. The bulletin provides a platform for growers to stay up to date on upcoming events and resources delivered by PotatoLink or other industry groups and projects.

EACH ISSUE INCLUDES

- Upcoming events – webinars, regional in person events, online training and conferences
- New resources – PotatoLink magazine, factsheets and case studies
- Updates from our demonstration sites
- Event reviews for all those who missed out
- General info, project updates and more

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REGIONAL REP DISPATCH TASMANIA

We are excited to introduce our new magazine segment *Regional Rep Dispatch*.

Each issue we will provide a spotlight on what is happening in the main potato growing regions of Australia, including topics of interest, concerns, and events in different parts of the country. This new segment will be an excellent addition to the PotatoLink magazine and encourage our readers to stay tuned for future updates from our regional representatives.

Our first dispatch comes from Tim Walker in Tasmania.

EVENTS

Earlier in the year, over 40 Tasmanian growers and other industry members took the opportunity to join Professor Andy Robinson (North Dakota State University, US) and the PotatoLink team for a field walk in North Motton, Tasmania.

Topics included herbicide and weed management, and the similarities and differences of the American and Australian potato systems.

The event was a great opportunity for the industry to get out, meet, talk, and tour a fantastic potato crop.

Attendees at the field walk

LATE SEASON ISSUES

Weather: crops looking good, but will the yields be decent?

The weather in Tasmania has resulted in late plantings for much of the industry, which will result in difficulties obtaining yields similar to earlier plantings as sunlight becomes limited later in the year.

Oxalis weed: come clean, go clean.

Oxalis, a weed with a similar appearance to red clover, is becoming a problem on a few properties in Tasmania. If ignored, the problem can become severe and have an impact on yield and harvesting. Potato operations significantly spread the weed by disrupting and moving the bulbs.

Oxalis is easily spread and can quickly get out of control.

To bring some focus to this challenge and make farmers aware of the weed and the importance of quick action, PotatoLink held an event in late March in nearby Gawler. Topics included identification tips, management strategies, and the potential severity of the weed.

In the meantime:

- Consult your agronomist for control options and be aware of biosecurity on farm.
- Do not ignore the problem. Ensure biosecurity protocols are updated - the best way to manage Oxalis is to prevent it.

Early senescence: Leaf tip blackening?

Noticing some unusual leaf tip blackening and early senescence in potatoes, Tim sent away some samples for pathological analysis.

Results currently only show the normal pathology expected for dying potatoes, with no clear indicator of what could be causing the black leaf tips.

This raises a few questions, including whether the issue has environmental causes, and if interventions make sense in a cost/benefit analysis context.

EXPLORE FURTHER

AUSVEG has several biosecurity resources for potato growers
http://bitly.ws/BURT

Soilwealth factsheet on oxalis management
http://bitly.ws/BURW

For more information about PotatoLink activities in Tasmania contact Tim
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Photo by Jenny Ekman

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